3. East Tennessee Technology Park

ETTP was originally built during World War II as part of the Manhattan Project. Known as the K-25 Site, its primary mission was to enrich uranium for use in atomic weapons. After the war, the mission was changed to include the enrichment of uranium for nuclear reactor fuel elements and recycling of uranium recovered from spent fuel, and the name was changed to the "Oak Ridge Gaseous Diffusion Plant." In the 1980s, a reduction in the demand for nuclear fuel resulted in the shutdown of the enrichment process, and production ceased. The emphasis of the mission then changed to environmental management and restoration operations, and the name was changed to the "East Tennessee Technology Park." Environmental management and remediation operations consist of operations such as waste management, the cleanup of outdoor storage and disposal areas, the demolition and/or cleanup of the facilities, land restoration, and environmental monitoring. Proper disposal of the huge quantities of waste that were generated over the course of production operations is also a major task. Beginning in the 1990s, reindustrialization (the conversion of underused government facilities for use by the private sector) also became a major mission at ETTP. Reindustrialization allows private industry to lease underused facilities, thus providing both jobs and a new use for facilities that otherwise would have to be demolished. State and federally mandated effluent monitoring and environmental surveillance at ETTP involve the collection and analysis of samples of air, water, soil, sediment, and vegetation from ETTP and the surrounding area. Monitoring results are used to assess exposures to members of the public and the environment, to assess the performance of treatment systems, to help identify areas of concern, to plan remediation efforts, and to evaluate the efficacy of remediation efforts. In 2013, there was 100% compliance with permit standards for emissions/discharges from ETTP operations.

3.1 Description of Site and Operations

Construction of ETTP (Fig. 3.1), originally known as the K-25 Site, 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 1 year, and 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 the "Oak Ridge Gaseous Diffusion Plant" (ORGDP).

After military production of highly enriched uranium was concluded in 1964, the two original process buildings were shut down. For the next 20 years, the plant's primary missions were the production of only low enriched uranium to be fabricated into fuel elements for nuclear reactors. 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 R&D.

By 1985, the demand for enriched uranium had 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 1990. Figure 3.2 shows the ETTP site areas before the start of D&D activities. In 1997, the K-25 Site was renamed the "East Tennessee Technology Park" to reflect its new mission. Fig. 3.3 shows the ETTP areas designated for D&D activities through 2013.

Fig. 3.1. East Tennessee Technology Park.

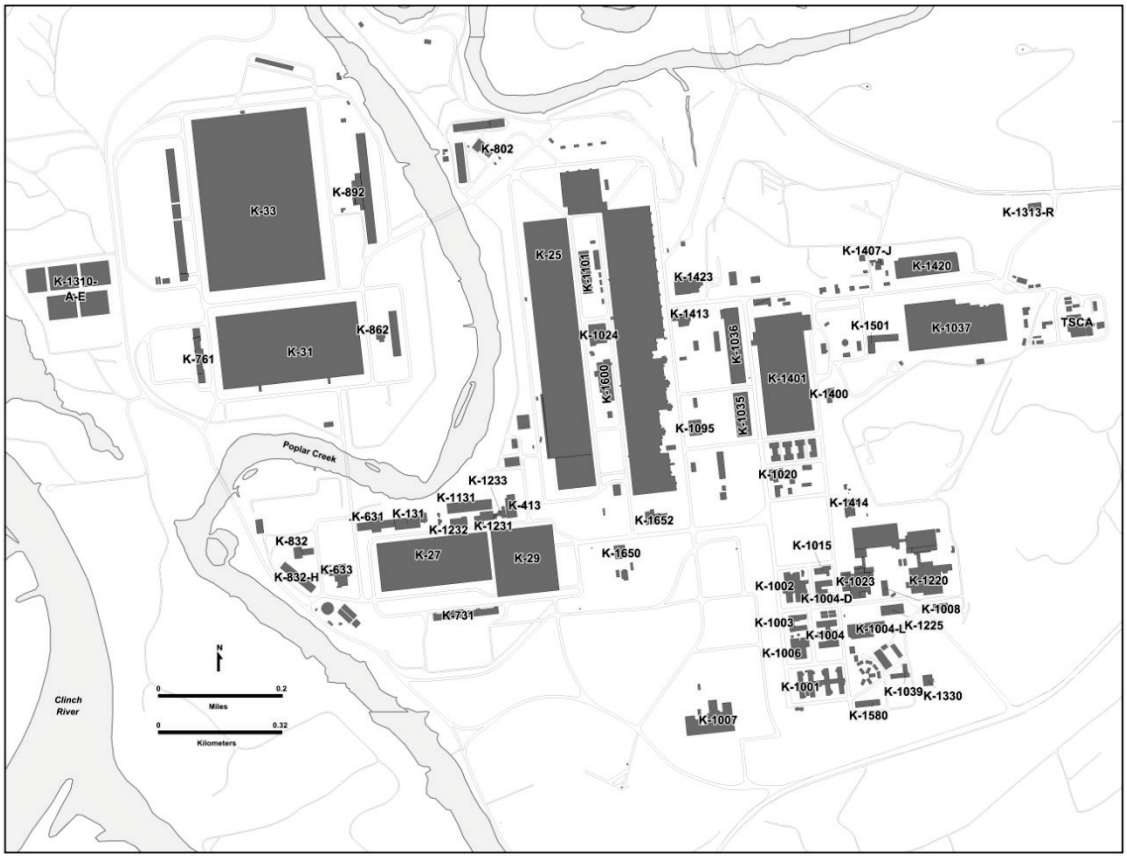


Fig. 3.2. East Tennessee Technology Park before the start of decontamination and decommissioning activities in 1991.

