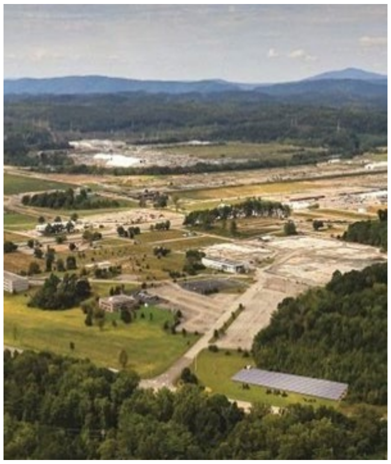


The East Tennessee Technology Park has changed greatly in recent years as remediation projects have been completed.

3

East Tennessee Technology Park

ETTP was built during World War II as part of the Manhattan Project. Formerly known as the K-25 Site, its primary mission was to enrich uranium for use in atomic weapons. After the war, the mission changed to include the enrichment of uranium for nuclear reactor fuel elements and recycling of uranium recovered from spent fuel, and the name changed to the "Oak Ridge Gaseous Diffusion Plant" (ORGDP). In the 1980s, a reduction in demand for nuclear fuel resulted in the shutdown of the enrichment process and production. The emphasis of the mission then changed to environmental management and remediation operations. In 1996, the name changed to the "East Tennessee Technology Park," or ETTP. The central portion of ETTP is also referred to as "the Heritage Center."

Environmental management and remediation consist of the cleanup of outdoor storage and disposal areas, the demolition and cleanup of facilities, waste management, land restoration, environmental monitoring, and the proper disposal of waste generated from production operations. Beginning in the 1990s, reindustrialization, the conversion of underused government facilities for use by the private sector, became part of ETTP's mission. State and federally mandated effluent monitoring and environmental surveillance involve the collection and analysis of air, water, soil, sediment, and biota samples from ETTP and surrounding areas. Monitoring results are used to assess exposures to the public and the environment, evaluate the performance of treatment systems, and identify concerns within permitted standards for emissions and discharges. On November 10, 2015, the DOE and the US Department of the Interior signed a memorandum of agreement (MOA) establishing the Manhattan Project National Historical Park (MPNHP; DOE 2015). The MOA defines agency roles and responsibilities in park administration and provisions for enhanced public access, management, interpretation, and historic preservation. The ORGDP footprint is included in the MPNHP; details are available on the MPNHP page of the National Park Service website, **here**. In addition, the K-25 Virtual Museum website, found **here**, details its history through narrative, interviews, and photographs.

3.1. Description of Site and Operations

Construction of the K-25 Site (Figure 3.1) began in 1943 as part of the World War II Manhattan Project. The plant's original mission was the production of enriched uranium for nuclear weapons. Enrichment was initially carried out in the S-50 thermal diffusion process facility, which operated for one year, and then in the K-25 and K-27 gaseous diffusion process buildings. Later, the K-29, K-31, and K-33 buildings were built to increase the production capacity of the original facilities by raising the assay of the feed material entering K-27. Following the war years, the site became officially known as ORGDP, the first such uranium processing plant in the world.

After military production of highly enriched uranium was concluded in 1964, the two original process buildings, K-25 and K-27, were shut down. For the next 20 years, the plant's primary mission was the production of low enriched uranium fabricated into fuel elements for nuclear reactors throughout the world. Other missions during the latter part of this 20-year period included developing and testing the gas centrifuge method of uranium enrichment and laser isotope separation research and development.

By 1985, the demand for enriched uranium declined, and the gaseous diffusion cascades at ORGDP were placed in standby mode. That same year, the gas centrifuge program was canceled. The decision to permanently shut down the diffusion cascades was announced in late 1987, and actions necessary to implement that decision were initiated soon thereafter. Because of the termination of the original and primary missions, ORGDP was renamed the "Oak Ridge K-25 Site" in 1989.

Figure 3.2 shows the ETTP site areas before the start of decontamination and decommissioning (D&D) activities. In 1996, the K-25 Site was renamed the "East Tennessee Technology Park" to reflect its new mission.

The ETTP mission is to reindustrialize and reuse site assets through leasing and/or transferring excess or underused land and facilities and by incorporating commercial industrial organizations as partners in the ongoing environmental restoration, D&D, and waste treatment and disposal. The site is undergoing environmental cleanup of its land, including remedial activities for soil and groundwater, as well as the removal of remaining media created during D&D activities. The cleanup approach makes land and various types of buildings (e.g., office, manufacturing) suitable for private industrial use and for title transfer to the Community Reuse Organization of East Tennessee (CROET) or other Not-for-Profit (NFP) entities such as the City of Oak Ridge. The long-term DOE goal for ETTP is to transfer as much of the site property as practicable out of DOE ownership and into the NFP's control for the development of a commercial business and industrial park. The facilities may then be subleased or sold, with the goal of stimulating private industry and recruiting businesses to the area. These transfers also reduce maintenance costs for DOE, which allows additional funds to be reallocated elsewhere on the reservation for environmental cleanup. Figure 3.3 shows the ETTP property transfer status through 2024.

UCOR, the lead environmental management contractor for ETTP, supports DOE in the reindustrialization program as part of the continuing effort to transform ETTP into a private-sector industrial park in addition to a national park and conservation area. Unless otherwise noted, information about non-DOE entities located on the ETTP site is not provided in this document.

Figure 3.1. The K-25 Site in 1946

Figure 3.2. East Tennessee Technology Park since the start of decontamination and decommissioning activities in 1991

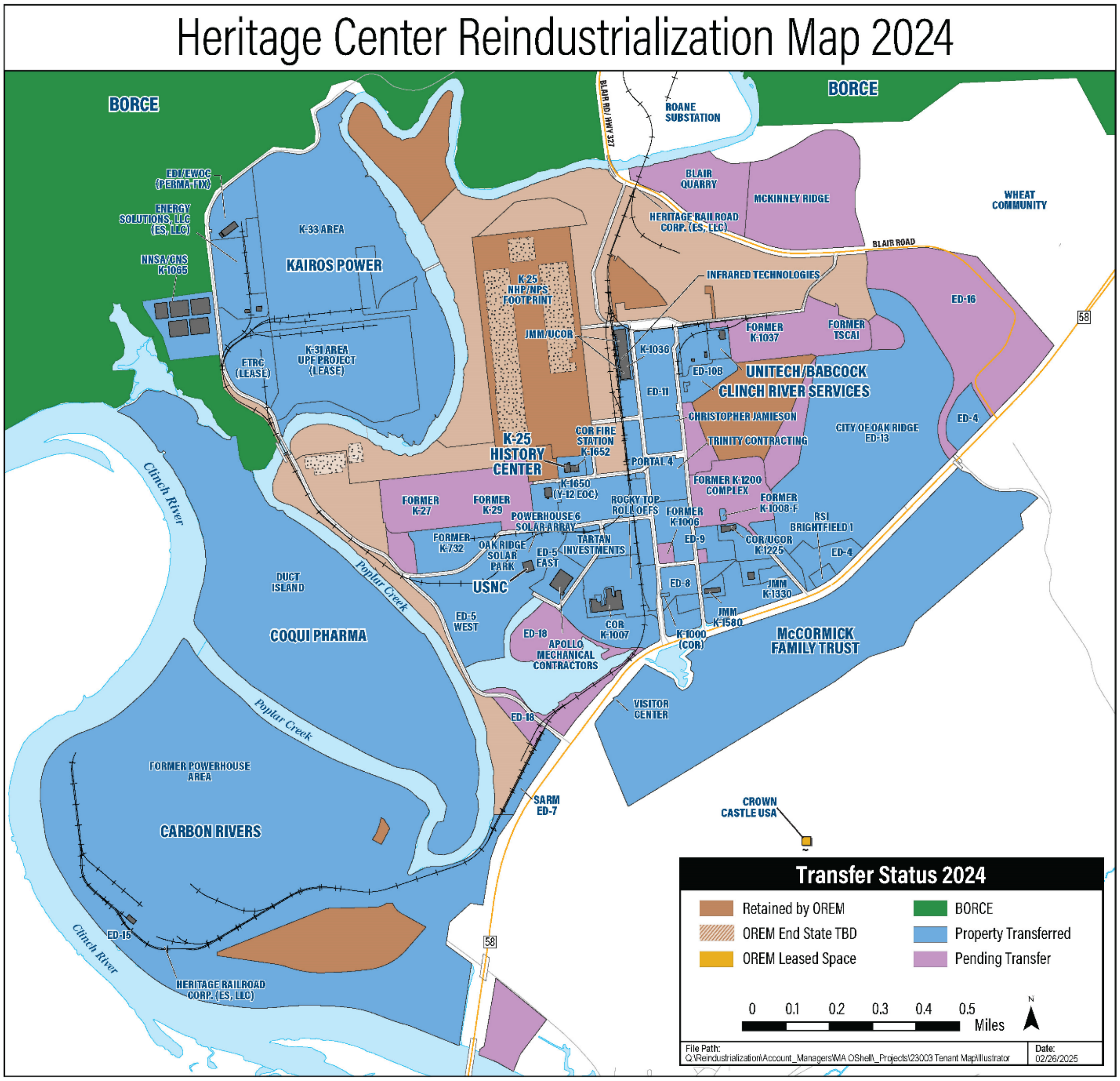


Figure 3.3. East Tennessee Technology Park in 2024, showing progress in reindustrialization

3.2. Environmental Management System

The DOE Environmental Management System (EMS) is integrated with the UCOR Integrated Safety Management System (ISMS). The EMS reflects the elements and framework contained in International Organization for Standardization (ISO) Standard 14001:2004, Environmental management systems—Requirements with guidance for use (ISO 2004). UCOR is committed to incorporating sound environmental management and protection in all business decisions, work processes and activities that are part of the DOE Environmental Management (EM) program in Oak Ridge. UCOR's environmental policy also includes a commitment to continually improve the environmental performance of their operations; to protect and sustain human, natural, and cultural resources; and to complete environmental cleanup safely with reduced risks to the public, workers, and the environment. To achieve this, UCOR's environmental policy adheres to the following principles, in part:

- **Leadership commitment**. Integrate responsible environmental practices into project operations.
- **Environmental compliance**. Comply with all environmental regulations and standards.
- **Environmental stewardship**. Minimize the effects of our operations on the environment through a combination of source reduction, recycling and reuse, sound waste management practices, and pollution prevention.
- **Partnerships/Stakeholder involvement**. Maintain partnerships through effective two-way communications with our customer and stakeholders.

3.2.1. Environmental Stewardship

UCOR's Efficiency and Stewardship initiative is designed to promote environmental resiliency and efficient operations. Through this program, measures are being incorporated throughout UCOR's processes and activities to focus on resilient operations and infrastructure, as well as education and partnerships to accelerate resiliency awareness and operations. This includes supporting clean energy technology development through reindustrialization, workforce education activities such as the UCOR Parking Lot Rodeo, and participating in community events like BizTown and STEM nights.

3.2.1.1. Workforce and Partnerships

UCOR reinforces environmental stewardship practices throughout the workforce. Three UCOR projects were recognized for efficiency and stewardship in 2024, as summarized below:

- The Environmental Management Disposal Facility (EMDF) Power Line Reuse project was recognized for removing and recycling 2 miles of 3-phase 161kV aluminum conductor line and associated ductile steel poles. The project diverted 26,000 lb of waste with cost savings of $10,620 of offset project costs.
- The Beta-1 Water Treatment System project installed the groundwater treatment system to treat water from the Beta-1 basement, and subsequently discharge the treated water, to the Upper East Fork Poplar Creek (UEFPC). As of September 2024, the treatment system has treated and discharged over 5.6 million gallons of water from the basement and will continue to operate until the deactivation of Beta-1 basement is completed. The project has saved $14,688 in fuel costs.
- The project for K-2500 AB Water Tank Reuse relocated a 7,800-gallon water tank from K-2500 AB to the Y-12 Heavy Equipment Yard for fire suppression operations to eliminate the need of hydrants in this area and allow for site expansion with improved fire safety posture saving a total of $19,925.

Together, the projects represented efficiency accomplishments in cost savings, waste diversion, and waste reduction.

In addition to building awareness and competency throughout the workforce, UCOR is leveraging partnerships and stakeholder engagement to achieve its environmental stewardship goals. These partnerships include public meetings and briefings, the Oak Ridge Site Specific Advisory Board (ORSSAB), Community Reuse Organization of East Tennessee (CROET) and other ORR contractors to develop the most efficient and collaborative approaches.

3.2.2. Environmental Compliance

UCOR maintains various layers of oversight to ensure compliance with legal and other requirements. The methods of evaluation include independent assessments by outside parties, assessments conducted by functional or project organizations, and routine field walkdowns conducted by a variety of functional and project personnel. Issues identified in assessments are handled, as required, by applicable procedures and requirements. Records are maintained for all formal assessments and audits. For additional information, see Section 3.4.

3.2.3. Environmental Aspects/Impacts

Using a graded approach appropriate for EMS includes an environmental policy that provides a unified strategy for the management, conservation, and protection of natural resources; the control and attenuation of risks; and the establishment and attainment of all environmental, safety, and health (ES&H) goals.

Continuous improvements are made to the EMS to reduce impacts from cleanup activities and associated effects on the environment (i.e., environmental aspects) and to communicate and reinforce this policy to its internal and external stakeholders.

3.2.4. Environmental Performance Objectives and Targets

UCOR conserves and protects environmental resources by incorporating environmental protection and the elements of EMS into the daily conduct of business by using appropriate waste management, treatment, storage, and disposal methods. This system fosters a spirit of cooperation with federal, state, and local regulators. UCOR has established a set of core company-level EMS objectives that remain fairly consistent from year to year. These objectives are generally applicable to all operations and activities throughout DOE's provided work scope. The core environmental objectives are based on compliance with applicable legal requirements and efficient environmental practices, and include the following:

- Compliance with all applicable environmental regulations, permits, regulatory agreements, and DOE orders.
- Reduction or elimination of the acquisition, use, storage, generation, and/or release of toxic, hazardous, and radioactive material waste; strategic acquisition of environmentally preferable products, conduct of operations, removal and safe disposition, waste minimization, and efficient practices.
- Reduction of degradation and depletion of environmental resources and maximize cost efficiency through post-consumer material recycling, energy, fuel, and water conservation efforts; and transfer of excess DOE real estate to become a valuable asset for public reuse.
- Reduction of the environmental impact on surface water and groundwater resources.
- Reduction of the environmental impact associated with project and facility activities.

The EMS objectives and targets provide performance measures that demonstrate reduced environmental impact from mission activities and increased efficiency. Each year, EMS performance and activities are reported in a DOE web-based dashboard, which collects data such as energy and water usage, efficient buildings, facility metering, waste diversion, renewable energy, efficient acquisitions, and electronic stewardship.

The Office of Management and Budget's Environmental Stewardship Scorecard is used to track and measure site-level EMS performance. During fiscal year (FY) 2024, OREM and their contractors received a "green" for EMS performance, indicating full implementation of EMS requirements.

3.2.5. Implementation and Operation

DOE and its contractors protect the safety and health of workers and the public by implementing sound work practices which include identifying, analyzing, and mitigating aspects, hazards, and impacts from daily operations. All OREM employees and subcontractors are held responsible for complying with all ES&H requirements during all work activities and are expected to correct noncompliant conditions immediately. UCOR's internal assessments also provide a measure of how well EMS attributes are integrated into work activities through the ISMS. DOE and UCOR's fundamental commitment to incorporating sound environmental management practices in all business decisions, work processes, and activities are embodied in its company-wide environmental management and protection policy.

3.2.6. Pollution Prevention/Waste Minimization/Release of Property

DOE's work control process requires that all waste-generating activities be evaluated for source reduction and that product substitution be used to produce less toxic waste, when practicable. The reuse or recycling of building debris and other generated wastes are evaluated in all cases.

The EMS program fosters waste diversion at every level of its operations, from routine office recycling of paper, cardboard, and plastics, to unique reuse and recycling at the project-field level. UCOR's environmental programs are successful because they are tightly bound to its work control process.

DOE Order 458.1, *Radiation Protection of the Public and Environment* (DOE 2011b), requires that a process be in place to ensure that radiologically contaminated materials are not released to the public or the environment, except in compliance with permit effluent requirements or other agreements with regulatory agencies.

Materials and equipment may be released to the public through an approved pollution prevention/recycling program or through property sales (procedure PROC-PR-2032, *Disposition of Personal Property* [UCOR 2020a], governs the process of releasing personal property), and real property may be transferred to the public through CROET or other NFP entities.

Materials and equipment to be recycled or reused may follow one of two paths. If process knowledge is sufficient to establish that the materials and equipment have never been in contaminated areas (for example, empty beverage cans from a specified break area or an office building), then the materials may be released for recycling or reuse. Materials and equipment that have been in radiologic areas must be examined by trained radiologic control technicians and the results documented before the materials and equipment may be released. Materials and equipment that fail to meet the free release criteria are either decontaminated to the point that they meet the free release criteria or are properly disposed of at an appropriate disposal facility. The release of property from radiologic areas is governed by procedure PROC-RP-4516, *Radioactive Contamination Control and Monitoring* (Table 3.1). In addition to recycled materials and equipment, 224,640 lb of heavy equipment, office furniture, storage containers, generators, and safety wear were released to the public through property sales.

Real property to be transferred must meet the release criteria established by DOE Order 458.1 (DOE 2011b) and the appropriate Record of Decision (ROD). DOE ensures that these requirements are met through independent verification by a third party. Currently, this verification is performed by Oak Ridge Associated Universities (ORAU) as an independent third party. ORAU reviews historical data, facility use history, verification strategies, methodologies, techniques, and equipment. When ORAU deems it appropriate, additional sampling and/or radiological surveys are undertaken. Results of the evaluation and verification are summarized in a report to DOE that is then submitted to DOE Headquarters for approval as part of the transfer package.

Table 3.1. Surface contamination values and DOE Order 458.1 authorized limits for surface activity

Radionuclide	Removable	Total (fixed + removable)
Natural Uranium, ^{235}U, ^{238}U, and associated decay products	1,000	5,000
Transuranic, ^{226}Ra,^{228}Ra,^{230}Th,^{228}Th,^{231}Pa,^{227}Ac,^{125}I,^{129}I	20	100/500
Natural Th, ^{232}Th,^{90}Sr,^{223}Ra,^{224}Ra,^{232}U,^{126}I,^{131}I,^{133}I	200	1,000
Beta-gamma emitters except ^{90}Sr and others noted above	1,000	5,000
Tritium and Special Tritium Compounds	10,000	
Hard to Detect: Pu-241, C-14, Fe-55, Ni-59, and Ni-63	10,000	50,000

Note: *Limits are shown in disintegrations per minute/100 centimeters squared (dpm/100 cm^2).*

3.2.7. Competence, Training, and Awareness

The UCOR training program and qualification process ensures that needed skills for the workforce are identified and developed and documents knowledge, experience, abilities, and competencies of the workforce for key positions requiring qualification. Completion and documentation of training, including required reading, are managed by the Local Education Administration Requirements Network (LEARN).

3.2.8. Communication

UCOR communicates externally regarding environmental aspects through the UCOR public website, found **here**, which includes a link to its environmental policy statement in *Environmental Management and Protection*, POL-UCOR-007 (UCOR 2020b), and a list of environmental aspects.

Several other documents and reports that address environmental aspects and cleanup progress are also published and made available to the public including the *Oak Ridge Annual Site Environmental Report* (DOE 2024a) and the *2023 Cleanup Progress—Annual Report to the Oak Ridge Regional Community* (DOE 2024b).

DOE and its contractors participate in a number of public meetings related to environmental activities at the site (e.g., Oak Ridge Site Specific Advisory Board (ORSSAB) meetings, which include community stakeholders, public permit reviews, and public Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) decision document reviews). Written communications from external parties are tracked using the weekly Open Action Report.

3.2.9. Benefits and Successes of Environmental Management System Implementation

An EMS program provides many benefits to an organization's success. Based upon the simplified model of the Plan-Do-Check-Act, it provides a framework by which work incorporates mitigation of environmental hazards into its work control and planning. This translates into many returns to the organization. UCOR uses EMS objectives and targets, strategic acquisition, work control processes in addition to a recycling program to meet efficiency and environmental stewardship goals and requirements. The approach is outlined in UCOR's *Pollution Prevention and Waste Minimization Program Plan for the East Tennessee Technology Park, Oak Ridge, Tennessee* (UCOR 2023a, UCOR-4127/R12). The EMS program is triennially audited by a third party to reverify conformance to ISO 14001:2004, with the most recent having been conducted in 2024. The results of the audit were zero findings, two observations, and three proficiencies. The two observations were analyzed and actions to improve external communications and evaluate waste tracking software for expanded use were implemented, and the issues were closed.

3.2.10. Management Review

A formal EMS program review/presentation with UCOR senior management was conducted in 2024. The review covered the program element identified in ISO 14001:2004 focus areas for the upcoming year, and the environmental policy. Also, the status of EMS calendar year (CY) company-level objectives and targets are periodically communicated to senior management.

3.3. Compliance Programs and Status

During 2024, ETTP operations were conducted in compliance with contractual and regulatory environmental requirements. There were no National Pollutant Discharge Elimination System (NPDES) noncompliances, nor did ETTP receive any notices of violation in 2024. Figure 3.4 shows the trend of NPDES compliance at ETTP since 2013. The following sections provide more detail on each compliance program and the environmental remediation-related activities in 2024.

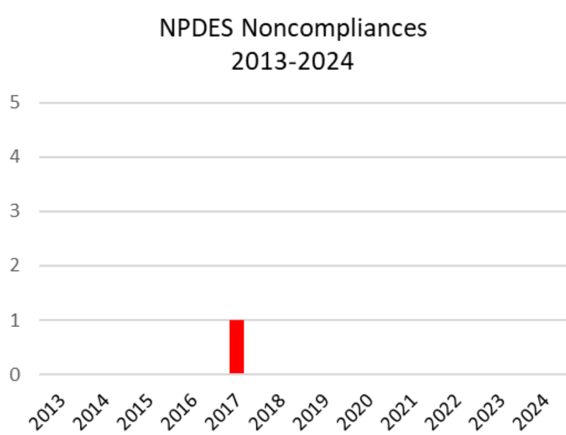


Figure 3.4. East Tennessee Technology Park NPDES permit noncompliances since 2013

In addition, ETTP is tracked on the US EPA Enforcement and Compliance History Online database (FRS ID 110002471094).

3.3.1. Environmental Permits Compliance Status

Table 3.2 contains a list of environmental permits that were in effect at ETTP in 2024. ETTP received no notices of environmental violations or penalties in 2024.

Table 3.3 presents a summary of environmental audits and oversight visits conducted at ETTP in 2024.

3.3.2. National Environmental Policy Act

The National Environmental Policy Act (NEPA) provides a means to evaluate the potential environmental impact of proposed federal activities and to examine alternatives to those actions. ETTP maintains compliance with NEPA through the use of site-level procedures and program descriptions that establish effective and responsive communications with program managers and project engineers to ensure NEPA is a key consideration in the formative stages of project planning.

For many of the current operations at ETTP conducted under CERCLA, NEPA reviews are conducted concurrently with the CERCLA planning process to ensure CERCLA projects and documentation incorporate NEPA values, including analysis of cumulative, off-site, ecological, and socioeconomic impacts. Opportunities for early public involvement are also provided early in the CERCLA process which meets the requirements of NEPA.

For non-CERCLA activities, a checklist incorporating NEPA and EMS requirements has been developed by UCOR's EC personnel as an aid for project planners to document the potential impacts on the environment during UCOR project operations. This checklist is used to collect necessary information to conduct a NEPA review.

To streamline the NEPA review and documentation process of non-CERCLA work, the DOE Oak Ridge Office of Environmental Management (OREM) utilizes the DOE agency-wide list of generic categorical exclusion (CX) determinations that cover certain proposed activities (i.e., maintenance activities, facility upgrades, personnel safety enhancements) as defined in 10 *Code of Federal Regulations* (CFR) Part 1021 – National Environmental Policy Act Implementing Procedures (DOE 1992b). A CX is a category of actions defined in 40 CFR Section 1508.4 (EPA 1978) that does not individually or cumulatively have a significant effect on the human environment and for which neither an environmental assessment nor an environmental impact statement is normally required. For activities that are not covered by a CX and have the potential for environmental impact, NEPA review reports, or environmental assessments (EA) as defined in 40 CFR 1508.9 (EPA 1978), are prepared to determine if the preparation of an environmental impact statement (EIS) or a finding of no significant impact (FONSI) is required for proposed project activities. A FONSI, as described in 40 CFR 1508.13 (EPA 1978), is prepared when there are no significant environmental impacts proposed in the integral components of a project's design. If a FONSI cannot be determined during an EA, then an EIS is prepared as described in 40 CFR 1508.11 (EPA 1978). During 2024, there were no NEPA review reports generated to document UCOR activities at ETTP.

Table 3.2. ETTP environmental permits, 2024

Regulatory driver	Permit title/description	Permit number	Issue date	Expiration date	Owner	Operator	Responsible contractor
CWA	NPDES permit for groundwater and storm water discharges	TN0002950	02-04-2022	03-31-2027	DOE	UCOR	UCOR
CWA	SOP—Waste transportation project; Blair Road and Portal 6 sewage pump and haul permit	SOP-05068	09-22-2022	02-28-2028	TTS	TTS	TTS
RCRA	Hazardous waste corrective action document (encompasses the entire ORR)	TNHW-164	09-15-2015	09-15-2025	DOE	DOE/All[a]	DOE/All[a]

[a] *DOE and ORR contractors that are co-operators of hazardous waste permits.*

Acronyms:

DOE = US Department of Energy
ID = identification (number)
NOA = Notice of Authorization
NPDES = National Pollutant Discharge Elimination System
ORR = Oak Ridge Reservation
PBR = Permit-by-Rule
RCRA = Resource Conservation and Recovery Act of 1976
SOP = state operating permit
TDEC = Tennessee Department of Environment and Conservation
TTS = Turnkey Technical Services, LLC.
UCOR = United Cleanup Oak Ridge LLC

Table 3.3. Regulatory oversight, assessments, inspections, and site visits at ETTP, 2024

Date	Reviewer	Subject	Issues
June 20	TDEC	ETTP NPDES Permit TN0002950 CEI	0
November 9	EPA	ETTP Site Tour	0

Acronyms:
CEI = Compliance Evaluation Inspection
COR = City of Oak Ridge
EPA = US Environmental Protection Agency
ETTP = East Tennessee Technology Park
RCRA = Resource Conservation and Recovery Act
TDEC = Tennessee Department of Environment and Conservation

3.3.3. National Historic Preservation Act Compliance at ETTP

In 1998, the *K-25 Site Cultural Resources Survey/Archaeological Reconnaissance* (DOE 2001, DOE/ORO-2085) was completed at ETTP to identify properties eligible for inclusion in the National Register of Historic Places (NRHP). The NRHP is a US National Park Service program to identify, evaluate, and protect historic and archeological resources in the United States. The survey concluded that there were 120 contributing structures and 37 noncontributing structures within the ETTP Main Plant Historic District, as well as 11 structures not within the historic district eligible for inclusion in the NRHP. There have been more than 800 facilities demolished at ETTP, and 110 of those facilities were eligible for inclusion on the NRHP.

To commemorate the historic contributions of the former ORGDP, a final mitigation plan was developed by DOE in 2012 in exchange for the demolition of the facility. The plan called for the designation of a commemorative area around the building's perimeter from which future surface development would largely be restricted; the demarcation of the building's footprint; the construction of the K-25 Interpretive Center that allows visitors to see across the entire footprint of the former K-25 Building (Figure 3.5); creation of an online virtual museum; and the development of a history center within ETTP Fire Station #4. The final MOA was signed in August 2012 between DOE, the State Office of Historic Preservation, the Federal Advisory Council on Historic Preservation, the City of Oak Ridge, and the East Tennessee Preservation Alliance (DOE 2012). In 2015 the MPNHP was established to incorporate the K-25 footprint; and on February 27, 2020, the K-25 History Center opened to the public (DOI 2015).

Construction of the K-25 Interpretive Center, sited just north of the K-25 History Center, began on May 11, 2023, and was completed on March 4, 2025. The facility was constructed by the U.S. Army Corps of Engineers using contractor Geiger Brothers Inc. to manage construction and UCOR to provide engineering support. The facility includes a viewing platform with 10-foot-tall wraparound glass windows and exhibits that provide quick facts and visuals related to the historic importance of the K-25 Building, as well as view scopes and a scale model of the original facility. OREM plans to hold a grand opening for the public in September 2025 that corresponds with the 80th anniversary of the end of World War II.

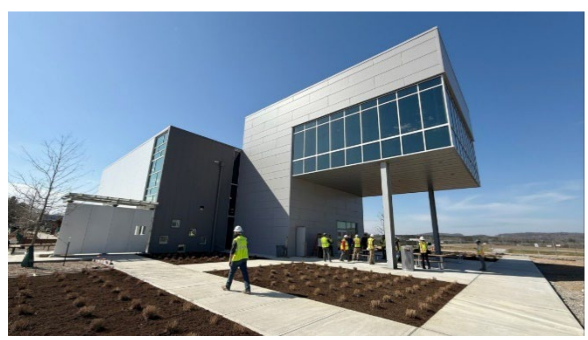


Figure 3.5. Final construction of the K-25 Interpretive Center

NHPA compliance throughout the ORR on D&D projects

In accordance with Section 106 of the National Historic Preservation Act (NHPA), UCOR works with OREM to provide a system of review for UCOR D&D projects throughout the ORR that have the potential to affect historic and archaeological resources on the ORR. The review process is guided by ORNL and Y-12 Programmatic Agreements, which follow the approach outlined in each site's Historic Preservation Plan, as well as MOAs between DOE, the State of Tennessee, the Advisory Council on Historic Preservation, and consulting parties.

In coordination with OREM and the Tennessee State Historic Preservation Officer, the UCOR NHPA coordinator evaluates proposed undertakings to determine if they have the potential to cause adverse effects on facilities identified as historical and cultural resources in the Historic Preservation Plans. DOE activities involving ORR artifacts of historical and/or cultural significance are identified before demolition and are catalogued in a database to aid in historic interpretation. In 2024, no undertakings on historically or culturally sensitive resources were proposed at ETTP.

3.3.4. Clean Air Act Compliance Status

The Clean Air Act (CAA), passed in 1970 and amended in 1977 and 1990, forms the basis for the national air pollution control effort. This legislation establishes comprehensive federal and state regulations to limit air emissions and includes five major regulatory programs: the National Ambient Air Quality Standards, State Implementation Plans, New Source Performance Standards, Prevention of Significant Deterioration permitting programs, and National Emission Standards for Hazardous Air Pollutants (NESHAP). Airborne discharges from DOE Oak Ridge facilities, both radioactive and nonradioactive, are subject to regulation by EPA and the TDEC Division of Air Pollution Control.

Full compliance with CAA regulations was demonstrated in 2024. The ETTP ambient air monitoring program as well as source operations tracking and record keeping, provided documentation fully supporting a 100-percent compliance rate.

3.3.5. Clean Water Act Compliance Status

The objective of the Clean Water Act (CWA) is to restore, maintain, and protect the integrity of the nation's waters. This act serves as the basis for comprehensive federal and state programs to protect the waters from pollutants (see Appendix C for water reference standards). One of the strategies developed to achieve the goals of the CWA was EPA's establishment of limits on specific pollutants allowed to be discharged in US waters by municipal sewage treatment plants and industrial facilities. EPA established the NPDES permitting program to regulate compliance with pollutant limitations. The program was designed to protect surface waters by limiting effluent discharges into streams, reservoirs, wetlands, and other surface waters. EPA has delegated authority for implementation and enforcement of the NPDES program to the State of Tennessee.