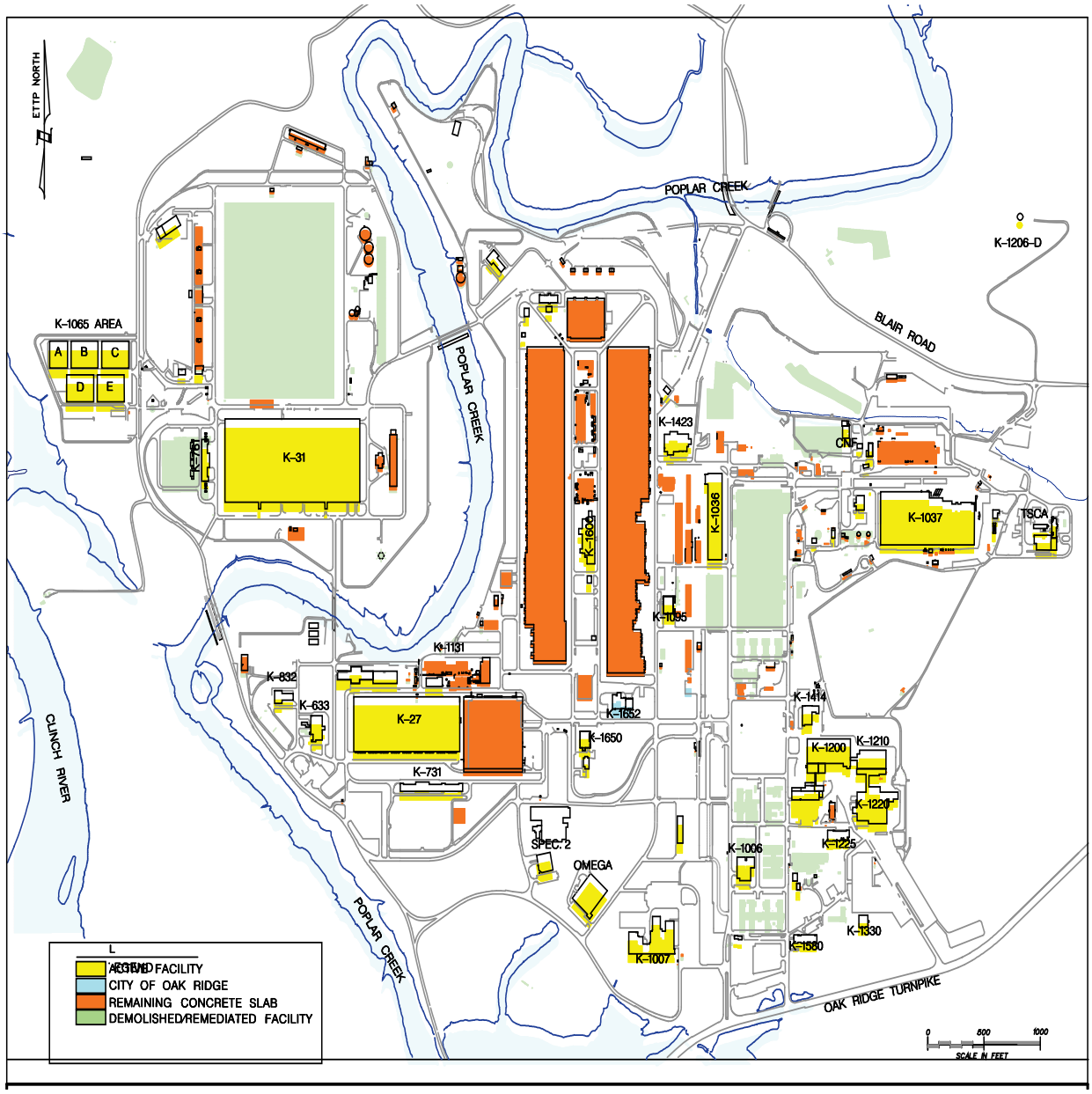


Fig. 3.3. East Tennessee Technology Park in 2013.

The ETTP mission is to reindustrialize and reuse site assets through leasing or transferring excess or underutilized land and facilities and through incorporating commercial industrial organizations as partners in the ongoing environmental restoration, D&D, and waste treatment and disposal.

DOE's long-term goal for ETTP is to convert as much of the site as possible into a private business and industrial park. The site is undergoing environmental cleanup of its land as well as D&D of most of its buildings. The reuse of key facilities through title transfer is part of the site's closure plan. The cleanup approach makes land and various types of buildings (e.g., office, manufacturing) suitable for private industrial use and for title transfer to CROET or other entities such as the City of Oak Ridge. The facilities may then be subleased or sold, with the goal of stimulating private industry and recruiting business to the area.

UCOR, the 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. Unless otherwise noted, information on non-DOE entities located on the ETTP site is not provided in this document.

3.2 Environmental Management System

The UCOR Environmental Management System (EMS) is integrated with the UCOR Integrated Safety Management System (ISMS). UCOR's EMS is based on a graded approach for a closure and remediation contract and reflects the elements and framework contained in International Organization for Standardization (ISO) standard 14001:2004 (ISO 14001:2004), *Environmental management systems—Requirements with guidance for use*. UCOR is committed to incorporating sound environmental management, protection, and sustainability practices in all work processes and activities that are part of the DOE EM program in Oak Ridge, Tennessee. UCOR's environmental policy states in part, "Our commitment to protect and sustain human, natural, and cultural resources is inherent in our mission 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.

- **Management Commitment**—Integrate responsible environmental practices into project operations.
- **Environmental Compliance and Protection (EC&P)**—Comply with all environmental regulations and standards.
- **Sustainable 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.
- **Partnership/Stakeholder Involvement**—Maintain partnerships through effective two-way communications with our customer and other stakeholders.

3.2.1 Environmental Stewardship Scorecard

The Environmental Stewardship Scorecard is used to track and measure site-level EMS performance. During 2013, UCOR received "green scores" for EMS performance. As an example, Fig. 3.4 presents information on UCOR's pollution prevention recycling activities for 2013. UCOR recycles office and mixed paper, cardboard, phone books, newspapers, magazines, aluminum cans, antifreeze, engine oils, batteries (lead acid, universal waste, and alkaline), universal waste bulbs, plastic bottles, all types of #1 and #2 plastics, and surplus electronic assets such as computers (CPUs and laptops) and monitors (CRT and LCD). Other recycling opportunities include unique structural steel, stainless steel structural members, transformers, and electrical breakers. Figure 3.4 shows the pollution prevention recycling activities at ETTP related to solid waste reduction.