In 2024, ETTP discharged storm water and groundwater to the waters of the State of Tennessee under the individual NPDES permit TN0002950, which regulates storm water discharges. Sewage discharges from routine breakrooms, restrooms, and change house showers were discharged to the City of Oak Ridge Rarity Ridge Wastewater Treatment Plant collection network.

In 2024, one CWA violation occurred on February 29, resulting from the unintentional release of approximately 30 mL of hydraulic fluid on the K-1007-P1 Pond. This release resulted in a surface water sheen that was reported to the National Response Center (Incident 1392686) as required.

3.3.6. National Pollutant Discharge Elimination System Permit Noncompliances

In 2024, compliance with ETTP NPDES storm water permit TN0002950 was determined by approximately 110 laboratory analyses, field measurements, and flow estimates. The NPDES permit compliance rate for all discharge points for 2024 was 100 percent.

3.3.7. Safe Drinking Water Act Compliance Status

Since October 1, 2014, all water at the ETTP site has been supplied by the City of Oak Ridge drinking water plant, located north of Y-12 in Oak Ridge. ETTP operations are in full compliance with this act.

3.3.8. Resource Conservation and Recovery Act Compliance Status

ETTP is regulated as a large-quantity generator of hazardous waste because the facility generates more than 1,000 kg of hazardous waste per month. At the end of 2024, ETTP had two hazardous waste Resource Conservation and Recovery Act of 1976 (RCRA) Central Accumulation Areas, managed and operated by personnel of the Uranium Processing Facility, a Consolidated Nuclear Security, LLC owned project.

TNHW-164 is the hazardous waste corrective action (CA) document that covers areas of concern and solid waste management units on the ORR.

In CY 2024, ETTP prepared and submitted to the TDEC Division of Solid Waste Management the CY 2023 annual report of hazardous waste activities. This report identifies the type and amount of hazardous waste that was generated, shipped off site, or is staged for shipment. In 2024, ETTP was in full compliance with this act.

3.3.9. Comprehensive Environmental Response, Compensation, and Liability Act Compliance Status

CERCLA, also known as "Superfund," was passed in 1980 and amended in 1986 by the Superfund Amendments and Reauthorization Act. Under CERCLA, a site is investigated and remediated if it poses significant risk to health or the environment. The EPA National Priorities List is a comprehensive list of sites and facilities that have been found to pose a sufficient threat to human health and/or the environment to warrant cleanup under CERCLA. The ORR is on the National Priorities List and numerous CERCLA decision documents are approved for ETTP site cleanup actions for both facility demolitions and soil remediation. In 2024, ETTP was in full compliance with this act.

3.3.10. East Tennessee Technology Park RCRA-CERCLA Coordination

The *Federal Facility Agreement for the Oak Ridge Reservation* (DOE 1992a, FFA-PM/18-011, DOE/OR-1014) is intended to coordinate the CA processes of Resource Conservation and Recovery Act (RCRA) required under the Hazardous and Solid Waste Amendments permit with CERCLA response actions.

3.3.11. Toxic Substances Control Act Compliance Status—Polychlorinated Biphenyls

On April 3, 1990, DOE notified EPA Headquarters (as required by 40 CFR Section 761.205, *Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions* [EPA 1979]) that ETTP is a generator with on-site storage, a transporter, and an approved disposer of PCB wastes.

At this time, no PCB-contaminated electrical equipment is in service at ETTP.

Because of the age of many ETTP facilities and the varied uses for PCBs in gaskets, grease, building materials, and equipment, DOE self-disclosed unauthorized use of PCBs to EPA in the late 1980s. As a result, the DOE Oak Ridge Office and EPA Region 4 developed a major compliance agreement known as the *Oak Ridge Reservation Polychlorinated Biphenyl Federal Facilities Compliance Agreement* (DOE 2018, ORR-PCB-FFCA), which became effective December 16, 1996, and was last revised on October 8, 2018, to Revision 6. The facilities that were included on the ORR-PCB-FFCA have been demolished and disposed.

ORR-PCB-FFCA specifically addresses the unauthorized use of PCBs in ventilation ducts and gaskets, lubricants, hydraulic systems, heat transfer systems, and other unauthorized uses; storage for disposal; disposal; cleanup and/or decontamination of PCBs and PCB items, including PCBs mixed with radioactive materials; and ORR records and reporting requirements. A major focus of the agreement is the disposal of PCB waste. As a result of that agreement, DOE and UCOR continue to notify EPA when additional unauthorized uses of PCBs, such as in paint, adhesives, electrical wiring, or floor tiles, are identified at ETTP. This notification process is routinely incorporated into the CERCLA documentation for demolition and remedial actions (RAs).

The ETTP site prepares a PCB Annual Document Log (PCBADL) per 40 CFR Section 761.180(a) (EPA 1979). The written PCBADL is prepared by July 1 of each year and covers the previous calendar year. The PCBADL documents such things as container inventory, shipments, and PCB spills at the facility. Authorized representatives of EPA may inspect the PCBADL at the facility where they are maintained during normal business hours. The PCBADL must be maintained on-site for a minimum of three years. A PCB Annual Report Form was submitted to EPA using EPA Form 6200-025 online before the due date of July 15, 2024. In 2024, ETTP was in full compliance with this act.

3.3.12. Emergency Planning and Community Right-to-Know Act Compliance Status

The Emergency Planning and Community Right-to-Know Act (EPCRA), which is also identified as Title III of the Superfund Amendments and Reauthorization Act, requires that facilities report inventory that exceed threshold planning quantities and releases of hazardous and toxic chemicals. The reports are submitted electronically and are available online for the local emergency planning committee, the state emergency response commission, and the local fire department. ETTP complied with these requirements in 2024 through the submittal of required reports as applicable under EPCRA Sections 302, 311, 312, and 313. In 2024, ETTP had no reportable releases of hazardous substances or extremely hazardous substances as defined by EPCRA.

3.3.12.1. Chemical Inventories (EPCRA Section 312)

Inventories, locations, and associated hazards of hazardous and extremely hazardous chemicals were submitted in an annual report to state and local emergency responders, as required by EPCRA Section 312. Of the ORR chemicals identified for 2024, six chemicals were located at ETTP. These chemicals were diesel fuel, unleaded gasoline, Chemical Specialties, Inc. Ultrapoles, various lubricating oils, sulfuric acid, and lead (including large, lead-acid batteries). As operations at ETTP are subsiding, there has been a steady decrease in the number of chemicals required to be reported under Section 312.

3.3.12.2. Toxic Chemical Release Reporting (EPCRA Section 313)

EPCRA Section 313 requires facilities to complete and submit a Toxics Release Inventory (TRI) form (Form R) annually. Form R must be submitted for each TRI chemical that is manufactured, processed, or otherwise used in quantities above the applicable threshold quantity. The reports address releases of certain toxic chemicals to air, water, land, and recycling, and waste management activities.

Threshold determinations and reports for each of the ORR facilities are made separately. Operations involving TRI chemicals were compared with regulatory thresholds to determine which chemicals exceeded the reporting thresholds based on amounts manufactured, processed, or otherwise used at each facility. After threshold determinations were made, releases and off-site transfers were calculated for each chemical that exceeded the threshold quantity. In 2024, there were no chemicals that met the reporting requirements.

3.4. Quality Assurance Program

Mission Assurance Program

Quality assurance (QA) program implementation and procedural and subcontract compliance are verified through the UCOR mission assurance program. The program identifies the processes for planning, conducting, and coordinating assessment and oversight of UCOR activities, including both self-performed and subcontracted activities, resulting in an integrated assessment and oversight process.

The program is composed of three key elements, including:

- External assessments conducted by organizations external to UCOR
- Independent assessments conducted by teams composed of UCOR personnel who are not directly involved with the project/function being assessed
- Management assessments, self-assessments, and surveillance conducted by the organization or on behalf of the organization manager

Management and self-assessments are performed by the organization/function with primary responsibility for the work, process, or system being assessed. Management assessments are periodic introspective self-analyses, conducted by or on behalf of management, to evaluate management systems, processes, and programs ensuring the organization's work is properly focused on achieving desired results. Self-assessments are lower-level assessments that can be implemented at any time to document review of emerging issues, facility walkdowns, observation checklists, or similar reviews that do not require extensive planning, approval, or resources. Surveillance (e.g., radiological protection, quality, and safety and health) is performed by functional organizations to evaluate functional program implementation at projects or operational areas.

Issues identified from internal and external assessments are documented, analyses are performed, and CAs are developed and tracked to closure. To perform analysis, data is collected and compiled on a periodic basis which allows for identification of adverse trends and opportunities for improvement for senior management action. UCOR is in the process of enhancing the CA closure process by developing a series of dashboards based upon the identified analysis needs.

3.5. Air Quality Program

The State of Tennessee has been delegated authority by EPA to convey the clean air requirements that are applicable to ETTP operations. New projects are governed by construction and operating permit regulatory requirements. The owner or operator of air pollutant emitting sources is responsible for ensuring full compliance with any issued permit or other generally applicable CAA requirement. During 2024, ETTP DOE EM operations were under UCOR responsibility for regulatory compliance.

3.5.1. Construction and Operating Permits

UCOR ETTP operations are subject to CAA regulations and permitting under TDEC Air Pollution Control rules that are specific to stationary fossil-fueled reciprocating internal combustion engines for emergency use. TDEC originally issued an operating permit (069346P) covering six stationary emergency reciprocating internal combustion engine (e-RICE) units on March 3, 2015. An amended permit was issued on November 22, 2016, that removed one permanently shut-down unit. The last operating permit was amended on November 22, 2016, and covered four stationary e-RICE generators and one stationary e-RICE firewater booster pump. On July 19, 2018, TDEC provided a Notice of Authorization to UCOR for coverage under Permit-by-Rule for all of the ETTP stationary e-RICEs (TDEC 2017b). During 2020 all generators and the firewater booster pump were either removed from the ETTP site or transferred to new owners;

UCOR then surrendered its Permit-by-Rule authorization. No stationary e-RICE units were operated by UCOR at ETTP in 2024.

All other ETTP operations that emit low levels of air pollutants have been classified as insignificant under TDEC rules. Any planned stationary sources that may emit air pollutants are evaluated and compared against applicable pollutant emission limits to document this classification and pursue permitting if required under TDEC regulations.

3.5.1.1. Generally Applicable Permit Requirements

ETTP is subject to a number of generally applicable requirements that involve management and control. Asbestos, ozone-depleting substances (ODSs), and fugitive particulate emissions are specific examples.

Control of asbestos

ETTP's asbestos management program ensures all activities such as demolitions and all other actions involving asbestos-containing materials (ACM) are fully compliant with 40 CFR Part 61, Subpart M, *National Emission Standards for Hazardous Air Pollutants*, "National Emission Standard for Asbestos" (EPA 1984, EPA 1990). This includes using approved engineering controls and work practices, inspections, and monitoring for proper removal and waste disposal of ACM. Most demolition and ACM abatement activities at ETTP are governed under CERCLA. Under this act, notifications of asbestos demolition or renovations, as specified in 40 CFR Section 61.145(b), are incorporated into CERCLA document regulatory notifications.

Non-CERCLA planned demolition or renovation activities were individually reviewed for applicability of the TDEC notification requirements of the rule. During 2024, four Notification of Demolition and/or Asbestos Renovation was submitted to TDEC for non-CERCLA ETTP activities. There were no regulated ACM demolitions during 2024.

The rule also requires an annual notification for all nonscheduled, minor asbestos renovations if the accumulated total amount of regulated or potentially regulated asbestos exceeds stipulated thresholds. For 2024, the total ETTP projected nonscheduled amounts were below thresholds that would require the submittal of an annual notification to TDEC. No releases of reportable quantities of ACM occurred at ETTP during 2024.

Stratospheric ozone protection

The management of ODSs at ETTP is subject to regulations in 40 CFR Part 82, Subpart F, "Recycling and Emissions Reduction" (EPA 1993); these regulations require preparation of documentation to establish that actions necessary to reduce emissions of Class I and Class II refrigerants to the lowest achievable level have been observed during maintenance activities at ETTP. The applicable actions include but may not be limited to the service, maintenance, repair, and disposal of appliances containing Class I and Class II refrigerants, such as motor vehicle air conditioners. In addition, the regulations apply to refrigerant reclamation activities, appliance owners, manufacturers of appliances, and recycling and recovery equipment. During 2024, the ODS inventory was zero.

3.5.1.2. Fugitive Particulate Emissions

ETTP has been the location of building demolition activities, soil remediation activities, and waste debris transportation with the potential for the release of fugitive dust. All planned and ongoing activities include the use of dust control measures to minimize the release of visible fugitive dust beyond the project perimeter. This includes the use of specialized demolition equipment and water misters. Gravel roads in and around ETTP that are under DOE control are wetted with water as needed to minimize airborne dusts caused by vehicle traffic.

3.5.1.3. Radionuclide National Emission Standards for Hazardous Air Pollutants

Radionuclide airborne emissions from ETTP are regulated under 40 CFR Part 61, *National Emission Standards for Hazardous Air Pollutants* (EPA 1989; Rad-NESHAP). Characterization of the impact on public health of radionuclides released to the atmosphere from ETTP operations was accomplished by conservatively estimating the dose to the maximally exposed member of the public. The dose calculations were performed using the Clean Air Assessment Package—1988 (CAP-88) computer codes, which were developed under EPA sponsorship for use in demonstrating compliance with the 10 mrem/year effective dose Rad-NESHAP emission standard for the entire ORR. Source emissions used to calculate the dose are determined using EPA-approved methods that can range from continuous sampling systems to conservative estimations based on process and waste characteristics. Continuous sampling systems are required for radionuclide-emitting sources that have a potential dose impact of greater than or equal to 0.1 mrem per year to any member of the public. The only ETTP Rad-NESHAP source that operated during 2024—the K-1407 Chromium Water Treatment System (CWTS) Volatile Organic Compound (VOC) Air Stripper—is considered minor based on emissions evaluations using EPA-approved calculation methods. A minor Rad-NESHAP source is defined as having a potential dose impact on the public that is less than 0.1 mrem/year. Compliance is demonstrated using data collected by the ETTP ambient air monitoring program.

Quarterly radiochemical analyses are performed on composited samples collected at all ETTP ambient air sampling stations. The selected isotopes of interest were ^{234}uranium (^{234}U), ^{235}U, and ^{238}U, with the ^{99}technetium (^{99}Tc) inorganic analysis results included as a dose contributor. The concentration for each of the nuclides at each monitoring station are presented in Table 3.4 for the 2024 reporting period. Dose calculations using the concentration results are included in Chapter 7, Table 7.5.

Table 3.4. Radionuclides in ambient air at ETTP, January 2024 through December 2024

Station	Concentration (µCi/mL)[a]			
	^{99}Tc	^{234}U	^{235}U	^{238}U
K11[b]	ND[c]	6.20E-19	5.70E-19	ND
K12[b]	ND	ND	2.53E-19	ND

[a] *µCi/mL = microcuries/milliliter*

[b] *K11 and K12 represent an on-site business exposure equivalent to half of a yearly exposure at this location.*

[c] *ND = not detectable*

3.5.1.4. Quality Assurance

QA activities for the Rad-NESHAP program are documented in the *Quality Assurance Program Plan for Compliance with Radionuclide National Emission Standards for Hazardous Air Pollutants, East Tennessee Technology Park, Oak Ridge Tennessee* (UCOR 2018, UCOR-4257/R2). The plan satisfies the QA requirements in 40 CFR Part 61, Method 114 (EPA 1989), for ensuring that the radionuclide air emission measurements from ETTP are representative of known levels of precision and accuracy and that administrative controls are in place to ensure prompt response when emission measurements indicate an increase over normal radionuclide emissions. The requirements are also referenced in TDEC regulation 1200-3-11-.08, *Emission Standards for Emissions of Radionuclides Other than Radon from Department of Energy Facilities*, (TDEC 2018). The plan ensures the quality of ETTP radionuclide emission measurement data from continuous samplers and minor radionuclide release points. Only EPA preapproved methods are referenced through the *Compliance Plan National Emission Standards for Hazardous Air Pollutants for Airborne Radionuclides on the Oak Ridge Reservation, Oak Ridge, Tennessee* (DOE/ORO/2196, DOE 2020a).

3.5.1.5. Greenhouse Gas Emissions

The EPA rule for mandatory reporting of GHGs (also referred to as the “Greenhouse Gas Reporting Program”) was enacted

October 30, 2009, under 40 CFR Part 98 (EPA 2009). According to the rule in general, the stationary source emissions threshold for reporting is 25,000 MT of CO_2 equivalent (CO_2e) or more of GHGs per year. The rule defines GHGs as:

- Carbon dioxide (CO_2)
- Methane (CH_4)
- Nitrous oxide (N_2O)
- Hydrofluorocarbons
- Perfluorocarbons
- Sulfur hexafluoride (SF_6)

A review was performed of ETTP processes and equipment categorically identified under 40 CFR Section 98.2 (EPA 2009) whose emissions must be included as part of a facility's annual GHG report, starting with the CY 2010 reporting period. Based on total GHG emissions from all ETTP stationary sources during 2024, ETTP did not exceed the annual threshold limit and therefore was not subject to mandatory annual reporting under the GHG rule during this performance period. The total GHG emissions for any continuous 12-month period beginning with CY 2008 have not exceeded 12,390 MT CO_2e of GHGs. The most significant decrease in stationary source emissions was due to the permanent shutdown of the TSCA Incinerator in 2009. The remaining sources are predominantly comfort heating systems, hot water systems, and power generators. For CY 2024, GHG emissions totaled 249 MT CO_2e, which is 0.99 percent of the 25,000 MT CO_2e per year threshold for reporting. The increase starting in 2020 resulted from the leasing of several large bays in Building K-1036 that are heated with natural gas.

The information reported here includes GHG emissions from the industrial landfills at Y-12 that are managed and operated by UCOR. The landfills are not part of the contiguous ETTP site; however, DOE requested that UCOR, as the operator, include landfill GHG emissions with ETTP reporting in the Consolidated Energy Data Report. To be consistent with reporting this information, the landfill emissions are also included with ETTP ASER data.

Total GHG emissions remain well below the levels first reported in the 2008 baseline year as demolition and remediation efforts continue at ETTP. Many of the early reductions were due to lower on-site combustion of fuels (stationary and mobile sources), lower consumption of electricity, and a smaller workforce.

The American Innovation and Manufacturing (AIM) Act of 2020 is a bill that aims to combat climate change by significantly reducing hydrofluorocarbons (HFCs), chemicals commonly used in refrigerants. The AIM Act directs the EPA to implement an 85 percent phasedown of the production and consumption of HFCs by 2035. Operations at ETTP are winding down to the point where insignificant HFC emissions are taking place.

3.5.1.6. Source-Specific Criteria Pollutants

ETTP operations included one functioning minor stationary source, the CWTS, with a potential to emit any form of criteria air pollutant. This unit is equipped with an air stripper to remove VOCs from the influent stream. Potential total VOC emissions from the CWTS air stripper were calculated to be 0.006 ton/year in 2024, as compared to an emission limit of 5 ton/year.

At ETTP, there are no processes or facilities containing inventories of chemicals in quantities exceeding thresholds specified in rules pursuant to CAA.

A variety of minor pollutant-emitting sources released airborne pollutants from ETTP operations, such as vents, and fugitive and diffuse activities. The emissions from all stacks and vents are evaluated following approved methods to establish their low emissions potential. This is done to verify and document their minor source permit exempt status under all applicable state and federal regulations.

3.5.1.7. Hazardous Air Pollutants (Nonradionuclide)

Unplanned releases of hazardous air pollutants are regulated through the risk management planning regulations under 40 CFR Part 68 (EPA 1994). To ensure compliance, periodic inventory reviews of ETTP operations were performed that used monthly data obtained through the EPCRA Section 311 reporting program. This program applies to any facility at which a hazardous chemical is present in an amount exceeding a specified threshold. A comparison of the EPCRA 311 monthly Hazardous Materials Inventory System chemical inventories at ETTP, with the risk management plan threshold quantities listed in 40 CFR Section 68.130 (EPA 1994), was conducted. This is an ongoing action that documents the potential applicability for maintaining and distributing a risk management plan and ensuring threshold quantities are not exceeded.

ETTP personnel have determined that there are no processes or facilities containing inventories of chemicals in quantities exceeding thresholds specified in rules pursuant to CAA, Title III, Section 112(r), "Prevention of Accidental Releases." Therefore, activities at ETTP are not subject to the rule. Procedures are in place and implemented to continually review new processes, process changes, or activities with the rule thresholds.

3.5.2. Ambient Air

Compliance of fugitive and diffuse sources is demonstrated based on environmental measurements. The ETTP Ambient Air Quality Monitoring Program is designed to provide environmental measurements to accomplish the following:

- Tracking the long-term trends of airborne concentration levels of selected air contaminant species
- Measuring the highest concentrations of the selected air contaminant species that occur in the vicinity of ETTP operations
- Evaluating the potential impact on air contaminant emissions from ETTP operations on ambient air quality

The three sampling programs in the ETTP area are designated as the Environmental Compliance (EC) program, TDEC program, and the ORR perimeter air monitoring program. Figure 3.6 shows an example of a typical EC program air monitoring station. Figure 3.7 shows the locations of all ambient air sampling stations in and around ETTP that were active during the 2024 reporting period.

Figure 3.6. East Tennessee Technology Park ambient air monitoring station (UCOR on the left, TDEC on the right)

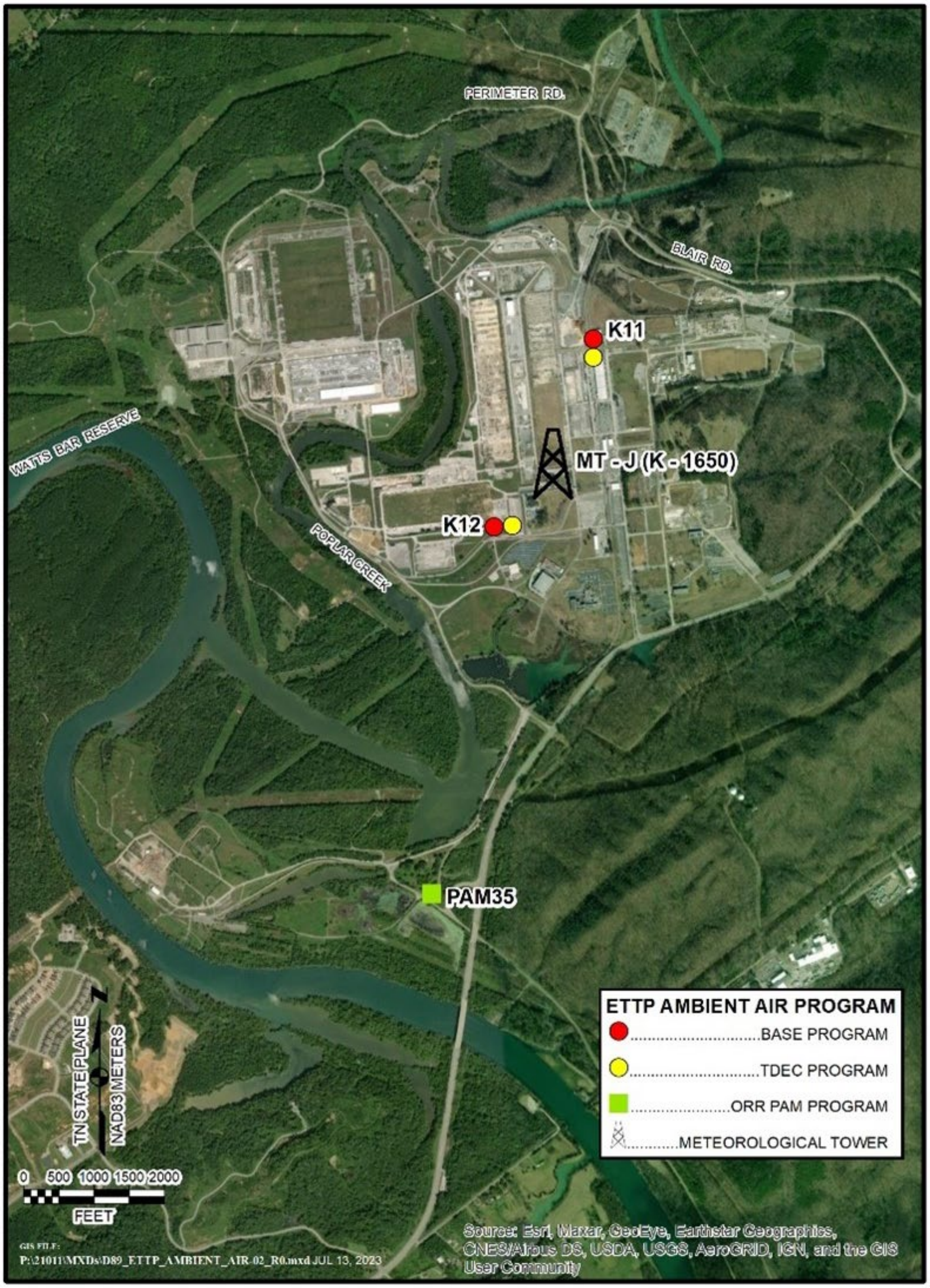
The EC program consisted of two sampling locations throughout 2024. All projects are operating similar high-volume sampling systems. The EC, TDEC, and perimeter air monitoring samplers operate continuously with exposed filters collected weekly. The radiological monitoring results for samples collected at the one ETTP area perimeter air monitoring station are the responsibility of UT-Battelle, LLC. TDEC is responsible for the data collected from their samplers. UT-Battelle, LLC and TDEC results are not included with the EC data presented in this section. However, results from the other programs are requested periodically for comparison.

The analytical parameters were chosen with regard to existing and proposed regulations and with respect to activities at ETTP. The principal reason for EC program stations is to demonstrate that radiological emissions from the demolition of ETTP gaseous diffusion buildings, supporting structures, and associated remediation activities are in compliance with the annual dose limit to the most exposed members of the public that are either on-site (on the ORR) or off-site. K11 and K12 were key sampling locations regarding the potential dose impact on the most exposed member of the public at an on-site business location during slab removals, demolition of small structures, excavation and removal of contaminated soils, and other activities. Changes of emissions from ETTP would warrant periodic reevaluation of the parameters being sampled.

Ongoing ETTP reindustrialization efforts will also introduce new locations for members of the public that may require adding or relocating monitoring site locations. To ensure understanding of the potential impacts on the public and to establish any required emissions monitoring and controls, a survey of all on-site tenants is reviewed every six months through a request for the most recent ETTP reindustrialization map.

All EC program stations collected continuous samples for radiological analyses during 2024. These analyses of samples from the EC stations test for the isotopes ^{234}U, ^{235}U, ^{238}U, and ^{99}Tc.

Stations K11 and K12 are located to provide a conservative measurement of the impact to on-site members of the public.



Acronyms:

ETTP = East Tennessee Technology Park
MT = meteorological tower
ORR = Oak Ridge Reservation
PAM = perimeter air monitoring
TDEC = Tennessee Department of Environment and Conservation

Figure 3.7. East Tennessee Technology Park ambient air monitoring station locations

3.6. Water Quality Program

Water quality is monitored via multiple programs at ETTP. Storm water monitoring is conducted through the NPDES Program (Section 3.6.1) and the Storm Water Pollution Prevention Program (SWPPP; Section 3.6.2). Surface water monitoring is conducted through the Environmental Monitoring Program (EMP) (Section 3.6.3). Groundwater monitoring is conducted through the Water Resources Protection Program (Section 3.6.4).

3.6.1. National Pollutant Discharge Elimination System Permit Monitoring

NPDES monitoring is conducted to demonstrate compliance with the ETTP NPDES Permit. The current NPDES permit was issued on February 4, 2022, became effective on April 1, 2022, and will expire on March 31, 2027. A minor modification to this permit was issued on October 31, 2024, that removed Outfall 690 from the permit.
Outfall 690's annual samples were collected prior to the permit modification that removed it from the permit. Under the ETTP NPDES Permit in effect for the majority of 2024, 20 representative outfalls are monitored annually (Figure 3.8). All 20 outfalls are sampled annually for total suspended solids (TSS), pH, and flow. Additionally, select outfalls are sampled annually for zinc (Outfall 142), oil and grease (Outfall 190), PCBs (Outfalls 280, 690), and benzidine (Outfall 430); and semiannually for total chromium and hexavalent chromium (Outfall 170). There were no permit noncompliances in 2024.

3.6.2. Storm Water Pollution Prevention Program

In addition to the NPDES permit required monitoring, storm water is also monitored for a variety of substances, including radionuclides, metals, and organic compounds (UCOR-4028, *East Tennessee Technology Park Storm Water Pollution Prevention Program Sampling and Analysis Plan, Oak Ridge, Tennessee*, UCOR 2024b). Routine SWPPP monitoring is conducted at locations that vary from year to year depending on activities within the drainage basins and historical monitoring results. SWPPP monitoring includes stream impairment monitoring, radiological monitoring, D&D and RA monitoring, CERCLA Phased Construction Completion Report (PCCR) monitoring, legacy contamination monitoring, investigative monitoring, and NPDES permit renewal sampling.

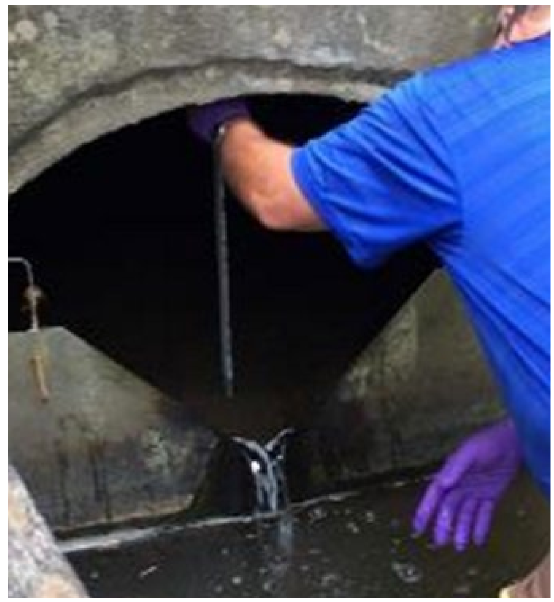


Figure 3.8. Storm water outfall monitoring

3.6.2.1. Radiologic Monitoring of Storm Water

Radiological monitoring is conducted to determine compliance with applicable dose standards. Composite samples from four outfalls were collected following a rain event and analyzed for gross alpha activity, gross beta activity, and specific radionuclides. The estimated discharge of radionuclides from ETTP via the storm water drainage system was calculated based on the radiological monitoring results, daily rainfall data for CY 2024, and flow rates. Table 3.5 presents the total calculated discharge of radionuclides from storm water discharged to off-site waters from ETTP in CY 2024.

Table 3.5. Radionuclides released to off-site waters from the ETTP storm water system in 2024

Isotope	^{234}U	^{235}U	^{238}U	^{99}Tc
Activity level (curies)	0.00443	0.00035	0.00200	0.03320

3.6.2.2. Demolition and Remedial Action Monitoring of Storm Water

Demolition and RA monitoring is conducted to evaluate the effectiveness of demolition and RAs and to ensure that storm water controls are preventing sediment and contaminants from discharging into receiving waters. Grab samples from select outfalls are collected prior to the start of demolition/RAs, following each 1-in. rain event during demolition/RAs, and after completion of demolition/RA activities.

3.6.2.3. K-25 Building ^{99}Tc Contaminated Soil Remedial Action Monitoring

Demolition of the K-25 Building was completed in 2014. The last section of the east wing that was demolished was contaminated with the radioactive isotope ^{99}Tc. Rain and dust control water that contacted the ^{99}Tc-contaminated piping and other building materials is believed to have caused the migration of ^{99}Tc into soils beneath the east wing debris pile during demolition. Remediation of the ^{99}Tc-contaminated soils within the K-25 footprint was completed in 2020. Storm water monitoring in Outfalls 190 and 490, located downgradient of the former K-25 Building, continued in 2024.

Outfall 190 is sampled quarterly. Except for the sample collected in July 2021, ^{99}Tc has not been detected in storm water samples from Outfall 190 since July 2013. Based on this data, it does not appear that ^{99}Tc-contaminated groundwater from the K-25 Building D&D project is discharging to Mitchell Branch via Outfall 190.

Outfall 490 is sampled semiannually. ^{99}Tc was detected in the storm water samples from Outfall 490 in February 2024 and July 2024 but was well below the reference standard of 390,000 picocuries/liter (pCi/L). Outfall 490 discharges into the K-1007-P1 Pond. Discharges from the K-1007-P1 Pond to Poplar Creek are monitored routinely as an exit pathway location per the ETTP EMP. The ^{99}Tc data is evaluated to determine the contribution of ^{99}Tc from the Outfall 490 drainage area to the total ^{99}Tc discharge from the K-1007-P1 pond, as further discussed in Section 3.6.3, "Surface Water Monitoring."

3.6.2.4. EU-21 Remedial Action Monitoring

Exposure Unit (EU)-21 is located between the east and west wings of the former K-25 Building and includes the slab associated with the former K-1024 Maintenance Shop. The K-1024 Maintenance Shop was used for the repair and calibration of instruments and equipment used in the K-25 uranium enrichment process. The maintenance shop used solvents, including trichloroethene (TCE), for cleaning instruments and equipment. As an accepted practice at the time, solvents were frequently discharged into the floor drains, then entered the storm drain network. The main source of TCE in the EU-21 area is presumed to be from Catch Basin 7097, located on the south side of the former K-1024 building. Although TCE is the primary contaminant of concern for the EU-21 soil RA, mercury droplets were discovered during removal of buried pipe. K-1024 was also used for cleaning mercury from line recorder chemical traps between 1946 and 1947, and the equipment shop had a problem with spilled mercury and mercury vapors.

Prior to the soil RA, the storm drain system within the proposed excavation and clean layback footprints was isolated from the active system in order to prevent sediment and contaminants from discharging to Poplar Creek via Outfalls 230 and 240. Outfall 210 receives water from the storm drain system located on the east side of the K-25 east wing (well outside of the excavation and layback footprints). All of the catch basins located on the west side of the K-25 west wing were previously plugged under a separate program.

The EU-21 RA was completed in 2024. Baseline samples were not collected prior to the start of the soil RA due to dry conditions. Monitoring of Outfalls 210, 230, and 240 was conducted during 1-in. rain events and final samples were collected after completion of the RA. All samples were analyzed for VOCs, metals, mercury, and TSS. TCE has not been detected in any of the samples collected from Outfalls 210, 230, or 240 in 2024. Several other parameters have been detected, but only the lead results exceeded their reference standard at these outfall locations.

3.6.2.5. EU-39 Remedial Action Monitoring

Outfall 170 is located downgradient of the EU-39 slab removal RA area. The EU-39 area includes the concrete slabs for the former K-1420 Decontamination and Uranium Recovery Facility, K-1421 Incinerator, and K-1422 Storage Building. The former K-1420 Decontamination and Uranium Recovery Facility provided radiological decontamination, uranium recovery, and metal plating capabilities and served as a storage area for drums of uranium-cascade motor lubricant oil containing PCBs and uranium. The K-1421 Incinerator was used to burn waste oil sludge and low-level contaminated combustibles such as gloves, coveralls, wood, paper, and plastic. The K-1422 Storage Building was used for storage of fissile materials and, reportedly, for uranium hexafluoride cylinder charging or emptying.

Prior to the slab removal RA, lined berms were installed around the K-1420, K-1421, and K-1422 slab to contain sediment, particulates, and debris within the excavation area and to divert sheet flow during rain events. The catch basin leading to Outfall 158, located northeast of the K-1420 pad, was plugged prior to slab demolition. The storm water pipes leading to Outfall 160, north of K-1420 were cut and capped north of the catch basin. There is no discharge pipe in the project area to Outfall 168. Only sheet flow would potentially impact these three outfalls during the slab removal RA. Therefore, storm water samples are obtained from Outfall 170, which is located downstream from the project area.

Monitoring of Outfall 170 was conducted during 1-in. rain events. Final samples were collected after the completion of the RA and analyzed for uranium isotopes, radium-thorium decay series, ^{99}Tc, alpha activity, beta activity, VOCs, PCBs, metals, and TSS. The EU-39 RA was completed in 2024. The alpha activity result of 24.6 pCi/L from the January 2024 storm event was the only result to exceed a reference standard in 2024.

3.6.2.6. EU-35 Remedial Action Monitoring

Outfall 180 is located downgradient of the EU-35 soil RA area. The EU-35 Soil RA 3 area is located in the area of the former K-1407-B Pond. The K-1407-B Pond was primarily used as a settling pond for metal hydroxide sludge and other waste streams that were precipitated/neutralized in the adjacent K-1407-A Neutralization Pit Facility but also received waste from many other nearby facilities. The pond was clean closed under the RCRA in 1994 and covered with 4–10 ft of fill above the contaminated soil. An estimated 2–3 ft of contaminated soil is located between the fill layer and the water table in these areas.

Prior to the soil removal RA, lined berms were installed around open excavations, contaminated soil stockpiles, and any debris to minimize water run-on and to contain contaminated water, debris, sediment, and particulates within the excavation areas. The storm water pipes in the northwestern corner of K-1407 B were temporarily plugged prior to excavation. Storm water samples were obtained from Outfall 180, which is located downstream from the project area.

Monitoring of Outfall 180 was conducted during 1-in. rain events and final samples were collected after completion of the RA and analyzed for uranium and thorium isotopes, ^{99}Tc, alpha activity, beta activity, VOCs, PCBs, metals, mercury, and TSS. The EU-35 RA was completed in 2024. Samples for a 1 in. storm event and final were collected in 2024. The alpha activity result of 15.7 pCi/L, from the July 2024 final sample, was the only result to exceed a reference standard in 2024.

3.6.2.7. Legacy Mercury Contamination Monitoring of Storm Water

Legacy mercury contamination monitoring is conducted to evaluate mercury concentrations over time and to determine if outfalls are contributing to mercury concentrations to site waterways.

Outfalls 180 and 190 discharge storm water from large areas on the north side of ETTP into Mitchell Branch. There were numerous historical mercury operations within Outfalls 180 and 190 drainage areas and the Mitchell Branch sub-watershed. Due to contaminated sediment within storm water networks and potential infiltration into the piping, these are potential contributors to the continuing legacy mercury discharges to Mitchell Branch.

The mercury concentrations detected from grab samples in Outfalls 180 and 190 during 2024 are presented in Table 3.6. Three of the eight mercury grab sample results exceeded the reference standard of 51 nanograms/liter (ng/L). The July 2024 mercury result from Outfall 190 was elevated compared to recent historical data from this location. The surface water locations within Mitchell Branch were sampled approximately one week after the anomalous Outfall 190 mercury result was first reported by the lab. Surface water locations Mitchell Branch kilometer (MIK) 0.45 and the K-1700 Weir are both located downstream from Outfall 190's discharge.

All in stream Mitchell Branch surface water results did not exceed or approach the reference standard for mercury. The mercury concentrations over time in Outfalls 180 and 190 and the K-1700 Weir on Mitchell Branch are presented in Figure 3.9.

Table 3.6. Mercury results for Outfalls 180 and 190 in 2024

Sampling location	Reference standard (ng/L)[a]	2/5/2024 (ng/L)	4/22/2024 (ng/L)	7/16/2024 (ng/L)	10/24/2024 (ng/L)
Outfall 180	51	17.3	**51.8**	**63.7**	47.7
Outfall 190	51	11.5	6.41	**403**	9.36

[a] *ng/L = nanograms/liter*

Note: *Results in bold exceed the reference standard for mercury, which corresponds to TDEC Rule 0400-40-03-.03(4)(j), Organisms Only Criteria.*

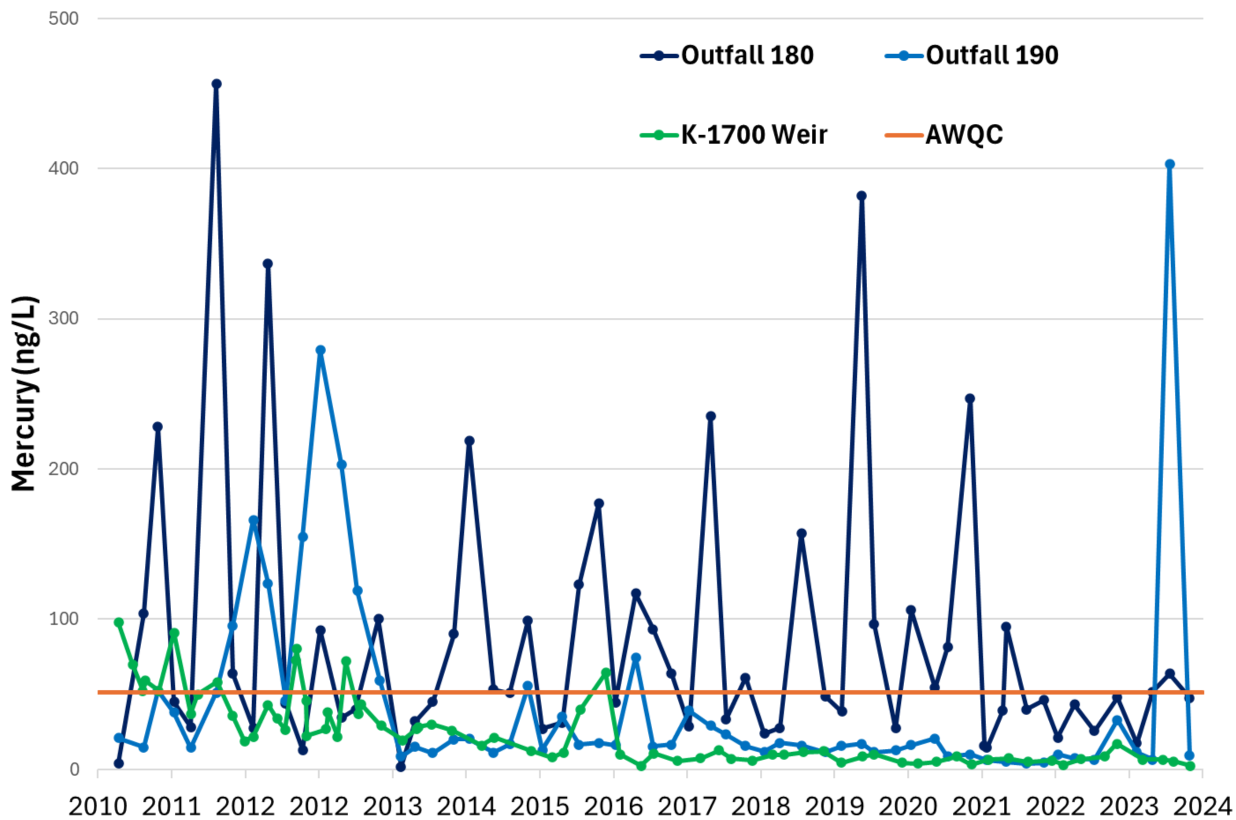


Figure 3.9. Mercury concentrations at Outfalls 180 and 190, and the K-1700 Weir

3.6.2.8. Flow Weighted Mercury Sampling

Monitoring of pollutant loading (flux monitoring) is conducted as part of the SWPPP to support the requirement defined in Section 5.9.1 of the ETTP NPDES permit to properly monitor mercury flux at Outfalls 180 and 190.

As part of the flow-weighted sampling effort at these outfalls, aliquots must be collected during a qualifying storm for the first 3 hours, or for the duration of the storm if it is less than 3 hours in duration. A qualifying storm event is one in which greater than 0.1 in. of rainfall occurs after a period of at least 72 hours following any previous storm event with rainfall of 0.1 in. or greater. Equal volume aliquots should be collected at variable time intervals commensurate with the flow volume that has passed. A minimum of three sample aliquots must be collected to qualify as a valid sampling event. Flow-weighted composite samples can be collected manually or automatically.

Four of the six flow weighted mercury sample results exceeded the reference standard. Flow-weighted sample results from 2024 are shown in Table 3.7.

Table 3.7. Flow-weighted sampling results from Outfalls 180 and 190

Outfall	Date	Mercury result (ng/L)[a]	Total storm event Precipitation (inches)
180	1/8/2024	270	0.26
	2/29/2024	92.7	0.37
	3/7/2024	132	0.85
190	1/8/2024	**53.8**	0.23
	2/13/2024	35.3	0.73
	2/26/2024	16.4	0.38

[a] *Results in bold exceed the reference standard. The reference standard for mercury (51 ng/L) corresponds to TDEC Rule 0400-40-03-.03(4)(j), "Recreation—Organisms Only Criteria."*

3.6.2.9. Investigative Monitoring of Storm Water

Investigative monitoring is conducted based on elevated analytical results, CERCLA requirements, and/or changes in site conditions. Investigative monitoring was conducted at Outfall networks 780, 880, and 890 in 2024.

Outfall 780, 880, and 890 investigative monitoring

Past investigative monitoring in the Old Powerhouse Area since 2018 has occasionally detected elevated concentrations of PCBs, mercury, metals (including arsenic, copper, and lead), and TSS from some of these outfalls. Activities being conducted in the area were not suspected as the cause of the elevated mercury and PCB concentrations, although process knowledge indicated that they could be legacy contaminants.

Outfall 780 once carried storm water runoff from former Buildings K-724 and K-725. These buildings were originally part of the S-50 Thermal Diffusion Plant. Building K-725 was later used for beryllium processing and contained mercury traps that occasionally released mercury. In addition, mercury was reportedly "swept down the floor drains" and into the storm drain system during cleanup activities in the 1970s. Mercury may also have been present in the dust collection system and transported to the storm drain system via storm water runoff during demolition of K-725 in the 1990s. Outfall 780 also received storm water from the K-722 area, where approximately 1,000 gal of oil was landfarmed for dust suppression in the 1980s.

Oak Ridge Forest Products LLC (ORFP) operated a wood yard and chipping facility at the K-722 site. Before ORFP began operation, Outfall 780 was dry and did not discharge water to the Clinch River except during substantial storm events. It is possible that discharge from ORFP mobilized contaminants that have been dormant in the Outfall 780 network for years. As of summer 2023, ORFP is no longer operating at this location.

In spring of 2022, Carbon Rivers, Inc. began operating and storing dismantled windmill parts in the area that is drained by Outfalls 780, 880, and 890. Carbon Rivers' footprint has steadily expanded and currently includes the area formerly used by ORFP, as well as surrounding areas. Carbon Rivers operations are not suspected as the source of these contaminants; however, it is possible that their operations (large equipment and ground disturbance) have contributed to mobilizing contaminants that may have been dormant for years. During the winter pool, when the water level in the Clinch River was sufficiently low to allow access to the end of the outfall piping network, storm water samples were collected from Outfalls 780, 880, and 890 and were analyzed for radionuclides, VOCs, PCBs, metals, mercury, and TSS.

Elevated concentrations of PCBs and lead were detected at Outfall 880. The PCB result of 4.4 µg/L from Outfall 880 was significantly higher than other PCB results from outfalls across the site. Method hold times prevented valid reanalysis of this sample. To investigate further, a follow up PCB sample was collected the following month and yielded a non-detect result for PCBs at Outfall 880. An elevated PCB concentration was also detected in Outfall 890.

Additional investigative sampling is planned for 2025 at Outfalls 780, 880, and 890.

3.6.2.10. Chromium Water Treatment System and Plume Monitoring

The CWTS (Figure 3.10) was constructed to intercept a plume of contaminated groundwater before it enters Mitchell Branch.

Figure 3.10. The Chromium Water Treatment System

The CWTS consists of interceptor wells, pumps, holding tanks, a treatment system, and an air stripper. Effluent is discharged through the pipeline that originally carried effluent from the Central Neutralization Facility (which was demolished). In CY 2024, monitoring was conducted at monitoring well 289 (TP-289), the chromium collection system wells, Outfall 170, and MIK 0.79. Figure 3.11 shows the results of the analyses for hexavalent chromium.

The analytical data indicates that both total and hexavalent chromium concentrations at TP-289 and the collection wells are variable but have trended downward over the long term. In 2024, concentrations of hexavalent chromium at Outfall 170 and MIK 0.79 were only detected in May 2024, with no results exceeding the ambient water quality criterion (AWQC) of 11 µg/L. Results for total chromium at Outfall 170 and MIK 0.79 were within historic ranges, and well below the AWQC for total chromium of 100 µg/L. These results demonstrate the continuing positive impact of the collection well system to minimize the release of chromium into Mitchell Branch.

3.6.2.11. Sampling for NPDES Permit Renewal Application

Preparations are being made for the NPDES permit application to be submitted to TDEC in CY 2026. The application for permit renewal is required to be submitted to TDEC at least 180 days in advance of permit expiration on March 31, 2027, so that TDEC has sufficient time to review. Additionally, DOE will require time to review the application prior to submittal. All permit renewal sampling began after October 2, 2023, and completion is expected before June 30, 2026. Effectively, this allows 33 months for sample collection efforts. This should also allow for sufficient time to process samples, receive laboratory results, and incorporate all relevant information into the permit application.

All 19 representative outfalls in the current ETTP NPDES Permit No. TN0002950 will be sampled for permit renewal purposes. All storm water monitoring results collected for permit renewal sampling will be used in the completion of EPA Form 3510-2F, Application Form 2F, Storm Water Discharges Associated with Industrial Activity, as applicable.

All samples shall be collected from discharges resulting from a qualifying storm event. A qualifying storm event is defined as a storm event in which greater than 0.1 in. of rain fall occurs in a 24-hour period, after a period of at least 72 hours following any previous storm event with rainfall of 0.1 in. or more. Additional sampling directions are specified in UCOR-4028 and are in accordance with EPA Form 3510-2F instructions and ETTP NPDES Permit No. TN0002950 guidance.

Permit renewal sampling results in a suite of more than 175 parameters from each location that are reported by the laboratories. In FY 2024, samples were collected from Outfalls 100, 190, 280, and 724. No results exceeded applicable reference standards. The permit renewal sampling efforts will continue in 2025.

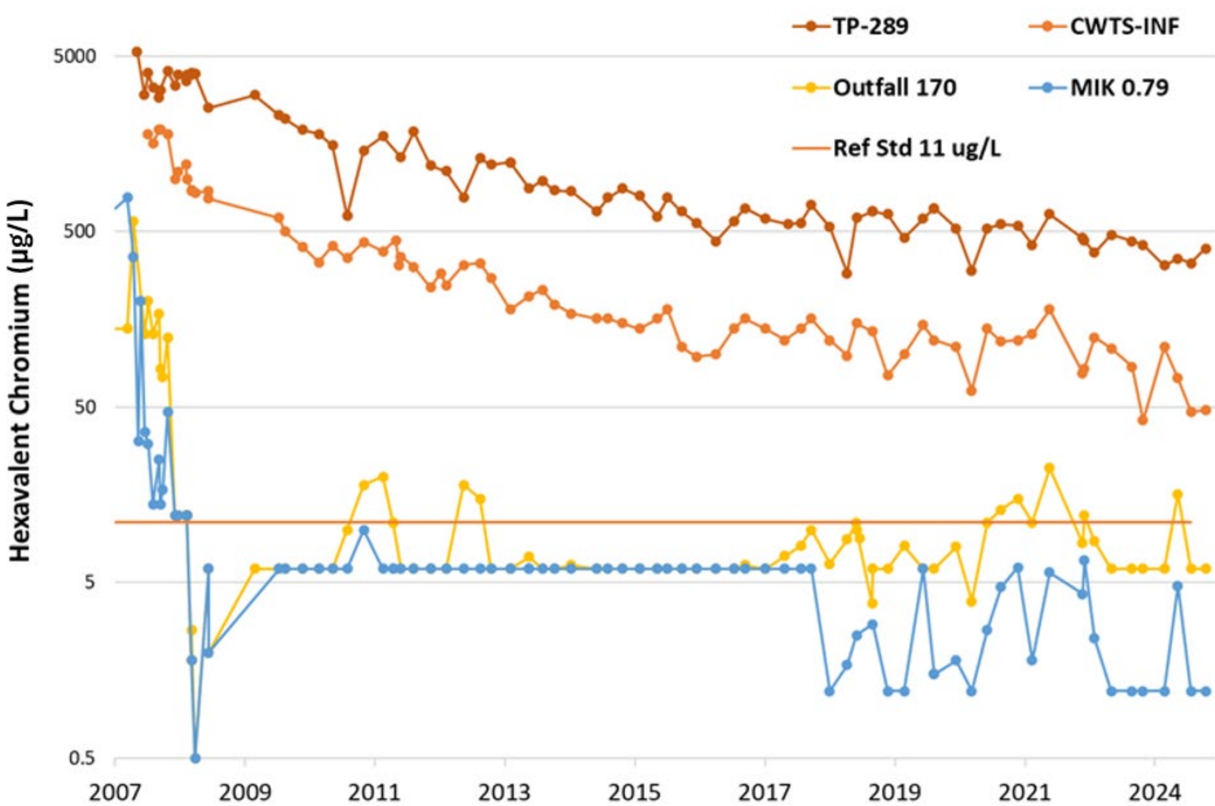
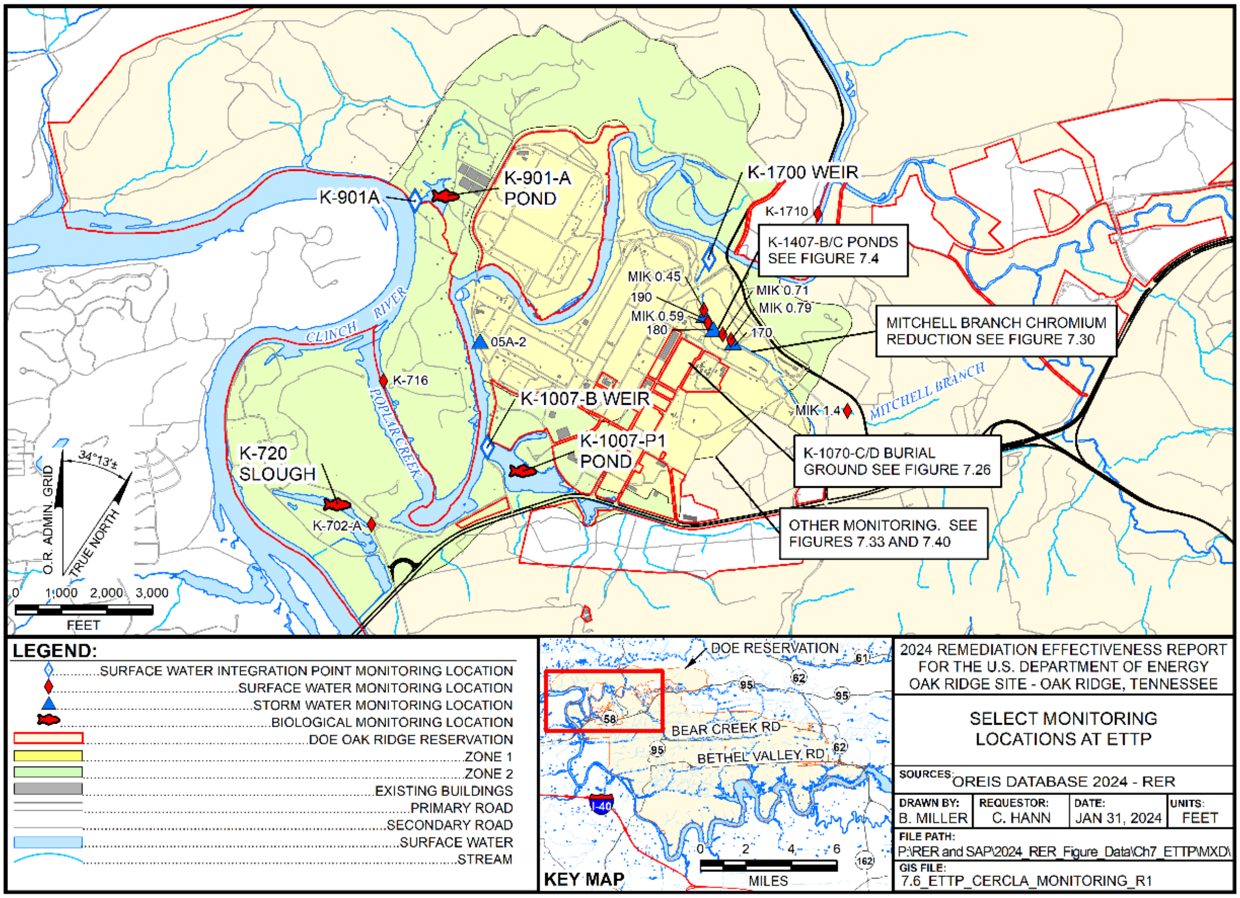


Figure 3.11. Hexavalent chromium sample results for the chromium collection system

3.6.3. Surface Water Monitoring

During 2024, ETTP EMP personnel conducted environmental surveillance activities at 12 surface water locations (Figures 3.12 and 3.13) to monitor surface water conditions at watershed exit pathway locations (K-702-A Slough, K-1700, K-1007-B, and K-901-A) or ambient stream conditions (Clinch River kilometers [CRKs] 16 and 23; K-1710; K-716; and MIKs 0.45, 0.59, 0.71, and 1.4). Monitoring locations K-1700 and MIKs 0.45, 0.59, 0.71, and 1.4 were sampled quarterly; and monitoring locations CRKs 16 and 23, K-716, K-1007-B, K-901-A, and the K-702-A slough were sampled semiannually.



Acronyms:

CRK = Clinch River kilometer

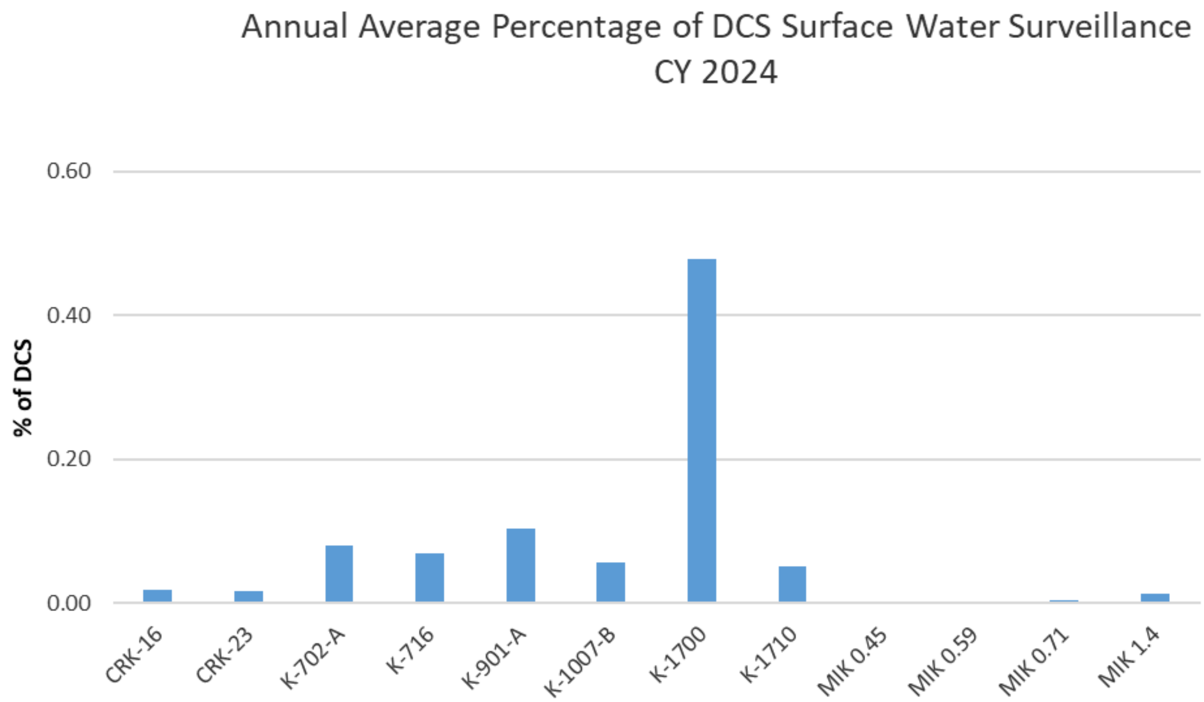
MIK = Mitchell Branch kilometer

Figure 3.12. Select surface water monitoring locations at East Tennessee Technology Park locations

Figure 3.13. Surface water surveillance monitoring

Results of radiological monitoring were compared with the derived concentration standard (DCS) values in the DOE standard *Derived Concentration Technical Standard* (DOE 2022a).

Radiological data are reported as fractions of DCSs for reported radionuclides, and the fractions for all of the isotopes are added together to produce the sum of fractions (SOF) and averaged to produce a rolling 12-month average. The average SOF is recalculated whenever new data becomes available. If the average SOF for a location exceeds the DCS requirement of remaining below 1.0 (100 percent) for the year, a formal source investigation is required. Sources exceeding DCS requirements would need an analysis of the best available technology to reduce the SOF to less than 1.0 (100 percent). In 2024, the monitoring results yielded SOF values of less than 0.01 (1 percent of the allowable DCS) at all surface water surveillance locations at ETTP (Figure 3.14).



Acronyms: *CRK = Clinch River kilometer DCS = derived concentration standard MIK = Mitchell Branch kilometer*

Figure 3.14. Annual average percentage of derived concentration standards at surface water monitoring locations, 2024

At MIKs 0.45, 0.59, and 0.71, quarterly monitoring is conducted for ^{99}Tc only.

Depending on the monitoring location, water samples may be analyzed for pH, selected metals, radionuclides, PCBs, pesticides, and VOCs. In 2024, 1,647 analytical results and 164 field readings were collected under the EMP. The majority of these results were well within the appropriate AWQC. Sample results that exceeded the appropriate AWQC are summarized in Table 3.8.

The exceedances for pesticides and PCBs may be associated with legacy sediment contamination. All of the pesticides and PCB detections occurred during the dry season when low flow can contribute to higher concentrations of sediment related contaminants in surface waters. The low dissolved oxygen measured at K-901-A on July 16, 2024, is within the historic range for this location and may be attributed to an increase in water temperature in the summer months.

Figure 3.15 illustrates the concentrations of TCE from the Mitchell Branch monitoring locations. In CY 2024, the K-1700 and MIK 0.45 monitoring locations were the only locations where VOCs were detected in surface water.

Concentrations of TCE and total 1,2-dichloroethene (total 1,2-DCE) were below the AWQCs for recreation, organisms only (300 µg/L for TCE and 10,000 µg/L for total 1,2 DCE), which are appropriate standards for Mitchell Branch. In addition, vinyl chloride (VC) has sometimes been detected in Mitchell Branch water.