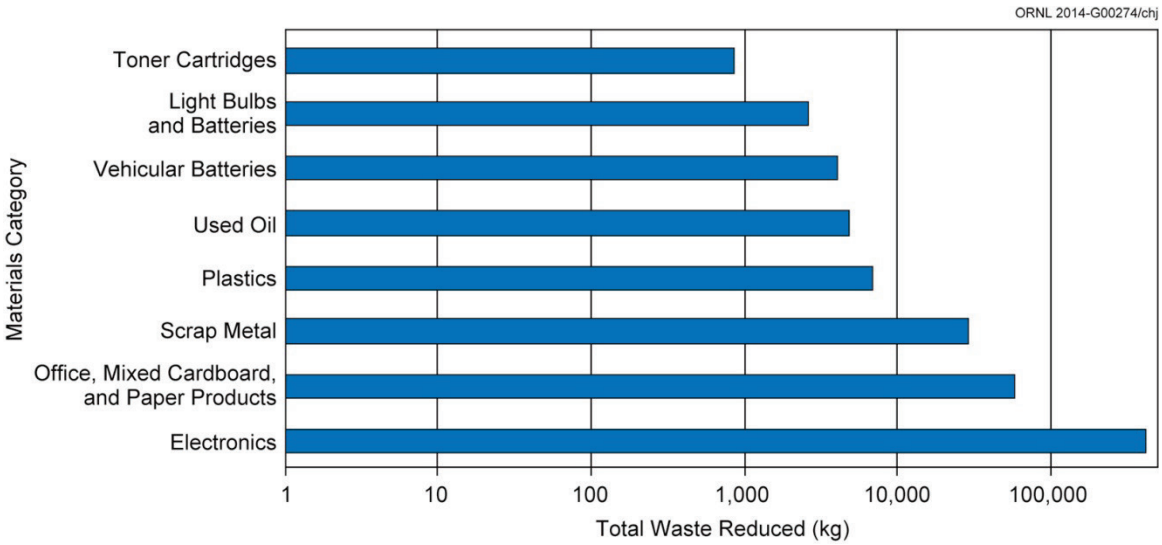


Fig. 3.4. Pollution prevention recycling activities related to solid waste reduction at East Tennessee Technology Park in FY 2013.

UCOR's electronic stewardship is award winning. In 2013 EPA awarded ETTP its second Federal Electronics Challenge (FEC) Platinum-Level Award. [ETTP won its first FEC Platinum-Level Award in 2012 for its electronics assets management achievements, including the Radio Frequency Identification Transportation System (RFITS).] UCOR also received two out of only five DOE headquarters sustainability awards in 2013. One, in the category of Waste Reduction and Pollution Prevention, was for successfully diverting more than 8,000 metric tons of construction and demolition (C&D) debris from projects at ETTP, ORNL, and Y-12 (Fig. 3.5). The other was an individual award in the category of Exceptional Service/Sustainability Champion for excellence in electronics stewardship.

Fig. 3.5. US Department of Energy headquarters sustainability award winners for 2012 (awarded in 2013).

Additionally, UCOR internally recognized six projects for their pollution prevention/waste minimization accomplishments during the year, representing 42,000 lb of construction debris being diverted from landfills and a cost savings of $170,000. In the area of alternative energy, Restoration Services, Inc. (RSI), in concert with UCOR, continued operation of ETTP's first solar farm on the east end of the plant property. Brightfield 1 (Fig. 3.6), as it is known, is a 200 kW solar array located at ETTP and built by RSI as part of the UCOR commitment to the revitalization of the former K-25 Site. The 0.405 ha (1-acre) tract was purchased from CROET. RSI self-financed the project, used solar panels manufactured in Tennessee, and partnered with other local small businesses for the installation. Power generated from Brightfield 1 is being sold to TVA through the City of Oak Ridge Electric Department using a TVA Generation Partners contract. The completed project was commissioned in April of 2012 and is part of RSI's brownfield to brightfield initiative that works to develop restricted use properties into solar farms. Brightfield 1 energy production in its first year was 110% more than projected, with no downtime due to maintenance issues. In CY 2013 Brightfield 1 produced 262,100 kWh of energy. UCOR also continued to use "green" products whenever possible and evaluated large quantity purchases for less toxic alternatives. In addition, UCOR maintained its extensive recycling program and benefitted the local community through donations of proceeds to local charities from its aluminum beverage can (ABC) recycling efforts.

In April 2013, Vis Solis, Inc., a Heritage Center tenant, completed construction of a 50 kW photovoltaic solar array near the west end of the property using dual-axis trackers from DEGERenergie and implementing smart technology to extract maximum energy from the sun. Like a sunflower does in nature, the solar panels follow the sun's path to produce more energy than a fixed unit installation. According to Vis Solis, this design produces a 40% greater energy yield compared with similar stationary

solar panels. The installed capacity at ETTP is 49.8 kW DC and 42 kW AC with an annual yield of about 91,000 kWh, which is equivalent to the power needed for seven homes per year and eliminates 132,000 lb of carbon dioxide emissions per year (equivalent to that from 11 passenger vehicles). The installation is located on a restricted use site and uses taller masts than traditional solar installations to permit the continued growth of a switchgrass crop used for biomass production.

Fig. 3.6. Brightfield 1 Solar Farm.

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, management assessments conducted by functional or project organizations, and routine field walkdowns conducted by a variety of functional and project personnel. Management and independent assessments are performed in accordance with *Management Assessment*, PROC-PQ-1420, and *Independent Assessment*, PROC-PQ-1401. Assessments are scheduled on the UCOR Assessments SharePoint Site in accordance with PROC-PQ-1420. Records are maintained for all formal assessments and audits. Issues identified in assessments are handled as required by ISO 14001, Section 4.5.3, "Nonconformity, Corrective Action, and Preventive Action" (ISO 2004).

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 environment, safety, and health (ES&H) goals. UCOR works continuously to improve EMS to reduce impacts from 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 an enabling EMS into the daily conduct of business; fostering a spirit of cooperation with federal, state, and local regulatory agencies; and using appropriate waste management, treatment, storage, and disposal methods. The environmental performance objectives are to achieve zero unpermitted discharges to the environment; comply with all conditions of environmental permits, laws, regulations, and DOE orders; integrate EMS and environmental considerations as part of ISMS; and, to the extent

practicable, reduce waste generation, prevent pollution, maximize recycle and reuse potential, and encourage environmentally preferable procurement of materials with recycled and biobased content.

UCOR has established a set of core EMS objectives that remain relatively unchanged from year to year. These objectives are generally applicable to all operations and activities throughout UCOR's work scope. The core environmental objectives are based on complying with applicable legal requirements and sustainable environmental practices contained in DOE O 436.1, *Departmental Sustainability* (DOE 2011), and include the following:

- comply with all environmental regulations, permits, and regulatory agreements;
- reduce or eliminate the acquisition, use, storage, generation, and/or release of toxic, hazardous, and radioactive materials; waste; and greenhouse gas (GHG) emissions through acquisition of environmentally preferable products, conduct of operations, waste shipment, and pollution prevention and waste minimization practices; and
- reduce degradation and depletion of environmental resources through postconsumer material recycling; energy, fuel, and water conservation efforts; and use or promotion of renewable energy.

3.2.5 Implementation and Operations

UCOR protects the safety and health of workers and the public by identifying, analyzing, and mitigating aspects, hazards, and impacts from ETTP operations and by implementing sound work practices. All UCOR 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 internal management assessments also provide a measure of how well EMS attributes are integrated into work activities through ISMS. UCOR has embodied its program for EC&P of natural resources in a companywide environmental management and protection policy. The policy is UCOR's fundamental commitment to incorporating sound environmental management practices into all work processes and activities.

3.2.6 Pollution Prevention/Waste Minimization

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

ETTP continues to operate its nationally recognized RFITS, an electronic waste management tracking system that uses paperless and otherwise enhanced transportation logistics to track and monitor on-site waste shipments to EMWMF. An electronic tracking station is shown in Fig. 3.7. The system eliminated errors associated with manual data entry, improved cycle times by 25 min per truck shipment (i.e., saving large quantities of fuel and paper that significantly reduces GHG emissions), improved performance of vehicle searches at truck stations when exiting controlled areas, and centralized logistics for all shipments to EMWMF. The overall project cost savings of $15.6 million from using RFITS is shown in Table 3.1.

Fig. 3.7. Truck carrying a waste shipment passing through an electronic tracking station, part of the Radio Frequency Identification Transportation System, en route to the Environmental Management Waste Management Facility.

Table 3.1. Radio Frequency Identification Transportation System sustainable results

Sustainable factor	Results
Diesel fuel use avoidance	108,645 L
NO_X and CO_2 emissions avoidance	5,039 kg and 287,845 kg
Paper and trees saved	11 metric tons and 73 trees

3.2.7 Competence, Training, and Awareness

The UCOR training and qualification process ensures that needed skills for the workforce are identified and developed. The process also documents knowledge, experience, abilities, and competencies of the workforce for key positions requiring qualification. This process is described in PROC-TC-0702, Training Program. Completion and documentation of training, including required reading, are managed by the Local Education Administration Requirements Network.

3.2.8 Communication

UCOR communicates externally regarding environmental aspects through the UCOR public website, which includes a link to its environmental policy statement, POL-UCOR-007; a list of environmental aspects; and a link to the ISMS Description, PPD-EH-1400. A number of other documents and reports that address environmental aspects and cleanup progress are also published and made available to the public [e.g., ASER and the annual cleanup progress report (UCOR 2013)]. UCOR participates in a number of public meetings related to environmental activities at the site (e.g., ORSSAB meetings, permit review public meetings, and CERCLA decision document public meetings). Written communications from external parties are tracked using the weekly Open Action Report.

3.2.9 Benefits and Successes of Environmental Management System Implementation

UCOR uses EMS objectives and targets, an internal pollution prevention recognition program, environmentally preferable purchasing, work control processes, and a recycle program to meet sustainability and 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 2013c). In 2012 the UCOR EMS program underwent the independent program verification required triennially by EO 13423 (CEQ 2007), which resulted in zero findings and five opportunities for improvement (mostly related to documentation). Further, the report noted several practices worthy of benchmarking. In 2013 UCOR conducted an internal management review of the EMS program that resulted in one finding and one observation, both of which were closed.

3.2.10 Management Review

Senior management review of EMS is performed at several layers and frequencies. A formal review/presentation with UCOR senior management that addresses the requirement elements contained in this section is conducted at least once per year. At least two of the senior managers are present for management reviews. The ISMS description is updated annually to address improvements and lessons learned and to update objectives and targets as necessary and signed by the UCOR president. The environmental policy is also reviewed during the management review annually and revised as necessary.

3.3 Compliance Programs and Status

During 2013, ETTP operations were conducted in compliance with contractual and regulatory environmental requirements, and there were no NPDES permit or Clean Air Act (CAA) noncompliances.

Figure 3.8 shows the trend of NPDES compliance at ETTP since 1999. No notices of violation (NOVs) or penalties were issued to ETTP operations in 2012 or 2013. The following sections provide more detail on each compliance program and the related activities in 2013.