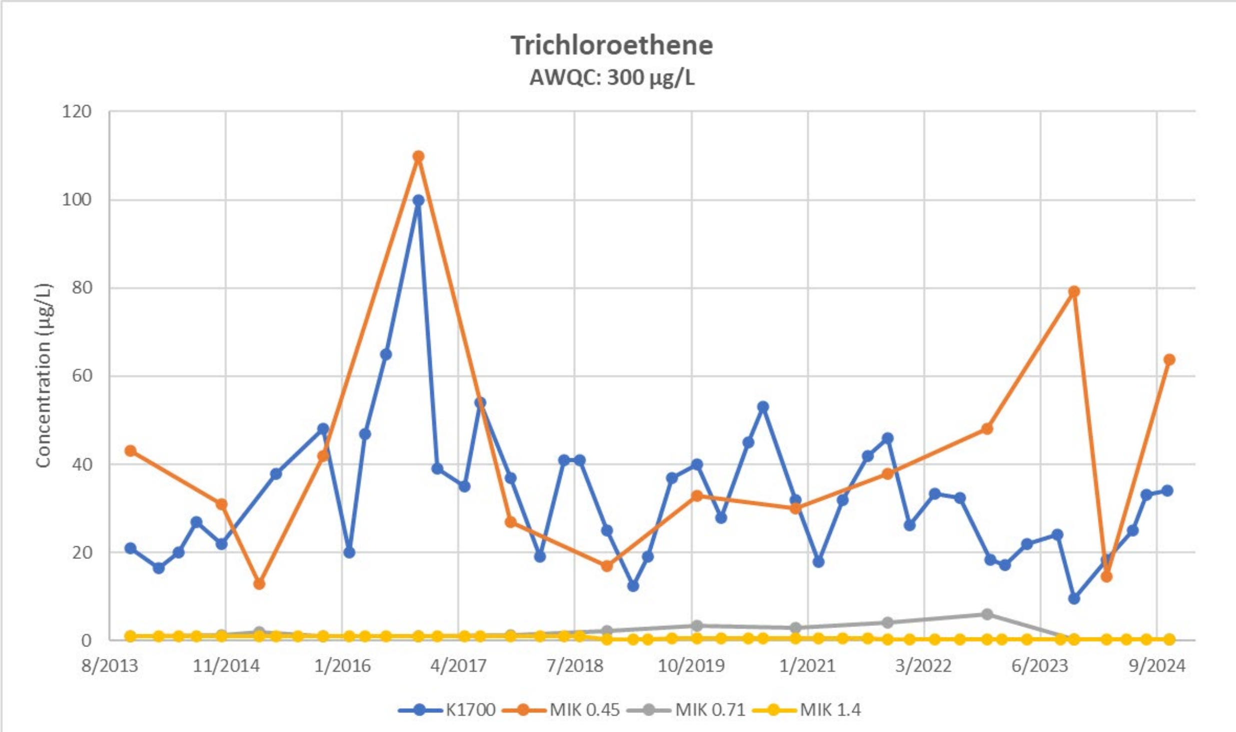
Table 3.8. Water quality criteria exceedances CY 2024

Location ID	Collection date	Chemical name	Reference standard[a]	Result[b]
K1700	6/13/2024	4,4'-DDT	0.0022	0.0185 J
K1700	6/13/2024	Dieldrin	0.00052	0.012 J
K-1007B	7/16/2024	Polychlorinated biphenyl	0.00064	0.446 P
K-901A	7/16/2024	Dissolved oxygen	>5.0	4.8
K1700	10/28/2024	Polychlorinated biphenyl	0.00064	0.0732 J
K1700	10/28/2024	4,4'-DDE	0.0022	0.0121 J
K1700	10/28/2024	4,4'-DDD	0.0031	0.0143 J
K1700	10/28/2024	4,4'-DDT	0.0022	0.0123 J
K1700	10/28/2024	Methoxychlor	0.03	0.0711 J
MIK 1.4	11/4/2024	Polychlorinated biphenyl	0.00064	0.108 J
K-702-A	11/18/2024	Dieldrin	0.00052	0.0102 J
K-702-A	11/18/2024	4,4'-DDE	0.0022	0.0132 J
K-702-A	11/18/2024	4,4'-DDD	0.0031	0.0131 J
K-702-A	11/18/2024	4,4'-DDT	0.0022	0.0096 J
K-702-A	11/18/2024	alpha-Chlordane	0.0043[c]	0.007 J

[a] *The reference standard for alpha-Chlordane and methoxychlor corresponds to TDEC Rule 0400-40-03-.03(3)(g), Fish and Aquatic Life—Criterion Continuous Concentration. All other reference standards correspond to TDEC Rule 0400-40-03-.03(4)(j), Recreation Organisms Only Criteria.*

[b] *All reference standards and results are reported in µg/L. Results with a J qualifier are estimates, not quantified numbers. Results with a P qualifier indicate >25% difference between two columns for Pesticides/Aroclors.*

[c] *A reference standard has not been promulgated for alpha-Chlordane. The reference standard shown is for Chlordane—a mixture that contains, among other compounds, two main isomers, alpha-Chlordane and gamma-Chlordane.*



Acronym: *MIK = Mitchell Branch kilometer*

Figure 3.15. Trichloroethene concentrations in Mitchell Branch

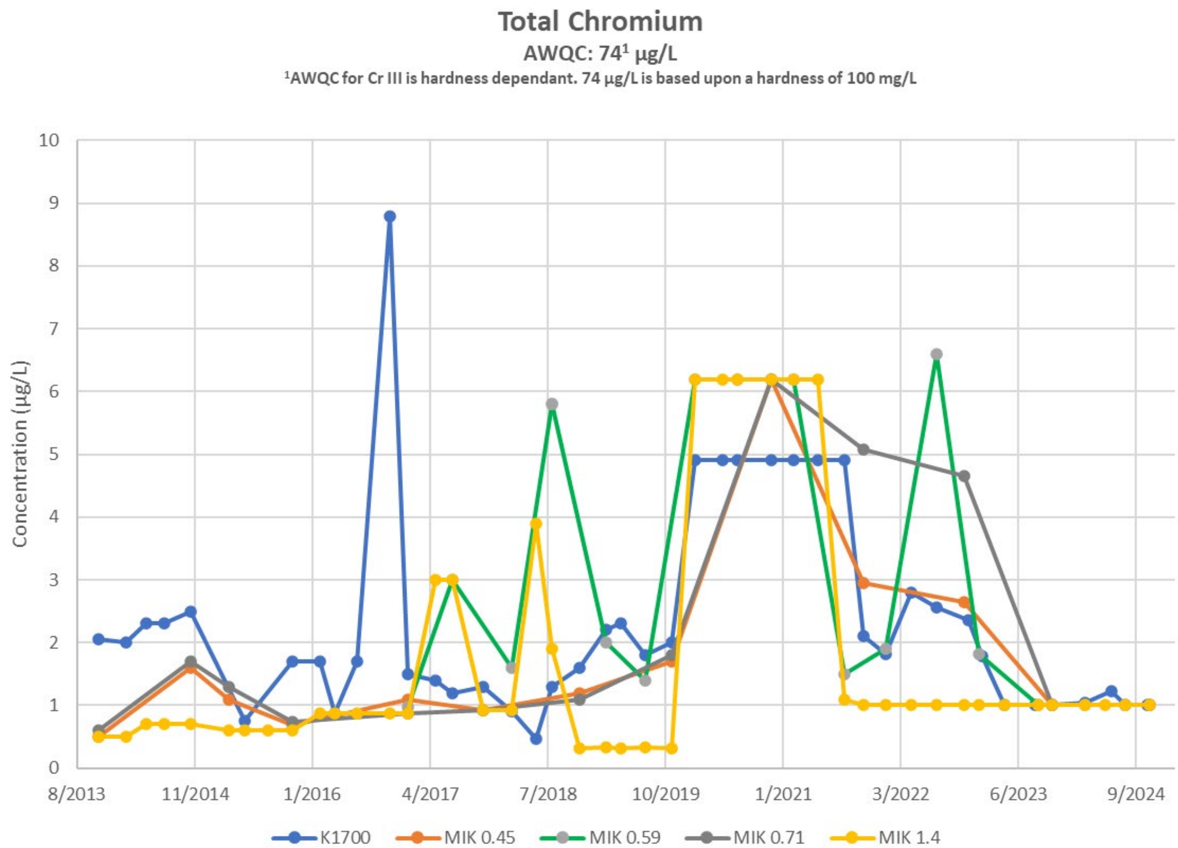
The concentrations for various VOCs in samples collected at Mitchell Branch in CY 2024 were much lower than the baseline samples collected on November 22, 2016. It should be noted that the November 22, 2016, sample date was at the end of an extended dry weather period that began in August 2016.

VOCs have been detected in groundwater in the vicinity of Mitchell Branch and in building sumps discharging into storm water outfalls that discharge into the stream; these compounds have generally not been detected in storm water during the monitoring of network discharges. It appears that the primary source of these compounds is contaminated groundwater.

Since the CWTS was installed, chromium levels in Mitchell Branch have dropped dramatically, with levels of total chromium being routinely measured at less than 6 µg/L (Figure 3.16). In 2024, hexavalent chromium levels in Mitchell Branch were all below the AWQC of 11 µg/L.

In CY 2024, ETTP did not conduct surface water monitoring for per- and polyfluoroalkyl substances (commonly known as "PFAS").

Since the CWTS was installed, chromium levels in Mitchell Branch have dropped dramatically.



***Note**: The AWQC for Cr(III), which is hardness-dependent, is 74 µg/L, based on a hardness of 100 mg/L in the receiving waters. The AWQC for Cr(VI) is 11 µg/L.*

***Acronyms**: AWQC = ambient water quality criterion MIK = Mitchell Branch kilometer*

Figure 3.16. Total chromium concentrations in Mitchell Branch

3.6.4. Groundwater Monitoring at ETTP

ETTP was divided into two zones to complete the primary source RA work. Zone 1 comprises 1,300 acres outside the ETTP Main Plant Area (MPA), and Zone 2 comprises 800 acres of the ETTP MPA. Actions have been ongoing to characterize and address soil, buried waste, and subsurface structures for protection of human health and the environment and to limit further groundwater contamination through source reduction or removal.

In FY 2024, the following two groundwater RODs were approved:

- *Interim Record of Decision for Groundwater in the Main Plant Area at the East Tennessee Technology Park, Oak Ridge, Tennessee* (DOE/OR/01-2949&D2; MPA Groundwater Interim ROD) on May 16, 2024.
- *Record of Decision for Groundwater in the K-31/K-33 Area at the East Tennessee Technology Park, Oak Ridge, Tennessee* (DOE/OR/01-2950&D2; K-31/K-33 Groundwater ROD) on May 9, 2024.

Cleanup of the remaining environmental media at ETTP (e.g., remaining groundwater, surface water/sediment, and remaining ecological receptors) will be addressed under the future MPA Groundwater Final ROD, the Zone 1 Groundwater Plumes ROD, and the Remaining Ecology/Surface Water/Sediment Final ROD. In support of the Zone 1 Groundwater Plumes ROD, an *Addendum to the Zone 1 Groundwater Plumes Remedial Investigation Work Plan for the K-1085*

Old Firehouse Burn Area, East Tennessee Technology Park, Oak Ridge, Tennessee (DOE/OR/01-2903&D2/A2) was submitted to EPA and TDEC for review on June 18, 2024.

The data screen and trend assignments show contaminant concentration trends are highly variable across the site. Maximum contaminant levels (MCLs) and maximum contaminant level derived concentrations (MCL-DCs) for radionuclides are used as screening levels for groundwater and are not ROD performance standards. RODs for ETTP groundwater are pending. A *Modification to the East Tennessee Technology Park Administrative Watershed Remedial Action Report Comprehensive Monitoring Plan, Oak Ridge, Tennessee* (DOE/OR/01-2477&D4/M1; ETTP RAR CMP) was approved on November 27, 2024. The modification to the ETTP RAR CMP included changes associated with provisional management of slabs, adding land use controls associated with the former Powerhouse Area, and updating CWTS sampling.

A summary of the continuing baseline groundwater monitoring in accordance with the approved ETTP RAR CMP follows:

- Monitoring results from wells in the K-1407-B/C Ponds area are generally consistent with results from previous years and show several-fold concentration fluctuations in seasonal and longer-term periods. Although most VOCs have exhibited significant decreasing trends over the past 10 years, these trends are generally indeterminate over the past 5 years. The continued detection of VOCs at concentrations above 1,000 µg/L and the relatively steady concentrations over recent years suggest the presence of dense nonaqueous phase liquid (DNAPL) in the vicinity of the former K-1407-B Pond.
- VOC concentrations in wells monitored downgradient of K-1070-C/D show a broad area is affected by past disposal releases of liquid VOCs at G-Pit. The persistent, high concentrations of these VOCs in nearby wells suggest an ongoing contaminant source release. However, decreases in parent VOC concentrations, with slight increases in concentrations of some degradation pathway compounds, likely represents the result of natural biodegradation from intrinsic dehalogenating bacteria in groundwater in the vicinity of G-Pit.
- In the K-31/K-33 area, only nickel was measured at levels slightly greater than the MCL and Tennessee groundwater criteria at well UNW-043. Nickel in this well shows a decreasing concentration trend.
- At the K-27/K-29 area, groundwater contamination migrates toward Poplar Creek in both north and south directions from the former area facilities.
  - Alpha activity and total uranium concentrations in BRW-016 in the north exit pathway continued to exceed the MCL in FY 2024. This well was inundated by water from D&D runoff in FY 2019. VC and cis-1,2-DCE also exceeded the MCL in the northern portion of the K-27/K-29 area north exit pathway in FY 2024.
  - Chromium and nickel exceeded the MCL and Tennessee groundwater criteria screening concentration (0.1 mg/L) in the unfiltered samples from well UNW-038 in the south/west exit pathway. TCE also exceeded the MCL screening concentration (0.005 mg/L) in two wells (UNW-038 and UNW-096). The 5-year TCE trends in the K-27/K-29 southern area are stable to increasing at these two wells.
- VOCs are present in groundwater at the now-remediated K-1070-A Burial Ground in the northwestern portion of ETTP. Groundwater contaminated primarily with TCE discharges at downgradient spring 21-002, which flows into the northern end of the K-901-A Holding Pond. Although TCE concentrations fluctuate above and below the MCL screening concentration of 5 µg/L, eight of the last 12 samples collected at spring 21-002 have exceeded the MCL for TCE.

- TCE is the most significant groundwater contaminant detected at spring PC-0, which is submerged beneath the Watts Bar lake level from April to October each year, and is located on the shore of Poplar Creek near the confluence with the Clinch River. During FY 2024, the maximum detected TCE concentration (6 μg/L) slightly exceeded the MCL of 5 μg/L, but remaining samples detected below the MCL. The PC-0 spring exhibits a decreasing trend in TCE concentration over the past 10-year and 5-year periods.

3.6.4.1. K-1407-B/C Ponds

The K-1407-B Pond, constructed in 1943, was primarily used for settling metal hydroxide precipitates generated during neutralization and precipitation of metal-laden solutions treated in the K-1407-A Neutralization Unit. It also received discharge from the K-1420 Metals Decontamination Building, K-1420 plating wastes that generated F006 hazardous wastes pond sludge and wastes from the K-1501 Steam Plant. The K-1407-C Pond, constructed in 1973, was primarily used to store potassium hydroxide scrubber sludge generated at ETTP. It also received sludge from the K-1407-B Pond. When the K-1407-B Pond reached maximum sludge capacity, it was dredged, and the sludge was transferred to the K-1407-C Pond.

The *Remedial Action Report for the K-1407-B Holding Pond and the K-1407-C Retention Basin, Oak Ridge, Tennessee* (DOE 1995) proposed semiannual groundwater monitoring for nitrate, metals, VOCs, and selected radionuclides, including gross alpha and beta activity, ^{99}Tc, ^{90}strontium (^{90}Sr), ^{137}cesium (^{137}Cs), ^{230}thorium (^{230}Th), ^{232}Th, ^{234}U, and ^{238}U. Target concentrations for these parameters were not established (DOE 1993b, DOE 1995). However, as recommended by EPA with concurrence from TDEC, monitoring for the constituents listed for the K-1407-B Pond is conducted in wells UNW-003 and UNW-009, and at the K-1700 Weir on Mitchell Branch.

The primary groundwater contaminants in the K-1407-B/C Ponds area are VOCs. VOCs are widespread and persistent in this portion of ETTP, including contaminant sources upgradient of the ponds. Figure 3.17 presents the combined unconsolidated and bedrock plume boundaries for total VOCs at the top of the map (north of 14th Street).

DOE has compiled analytical data from groundwater monitoring well UNW-003 to evaluate concentration trends for regulated contaminants. Data are compared to EPA's National Primary Drinking Water Regulations MCLs or MCL-DCs for radionuclides, for screening purposes and for identifying constituents and wells for trend analysis. The MCLs and MCL-DCs are not criteria identified in the 1993 K-1407-B/C Ponds ROD.

In recent years, large seasonal variations in VOC concentrations have been measured at well UNW-003, which continues to exhibit high concentrations of VOCs in the unconsolidated zone at the K-1407-B pond. DOE suspects a DNAPL source exists somewhere beneath the former pond site based on persistent high VOC concentrations in both shallow and deeper groundwater wells. Data is consistent in showing significant decreasing contaminant concentration trends for five VOCs (1,1-DCE, cis-1,2-DCE, tetrachloroethene [PCE], TCE, and VC) at this location over the past 10 years. However, no trends could be determined over the past 5 years for these VOCs, but significant decreasing contaminant concentration trends are present for the maximum concentration evaluations for these same five VOCs over the past 10 years. The FY 2024 results from UNW-003 remain consistent with the plume boundary depicted in Figure 3.17.

3.6.4.2. K-1070-C/D G-Pit and Concrete Pad

The K-1070-C/D G-Pit was the primary source of organic contaminant releases to soil and groundwater in the area immediately west of the K-1070-C/D Waste Disposal area. The K-1071 Concrete Pad, located in the southeastern portion of the K-1070-C/D area, was determined to pose an unacceptable health risk to workers from future exposure to soil radiological contaminants (DOE 1998). The contents of the pit were excavated, and a soil cover was placed over the concrete pad. Residual contaminated groundwater in the K-1070-C/D G-Pit and Burial Ground area will be addressed in a future decision. Monitoring locations, analytical parameters, and cleanup levels were not specified for groundwater monitoring at the K-1070-C/D Burial Ground, although the primary contaminants of concern (COCs) in that area are VOCs. Semiannual samples collected at wells and surface water locations outside the perimeter (downgradient) of the K-1070-C/D Burial Ground are analyzed for VOCs and general water quality parameters. Monitoring at the site focuses on providing data for evaluating changes in contaminant concentrations near the source units or potentially discharging to surface water within the ETTP boundaries.

Following G-Pit remediation, monitoring wells UNW-114, TMW-011, and UNW-064 (see Figure 3.17) were selected to monitor the VOC plume leaving the K-1070-C/D Burial Ground because they were located in the principal known downgradient groundwater pathway. Well monitoring results show elevated VOC concentrations. The VOC concentrations at these three wells began to decrease prior to excavating the G-Pit contents (during FY 2000) and continue to decrease, while daughter VOC concentrations (1,1-DCE, 1,2-dichloroethane [1,2-DCA], and VC) show recent increasing trends. Although 1,1,1-trichloroethane (1,1,1-TCA) was formerly present at concentrations far greater than its 0.2 mg/L MCL, natural biodegradation and advective groundwater processes within the monitoring zone have reduced 1,1,1-TCA concentrations to less than the drinking water standard. Several direct-push technology monitoring points were installed to the west of UNW-114 during investigations conducted in 2005. The purpose of these monitoring points was to investigate groundwater contamination in an area along potential geologically controlled seepage pathways that may have connected the G-Pit contaminant source to the former SW-31 spring. DOE continues to monitor to measure VOC concentrations and their fluctuations downgradient of G-Pit.

DOE has compiled analytical data from K-1070-C/D groundwater monitoring to evaluate concentration trends for regulated contaminants. Data are compared to EPA's National Primary Drinking Water Regulations MCL for screening purposes; however, MCLs are not identified as criteria in the ROD (DOE 1997). Groundwater contaminant trends in the area downgradient of the G-Pit source are mostly stable (*i.e.*, data expresses no upward or downward trend with negligible variance) to indeterminate (*i.e.*, data expresses no upward or downward trend with sufficient statistical variance), with decreasing trends for PCE and TCE at well UNW-114 for the 10-year evaluation period. Although most contaminants exhibit stable, indeterminate, or decreasing trends over the past 5-year and 10-year periods, concentrations of 1,1-dichloroethane (1,1-DCA) and VC at well UNW-114 have risen since 2008 and 2009, respectively. Seasonal variations in VOC concentrations are very commonly observed. The FY 2024 results from UNW-114, UNW-064, and TMW-011 remain generally consistent with the plume boundary depicted in Figure 3.17.

Well UNW-064 is located slightly further downgradient from the contaminant source area than UNW-114 and its monitoring data exhibits a slightly different behavior. Similar to the overall trend observed at UNW-114, the majority of VOC concentrations at UNW-064 decreased from about 2002 to 2006 but have remained relatively stable since that time period. Trend evaluations for VOCs in well UNW-064 for a 10- year period indicate a stable, or no significant, trend for 1,1,2-trichloroethane (1,1,2-TCA), 1,1-DCE, TCE, and VC. The most recent five-year period trends indicate a stable trend for 1,1,2-TCA, 1,1-DCE, and TCE; and no determinate trend for VC at well UNW-064.

Well TMW-011 is located furthest from the contaminant source area near the base of the hill below K-1070-C/D. VOC concentrations at TMW 011 tend to fluctuate in a fashion similar to those at UNW-064, except the seasonal signature is reversed, with higher concentrations in summer than during winter. This relationship suggests groundwater recharge during winter tends to dilute the VOCs near TMW-011 rather than cause a pulse of higher concentration groundwater, as was observed at the mid-slope location near UNW-064.

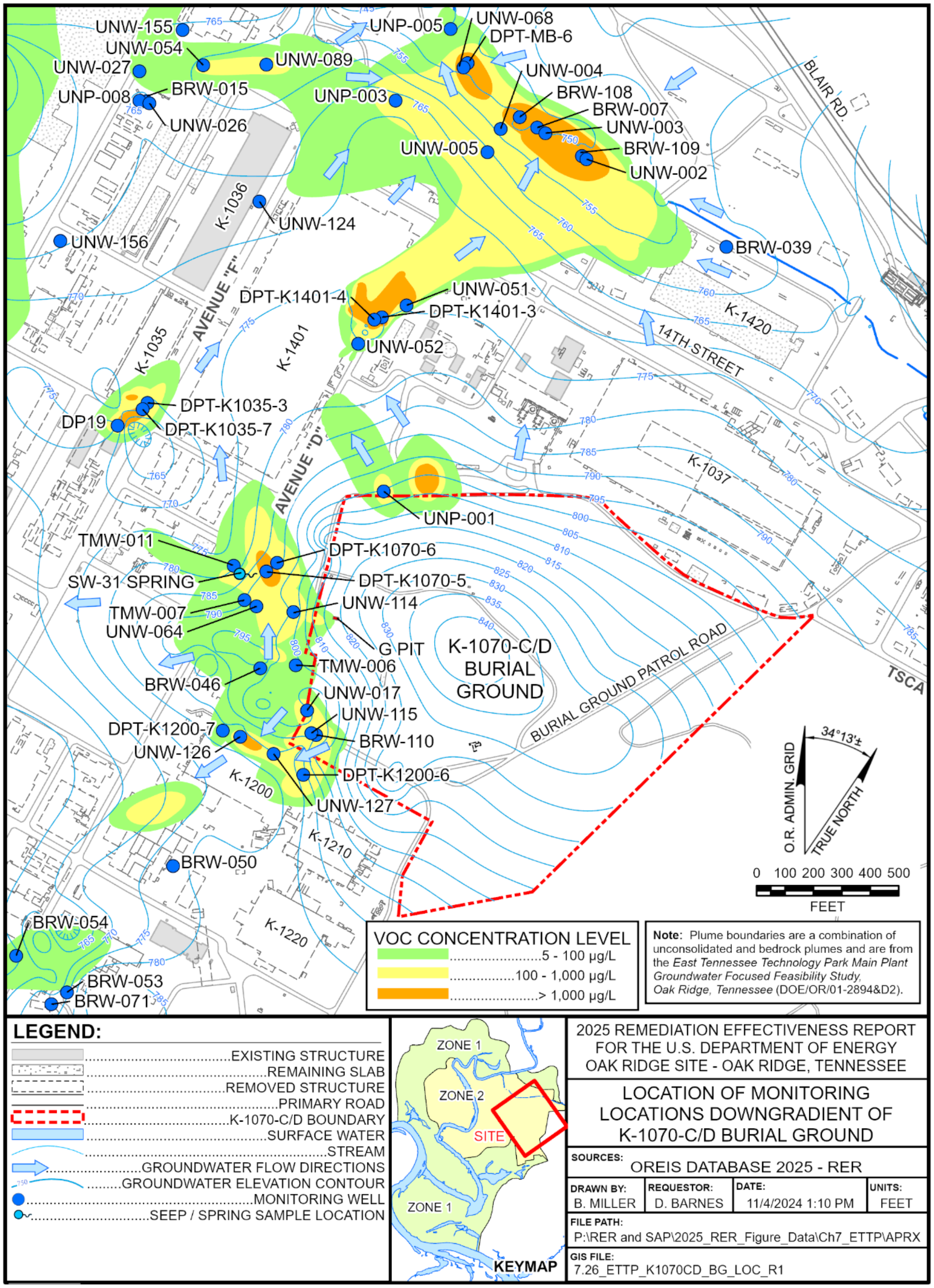


Figure 3.17. Location of monitoring locations downgradient of K-1070-C/D Burial Ground

Overall, throughout the monitoring period of record, there have been decreases in the parent VOC (1,1,1-TCA and TCE) concentrations, with slight increases in concentrations of some of the degradation pathway compounds (e.g., 1,1-DCA and VC) in the vicinity of the source (UNW-064 and UNW-114). The FY 2024 increase in VC concentrations at UNW-114, which generally correlates to TCE and other precursor compounds (i.e., cis-1,2-DCE) decreasing in concentration, likely represents the result of natural biodegradation from intrinsic dehalogenating bacteria in groundwater in the vicinity of these wells.

3.6.4.3. Groundwater Pathway Plumes

Figure 3.18 presents the current sitewide contaminant plume map for the sum of VOC plumes from the MPA Focused Feasibility Study (DOE 2022b), K-31/K-33 Remedial Investigation/Feasibility Study (DOE 2022c), and Zone 1 Remedial Investigation Work Plan (DOE 2022d). Figure 3.18 also shows the locations of exit pathway monitoring wells throughout the ETTP site that are routinely sampled by the Water Resources Restoration Program (WRRP) for known COCs, inferred groundwater flow directions in plume areas, and direction of surface water flow. As shown, the inferred groundwater flow directions are based on the water table piezometric surface contours. Shallow groundwater plumes generally flow in conformance to the local gradients, however in some areas, especially where geologic structures such as bedrock folding, fracturing, and karst development occur, groundwater may flow through secondary porosity features in directions oblique to inferred gradients.

For each of these exit pathway wells, DOE has compiled analytical data for groundwater contaminants for the past 10 years. The compiled data is compared to EPA's National Primary Drinking Water Regulations MCLs or MCL-DCs for radionuclides. The summary of trend evaluations for the exit pathway wells in increments of the past 10 years and the last 5 years of monitoring show that, in general, contaminants that have previously exceeded their respective MCL concentrations have decreased in concentrations. Trends also show mixed results of statistically significant decreases in some cases, increasing trends in other cases, and some instances in which trends are indeterminate or stable. Some metals (e.g., chromium and nickel) tend to be measured at or above MCL concentrations, with a tendency for particle-associated metals to lead to these MCL exceedances, based on often-lower metal concentrations in filtered sample aliquots.

Mitchell Branch

The Mitchell Branch groundwater exit pathway is monitored using surface water data from the K-1700 Weir on Mitchell Branch. Wells BRW-083 and UNW-107, located near the mouth of Mitchell Branch, have also been monitored since 1994. Detection of VOCs in groundwater near the mouth of Mitchell Branch is considered an indication of the migration of the Mitchell Branch VOC plume complex. The intermittent detection of VOCs in this exit pathway is thought to be a reflection of variations in groundwater flowpaths that can fluctuate with seasonal hydraulic head conditions, which are strongly affected by rainfall and long-term and short-term Watts Bar Reservoir fluctuations. During FY 2024, VOCs were not detected in the semiannual samples from these two exit pathway monitoring wells. No other constituents were detected above MCLs or MCL-DCs in FY 2024.

K-1064 Peninsula Burn area

Exit pathway wells BRW-003 and BRW-017 monitor metals and VOCs in groundwater at the K-1064 Peninsula Burn area. Historically, arsenic has been the primary metal detected at concentrations exceeding the MCL in groundwater at the site. However, during FY 2024, concentrations of arsenic were less than the MCL. Historically, VOC contaminants exceeded MCLs in wells BRW-003 and BRW-017. However, regulated VOC concentrations have declined to below screening levels.

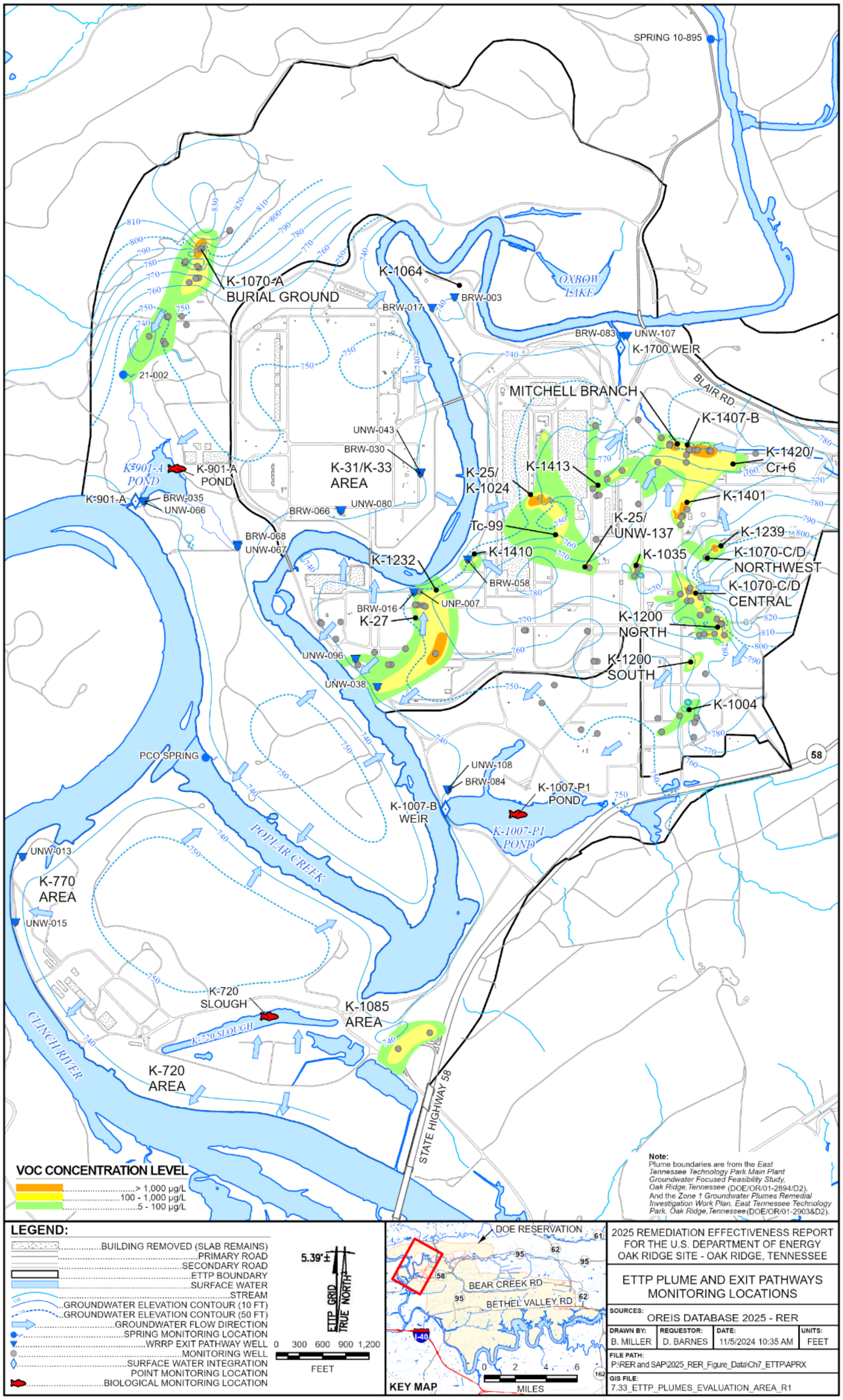


Figure 3.18. East Tennessee Technology Park plume and exit pathways monitoring locations

K-31/K-33 area

Groundwater is monitored in four wells (BRW-066, BRW-030, UNW-080, and UNW-043) that lie between the K-31/K-33 area and Poplar Creek. During FY 2024, only nickel was detected at concentrations greater than its MCL. Nickel was detected in FY 2024 in both filtered and unfiltered samples from UNW-043 at concentrations slightly above (0.11 mg/L) the MCL screening concentration (0.1 mg/L) in the December 2023 sample. However, concentrations of nickel in subsequent samples from UNW-043 in FY 2024 were all below the MCL, and trend evaluations for nickel in UNW-043 indicate declining 5-year and 10-year concentrations trends at this well. Nickel was detected in FY 2024 below the MCL screening concentration in BRW-030 and UNW-080 filtered and unfiltered samples.