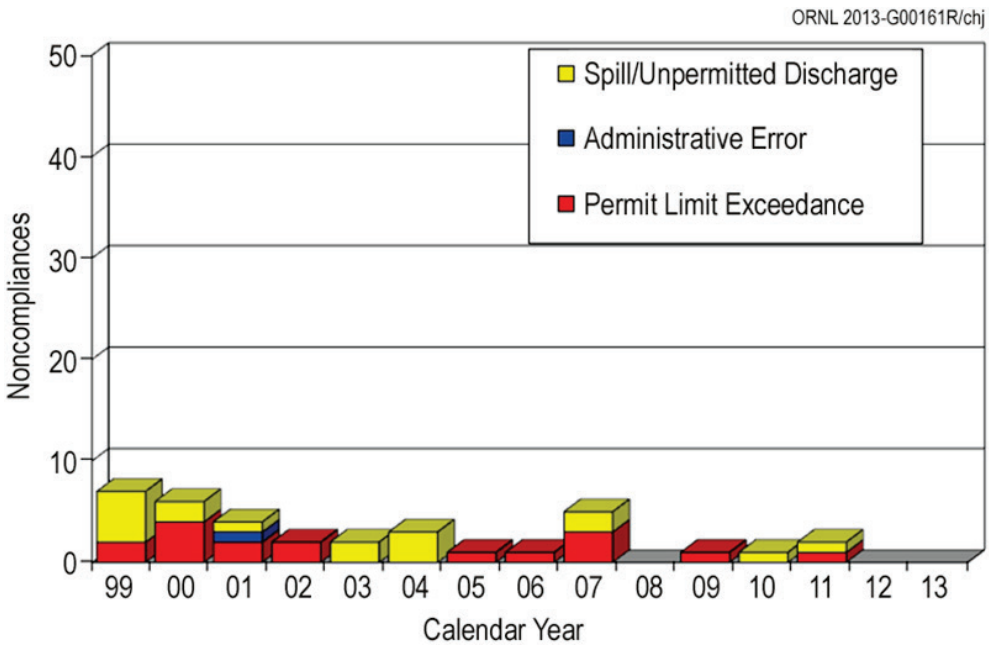


Fig. 3.8. East Tennessee Technology Park National Pollutant Discharge Elimination System permit compliance since 1999.

3.3.1 Environmental Permits

Table 3.2 contains a list of environmental permits that were in effect at ETTP in 2013.

3.3.2 Notices of Violations and Penalties

ETTP did not receive any NOVs or penalties from regulators in 2013.

3.3.3 Audits and Oversight

Table 3.3 presents a summary of environmental audits conducted at ETTP in 2013.

Table 3.2. East Tennessee Technology Park Environmental Permits, 2013

Regulatory driver	Permit title/description	Permit number	Issue date	Expiration date	Owner	Operator	Responsible contractor
CAA	State permit to construct or modify an air contaminant source—Internal combustion engine–powered emergency generators and fire water pump	967220P	08-22-2013	08-23-2014	UCOR	UCOR	UCOR
CWA	NPDES permit for the Central Neutralization Facility Wastewater Treatment System	TN0074225	10-29-10	Expired[a] 12-31-13	UCOR	UCOR	UCOR
CWA	NPDES permit for storm water discharges	TN0002950	02-26-10	12-31-13[b]	DOE	UCOR	UCOR
CWA	State operating permit—Waste Transportation Project; Blair Road and Portal 6 Sewage Pump and Haul Permit	SOP-05068	08-19-11	02-28-14	TOPS	TOPS	UCOR
CWA	State operating permit—K-1310-DF and K-1310-HG Trailers	SOP-99033	04-30-10	04-30-15	UCOR	UCOR	UCOR
CWA	State operating permit—K-1065 Facility; Trailer K-1310-BS added in March 2009	SOP-01042	11-30-06	Terminated 5-31-11	UCOR	UCOR	UCOR
CWA	Authorized/certified USTs at K-1414 Garage	Customer ID 30166 Facility ID 073008	03-20-89	Ongoing	DOE	UCOR	UCOR

Table 3.2. (continued)

Regulatory driver	Permit title/description	Permit number	Issue date	Expiration date	Owner	Operator	Responsible contractor
RCRA	ETTP Container Storage and Treatment Units	TNHW-117	09-30-04	09-30-14	DOE	UCOR	UCOR
RCRA	Hazardous Waste Corrective Action Document (encompasses the entire ORR)	TNHW-121	09-28-04	09-28-14	DOE	DOE/All[c]	DOE/All[c]

[a]The Central Neutralization Facility ceased operation in 2013 and was permanently shut down. NPDES permit TN0074225 was allowed to expire.
[b]An NPDES permit renewal application has been submitted in a timely manner. In cases where permit renewal applications have been submitted to regulatory agencies in a timely manner, but a new permit has not been issued, permission is granted by regulators to continue operating under the terms of the existing but expired permit.
[c]DOE and all ORR co-operators of hazardous waste permits.

Acronyms
CAA = Clean Air Act
CWA = Clean Water Act
DOE = US Department of Energy
ETTP = East Tennessee Technology Park
ID = identification (number)
NPDES = National Pollutant Discharge Elimination System
ORR = Oak Ridge Reservation
RCRA = Resource Conservation and Recovery Act
SOP = state operating permit
TOPS = Transportation, Operations and Professional Services, Inc.
UCOR = URS | CH2M Oak Ridge LLC
UST = underground storage tank

Table 3.3. Regulatory oversight, assessments, inspections, and site visits at East Tennessee Technology Park, 2013

Date	Reviewer	Subject	Issues
January 24	TDEC	Inspection of ETTP USTs	0
February 11–12	TDEC	Annual RCRA Compliance Inspection	0
September 30	TDEC-Knoxville	CNF NPDES Compliance Evaluation Inspection	0
October 24	EPA Region 4	TSCA Incinerator—PCB Site Visit	0

Acronyms
CNF = Central Neutralization Facility
EPA = US Environmental Protection Agency
ETTP = East Tennessee Technology Park
NPDES = National Pollutant Discharge Elimination System
PCB = polychlorinated biphenyl
RCRA = Resource Conservation and Recovery Act
TDEC = Tennessee Department of Environment and Conservation
TSCA = Toxic Substances Control Act
UST = underground storage tank

3.3.4 National Environmental Policy Act/National Historic Preservation 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. Many of the current operations at ETTP are conducted under CERCLA. NEPA reviews are part of the CERCLA planning process to ensure that NEPA values are incorporated into CERCLA projects and documentation.

During 2013, ETTP continued to operate under site-level, site-specific procedures that provide requirements for project reviews and NEPA compliance. These procedures call for a review of each proposed project, activity, or facility to determine the potential for impacts to the environment. To streamline the NEPA review and documentation process, DOE ORO has approved generic categorical exclusion (CX) determinations that cover certain proposed activities (i.e., maintenance activities, facilities upgrades, personnel safety enhancements). A CX is one of a category of actions defined in 40 CFR 1508.4 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. UCOR activities on ORR are in full compliance with NEPA requirements, and procedures for implementing NEPA requirements have been fully developed and implemented. At ETTP, a checklist incorporating NEPA and EMS requirements has been developed as an aid for project planners. For routine, recurring activities, DOE generic CX determinations are used. During 2013, no new CX determinations for activities at ETTP were issued by DOE.

Compliance with the National Historic Preservation Act (NHPA) at ETTP is achieved and maintained in conjunction with NEPA compliance. The scope of proposed actions is reviewed in accordance with the ORR cultural resource management plan (Souza et al. 2001). At ETTP there were 135 facilities eligible for inclusion on the NRHP, as well as numerous facilities that were not eligible for inclusion on the NRHP. To date, more than 220 facilities have been demolished. Artifacts of historical and/or cultural significance are identified before demolition and are cataloged in a database to aid in historic interpretation of ETTP.

Consultation for the development of an MOA for D&D of the K-25 and K-27 buildings started in 2001; the document, approved in 2003, required a third-party analysis of the preservation and interpretive strategies for those two buildings. In 2005 DOE, the Tennessee SHPO, and ACHP entered into an MOA that included the retention of the north end tower (also known as north wing, north end, north tower) of the K-25 building and Portal 4 (K-1028-45), among other features, as the "best and most cost-effective mitigation to permanently commemorate, interpret, and preserve the significance" of ETTP. Another series of consultation meetings ensued in 2009, and DOE advised that prohibitive costs and safety

considerations precluded fulfillment of three stipulations in the 2005 MOA, including the preservation of the north end tower. The parties offered a wide array of potential mitigation measures and, in the absence of consensus on how best to commemorate Building K-25, DOE, SHPO, and ACHP entered into a bridge MOA until the parties could reach a final agreement. After completing an evaluation of the structural integrity of the K-25 building and interpretative approaches for the site, DOE distributed a preferred mitigation plan to the consulting parties in October 2011. The DOE final mitigation plan, addressing comments submitted by consulting parties in November 2011, permitted demolition of the entire K-25 building and called for, among other mitigation measures, the designation of a commemorative area around the building's perimeter from which future surface development would largely be restricted; the retention, if possible, of the entire concrete slab or the demarcation of the building's footprint; the construction of a viewing tower and of a structure for equipment display; and the development of a history center within the ETTP Fire Station. A final MOA was signed in August 2012 finalizing the aspects set forth in the mitigation plan. During 2013, a request for proposal was issued for a "Professional Design Team and Museum Professional" as specified in the MOA. Nine firms were prequalified, and the selection and award are expected in 2014. The procurement process for the K-25 "virtual museum" web design firm was also begun in 2013. This procurement and award should be completed in 2014.

3.3.5 Clean Air Act Compliance Status

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 (NSPSs), Prevention of Significant Deterioration permitting programs, and National Emission Standards for Hazardous Air Pollutants (NESHAPs). 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.

3.3.6 Clean Water Act Compliance Status

The objective of 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 CWA was EPA establishment of limits on specific pollutants allowed to be discharged to US waters by municipal sewage treatment plants (STPs) 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 CY 2013, ETTP discharged to the waters of the state of Tennessee under two individual NPDES permits:

- NPDES permit TN0002950, which regulates storm water discharges, and
- NPDES permit TN0074225, which regulates industrial discharges from the Central Neutralization Facility (CNF).

In 2013, compliance with ETTP NPDES storm water permit TN0002950 was determined by more than 200 laboratory analyses, field measurements, and flow estimates. The NPDES permit compliance rate for all discharge points for 2013 was 100%.

In 2013, compliance with the ETTP NPDES permit for industrial wastewater from CNF was determined by almost 1,000 laboratory analyses and field measurements. The CNF NPDES permit compliance rate for 2013 was 100% with no noncompliances. The CNF facility was permanently shut down in August 2013 and did not discharge in the months of September through December 2013. The CNF NPDES permit was allowed to expire on December 31, 2013.

3.3.7 National Pollutant Discharge Elimination System Permit Noncompliances

During 2013 ETTP and UCOR operations were conducted in compliance with contractual and regulatory environmental requirements. There were no NPDES permit noncompliances in 2013.

3.3.8 Safe Drinking Water Act Compliance Status

The ETTP water distribution system is designated as a nontransient, noncommunity water system by TDEC's Division of Water Supply. Chapter 0400-45-01 of the Tennessee regulations for public water systems (TDEC 2012) sets limits for biological contaminants and for chemical activities and chemical contaminants. TDEC requires sampling for the following constituents for compliance with state and federal regulations:

- chlorine residual levels,
- bacteriological (total coliform),
- lead and copper, and
- disinfectant by-products (trihalomethanes and haloacetic acids).

The City of Oak Ridge supplies potable water to the ETTP water distribution system. The water treatment plant, located on ORR, southwest of ETTP, is owned and operated by the City of Oak Ridge.

3.3.9 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. This amount includes hazardous waste generated under permitted activities (including repackaging or treatment residuals). At the end of 2013, ETTP had three generator accumulation areas for hazardous or mixed waste.

In addition, ETTP is permitted to store and treat hazardous and mixed waste under Resource Conservation and Recovery Act (RCRA) Part B Permit TNHW-117. Hazardous waste may be treated and stored at permitted locations in Building K-1423 and at the K-1065 complex. This hazardous waste permit will be expiring in September 2014, and activities have commenced to prepare the permit renewal application for submission to TDEC at least 180 days before the permit expiration date.