K-27/K-29 exit pathway areas

Groundwater discharges toward Poplar Creek in both a northward pathway beneath the K-1232 area and in a south-to-westward pathway, as shown earlier on Figure 3.18. Two wells (BRW-016 and BRW-058) in the northern plume near K-27/29 and two wells (UNW-038 and UNW-096) in the south/western plume have been designated for exit pathway monitoring.

BRW-016 was inundated by water from D&D runoff in FY 2019, resulting in high alpha activity contamination. Alpha activity concentrations in the K-27/K-29 area northern pathway have continued to decrease over the past five years. In comparison to FY 2023, alpha activity remained lower in FY 2024 with a concentration of 37 and 21 pCi/L but remained greater than the MCL screening concentration (15 pCi/L). VOCs have exceeded MCLs in the K-27/K-29 area northern pathway. In FY 2024, VC was detected above its MCL screening concentration (0.002 mg/L), with a maximum detected concentration of 0.035 mg/L in well BRW-058. In addition, cis-1,2-DCE exceeded the MCL (0.070 mg/L) with a maximum concentration of 0.092 mg/L at BRW-058. Trend evaluations for well BRW-058 indicate significant upward trends for VC and no determinate trend cis-1,2-DCE for the prior 10-year period and no determinate trend over the five-year period for VC and cis-1,2-DCE at this well.

In the south/west exit pathway from the K-27/K-29 area, TCE is persistent in the exit pathway wells and exceeds the MCL at both wells with stable concentration trends at well UNW-038 over the 10-year and 5-year periods, and an increasing trend and no determinate trend at well UNW-096 over the 10-year and 5-year periods, respectively. Chromium concentrations equaled or exceeded the MCL in one unfiltered sample from well UNW-038 in FY 2024 with a concentration of 0.68 mg/L. The corresponding filtered sample from UNW-038 was below the chromium MCL at a concentration of 0.0072 mg/L. Nickel concentrations equaled or exceeded the MCL of 0.1 mg/L in well UNW-038 in one unfiltered FY 2024 sample, with maximum concentration 0.14 mg/L. Similar to chromium at UNW-038, the corresponding filtered sample for nickel was below the MCL at a concentration of 0.066 mg/L.

K-1007-P1 Holding Pond area

Wells BRW-084 and UNW-108 are exit pathway monitoring locations at the northern edge of the K-1007-P1 Holding Pond (Figure 3.18). During FY 2024, no regulated contaminants have equaled or exceeded their respective MCLs.

K-901-A Holding Pond and Duct Island areas

Exit pathway groundwater in the K-901-A Holding Pond area (Figure 3.18) is monitored by four wells (BRW-035, BRW-068, UNW-066, and UNW-067) and two springs (21-002 that flows into the K-901-A Holding Pond, and PC-0 that discharges into Poplar Creek on the west side of Duct Island). No regulated contaminants equaled or exceeded MCL concentrations at any of the four wells in FY 2024 samples.

TCE is the most significant groundwater contaminant detected in the springs. TCE that originates from the now-remediated K-1070-A Burial Ground is the principal contaminant detected at spring 21-002.

The conceptual behavior of this TCE contaminant discharging at spring 21-002 plume is described by higher concentration, but lower flow, during the dry season with apparently subdued effects of rainfall on spring TCE concentrations. During the wet season, the overall TCE concentrations at spring 21-002 are lower; however, wet-season, increased rainfall-driven, groundwater-flow pulses push TCE concentration pulses through conduits that discharge at spring 21-002. TCE exceeded the MCL in FY 2024 samples collected at spring 21-002 with a maximum concentration of 0.02 mg/L detected in the May 2024 sample. The remaining FY 2024 samples for TCE also exceeded the MCL of 0.005 mg/L with concentrations of 0.0054 in March 2024 and 0.016 J mg/L in December 2023. The M-K trends for TCE show a stable and no determinate trend for the 10-year and 5-year periods, respectively at spring 21-002.

PC-0 Spring was added to the sampling program in 2004. During April–October each year, spring PC-0 is submerged beneath the Watts Bar Lake level. In the late winter of 2012, DOE installed a sampling pump in the spring mouth to allow year-round sampling. The contaminant source for spring PC-0 is presumed to be legacy waste disposed of at the former K-1070-F contractor's spoil area located on Duct Island. The TCE concentrations in spring PC-0 have varied between non-detectable levels and 0.026 mg/L and have decreased from their highest measured value in 2006. During FY 2024, the maximum TCE concentration in spring PC-0 quarterly samples was 0.0059 J mg/L measured in a sample collected in December 2023. The remaining FY 2024 samples were all below the MCL screening concentration of 0.005 mg/L, and TCE shows a significant decreasing trend for both the 10-year and 5-year periods.

TCE that originates from the now-remediated K-1070-A Burial Ground is the principal contaminant detected at spring 21-002.

Because water that discharges from the springs monitored in the ETTP area originates mostly from shallow flow systems, the flow rates and dissolved contaminant concentrations are highly variable. For this reason, there is uncertainty associated with the contaminant trend directions assigned to the spring data.

K-770 area

Exit pathway groundwater monitoring is also conducted at the K-770 area, where wells UNW-013 and UNW-015 are used to assess radiological groundwater contamination along the Clinch River (Figure 3.18). Alpha activity measured in samples from well UNW-015 exceeded the 15 pCi/L MCL in both FY 2024 samples. During FY 2024, the maximum alpha activity was 19 pCi/L in the September 2024 sample. The trend analysis determined an increasing trend for both the 10-year and 5-year periods for alpha activity at UNW-015, although FY 2024 is the first year since 2019 that alpha activity has exceeded the MCL at this well. No other regulated contaminants exceeded their MCLs in these two wells.

3.7. Biological Monitoring

The ETTP Biological Monitoring and Abatement Program (BMAP) consists of two tasks designed to evaluate the effects of ETTP legacy operations on the local environment, identify areas where abatement measures would be most effective, and test the efficacy of the measures—
1) bioaccumulation studies and 2) instream monitoring of biological communities. Figure 3.19 shows the major water bodies at ETTP and the BMAP monitoring locations along Mitchell Branch. The results from this program will support future CERCLA cleanup actions.

3.7.1. Task 1: Bioaccumulation Monitoring

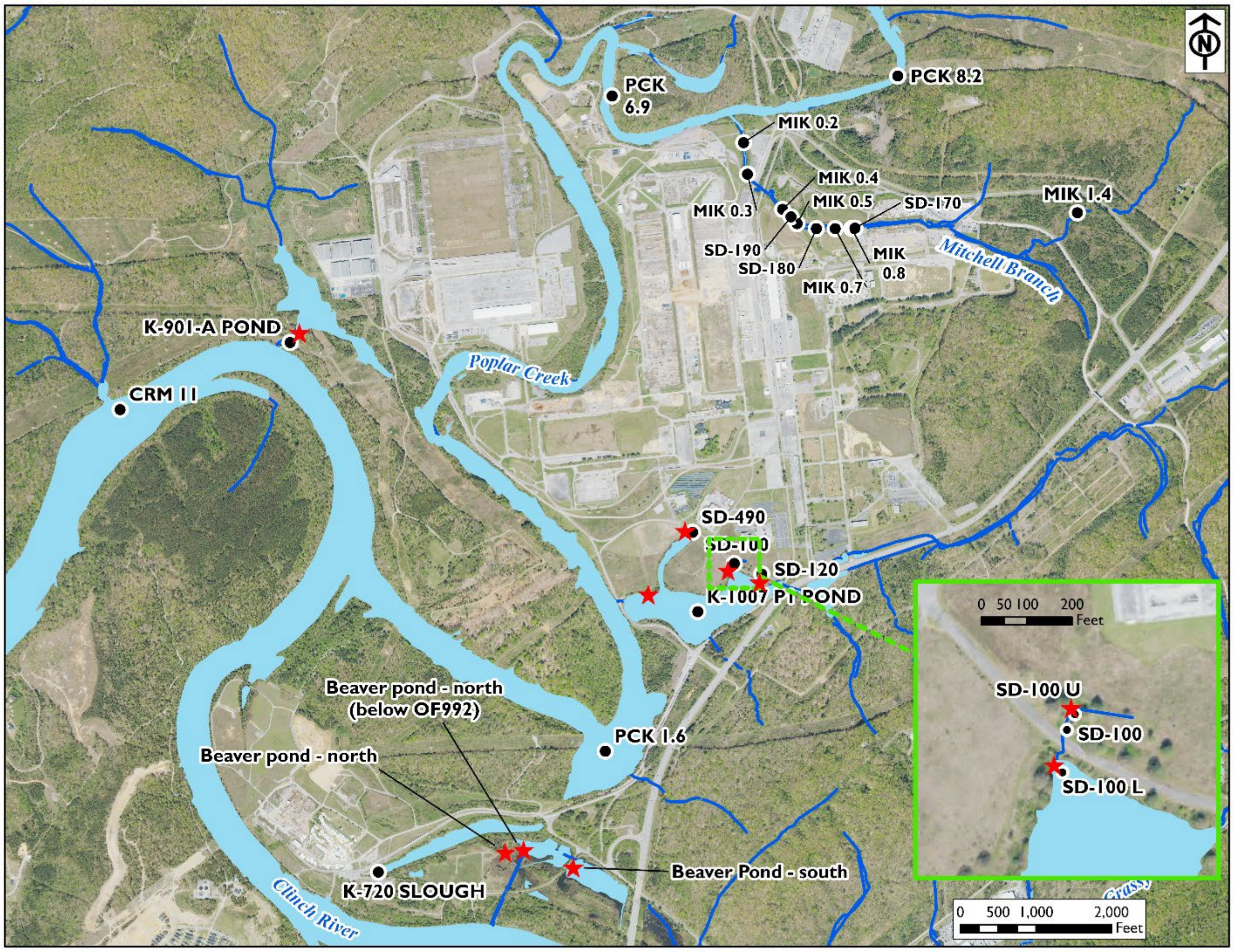
Bioaccumulation monitoring for the ETTP BMAP has focused on evaluating the impact of PCB discharges into the environment because of historical operations at the ETTP complex. It was previously assumed that mercury flux into Poplar Creek and the Clinch River originated largely from Y-12 discharges into East Fork Poplar Creek. However, more recent monitoring has shown that water in ETTP storm drains and biota from lower Mitchell Branch have elevated mercury concentrations as well. Mercury bioaccumulation monitoring is routinely conducted in the watersheds adjacent to ETTP by the Y-12 and

ORNL BMAPs, both on and off the ORR. The available mercury bioaccumulation monitoring data will be presented in the following subsections with long-term trends in PCB contamination in resident fish and caged clams from ETTP waters.

Because the consumption of contaminated fish represents the largest dose of mercury and many other bioaccumulative contaminants to humans, fish fillet concentrations are necessary to assessing human health risks, whereas whole body fish are necessary to assessing ecological risks. Largemouth bass (*Micropterus salmoides*) and various sunfish species are used to monitor mercury and PCB fillet concentrations. Gizzard shad (*Dorosoma cepedianum*) and bluegill (*Lepomis macrochirus*) are used to monitor whole body concentrations at various locations over time. Largemouth bass are larger, upper trophic level predatory fish and are, therefore, susceptible to mercury and PCB bioaccumulation. Fillet concentrations in these fish represent the near maximum potential dose to humans, if eaten. Largemouth bass tend to live in larger, deeper pools of water and are collected in the ponds at ETTP (K-1007-P1 Pond, K-901-A Pond, and K-720 Slough) as well as in off-site river and reservoir locations. Sunfish are short-lived and have small home ranges, so fillet mercury and PCB concentrations in these fish are representative of exposure at the site of collection. These fish are used in long-term studies to monitor changes in bioaccumulation at a given site over time.

Collections of sunfish are restricted to sizes large enough to be taken by sport anglers (generally 50–150 g total weight) to minimize effects of covariance between size and contaminant concentrations, as well as for spatial and temporal comparability. The target sunfish species for bioaccumulation studies in Mitchell Branch and other ORR stream sites is redbreast sunfish (*Lepomis auritus*), but where these fish are not present, other species with similar feeding habits (e.g., bluegill [*L. macrochirus*]) are collected. For bioaccumulative contaminants such as mercury and PCBs, fish bioaccumulation data have become important measures of compliance for both the CWA and CERCLA.

For mercury, the EPA National Recommended Water Quality Criterion for mercury in fish (0.3 micrograms/gram [μg/g]) is used as the trigger point for fish consumption advisories in Tennessee, the target concentration for NPDES permit compliance, and the threshold for impairment designations that require a Total Maximum Daily Load (TMDL) assessment. In addition to fish mercury limits, the state of Tennessee continues to use the statewide AWQC for mercury of 51 ng/L in water, based on organisms only, and 50 ng/L for recreation-water and organisms. Regulatory guidance and human health risk levels have varied more widely for PCBs, depending on the regulatory program and the assumptions used in the risk analysis. The Tennessee water quality criteria for individual Aroclors and total PCBs are both 0.00064 μg/L under the recreation designated use classification and are the target for PCB-focused TMDLs, including for local reservoir (Melton Hill, Watts Bar, and Fort Loudon). However, most conventional PCB water analyses have detection limits much higher than the PCB AWQC.



***Note:** Red stars indicate clam sampling locations in and around the ETTP complex in 2024 (all Mitchell Branch sites were sites of clam deployment [except MIK 1.4] but stars have been omitted for clarity).*

Acronyms:

CRM = Clinch River mile PCK = Poplar Creek kilometer MIK = Mitchell Branch kilometer

SD = storm drain

Figure 3.19. Water bodies at the East Tennessee Technology Park

Therefore, in Tennessee and in many other states, assessments of impairment to water body segments, as well as public fishing advisories for PCBs, are based on fish tissue concentrations. Historically, the US Food and Drug Administration threshold limit of 2 µg/g in fish fillet was used for PCB advisories; then for many years in Tennessee, an approximate range of 0.8 to 1 µg/g was used, depending on the data available and factors such as the fish species and size. The remediation goal for fish fillet at the ETTP K-1007-P1 Pond is 1 µg/g. Most recently, the water quality criterion that has been used by TDEC to calculate the fish tissue concentration triggering a determination of impairment and a TMDL of 0.02 µg/g in fish fillet. The fish PCB concentrations at and near ETTP are above this most conservative concentration.

In addition to monitoring for human health and ecological risks as well as long-term trends, bioaccumulation monitoring also includes investigations of sources of contamination to ETTP waterways. Caged Asiatic clams (*Corbicula fluminea*) are used as bioindicators of contaminant sources in Mitchell Branch and other sites around ETTP. These clams are collected from an uncontaminated reference site (Little Sewee Creek in Meigs County, Tennessee) and are divided into groups of 10 clams of equal mass. In 2024, clams were placed in baskets to be deployed at strategic locations around ETTP (i.e., in and around storm drains) for a four-week exposure period (May 7–June 4, 2024). Two clam baskets were placed at each site with 10 clams in each basket.

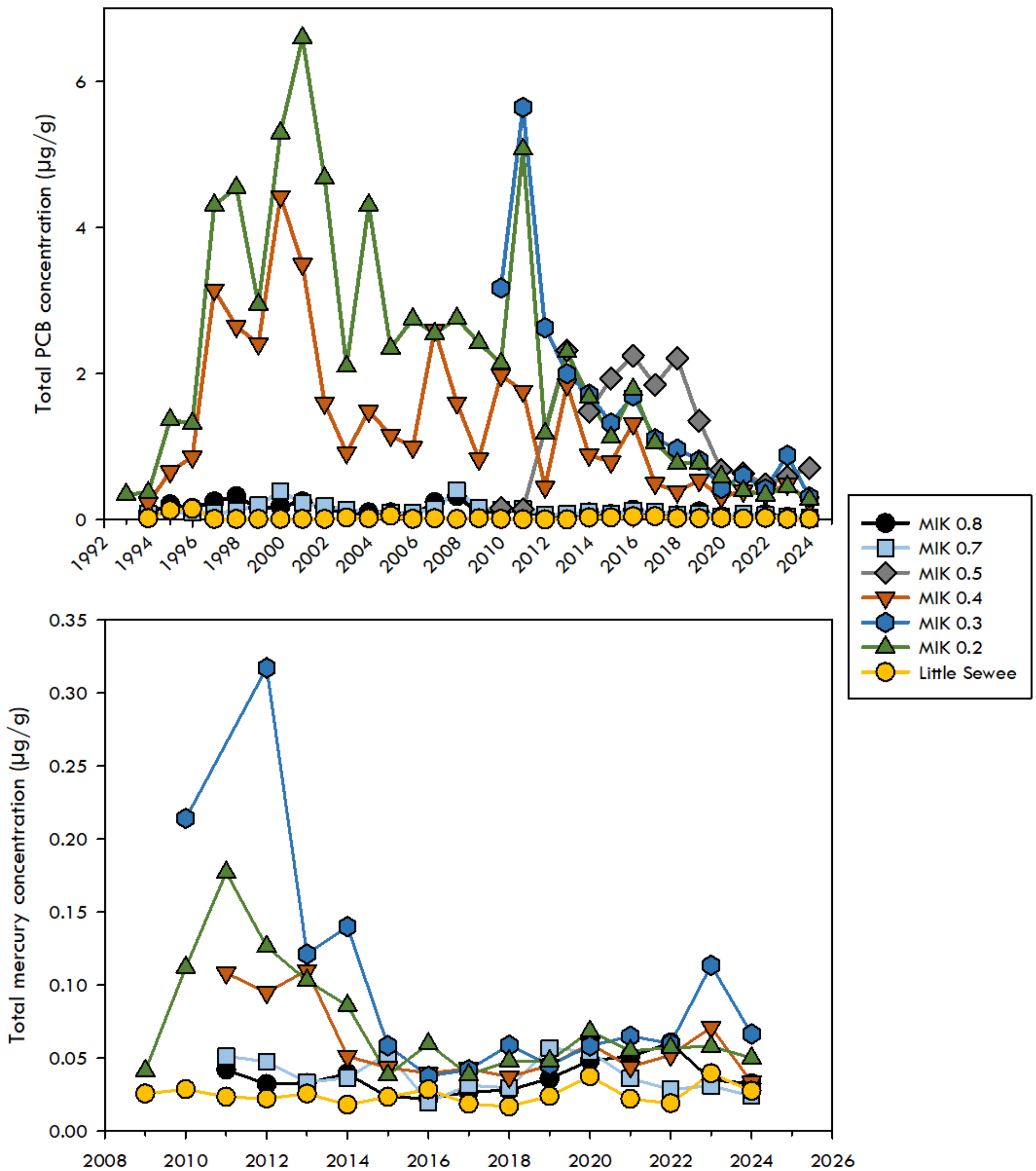
Because these animals are sedentary filter feeders, they accumulate contaminants that are present in the water and in suspended particles at a given site. They are useful indicators of the bioavailable (and therefore potentially toxic) portion of contaminants that enter the environment at a given location, and they provide spatial resolution of contamination on a finer scale than is possible with fish bioaccumulation studies. Caged clams have been used for more than 25 years to evaluate the importance of storm drains and other inputs of PCBs into the waterways around ETTP and for the past 10+ years to monitor total mercury (Hg_T) and methylmercury (MeHg) inputs to Mitchell Branch. Whereas most of the mercury in the environment is inorganic mercury (Hg^{2+}), a small fraction of Hg^{2+} is converted to the more toxic and bioaccumulative MeHg. Because MeHg biomagnifies in aquatic systems, increasing in concentration as it moves up through the food chain, more than 90 percent of the mercury in upper trophic level fish is MeHg. Clams, which feed on periphyton and detritus at the base of the food chain, have a much smaller proportion of MeHg in their tissues but are still good indicators of MeHg hot spots and sources. The soft tissues of the clams from each cage were homogenized, and aliquots were taken for PCB and mercury analysis.

To assess spatial and temporal variability in exposure to PCBs following remediation activities, water samples have been collected for analysis of aqueous PCBs and TSS from the outfalls of K-1007-P1 and K-901-A, upper and lower storm drain (SD)-100, and an uncontaminated reference site (upper First Creek, ORNL). Samples are collected four times each year (March/April, June, July, and August).

3.7.1.1. Mitchell Branch

Figure 3.20 shows long-term monitoring results in caged clams deployed at various sites in Mitchell Branch. The lower portion of this stream (MIK 0.5 [SD-190]–MIK 0.2) has historically been a hot spot for both mercury and PCB contamination. In 2024 PCB concentrations in clams in this stretch of the creek decreased slightly, except at MIK 0.5 when compared to 2023 concentrations, but broadly remained below concentrations seen before 2016. Although there is considerable interannual variability, PCB concentrations in clams placed in lower Mitchell Branch appear to be generally trending downward since peak years in 2000–2001. PCB concentrations in the upper portion of Mitchell Branch (MIK 0.8) were similar to previous years' concentrations and were slightly elevated (0.034 µg/g) with respect to the reference site (0.01 µg/g).

Mercury concentrations in clams deployed in Mitchell Branch in 2024 were similar to concentrations seen in 2023, except at MIK 0.3 and 0.4, where the mercury concentrations decreased by nearly half (from 0.11 to 0.07 µg/g and from 0.07 to 0.03 µg/g, respectively; Figure 3.20). Within the Mitchell Branch system, the highest mercury concentrations were seen in clams deployed at SD180 (0.10 µg/g). Unlike in fish tissue, MeHg in the soft tissues of clams generally made up a small proportion of Hg_T (Figure 3.21). MeHg concentrations in clams remained low in 2024, comparable to concentrations in 2023.

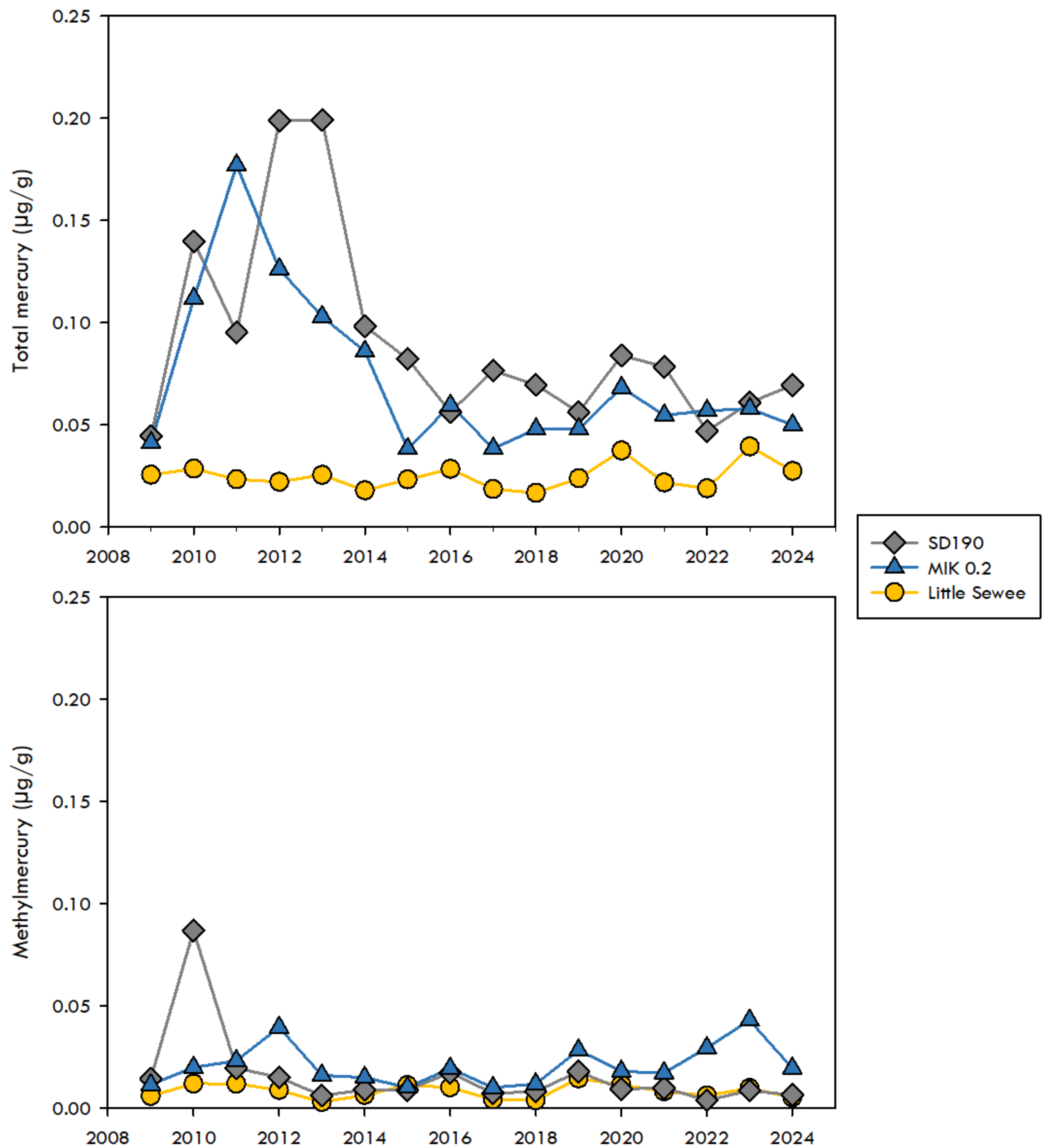


Notes:

1. *N = 2 composites of 10 clams each per year.*
2. *Shown in yellow are data for clams collected from the reference site, Little Sewee Creek (Meigs County, Tenn.).*
3. *Total PCBs is defined as the sum of Aroclors 1248, 1254, and 1260.*

Acronyms*: MIK = Mitchell Branch kilometer   PCB = polychlorinated biphenyl*

Figure 3.20. Mean total PCB (Top: µg/g, wet wt; 1993–2024) and mercury (Bottom: µg/g wet wt; 2009–2024) concentrations in the soft tissues of caged Asiatic clams deployed in Mitchell Branch



Notes:

1. *N = 2 composites of 10 clams each per year.*
2. *Shown in yellow are data for clams collected from the reference site, Little Sewee Creek (Meigs County, Tenn.)*

Acronyms: *MIK = Mitchell Branch kilometer* *SD = storm drain*

Figure 3.21. Total (top panel) and methylmercury (bottom panel) concentrations in the soft tissues of caged Asiatic clams deployed in Mitchell Branch (µg/g wet wt; 2009–2024)

Figure 3.22 shows long-term monitoring results in redbreast sunfish (*L. auritus*) at MIK 0.2. Average PCB concentrations in fish collected at MIK 0.2 in 2024 (0.41 ± 0.1 µg/g) were lower than those seen in 2023 (0.59 ± 0.1 µg/g) but remained comparable to concentrations seen at this site in recent years. Although there is not a regulatory limit for PCBs in fish, the level most often used in practice to issue fish consumption advisories in the State of Tennessee, as previously stated, is 1 µg/g. In 2024, the mean PCB concentration in sunfish fillets collected from MIK 0.2 was below this limit, but was above the most conservative limit of 0.02 µg/g. While the observed fish tissue concentrations in Mitchell Branch are lower than they have historically been, they are still two to three orders of magnitude higher than concentrations seen in the same species at the Hinds Creek reference site in Anderson County.

Hg_T has been monitored more sporadically in redbreast sunfish fillets at MIK 0.2. Figure 3.22 shows long-term trends in Hg_T concentrations (µg/g) in these fish. A rapid increase in fillet Hg_T concentrations was observed in the early 1990s and concentrations have generally remained elevated, with mean concentrations exceeding the AWQC (0.3 µg/g) in most years. Similar to the PCB concentrations in fish from this site, Hg_T concentrations at MIK 0.2 have been oscillating around the EPA's recommended AWQC for the past several years. Mean mercury concentrations in redbreast at this site remained just above the mercury tissue criterion, averaging 0.49 ± 0.05 µg/g in 2024.

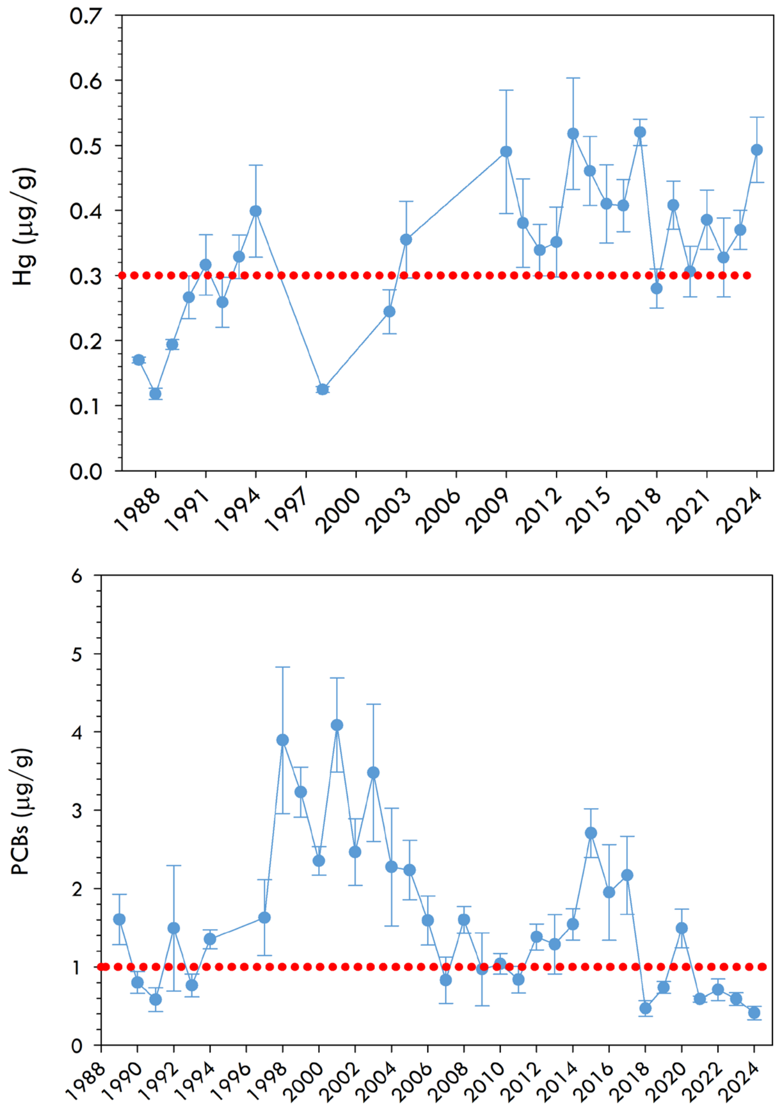
3.7.1.2. K-1007-P1 Pond

Over the past decade, mean aqueous PCB concentrations in the K-1007-P1 Pond have fluctuated significantly but have generally been lower than concentrations seen before 2009 remediation activities (e.g., 35 ng/L in 2024 compared with 161 ng/L in 2007; Figure 3.23). Concentrations in 2024 were slightly lower than in 2023, but still were also comparable to the lowest recorded average PCB concentration since remediation (26 ng/L in 2015). PCBs tend to be particle associated and are positively correlated with TSS. The fluctuations in PCB and TSS concentrations in water in the K-1007-P1 Pond could be related to fluctuations in aquatic plant coverage, which can affect sediment stability. The aqueous PCB concentrations measured in the K-1007-P1 Pond are above concentrations seen at the First Creek reference site (0.16 ng/L in 2024) and are above the State of Tennessee water quality criterion for the protection of fish and wildlife (14 ng/L).