There were no RCRA generator or permitted noncompliances in 2013.

3.3.10 Resource Conservation and Recovery Act Underground Storage Tanks

Underground storage tanks (USTs) containing petroleum and hazardous substances are regulated under RCRA Subtitle I (40 CFR 280). EPA granted TDEC authority to regulate USTs containing petroleum under TDEC Rule 0400-18-01 *Underground Storage Tank Programs*; however, EPA still regulates hazardous-substance USTs.

3.3.11 Comprehensive Environmental Response, Compensation, and Liability Act Compliance Status

CERCLA, also known as Superfund, was passed in 1980 and was amended in 1986 by the Superfund Amendments and Reauthorization Act (SARA). Under CERCLA, a site is investigated and remediated if it poses significant risk to health or the environment. The EPA National Priorities List (NPL) 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. ORR is on the NPL.

3.3.12 East Tennessee Technology Park RCRA-CERCLA Coordination

The ORR federal facility agreement (FFA; DOE 1994) is intended to coordinate the corrective action processes of RCRA required under the Hazardous and Solid Waste Amendments permit with CERCLA response actions.

3.3.13 Toxic Substances Control Act Compliance Status—Polychlorinated Biphenyls

On April 3, 1990, DOE notified EPA headquarters (as required by 40 CFR 761.205) that ETTP is a generator with on-site storage, a transporter, and an approved disposer of PCB wastes.

PCB waste generation, transportation, disposal, and storage at ETTP are regulated under EPA ID number TN0890090004. In 2013, ETTP operated 10 PCB waste storage areas in ETTP generator buildings, and when longer term storage of PCB/radioactive wastes was necessary, RCRA-permitted storage buildings were used. The continued use of authorized PCBs in electrical systems and/or equipment (e.g., transformers, capacitors, rectifiers) is regulated at ETTP. At this time, no PCB-contaminated electrical equipment is in service at ETTP. Most Toxic Substances Control Act–(TSCA)-regulated equipment at ETTP has been disposed of. However, some ETTP facilities continue to use or store nonelectrical PCB-contaminated equipment for future reuse.

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 ORO and EPA Region 4 consummated a major compliance agreement known as the *Oak Ridge Reservation Polychlorinated Biphenyl Federal Facilities Compliance Agreement* (DOE 2012), which became effective December 16, 1996, and was last revised on May 23, 2012. The agreement 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 PCBs in paint, adhesives, electrical wiring, or floor tile, are identified at ETTP.

ETTP was home to the TSCA Incinerator. On December 2, 2009, the TSCA Incinerator ceased operations as a waste incinerator and transitioned to a facility closure and decommissioning mode. The RCRA and PCB closure certification report for the TSCA Incinerator RCRA Permitted Unit areas was submitted to EPA and TDEC on June 10, 2011. A Closure Certification Letter was issued by EPA Region 4 on June 14, 2012, and by TDEC on September 21, 2012. The PCB Institutional Control walkdown inspection was completed in July 2012. During 2012, the primary focus at the TSCA Incinerator was completing the decontamination of the Permit-by-Rule components of the TSCA Incinerator facility for RCRA and TSCA closure actions. The decontamination steps were completed in 2012, and the Permit-by-Rule components of the facility are no longer active.

During 2012, a postclosure TSCA Incinerator PCB Institutional Control Plan that requires monthly inspections of the facility was implemented and will remain in effect as agreed upon in the closure certification while the facility is in a surveillance and maintenance (S&M) mode pending demolition.

3.3.14 Emergency Planning and Community Right-to-Know Act Compliance Status

The Emergency Planning and Community Right-to-Know Act (EPCRA) and Title III of SARA require that facilities report inventories and releases of hazardous and toxic chemicals that exceed threshold planning quantities. The reports are submitted to the local emergency planning committee and the state emergency response commission and the local fire department. ETTP complied with these requirements in 2013 through the submittal of reports under EPCRA Sections 302, 303, 311, and 312. ETTP had no releases of extremely hazardous substances, as defined by EPCRA, in 2013.

3.3.14.1 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 2013, nine were located at ETTP. These chemicals were nickel metal, lead metal (includes large lead acid batteries), sodium metal, diesel fuel, sulfuric acid

(includes large lead acid batteries), Chemical Specialties Ultrapoles, creosote-treated wood, unleaded gasoline, and Sakrete Type S or N mortar mix.

3.3.14.2 Toxic Chemical Release Reporting (EPCRA Section 313)

Section 313 requires facilities to complete and submit a toxic chemical 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. A Form R for each chemical must be submitted by July 1 of each year. DOE electronically submits annual TRI reports to EPA on or before July 1 of each year. The reports address releases of certain toxic chemicals to air, water, and land and waste management, recycling, and pollution prevention 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 2013, the only chemicals that met the reporting requirements were diisocyanates associated with foaming activity to stabilize deposits in pipes undergoing remediation actions.

3.4 Quality Assurance Program

3.4.1 Integrated Assessment and Oversight Program

Quality assurance (QA) program implementation and procedural and subcontract compliance are verified through the UCOR Integrated Assessment and Oversight 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: (1) external assessments conducted by organizations external to UCOR, (2) independent assessments conducted by teams independently of the project/function being assessed, and (3) management assessments and surveillances conducted as self-assessments and surveillances by the organization or on behalf of the organization manager.

Self-assessments are performed by the organization/function with primary responsibility for the work, process, or system being assessed. Organizations and functions within the company plan and schedule self-assessments. Self-assessments encompass both formal and informal assessments. The formal self-assessments include management assessments and surveillances and subcontractor oversight. Informal self-assessments include weekly inspections and routine walkthroughs conducted by subcontractor coordinators, ES&H and QA representatives, quality engineers, and line managers.

Conditions adverse to quality identified from internal and external assessments are documented, causal analyses are performed, and corrective actions are developed and tracked to closure. Analyses are conducted periodically to identify trends for management action. Senior management evaluates data from those processes to identify opportunities for improvement.