PCB concentrations in clams placed at lower and upper SD-100 locations have fluctuated significantly since 1995, but displayed a decreasing trend from 2007 to 2010. and 2017 to 2018 (Figure 3.24). PCB concentrations in clams deployed at this site increased significantly in 2021–2023, but in 2024, they decreased significantly at upper SD100 (from 9.9 µg/g to 3.3 µg/g), returning to the range of concentrations recorded from 2008 to 2021. PCB concentrations at upper SD100 have been below values found at lower SD100 for the entire monitoring period, a trend that continued in 2024: concentrations decreased slightly while remaining somewhat elevated from concentrations seen from 2006 to 2021. Although PCB concentrations in clams placed at the K-1007-P1 Pond outfall are an order of magnitude lower than those deployed at upper SD100, concentrations here followed the same temporal trends as those at SD100 locations, with a slight increase 2022 and 2023 followed by a decrease in 2024. PCB concentrations at SD120 and SD490 remained similar to values recorded since 2012. Hg_T and MeHg concentrations in clams deployed at the K-1007-P1 Pond were similar to concentrations in clams deployed at the reference site, Little Sewee Creek (Figure 3.24).

Average PCB concentrations in fish collected from the K-1007-P1 Pond appear to be generally decreasing (Figure 3.25). In FY 2024, mean PCB concentrations in both fillets and whole-body composites of bluegill were below the targets for the K-1007-P1 Pond. Mean PCB concentrations in fillets in the K-1007-P1 Pond were 0.22 µg/g in 2024, which is below the remediation goal for this pond (1 µg/g total PCBs in fillets). The mean concentration in whole-body bluegill was 1.00 µg/g in 2024, which is below the remediation target for this pond (2.3 µg/g in whole-body composites; Figure 3.26).

The interannual fluctuations in PCB concentrations could be due to water quality changes that have taken place in this pond, e.g., higher TSS, PCB inputs, and fluctuations in vegetation cover (Figures 3.23, 3.25, and 3.26).

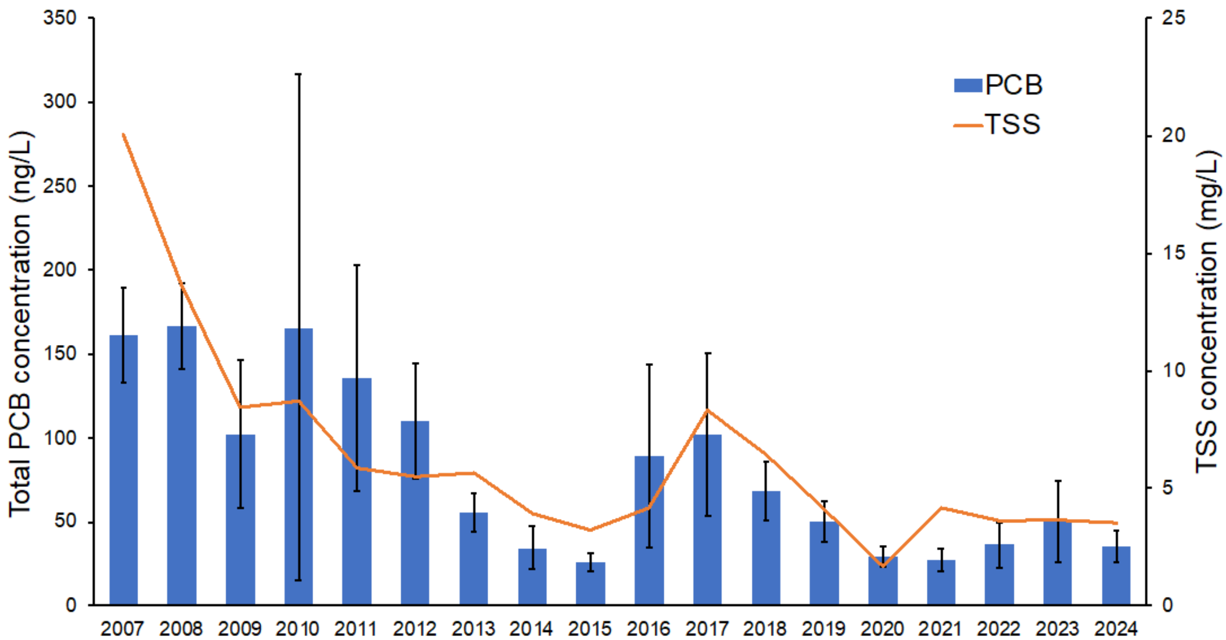


Notes:

1. *N = 6 fish per year.*
2. *Shown in red is the fish advisory level for mercury in fish fillets (0.3 µg/g).*

Acronyms*: Hg = mercury* *MIK = Mitchell Branch kilometer* *PCB = polychlorinated biphenyl*

Figure 3.22. Mean mercury (top panel) and PCBs (bottom panel) concentrations (µg/g, wet wt) in redbreast sunfish fillets in Mitchell Branch (MIK 0.2), 1989–2024

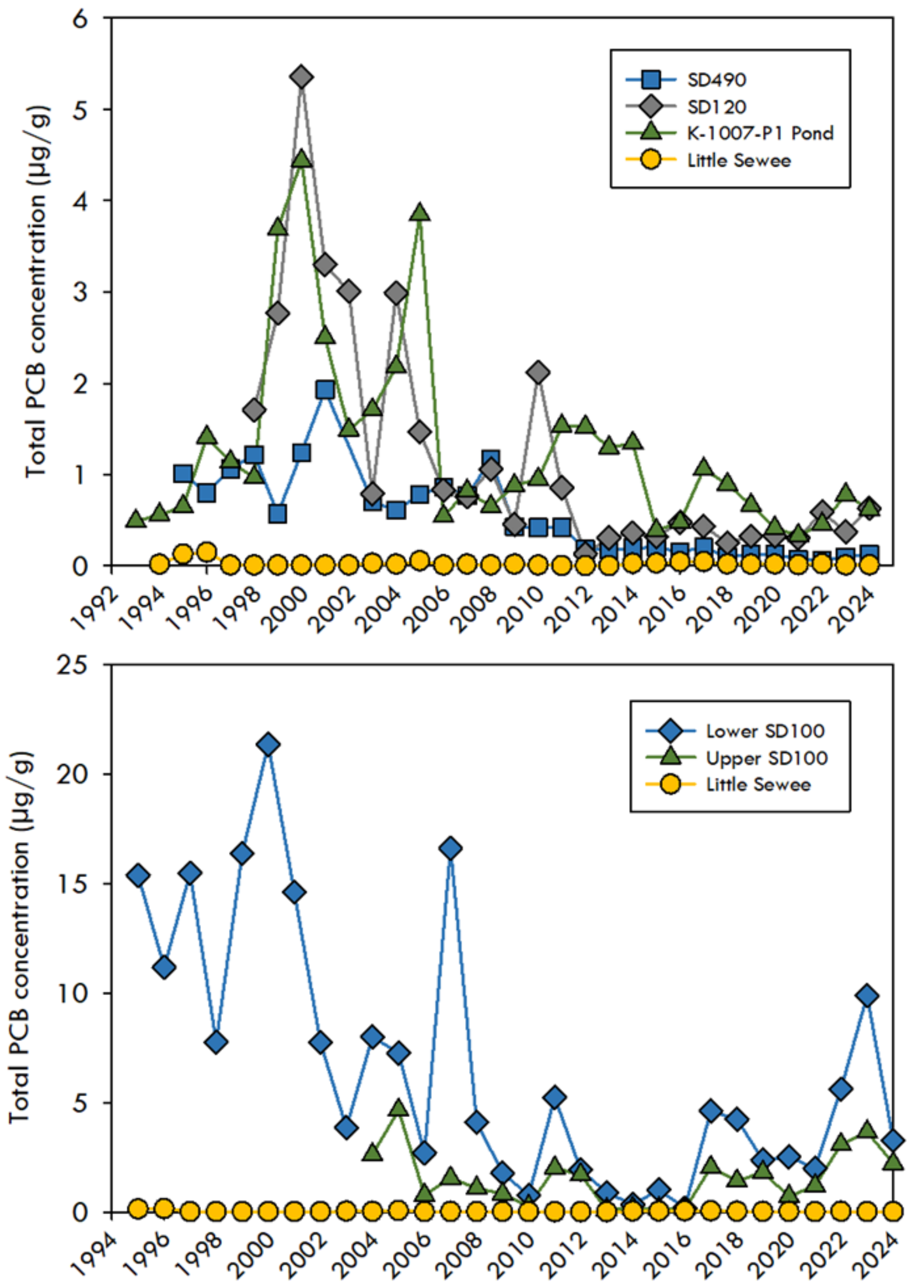


Notes:

1. *Means for PCBs in water and TSS are based on results across all collections made each year.*
2. *Note that mean concentrations of PCBs in water from First Creek were <1.5 ng/L in all years.*

Acronyms: *PCB = polychlorinated biphenyl* *TSS = total suspended solids*

Figure 3.23. Mean aqueous total PCB concentrations, total suspended solids, and vegetation cover in the K-1007-P1 Pond, 2007–2024

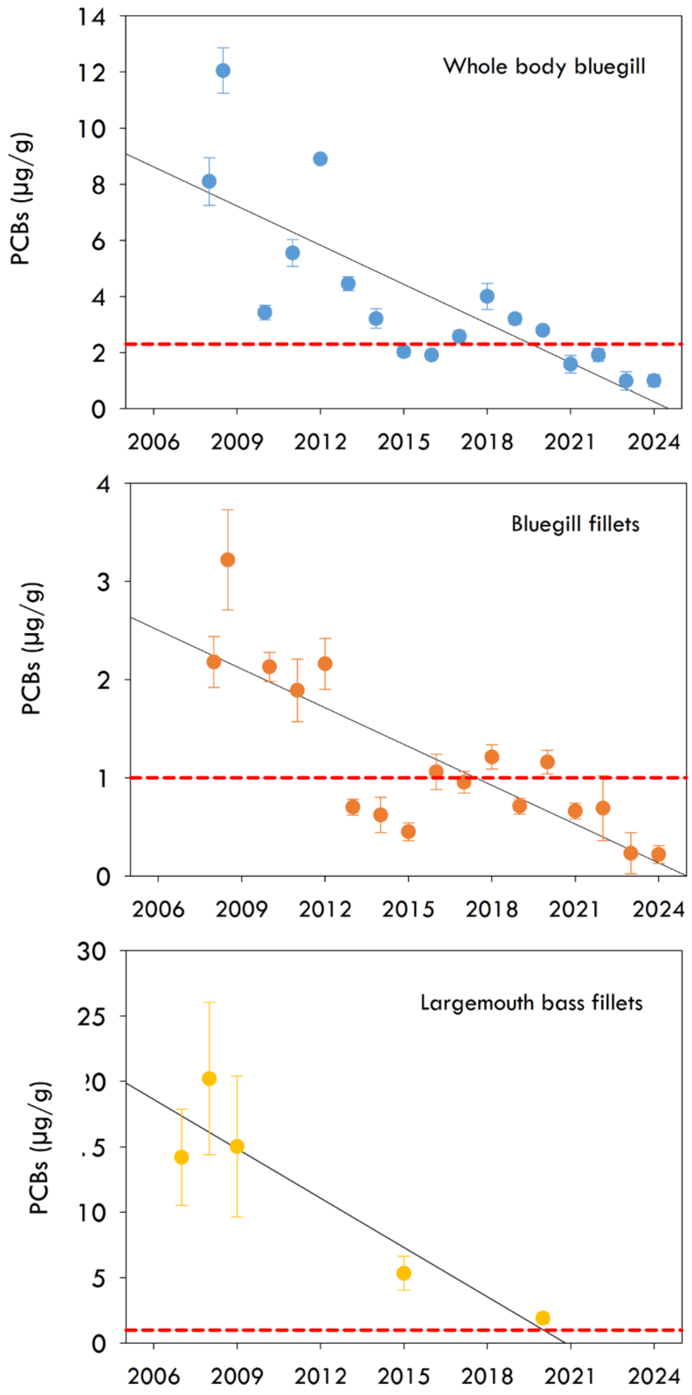


Notes:

1. *N = 2 clam composite samples per site/year.*
2. *Total PCBs defined as the sum of Aroclors 1248, 1254, and 1260.*
3. *Photos: Upper graph shows the SD-490 location; lower graph photo shows placement of clam cages in the Upper SD-100 location.*

Acronyms: *PCB = polychlorinated biphenyl   SD = storm drain*

Figure 3.24. Mean total PCB concentrations (µg/g, wet wt) in caged clams placed at K-1007-P1 outfalls compared with reference stream clams (Little Sewee Creek), 1993–2024

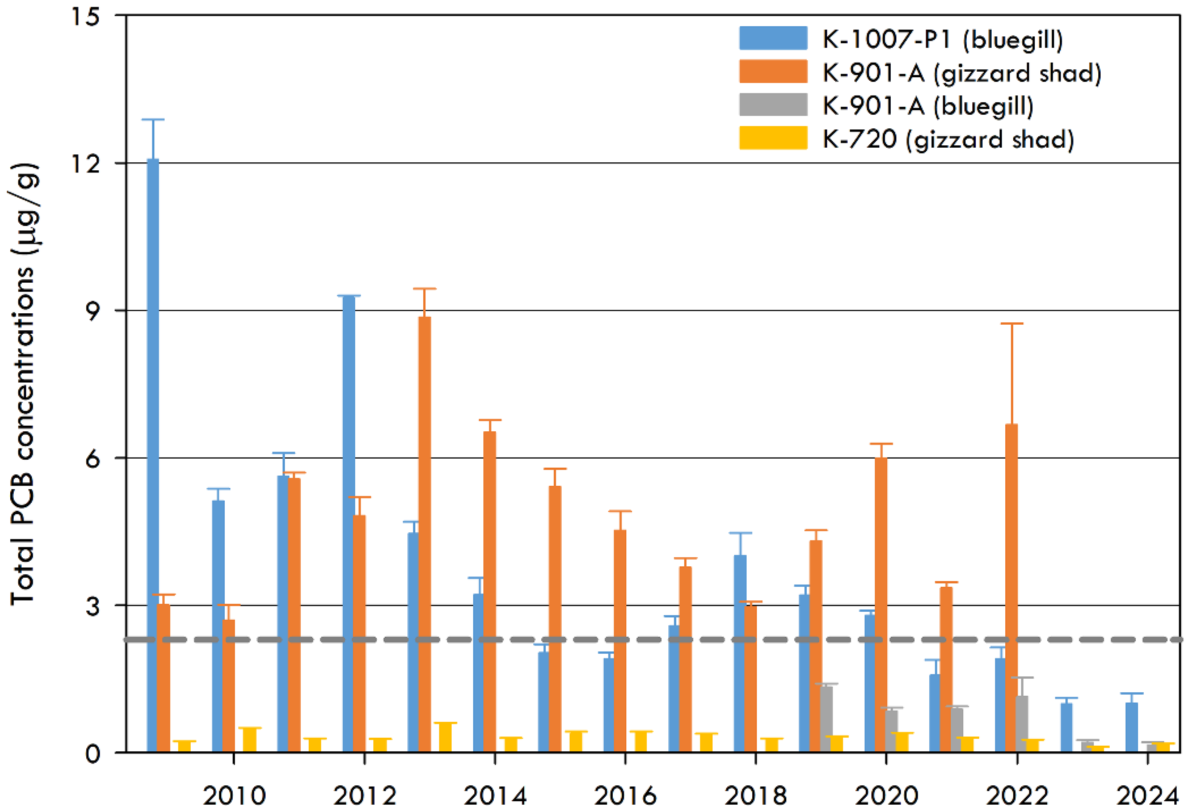


Notes:

1. *For largemouth bass, N = 6 fish per site/year. For bluegill sunfish, N = 20 for fillets and N = 6 composites of 10 whole body fish.*
2. *The target for fillet (1 µg/g) and whole-body concentrations (2.3 µg/g) is shown with the gray dotted lines.*

Acronym: *PCB = polychlorinated biphenyl*

Figure 3.25. Mean PCB concentrations (µg/g, wet wt) in fish from the K-1007-P1 Pond, 2007–2024



Notes:

1. *Total PCBs are defined as the sum of Aroclors 1248, 1254, and 1260.*
2. *The dotted line signifies the target PCB concentration of 2.3 µg/g in whole body fish.*

Acronym: *PCB = polychlorinated biphenyl*

Figure 3.26. Mean (+1 standard error) total PCB concentrations (µg/g, wet wt) in whole body fish from K1007-P1 Pond, K-901-A Holding Pond, and K-720 Slough, 2009–2024

Table 3.9. Average concentrations of total PCBs in fillets and whole-body composites of fish collected in 2024 near the ETTP

Site	Species	Sample type	Sample size (n)	Total PCBs (mean ± SD)	Range of PCB values	No. > target (PCBs)/n	Total Hg (mean + SD)
K-1007-P1 Pond	Bluegill	Fillet	20	0.22 ± 0.09	0.11–0.41	0/20	—
		Whole-body composite	6	1.00 ± 0.21	0.77–1.31	0/6	—
K-901-A Pond	Common carp	Fillet	1	1.69	—	1/1	—
	Largemouth bass	Fillet	14	0.05 ± 0.03	0.02–0.04	0/14	—
K-720 Slough	Largemouth bass	Fillet	16	0.02 ± 0.01	0.01–0.04	0/16	—
	Common carp	Fillet	3	0.55 ± 0.09	0.49–0.65	0/3	—
	Gizzard shad	Whole-body composite	6	0.12 ± 0.01	0.17–0.19	0/6	—
CRM 11.0	Bluegill	Whole-body composite	6	0.02 ± 0.01	0.01–0.03	0/6	—
	Gizzard shad	Whole-body composite	6	0.04 ± 0.005	0.03–0.04	0/6	—
PCM 1.0	Bluegill	Whole-body composite	6	0.08 ± 0.02	0.05–0.10	0/6	—
	Gizzard shad	Whole-body composite	6	0.13 ± 0.02	0.11–0.17	0/6	—
Mitchell Branch	Redbreast sunfish	Fillet	6	0.41 ± 0.09	0.21–0.81	0/6	0.49 ± 0.05
Hinds Creek	Redbreast sunfish	Fillet	6	0.01 ± 0.002	0.01–0.02	0/6	0.08 ± 0.02

Notes:

1. *Average concentrations = μg/g, wet wt.*
2. *Total PCBs = Aroclors 1248, 1254, and 1260.*
3. *Values are mean concentrations (μg/g) ± 1 SE.*
4. *Each whole-body composite sample is composed of 10 individual fish.*
5. *Also shown are the ranges of values observed for PCBs and the number of fish whose fillet PCB concentrations exceeded 1 μg/g out of the total number of fish (or composites) sampled (n). (1 μg/g total PCBs in fish fillets and 2.3 μg/g in whole-body composites.*

Acronyms and abbreviations:

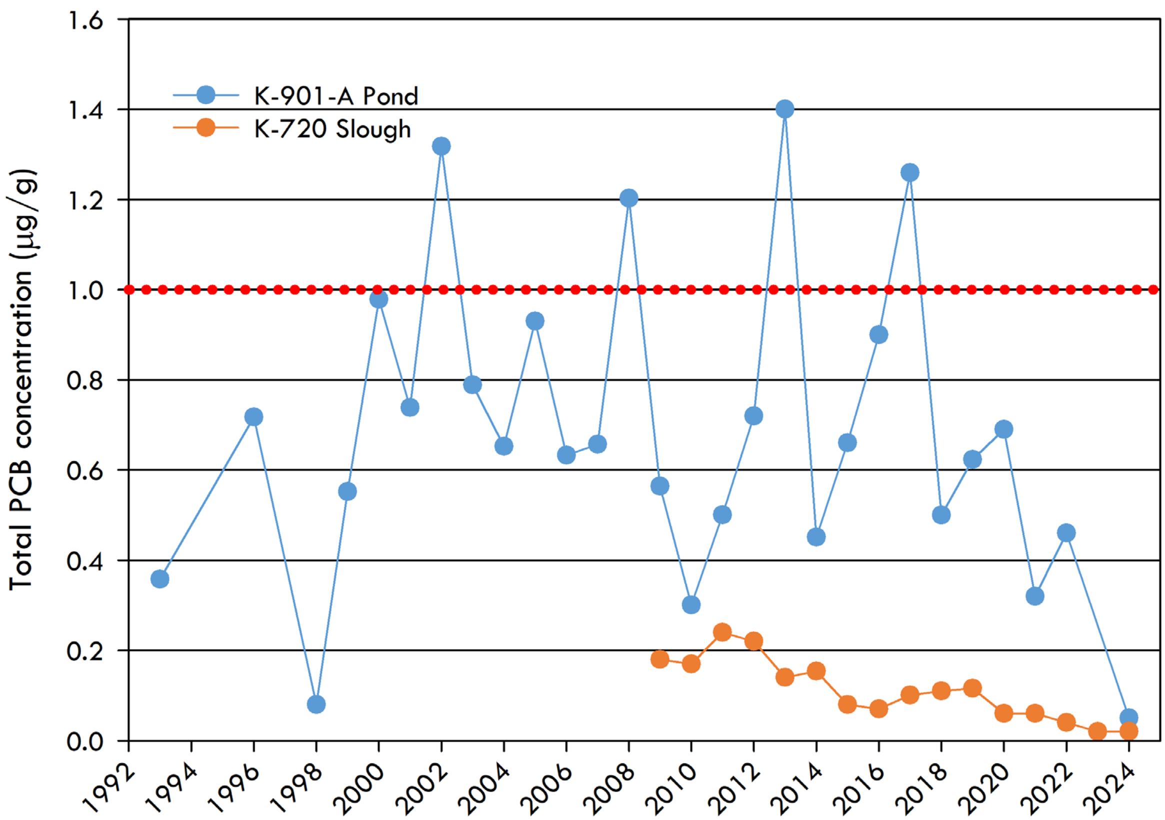
CRM = Clinch River mile
PCB = polychlorinated biphenyl
SE = standard error
n = sample size number
No. = number
PCM = Poplar Creek mile

3.7.1.3. K-901-A Pond

The target fish species for analysis of PCBs in the K-901-A Holding Pond were gizzard shad (*D. cepedianum*) and largemouth bass (*M. salmoides*), but the vegetation planting in this pond was so successful that the habitat for these larger fish has been decreasing and they have become less abundant. In 2024, only one common carp and 14 largemouth bass were collected for analysis.

The PCB concentration in the carp collected in 2024 was 1.69 µg/g, which was higher than in previous years. The mean concentration in largemouth bass seen in 2024 remained the same as 2023 (0.05 µg/g) and was below the target concentration set for the K-1007-P1 Pond of 1 µg/g total PCBs (Figure 3.27). The mean PCB concentration in bluegill fillets in the K-901-A Pond was 0.08 µg/g, which is lower than the concentrations seen in the K-1007-P1 Pond, and well below the target set for both of the ponds.

PCB concentrations in clams deployed in the K-901-A Pond were comparable to those deployed at the reference site, Little Sewee Creek, and were lower in 2024 (0.02 µg/g) than in 2023 (0.03 µg/g; Figure 3.28).



Notes:

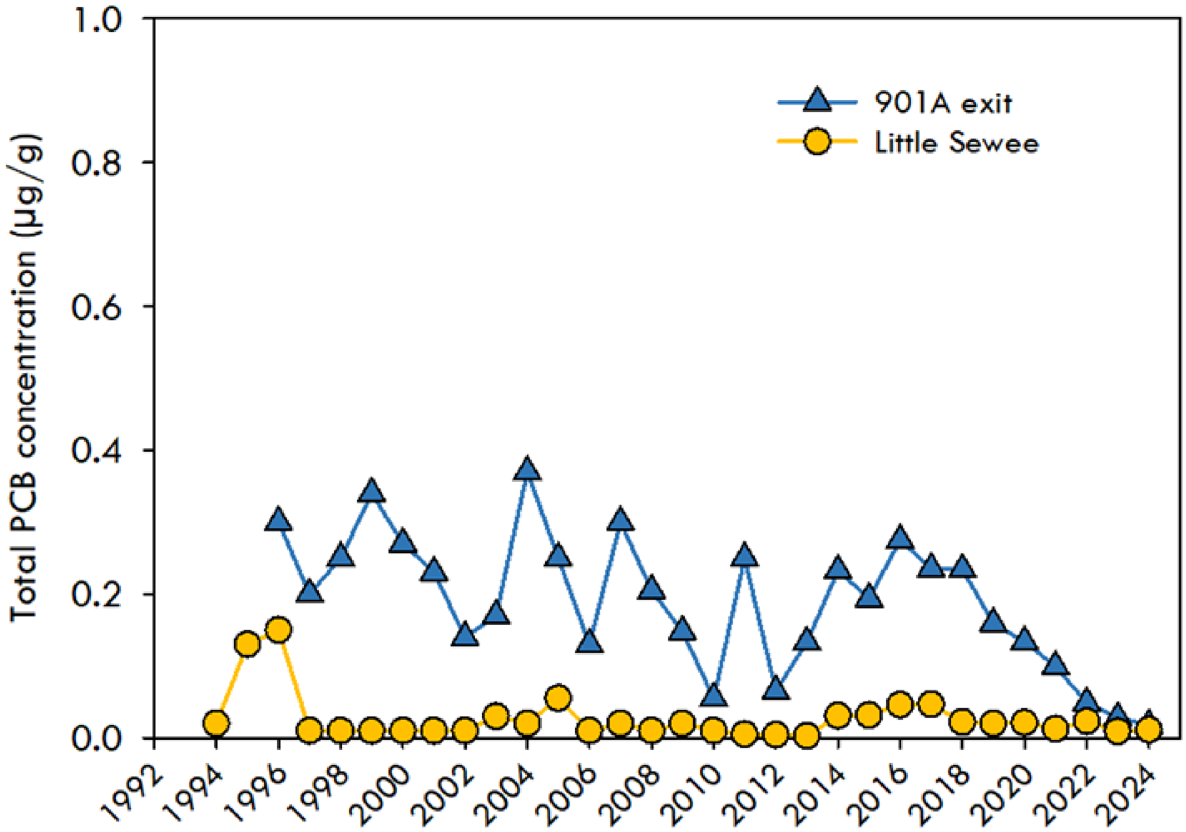
1. *Mean PCBs (± 1 SE) in largemouth bass fillets, 1993-2023 (µg/g).*
2. *N = 6 fish per year, when possible.*
3. *The dotted red line shows the advisory level for PCBs in fish fillets (1 µg/g).*

Acronyms:

PCB = polychlorinated biphenyl

SE = standard error

Figure 3.27. Mean total PCB concentrations in largemouth bass from the K-901-A Pond and the K-720 Slough



Notes:

1. *Total PCBs defined as the sum of Aroclors 1248, 1254, and 1260.*
2. *N = 2 composites of 10 clams each per year.*
3. *Shown in green are data for clams collected from the reference site, Little Sewee Creek (Meigs County, Tenn.).*

Acronym:

PCB = polychlorinated biphenyl

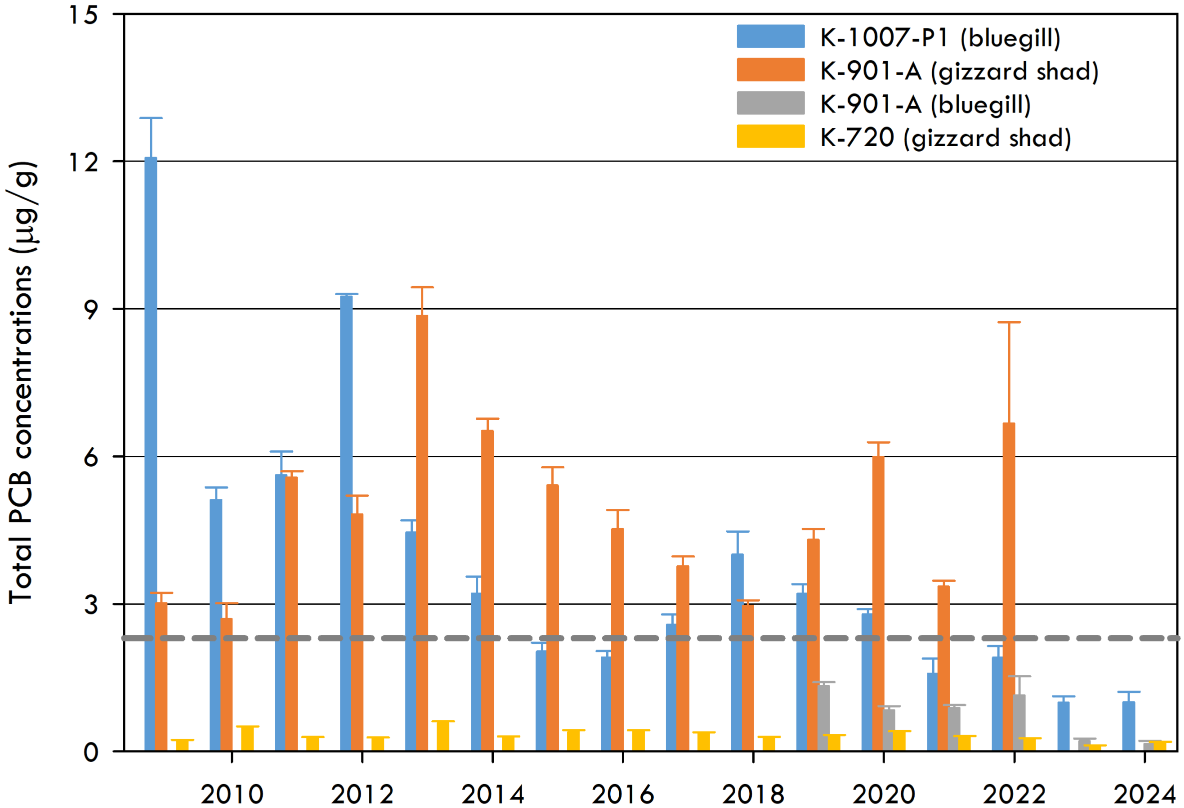
Figure 3.28. Mean total PCB (µg/g, wet wt; 1993–2024) concentrations in the soft tissues of caged Asiatic clams deployed in the K-901-A Pond for a 4-week period

3.7.1.4. K-720 Slough

Routine bioaccumulation monitoring in the K-720 Slough began in 2009 (Figure 3.29). Although the target species for fish fillet monitoring in this slough is largemouth bass, as in the K-901-A Pond it has been difficult to collect a full sample of 20 fish of this species; to complete the collection, common carp also are collected for a total of 20 fish. Figure 3.29 also shows the temporal trends in fish fillet concentrations in the slough. In 2024, PCB concentrations in both fish species monitored were below the state advisory limit of 1 µg/g.

In all cases PCB levels in fish collected from the K-720 Slough were significantly lower than in the K-901-A Holding Pond for the same species (Table 3.9). PCB concentrations in largemouth bass collected from the K-720 Slough have been steadily decreasing since monitoring began (shown earlier in Figure 3.27), averaging 0.02 µg/g in 2024. This concentration is just at the most conservative guideline for PCBs in the State of Tennessee (0.02 µg/g, based on TMDL calculations).

Concentrations in carp collected from the slough were slightly higher than concentrations in bass, averaging 0.55 µg/g in 2024. Total PCBs in whole body gizzard shad from the K-720 Slough were similar to those seen in recent years and were lower than those seen in whole body fish collected from the other monitored ponds, averaging 0.18 µg/g in 2024.



Notes:

1. *Total PCBs defined as the sum of Aroclors 1248, 1254, and 1260.*
2. *The target sample was 20 largemouth bass, but because these fish are not abundant in the slough, carp and smallmouth buffalo were collected to complete the sample size of 20 fish.*

Acronym:

PCB = polychlorinated biphenyl

Figure 3.29. Mean total PCB (µg/g, wet wt; 2009–2024) concentrations in the fillets of largemouth bass, common carp, and smallmouth buffalo collected from the K-720 Slough

3.7.2. Task 2: Instream Benthic Macroinvertebrate Communities

Benthic macroinvertebrate communities in Mitchell Branch are sampled using ORNL and TDEC protocols (Figures 3.30 and 3.31). Evaluation of long-term trends of macroinvertebrate communities in the stream make it possible to document the effectiveness of pollution abatement activities or remediation, efforts as well as to assess the potential consequences of unanticipated events as sitewide remediation continues (e.g., chromium release into Mitchell Branch).

Figure 3.30. Collecting an invertebrate sample using ORNL BMAP protocols

Long-term monitoring of pollution-intolerant benthic macroinvertebrates such as stoneflies, mayflies, and caddisflies helps us understand changes in ecological health of Mitchell Branch in response to remedial action at ETTP.

Figure 3.31. Sampling for benthic macroinvertebrates with TDEC protocols

3.7.2.1. Benthic Macroinvertebrates

The major objectives of the benthic macroinvertebrate task are to help assess the ecological condition of Mitchell Branch and to evaluate changes in stream ecology associated with changes in facilities operations and RAs within the Mitchell Branch watershed. To meet these objectives, the condition of the benthic macroinvertebrate community of Mitchell Branch has been monitored routinely since late 1986. This summary includes results of samples collected each April from 1987 to 2024 following ORNL BMAP quantitative sampling protocols and samples collected annually (August/September) with TDEC semiquantitative sampling protocols for estimating the North Carolina Biotic Index (NCBI) and the Habitat Index (TDEC 2021). For both sets of protocols, four sites were assessed in Mitchell Branch—MIKs 0.4, 0.7, 0.8, and 1.4. MIK 1.4 serves as the primary reference site, but narrative Biotic Index results for TDEC protocols are based on reference conditions established by TDEC from a suite of reference sites in the same ecoregion as Mitchell Branch. Finally, also included in this summary is a comparison between the macroinvertebrate community structure at the four Mitchell Branch sites and five other reference sites on the ORR. Most of these reference sites—spanning a range of stream sizes both smaller and larger than Mitchell Branch (based on watershed area)—have been monitored using ORNL protocols since the mid1980s for other biological monitoring projects on ORR (ORNL BMAP and WRRP/Bear Creek Biological Monitoring Program) (as shown earlier in Table 3.9). This summary provides information on how invertebrate community structure at Mitchell Branch sites, including MIK 1.4, compares with the community structure of a range of relatively unaffected reference sites on the ORR.

3.7.2.2. Mitchell Branch—ORNL and TDEC Protocols

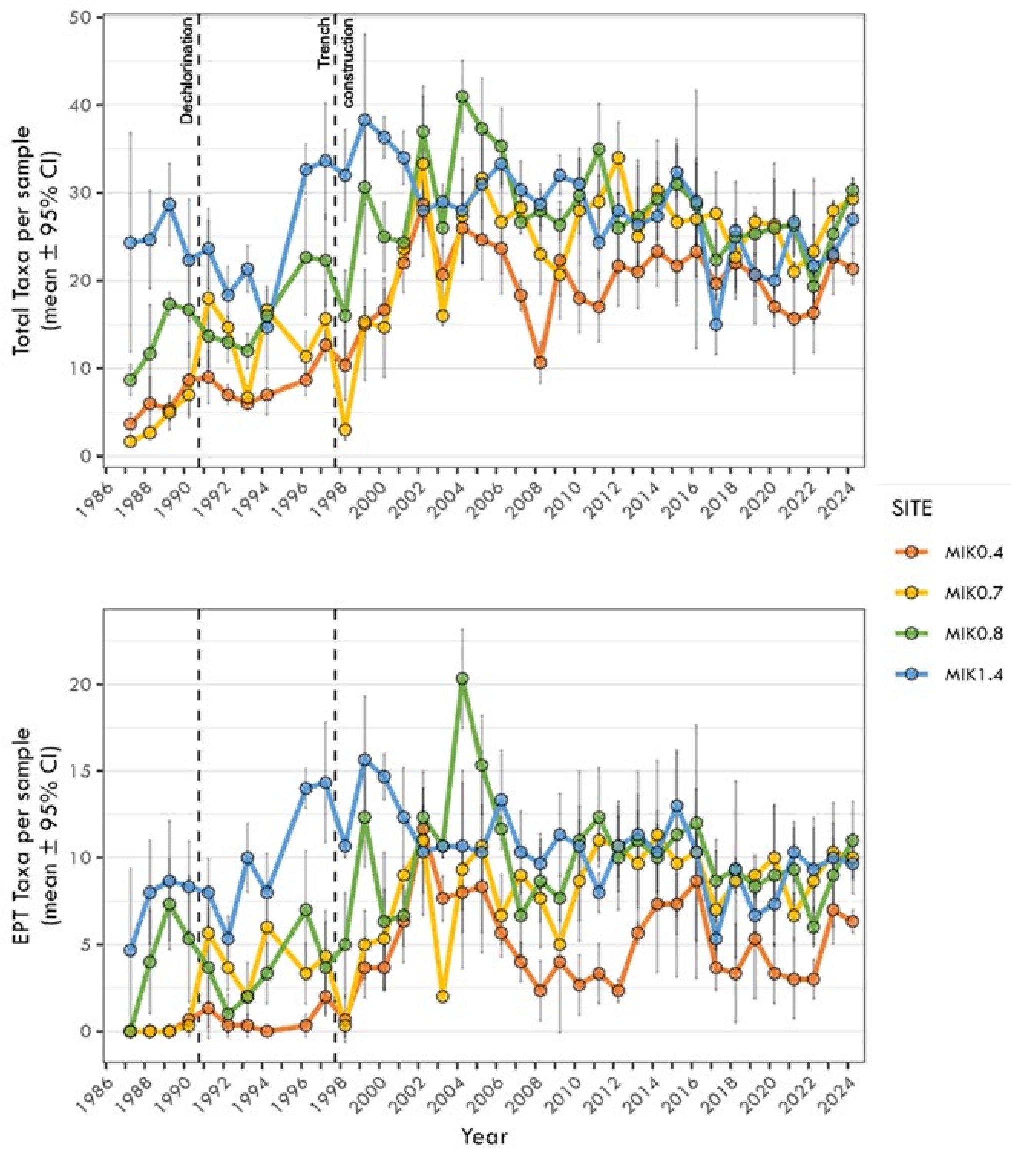
Total taxa richness (i.e., the total number of taxa per sample) and *Ephemeroptera*, *Plecoptera*, and *Trichoptera* (EPT) taxa richness (i.e., the total number of pollution-intolerant EPT taxa [mayflies, stoneflies, and caddisflies] per sample) measured using ORNL protocols has varied over the measurement period (1987–2023) in all Mitchell Branch sites (Figure 3.32). Both total taxa richness and EPT taxa richness increased in MIKs 0.4, 0.7, and 0.8 from 1987 to the late 1990s. Despite considerable year to year variations the total taxa richness and EPT taxa richness have expressed a fairly stable trend from the late 1990s and onward in MIKs 0.4, 0.7, and 0.8 (Figure 3.32). Total taxa richness and EPT taxa richness have been fairly consistent throughout the measurement period in the reference site, MIK 1.4, though values have been lower in five of the past seven years (Figure 3.32). In comparing values from April 2024 to those in April 2023, total taxonomic richness and EPT taxonomic richness increased only at MIK 0.8 and no sites showed significant decreases in either total or EPT taxonomic richness values (Figure 3.32). Both richness metric values were lowest at MIK 0.4 and highest at MIK 0.8, though the values at the three upstream sites were more similar to each other than to MIK 0.4 (Figure 3.32). The EPT taxonomic richness at MIK 0.8 displayed a second consecutive year of increased values, reaching levels not seen since 2016 (Figure 3.32).

The percent density of the pollution-intolerant taxa (higher values indicate better conditions) was highest at MIK 1.4, the reference site—a trend that has been observed over most of the time series (Figure 3.33).

The percent density of pollution-tolerant taxa (lower values indicate better conditions) in 2024 was lowest at MIK 1.4 and highest at MIK 0.4 (Figure 3.33). In 2024, the percent density of pollution-tolerant taxa at MIK 1.4 was closer to, but slightly above, levels typically observed over the monitoring period (Figure 3.33). These results suggest that the invertebrate community in Mitchell Branch continues to be mildly to moderately degraded downstream of MIK 1.4.

Based on TDEC protocols (TDEC 2021), scores for the TMI (Tennessee Macroinvertebrate Index) in 2024 rated the invertebrate community at MIK 1.4 as passing biocriteria guidelines, whereas scores for communities in the three lower Mitchell Branch sites fell below biocriteria guidelines (Figure 3.34, Table 3.10). From 2023 to 2024, TMI scores decreased at all sites except MIK 0.4, where the score increased. The decreased scores at the three upper MIK sites in 2024 reflected decreases in several different biocriteria, including the taxonomic richness score (MIK 0.8), the EPT richness score (MIK 0.7 and 0.8), the EPT percent abundance score (MIK 0.7), and the clinger percent abundance score (MIK 1.4; Table 3.10). The increased TMI score at MIK 0.4 was due to increases in both the EPT richness and North Carolina Biotic Index scores, indicating that more pollution-intolerant species were present. The improved score at MIK 1.4 reflected increases in EPT taxa richness and the percentage of clinger taxa (Table 3.10). The TDEC protocol states that TMI scores should be calculated only for samples with 160–240 invertebrates identified to genus (TDEC 2021). In 2024, samples at MIK 0.7 and MIK 0.8 fell below this threshold (Figure 3.34), indicating results should be interpreted with caution.

Mitchell Branch is situated within ecoregion 67f, the Southern Limestone/Dolomite Valleys and Low Rolling Hills, which is composed of diverse aquatic habitats and fish fauna (EPA 2013). Based on TDEC stream habitat protocols, habitat quality was above the ecoregion 67f guideline at all sites within Mitchell Branch (Figure 3.34). Habitat scores remained similar (MIK 0.7 and MIK 0.8) or decreased (MIK 0.4 and MIK 1.4) in 2024, while remaining above the habitat quality threshold over the past four years (Figure 3.34). In general, these decreases were driven by increased sediment deposition, embeddedness of riffles, bank stability, and bank vegetation protection issues. Small riparian width, particularly on the left bank, remains an issue at all sites except MIK 1.4. Habitat conditions related to riffle stability (i.e., frequency of reoxygenation zones) and channel flow improved or remained constant at all sites.



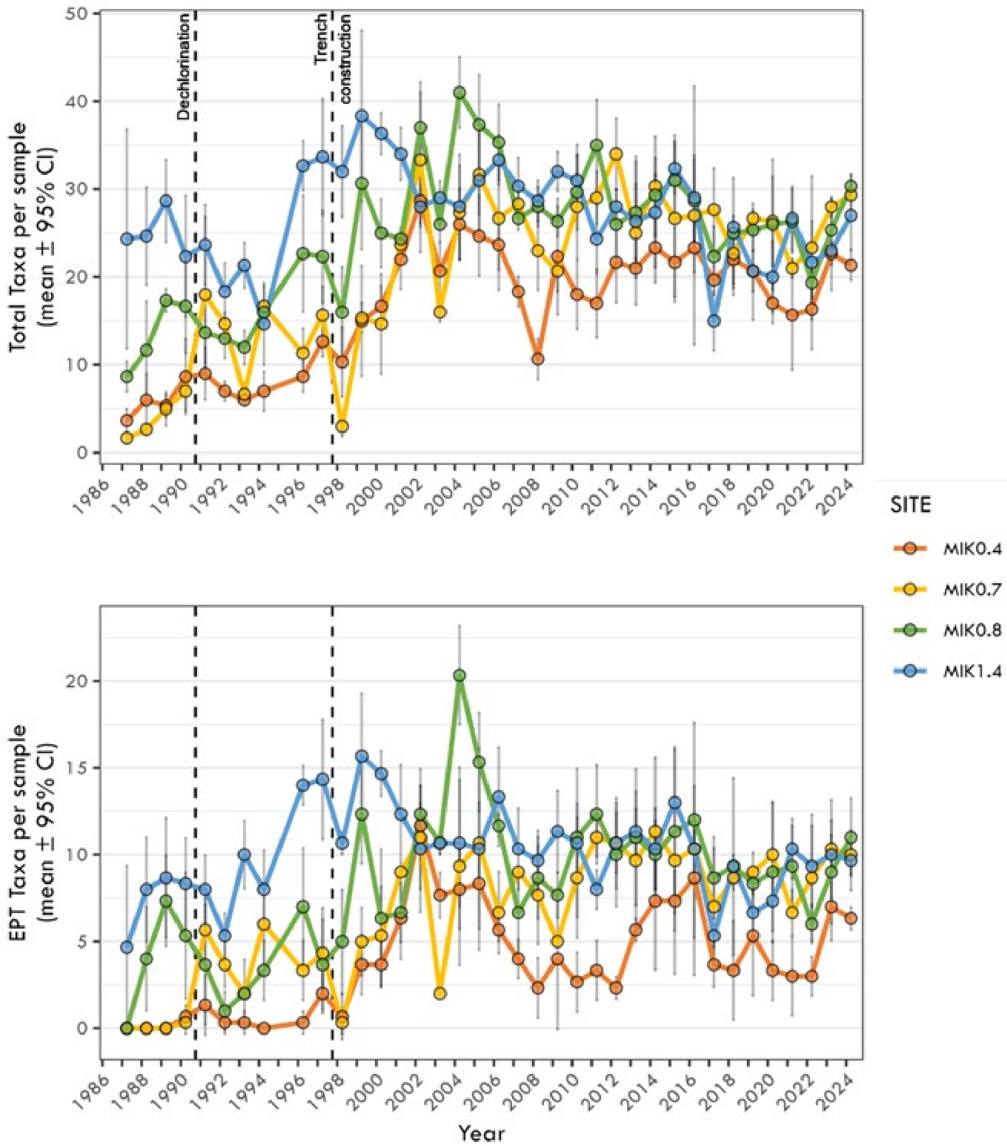
Note: *Samples were not collected in April 1995.*

Acronyms:

EPT = Ephemeroptera, Plecoptera, and Trichoptera *MIK = Mitchell Branch kilometer*

CI = confidence interval

Figure 3.32. Mean (± 95 percent confidence interval) total taxonomic richness (top) and richness of the pollution-intolerant taxa per sample (bottom) for Mitchell Branch sites, April 1987–2024



Notes:

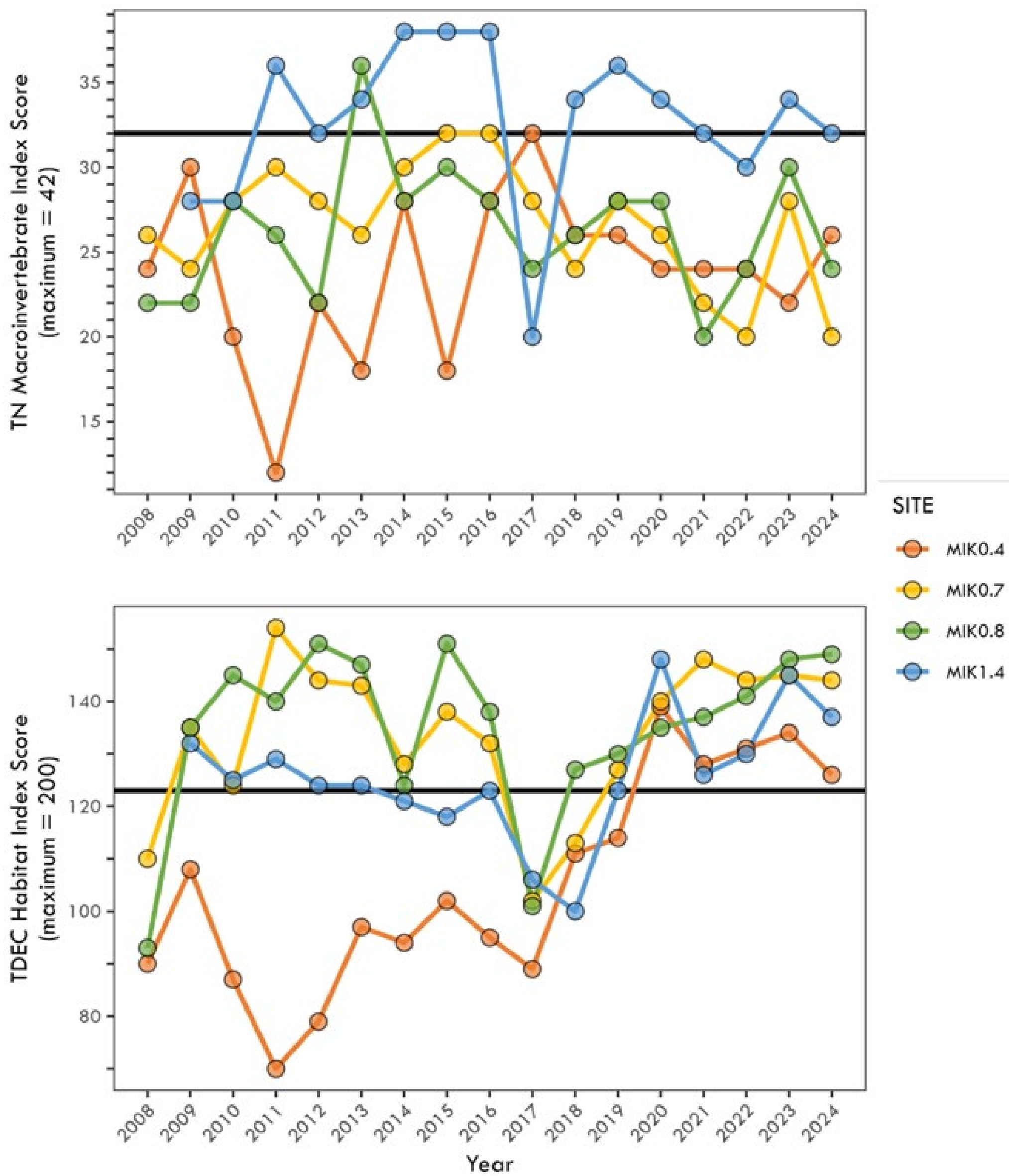
1. *Pollution-intolerant taxa, i.e., stoneflies, mayflies, and caddisflies or Ephemeroptera, Plecoptera, and Trichoptera taxa (top).*
2. *Percentages were based on total densities for each site.*
3. *Samples were not collected in April 1995.*

Acronyms:

MIK = Mitchell Branch kilometer CI = confidence interval

EPT = Ephemeroptera, Plecoptera, and Trichoptera (pollution-intolerant taxa)

Figure 3.33. Mean percent density of pollution-intolerant taxa and of the pollution-tolerant *Orthocladiinae* midge larvae (*Chironomidae*) at Mitchell Branch sites, April 1987–2024



Notes:

1. *Mitchell Branch site MIK 1.4 was not sampled with TDEC protocols in 2008.*
2. *The horizontal line on each graph shows the rating threshold for each index for ecoregion 67f; TDEC macroinvertebrate index threshold is 32; TDEC habitat index threshold is 123. Values above the thresholds are indicative of passing biocriteria or habitat guidelines.*

Figure 3.34. Temporal trends in the TMI (top) and Stream Habitat Index (bottom) scores for four Mitchell Branch sites, August 2008–2024

Table 3.10. Tennessee Macroinvertebrate Index metric values and scores and index scores for Mitchell Branch, August 19, 2024[a,b,c]

Site	Metric values							Metric scores							TMI[d]
	Taxa rich	EPT rich	%EPT	%OC	NCBI	% Cling	%TN Nuttol	Taxa rich	EPT rich	%EPT	%OC	NCBI	% Cling	%TN Nuttol	
MIK 0.4	17	4	10.6	1.9	4.5	76	36.5	2	2	0	6	6	6	4	26
MIK 0.7	12	3	10.3	10.3	5.8	46.2	41	2	0	0	6	4	4	4	20
MIK 0.8	12	2	25	14.3	5.3	73.2	44.6	2	0	2	6	4	6	4	24
MIK 1.4	25	9	40.2	8.9	4.4	51.4	41.6	4	4	4	6	6	4	4	32 [pass]

[a] *TMI metric calculations and scoring and index calculations are based on Tennessee Department of Environment and Conservation (TDEC) protocols for ecoregion 67f: TDEC 2021, Quality System Standard Operating Procedures for Macroinvertebrate Stream Surveys, TDEC Division of Water Resources, Nashville, Tennessee. Available* ***here***.

[b] *Taxa rich = Taxa richness; EPT rich = Ephemeroptera, Plecoptera, and Trichoptera (mayflies, stoneflies, and caddisflies) taxa richness; %EPT = EPT abundance excluding Cheumatopsyche spp.; %OC = percent abundance of oligochaetes (worms) and chironomids (nonbiting midges); NCBI = North Carolina Biotic Index; %Cling = percent abundance of taxa that build fixed retreats or otherwise attach to substrate surfaces in flowing water excluding Cheumatopsyche spp; %TN Nuttol. = percent abundance of nutrient-tolerant organisms.*

[c] *MIK = Mitchell Branch kilometer*

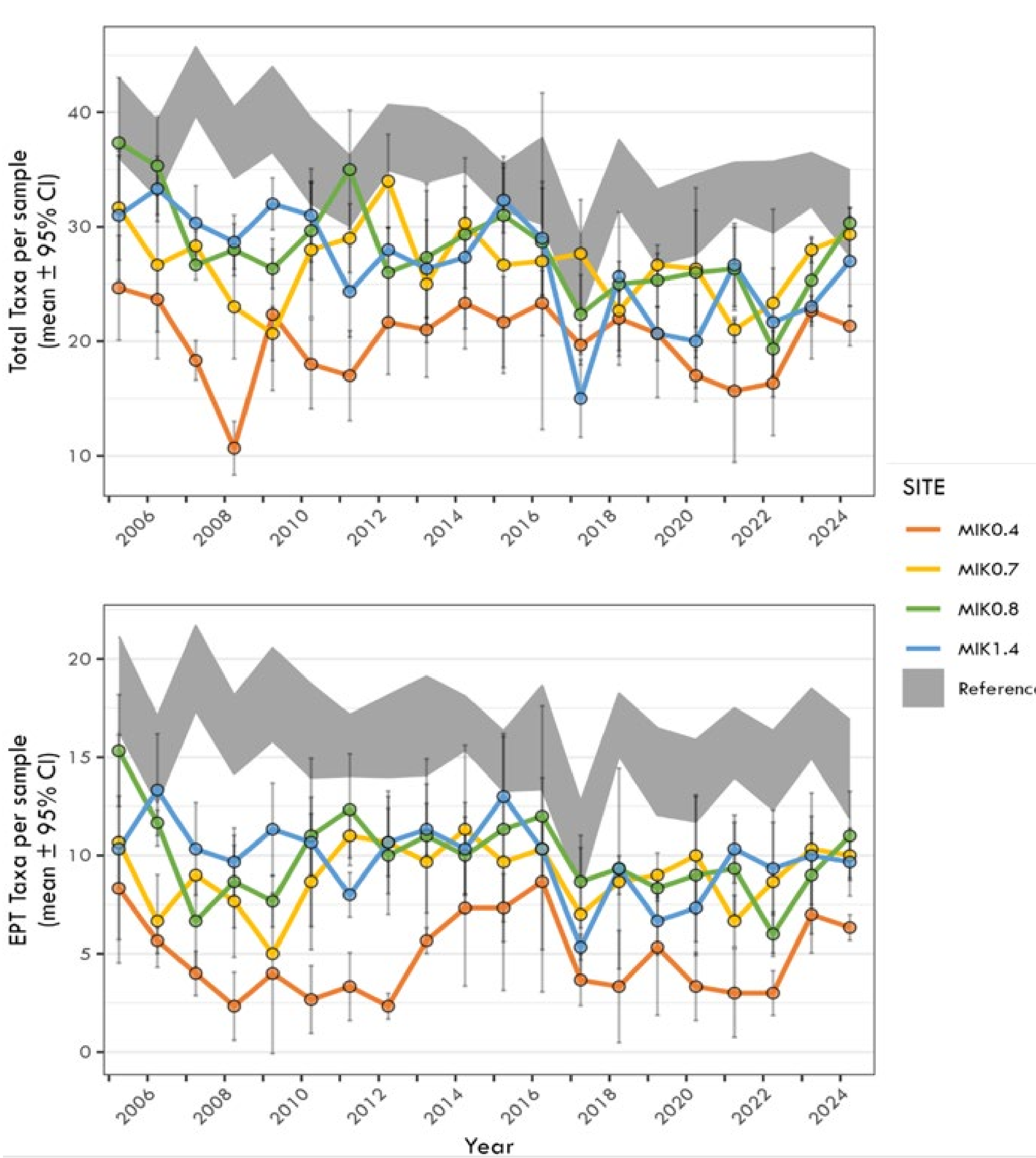
[d] *TMI = Tennessee Macroinvertebrate Index score. TMI is the total index score, and higher index scores indicate higher-quality conditions. A score of ≥ 32 is considered to pass biocriteria guidelines.*

3.7.2.3. Comparison between Mitchell Branch and Other Reference Sites on the ORR

In Figure 3.35, the benthic macroinvertebrate communities in Mitchell Branch are compared to ORR reference streams over an 18-year period. Mean values for total taxa richness and taxa richness of pollution-intolerant (EPT) taxa for Mitchell Branch are shown in Figure 3.35, and percent density of the pollution-intolerant and pollution-tolerant taxa are shown in Figure 3.36. Also shown in gray shading in Figures 3.35 and 3.38 is the 95 percent confidence interval for the five ORR reference sites—First Creek kilometer 0.8, Fifth Creek kilometer 1.0, White Oak Creek kilometer 6.8, Walker Branch kilometer 1.0, and Gum Hollow Branch kilometer 2.9.

In 2024, the total taxonomic richness at MIK 0.4 and MIK 1.4 and the taxonomic richness of pollution-intolerant (EPT) taxa at all Mitchell Branch sites fell below the 95 percent confidence interval of the ORR reference sites (Figure 3.35). Although the overall pattern for EPT taxonomic richness remains similar to that generally seen throughout the time series, the 95 percent confidence interval for total taxonomic richness at the reference sites has shifted down over the course of the time series since the mid-to-late 2000s, though pollution-tolerant taxa may have comprised most of those lost over this time period (Figure 3.36). In contrast to richness metrics, the mean percent densities of pollution-intolerant and pollution-tolerant taxa at MIK 1.4 were not often outside of the range for the reference sites prior to 2019 and 2020 but were similar to those of ORR reference sites in 2021 and 2022; however, the mean percent density of pollution-tolerant taxa was again higher at MIK 1.4 than the reference sites (Figure 3.36). Since 2005, the mean percent densities of pollution-intolerant and pollution-tolerant taxa at all other MIK sites have been outside the 95 percent confidence interval for ORR reference sites, with few exceptions. (Figure 3.36).

These results from the comparison of Mitchell Branch sites with the reference sites, combined with the long-term results for all Mitchell Branch sites discussed above, suggest that from the standpoint of reference sites, MIK 1.4 has generally fallen within or below expected reference conditions on the ORR (depending on the macroinvertebrate metric examined). Furthermore, after a brief excursion in 2019 and 2020, MIK 1.4 has once again fallen outside the 95 percent confidence interval of the mean percent densities of pollution-intolerant and pollution-tolerant taxa at ORR reference sites in 2024. Factors potentially contributing to excursions of invertebrate community metrics outside of the range of other reference sites include the somewhat smaller size of MIK 1.4 compared with the other reference sites (based on watershed area, Table 3.11), which may limit the range of invertebrate species that can colonize and thrive at the site, and habitat characteristics that have typically contributed to the lower-quality habitat at the site, such as low flow and poor substrate quality (seen earlier in Figures 3.33 and 3.34).



Note: *The gray shading on each graph shows the 95 percent confidence interval of values at five additional reference stream sites on the ORR from 2005 to 2023.*

Acronyms:

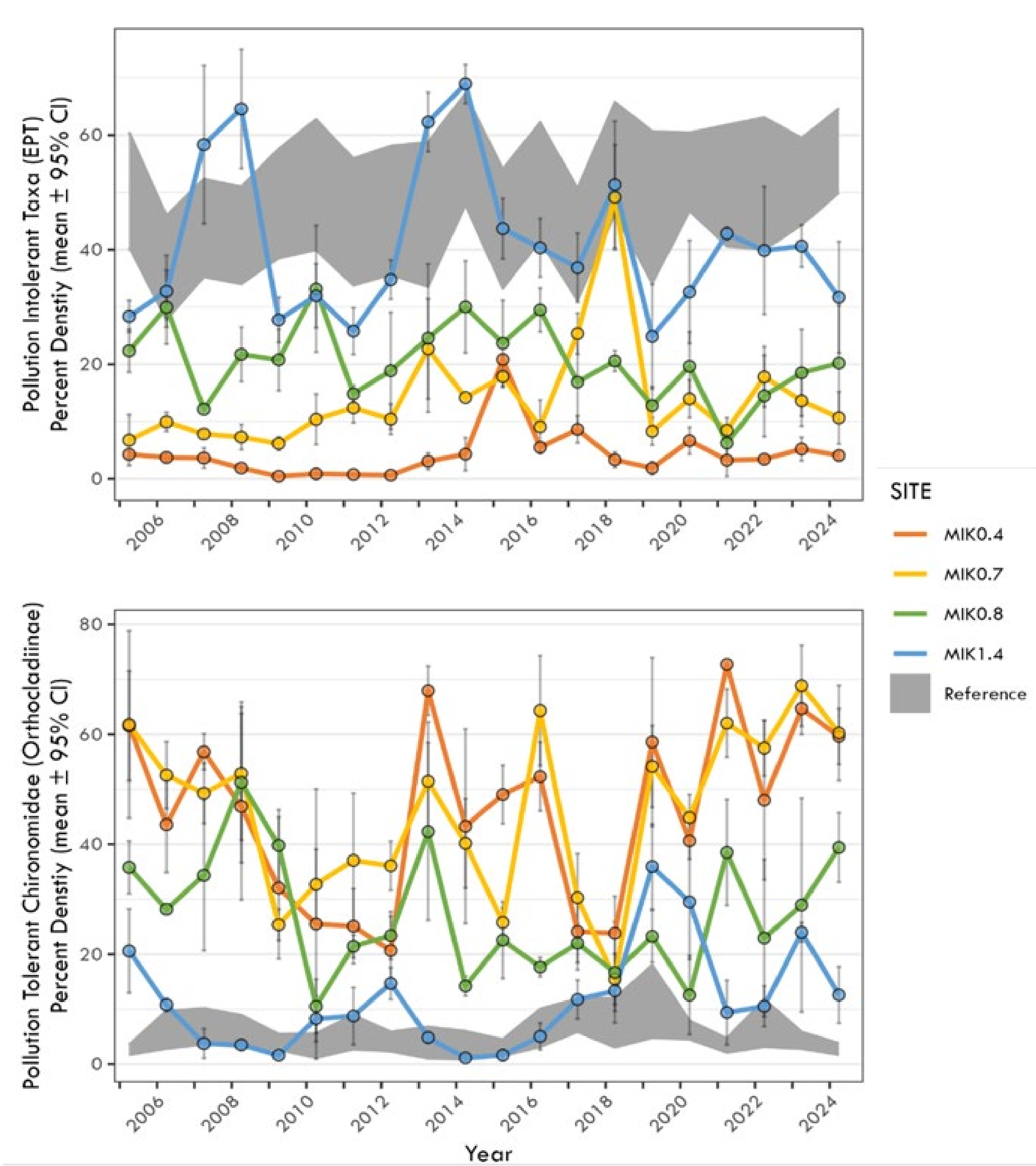
CI = confidence interval

EPT = Ephemeroptera, Plecoptera, and Trichoptera

MIK = Mitchell Branch kilometer

MIK 1.4 = reference site

Figure 3.35. Mean total taxonomic richness (top) and pollution-intolerant taxa per sample (bottom) for the benthic macroinvertebrate community at Mitchell Branch and the 95 percent confidence interval for ORR reference sites, April 2005–2024



Notes:

1. *Pollution-intolerant taxa, i.e., stoneflies, mayflies, and caddisflies or Ephemeroptera, Plecoptera, and Trichoptera taxa (top).*
2. *Pollution-tolerant Orthocladiinae midge larvae (bottom).*
3. *Percentages were based on total densities for each site.*
4. *The gray shading on each graph shows the 95 percent confidence interval for values at five additional reference sites on the ORR from 2005 to 2023.*

Acronyms:

CI = confidence interval *MIK 1.4 = reference site* *EPT = Ephemeroptera, Plecoptera, and Trichoptera*

ORR = Oak Ridge Reservation *MIK = Mitchell Branch kilometer*

Figure 3.36. Mean percent density of pollution-intolerant taxa (top) and pollution-tolerant *Chironomidae* (bottom) in Mitchell Branch the 95 percent confidence interval for ORR reference sites, April 2005–2024

Table 3.11. Stream sites included in the comparison between Mitchell Branch and other reference sites on the ORR

Site	Location		Watershed area (km²)	Program
	Latitude (N)	Longitude (W)		
Mitchell Branch				
MIK 0.4	35.93859	84.39040	1.554	ETTP BMAP
MIK 0.7	35.93786	84.38792	1.347	ETTP BMAP
MIK 0.8	35.93786	84.38682	1.269	ETTP BMAP
MIK 1.4 (reference)	35.93790	84.37662	0.311	ETTP BMAP
Other ORR reference sites				
First Creek (FCK 0.8)	35.92670	84.32355	0.596	ORNL BMAP
Fifth Creek (FFK 1.0)	35.93228	84.31746	0.596	ORNL BMAP
Gum Hollow Branch (GHK 2.9)	35.96385	84.31594	0.777	Bear Creek BMP/WRRP
Walker Branch (WBK 1.0)	35.95805	84.27953	1.010	ORNL BMAP
White Oak Creek (WCK 6.8)	35.94106	84.30145	2.072	ORNL BMAP

Acronyms:
BMAP = Biological Monitoring and Abatement Program
BMP = Biological Monitoring Program
ETTP = East Tennessee Technology Park
km² = square kilometers
MIK = Mitchell Branch kilometer
N = north
ORNL = Oak Ridge National Laboratory
ORR = Oak Ridge Reservation
W = west
WRRP = Water Resources Restoration Program

3.7.3. Task 3: Fish Community

Fish population and community studies are used to evaluate the biotic integrity (or general ecological health) of Mitchell Branch. The fish community is sampled quantitatively at two sites in Mitchell Branch, MIK 0.4 (downstream of SD-190) and MIK 0.7 (downstream of SD-170) and at local reference streams each spring.

Mitchell Branch fish community

Historically, the fish community in Mitchell Branch was most severely affected in the late 1980s and early 1990s. After some recovery in the mid-1990s, Mitchell Branch was affected negatively again in 1998 in association with a remedial activity that replaced a large section of stream bottom with a liner and interlocking rock substrate (Figure 3.37). In recent years, this reach of stream appears to be developing more natural habitat, including a more robust riparian plant community and some instream riffle/pool sequences as substrate is slowly beginning to accumulate throughout the reach (Figure 3.38).

Figure 3.37. Construction of lined section of Mitchell Branch, MIK 0.7, in 1998

Figure 3.38. More recent habitat conditions at Mitchell Branch in 2024

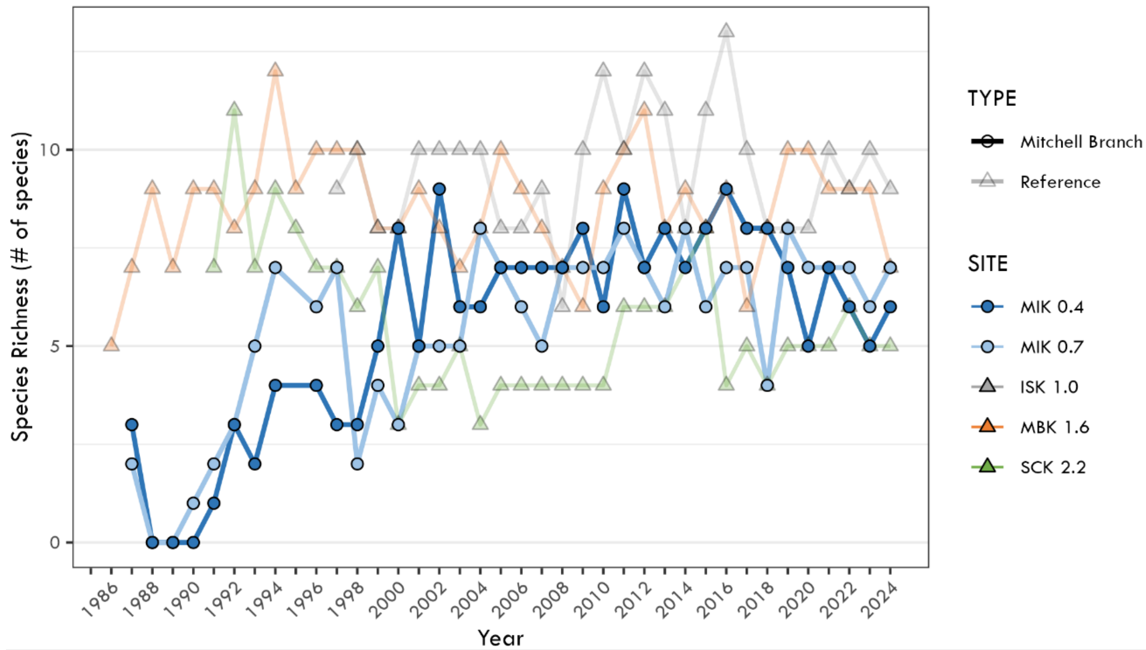
This has added to the complexity of the habitat available for fishes to colonize. Since 2000, the fish community has had relatively stable species diversity but rather large variations in fish density and biomass, which are often reflective of unstable, impaired streams. Streams that experience high density and biomass of tolerant fish species are often indicative of either high nutrient influences on a fish community (i.e., more algal growth means more food at the base of the food chain) or poor instream habitat—and often a combination of both. Of the two sites sampled for fish community, MIK 0.7 has experienced the greatest fluctuations in these community parameters. This is likely due to the modified stream channel and riparian areas and poor instream habitat associated with the remediation work in this reach. Similar conditions are seen in other area streams on the ORR, including sections of East Fork Poplar Creek where tolerant species dominate the concrete- and bedrock-lined channel, which supports little riparian protection. In addition, extremely low precipitation amounts, which often occur in the summer, result in very low flows in many area streams. Small first and second order streams without springs or groundwater influence are most severely affected by these conditions. This may partially explain the decreased density and biomass numbers observed in some years and the apparent return of higher values in following years.

At both MIK 0.4 and MIK 0.7, the 2023 sample of fish community parameters indicated continued variation. Species richness (number of species) at both sites increased slightly compared to 2023 values (Figure 3.39).

Both sites have species richness slightly lower than similar sized reference streams. Density (number of fish) at both sites still remains well above reference conditions (Figure 3.40). Biomass (weight) also remains elevated at both sites (Figure 3.41). Both the lower Mitchell Branch site and the upper site had reduced diversity and density of sensitive fish species in 2024 compared to reference sites.

Over the last decade, there has been a slight uptick in the occurrence of sensitive fish species at both sampled sites in Mitchell Branch, which can be attributed to the regular presence of fish such as banded sculpin (*Cottus carolinae*) that appear to be a resident species in Mitchell Branch, and also occasional occurrences of other more sensitive fish. In 2024, no new species were observed in the two sites and the resident banded sculpin continued to be very limited at both sites. However, new species of darters, suckers, and sunfish continue to be discovered within Mitchell Branch every year, and some represent unique sensitive species in this reach of stream.

In general, the Mitchell Branch fish communities at MIK 0.4 and MIK 0.7 continue to lack diverse resident species that are sensitive to stress or that have specialized feeding or reproductive requirements, such as darters or suckers that occur consistently at higher frequencies in the reference streams. Like the benthic communities, fish community monitoring provides an integrated response to all of the various water chemistry and habitat influences in a stream. Identifying the major stressor influences on the community (i.e., causal analysis) would require additional investigatory strategies coupled with the monitoring data.

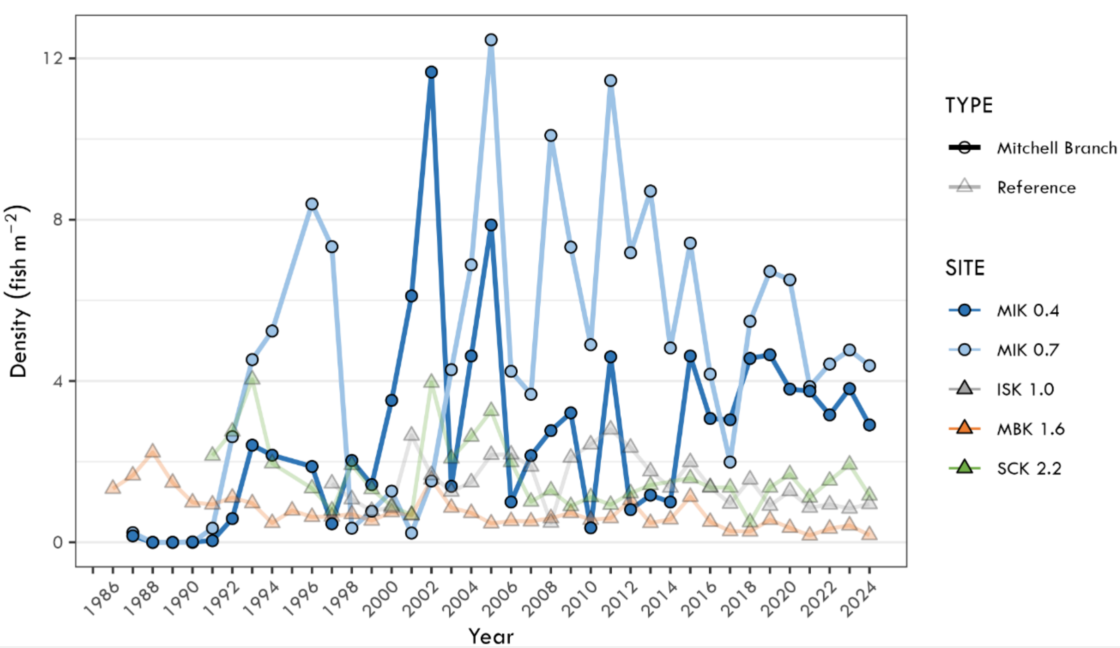


Acronyms:

ISK = Ish Creek *MIK = Mitchell Branch kilometer*

MBK = Mill Branch kilometer *SCK = Scarboro Creek*

Figure 3.39. Species richness for the fish communities at sites in Mitchell Branch and in reference streams Mill Branch, Scarboro Creek, and Ish Creek, 1987–2024

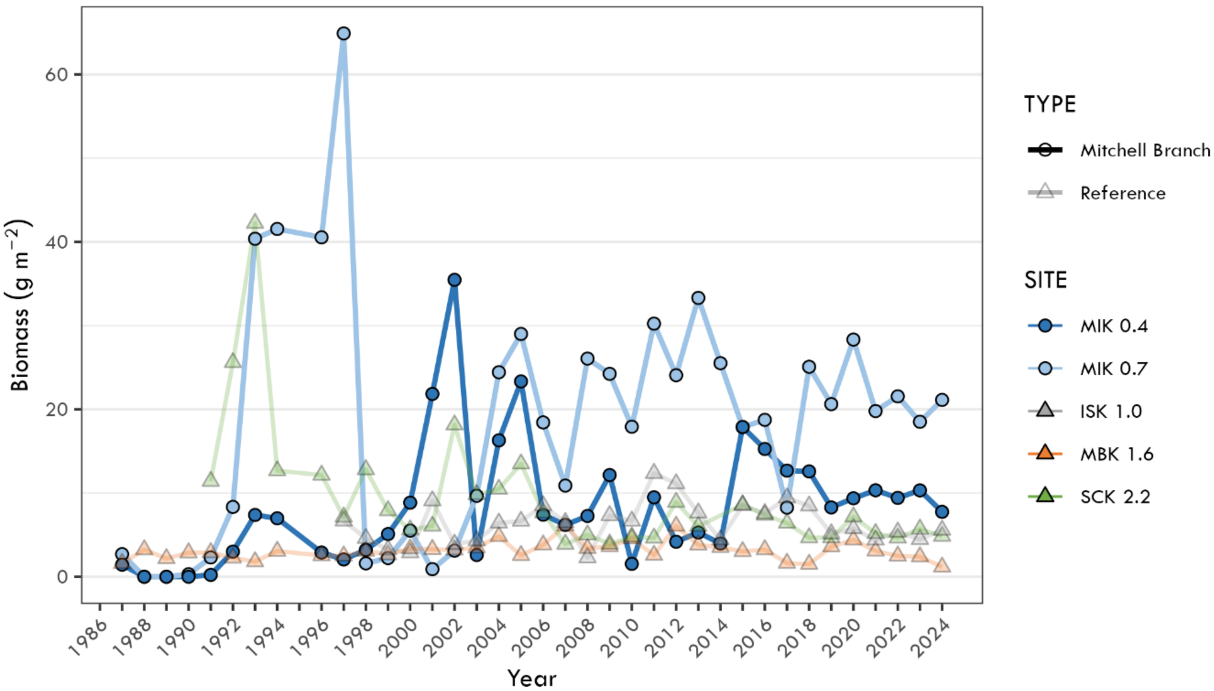


Acronyms:

ISK = Ish Creek *MIK = Mitchell Branch kilometer*

MBK = Mill Branch kilometer *SCK = Scarboro Creek*

Figure 3.40. Density for the fish communities at sites in Mitchell Branch and in reference streams Mill Branch, Scarboro Creek, and Ish Creek, 1987–2024



Acronyms:

ISK = Ish Creek

MBK = Mill Branch kilometer

MIK = Mitchell Branch kilometer

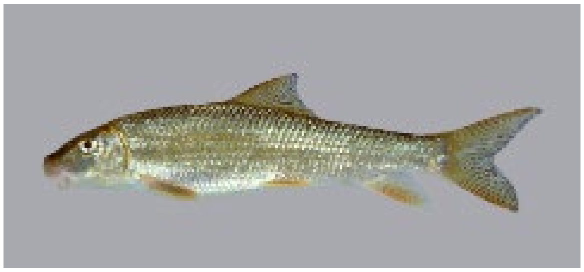
SCK = Scarboro Creek

Figure 3.41. Biomass for the fish communities at sites in Mitchell Branch and in reference streams Mill Branch, Scarboro Creek, and Ish Creek, 1987–2024

During routine bioaccumulation sampling, several species of fish are collected regularly at MIK 0.2 that are infrequently observed in the Mitchell Branch fish community monitoring activities at the upstream sites. These included four pollution-sensitive species: black redhorse (*Moxostoma duquesnei*), snubnose darter (*Etheostoma simoterum*, greenside darter (*Etheostoma blennioides*), and northern hogsucker (*Hypentelium nigricans*) (Figure 3.42). Future monitoring will help determine if these species are becoming established farther upstream in Mitchell Branch or are merely seasonal migrants to the stream's lower section, which is easily accessible from the much larger Poplar Creek.

K-1007-P1 Pond fish community

The fish communities in the K-1007-P1 Pond are assessed annually. This sampling is conducted to evaluate the effectiveness of remediation efforts implemented in 2009 and is aimed at reducing the PCBs available for transfer out of the pond via natural routes (i.e., trophic transfer). The RAs included capping contaminated sediment with fill dirt, planting native aquatic vegetation to stabilize sediment, and removing potentially contaminated fish from the pond. Fish initially were removed from the pond using the piscicide rotenone, and uncontaminated native fish were stocked in the pond with the goal of establishing a sunfish-dominated community. Sunfish have a shorter lifespan than many other species of fish, especially higher trophic level fish, and they have a prey source that is generally varied but consistently lower on the aquatic food chain compared with species such as largemouth bass, thus reducing the likelihood that contaminants would biomagnify in the system.



Black redhorse *(Moxostoma duquesnei)*

Snubnose darter *(Etheostoma simoterum)*

Northern hogsucker *(Hypentelium nigricans)*

Greenside darter *(Etheostoma blennioides)*

Photos: Chris Bryant

Figure 3.42. Sensitive fish species observed in lower Mitchell Branch

Overall, the K-1007-P1 Pond fish community surveys conducted in February 2024 revealed the presence of nine species of fish. An observation of particular importance from earlier surveys is the abundance of sunfish species (bluegill, redear sunfish, and warmouth), which constitute approximately 91 percent of the total fish population in the pond (Figure 3.43). Bluegill, the most prevalent of these species, were historically the dominant sunfish species in the pond, and they are the desired bioindicator fish species to have in the remediated pond. Although largemouth bass continue to persist in the pond, their abundance remains relatively low. Despite removal efforts, their presence is likely to continue, given the habitat conditions currently in the pond (i.e., abundant prey sources and open water). Gizzard shad (*D. cepedianum*) continues to be present in the pond and are suspected of reproducing some years. Although they constituted a much larger portion of the fish population in 2020, they have rarely been found in samples since then. Their abundance has had some minor fluctuations each year but in general has remained relatively low compared with earlier years.

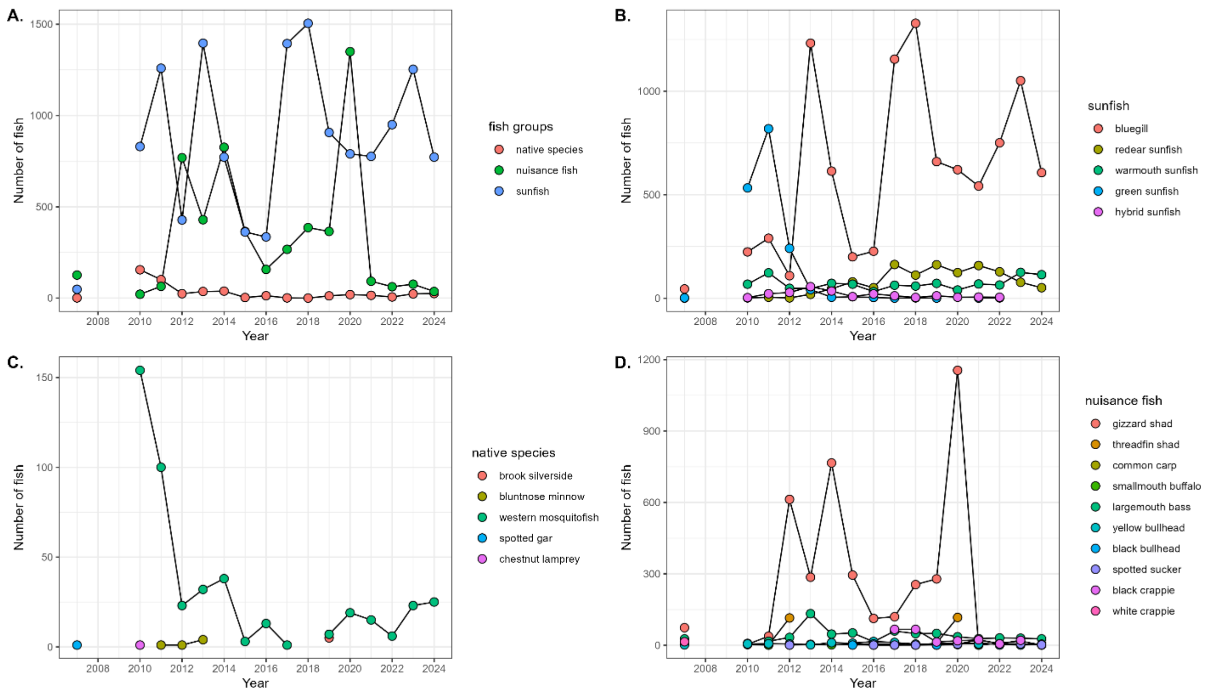


Figure 3.43. Changes in the K-1007-P1 Pond fish community from 2007–2024

3.8. Environmental Management and Waste Management Activities

Remediation activities were underway across ETTP in 2024. Wastes were generated during these operations and were handled in accordance with the applicable regulations.

3.8.1. Waste Management Activities

Most of the waste generated during FY 2024 cleanup activities in Oak Ridge went to disposal facilities on the ORR—namely, the Environmental Management Waste Management Facility (EMWMF) and the Oak Ridge Reservation Landfills (ORRL). These facilities are owned by DOE and operated and maintained by UCOR. They have been vital to cleanup progress and success, enabling OREM to accomplish more cleanup by avoiding costly and unnecessary cross-country shipments.

EMWMF only receives low-level radioactive and hazardous waste meeting specific criteria. The waste is mostly soil and building debris. In FY 2024, EMWMF received 1,526 waste shipments from cleanup projects at ETTP, ORNL, and Y-12, plus 145 clean fill shipments for the enhanced operational cover expansion and constructing access roads and dump ramps. The EMWMF landfill has a design capacity of 2.3 million yd^3 and is now over 85.3 percent filled.

EMWMF generated 12.02 million gal of wastewater in FY 2024. Approximately 3.42 million gal of leachate (water that enters the leachate collection system) was transported by tanker to the ORNL Liquid and Gaseous Waste Operations for treatment and release. Approximately 8.6 million gal of contact water (water that contacts waste but does not enter the leachate collection system) was released to Bear Creek after laboratory analysis verified it met all regulatory limits and discharge standards. ORRL accepts sanitary/industrial waste and construction/demolition debris. In FY 2024, these three active landfills received 9,976 waste shipments, totaling 131,597 yd^3.

ORRL also manages nonregulated leachate. In FY 2024, ORRL compliantly discharged 3.8 million gal of leachate from the three active landfills to the Y-12 sanitary sewer system.

In FY 2024, ORRL continued improvements for all sediment and erosion controls. These measures included upgrading drainage features, which significantly reduces the amount of sediment released from these landfills. TDEC inspections in FY 2024 noted excellent sediment and erosion controls with no areas of concern or violations.

Construction/Demolition Landfill VII Area 5 expansion was completed in FY 2024, and the Spoils Area expansion was constructed to 95 percent completion. Work continued on seep mitigations for Sanitary Landfill II (a closed landfill) and active Landfill VII with recontouring of Phases 2 and 3 completed. Landfill VII minor modification trenching continues with Trenches 1 and 2 completed during FY 2024.

EMWMF will reach capacity before OREM completes its cleanup at Y-12 and ORNL. Planning continued in FY 2024 for another disposal facility, the EMDF, to provide the capacity required to complete Oak Ridge's cleanup mission.

Crews completed fieldwork for the early site preparation activities in May 2024. This work included rerouting portions of Bear Creek Road and the Haul Road, and development of other support areas.

Fieldwork for the Groundwater Field Demonstration (GWFD) began in April 2024. A cover system is being installed to replicate conditions following construction of the landfill liner system. Groundwater elevations will be monitored for two wet seasons following installation of the cover to ensure the liner system will be above the groundwater elevation in this area. Topsoil and clean fill removed from the EMDF area during construction activities benefited other UCOR projects at ETTP.

OREM continues to work with EPA and TDEC on regulatory documents for the EMDF landfill. The GWFD Remedial Design Work Plan/Remedial Action Work Plan was approved in October 2023 and the Remedial Design Work Plan for the EMDF design was prepared and reviewed with approval in September 2024.

OREM continued to monitor 31 groundwater wells at the selected site for the disposal facility, measuring and recording water levels and groundwater characteristic data for the entire year. Several piezometers within the active construction area were not monitored but were protected for continued use when GWFD construction is complete.

The Transuranic Waste Processing Center (TWPC) team completed a significant amount of hazardous inventory reduction in FY 2024 by safely and compliantly performing 12 shipments of legacy transuranic (TRU) waste to the Waste Isolation Pilot Plant (WIPP) in Carlsbad, New Mexico, totaling 301 drums of inventory reduction. The TWPC team also completed 12 shipments of mixed low-level waste (MLLW), low-level waste, and hazardous industrial waste resulting from the processing and certification of the TRU legacy waste.

TWPC's operational focus continued in FY 2024 on managing challenging Nuclear Fuel Services Inc. waste, where 4 boxes and 13 drums were processed and repackaged into 140 drums of compliant soil and debris for disposal.

3.8.2. Environmental Remediation Activities

Several years of characterization, data analysis, delineation, and modeling have resulted in the identification of numerous contaminated areas at ETTP that are now in the final stages of cleanup. Remediation efforts are being performed to eliminate hazards at the site and pave the way for future industrial use.

The site is divided into two cleanup regions: Zone 1, a 1,300-acre area outside the MPA, and Zone 2, the 800-acre area that comprises the MPA. The areas in these zones are divided into EUs that vary in size from 6 to 38 acres. Remediation efforts are designed to protect groundwater, wildlife, and the future workforce.

Highlights of this effort are given below. For details, please see the *2024 Cleanup Progress—*

Annual Report to the Oak Ridge Regional Community (UCOR 2025, OREM-24-7651).

3.8.2.1. Soil Remediation

Crews completed soil remediation at ETTP in CY 2024. That effort involved excavating and disposing of 554,000 yd^3 of soil, equaling nearly 50,000 dump truck loads. Completion of this remediation, referred to as Vision 2024, comes four years after completed demolition of all unneeded facilities at the site. Some of the approaches that helped keep remediation efforts on track included shipments by rail for some of the waste, implementing efficient methods for loading and transporting excavated soil, and reusing topsoil excavated from other OREM projects for backfill. During this cleanup, OREM worked to transform ETTP into a multiuse industrial park, with 25 businesses currently operating at the site. It also focused on historic preservation and conservation, designating land for these purposes.

Highlights at ETTP for 2024 include the following activities:

- The EU-21 TCE Project made the final soil shipment from ETTP on May 2, 2024. The project began in July 2021 and was estimated to create 19,000 yd^3 of TCE-contaminated waste. The project shipped more than 102,000 yd^3 of material both onsite and offsite. The project ran into several challenges during the three-year effort: mercury process piping, multiple high-concentration-TCE areas, schedule targets, supply chain issues, and the process for defining the extent of the contamination.
- Crews removed two structures from the EU-20 footprint in October as part of the remaining facilities disposition effort. This area included the north end of the previously demolished K-25 Building. The K-2500-J tent, also known as the Segmentation Shop Storage Facility, and the K-2500-AB facility were demolished and hauled to ORRL. After removing these facilities, radiological surveys on the slabs below the structures were completed in support of national historical preservation and future public access.
- Excavation of two remaining soil contamination areas were completed in CY 2024: TCE contaminated soil at EU-30 and two "hotspots" in Area B of EU-35. The EU-30 RA targeted approximately 500 yd^3, and took place on the southern edge of EU-30, between the former K-1301 and K-1401 facilities. The EU-35 remediation focused on approximately 4,700 yd^3 of contaminated soil around the perimeter of the K-1407-B Pond, which was primarily used as a settling pond for metal hydroxide sludge and other waste streams that were precipitated/neutralized in the adjacent K-1407-A Neutralization Pit Facility.

3.8.2.2. Groundwater Protection

Now that crews have finished excavating and removing contaminated soil from the site in 2024, the spotlight is turning to groundwater.

ETTP is divided into three sections for groundwater remediation planning.

One section is the MPA, which encompasses most of the operations area at the former enrichment complex. The MPA Groundwater Interim ROD (DOE/OR/01-2949&D2) was approved on May 16, 2024.

The second section is the area where the large K-31 and K-33 uranium enrichment buildings once stood. The K-31/K-33 Groundwater ROD (DOE/OR/01-2950&D2) was approved for groundwater in this area on May 9, 2024.

The third section encompasses Zone 1, the area immediately surrounding the main plant and K-31/K-33 areas. Cleanup of the Zone 1 groundwater plumes will be addressed in a future ROD. In support of this upcoming ROD, DOE/OR/01-2903&D2/A2 was submitted to EPA and TDEC for review on June 18, 2024.

The preferred approach for groundwater remediation in the MPA is a process called enhanced in situ bioremediation. A widely used technology for treating contaminated waste involves injecting microorganisms and a carbon source such as vegetable oil into the ground. The microorganisms reduce or detoxify the contaminants.

For the K-31/K-33 area, OREM is proposing a process called monitored natural attenuation along with land use controls. Monitored natural attenuation relies on natural processes that reduce contaminant concentrations in groundwater. Using this process as the RA involves monitoring groundwater conditions with land use controls, limiting potential exposures.

3.8.3. Reindustrialization

The Reindustrialization Program maintained progress in 2024 by continuing partnerships and planning for the transfer of remediated land and remaining infrastructure at ETTP to public or private ownership for the economic benefit of the community. Reindustrialization efforts at ETTP are expected to generate 1,400 jobs from the $1.35 billion in investments announced by the onsite companies (Figure 3.44).

OREM has transferred over 1,700 acres for economic development at ETTP, including 470 acres during FY 2024. OREM and UCOR also completed the final transfer of major utilities, marking a significant milestone for the Reindustrialization Program. ETTP is now served by a public infrastructure system of water, sewer, electric, and natural gas utilities.

Clean energy technology has been a focus of these industrial development efforts. For instance, Kairos Power has just started construction of the Hermes Low-Power Demonstration Reactor at the site. This will be the first non-light-water reactor permitted in the United States in over 50 years. The company's $100 million investment will bring 55 high quality jobs to the site.

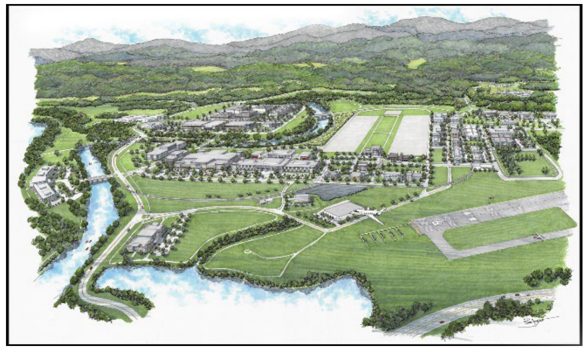


Figure 3.44. Artist's rendering of East Tennessee Technology Park as a multiuse industrial park

The national historical preservation activities continued with the ongoing construction of the K-25 Interpretive Center, which is scheduled to open to the public in September 2025. This new facility is adjacent to the K-25 History Center and is positioned to overlook the former K-25 Building footprint.

Public involvement

Since 2011, DOE and its contractors have provided environmental management, remediation, and cleanup services to OREM to move forward the site's transformation to a multiuse industrial center, national park, and recreational area.

OREM and UCOR continued to share progress and lessons learned with the community and stakeholders through a variety of outlets. In 2024, the ORSSAB issued a recommendation on the site's budget request and discussed ongoing expansion of ORR waste disposal capacity through ongoing development of the planned new on-site waste disposal facility, the EMDF. ORSSAB also hosted the annual EM SSAB Fall Chairs Meeting, allowing board members to meet representatives from similar boards at other DOE sites across the country and receive updates from DOE leadership.

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