3.5 Air Quality Program

The State of Tennessee has been relegated 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 2013, ETTP DOE EM operations were under UCOR responsibility for regulatory compliance

3.5.1 Construction and Operating Permits

During 2013, UCOR ETTP operations became subject to amended CAA regulations and permitting under TDEC Air Pollution Control Rules. The regulations were specific to stationary fossil-fueled reciprocating internal combustion engines (RICEs) for emergency use. UCOR has responsibility for five

RICE units subject to permitting and therefore prepared and submitted permit applications. TDEC issued a Permit to Construct or Modify (967220P) with an effective date of August 22, 2013. The permit covers compliance demonstration requirements for four emergency generators and one fire water pump system. Compliance for all units is demonstrated by following specified maintenance schedules, limiting hours of operations for nonemergencies to 100 h/year, and record keeping. Regulations exempt any operating hours of these units during unscheduled (emergency) power outages. All other ETTP operations that do 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.

3.5.1.1.1 Control of Asbestos

ETTP's asbestos management program ensures all activities involving demolitions and all other actions impacting asbestos-containing materials (ACMs) are fully compliant with 40 CFR 61, Subpart M. This includes using approved engineering controls and work practices, inspections, and monitoring for proper removal and waste disposal of ACMs. ETTP has numerous buildings and equipment that contain ACMs. Major demolition activities during 2013 involved the abatement of significant quantities of ACMs that were subject to the requirements of 40 CFR 61, Subpart M. Most demolition and ACM abatement activities are governed under CERCLA. Under this act, notifications of asbestos demolition or renovations as specified in 40 CFR 61.145(b) are incorporated into CERCLA document regulatory notifications. All other non-CERCLA planned demolition or renovation activities were individually reviewed for applicability of the TDEC notification requirements of the rule. During 2013, no individual non-CERCLA ETTP activity required a notification submittal. 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 2013 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 ACMs occurred at ETTP during 2013.

3.5.1.1.2 Stratospheric Ozone Protection

The management of ODSs at ETTP is subject to regulations in 40 CFR Part 82, Subpart F, Recycling and Emissions Reduction; 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, including motor vehicle air-conditioners. In addition, the regulations apply to refrigerant reclamation activities, appliance owners, manufacturers of appliances, and recycling and recovery equipment. Figure 3.9 illustrates the historical on-site ODS inventory at ETTP.

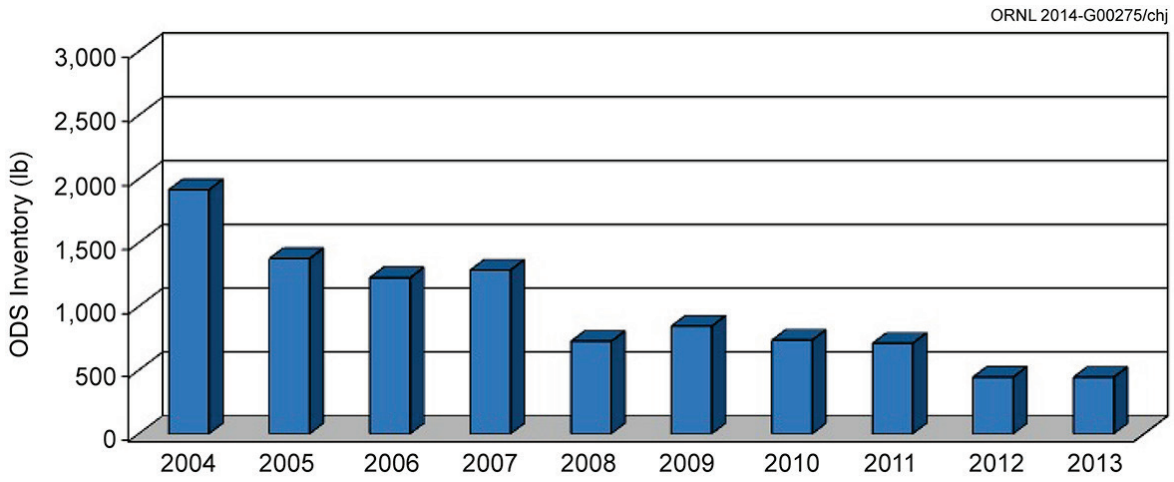


Fig. 3.9. East Tennessee Technology Park total on-site ozone depleting substances (ODSs) inventory 10-year history.

3.5.1.1.3 Fugitive Particulate Emissions

ETTP has been the location of major building demolition activities and waste debris transportation with the potential for 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 as needed to minimize airborne dusts caused by vehicle traffic.

3.5.1.2 Radionuclide National Emission Standards for Hazardous Air Pollutants

Radionuclide airborne emissions from ETTP are regulated under 40 CFR 61, National Emission Standards for Hazardous Air Pollutants: Department of Energy Facilities (Rad-NESHAPs). 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 (CAP-88) computer codes, which were developed under EPA sponsorship for use in demonstrating compliance with the 10 mrem/year effective dose (ED) Rad-NESHAPs for the entire DOE ORR. Source emissions used to calculate the dose are determined using EPA-approved methods that can range from continuous in-stack sampling systems and ambient air sampling to conservative estimations based on process and waste characteristics. Continuous in-stack sampling systems are required for radionuclide-emitting sources that have a potential dose impact of not less than 0.1 mrem per year to any off-site member of the public. ETTP Rad-NESHAPs sources—the K-1407 CNF Volatile Organic Compound (VOC) Air Stripper; K-1407 Chromium Water Treatment System (CWTS) VOC Air Stripper; K-2527-BR Grouting Facility; and K-2500-H Segmentation Shops A, B, C, and D—are considered minor based on emissions evaluations using EPA-approved calculation methods. A minor Rad-NESHAPs source is defined as having a potential dose impact on the public not in excess of 0.1 mrem/year. Figure 3.10 provides a historical dose trend on the most impacted on-site member of the public. The results are based on actual ambient air sampling in a location conservatively representative to the on-site location.

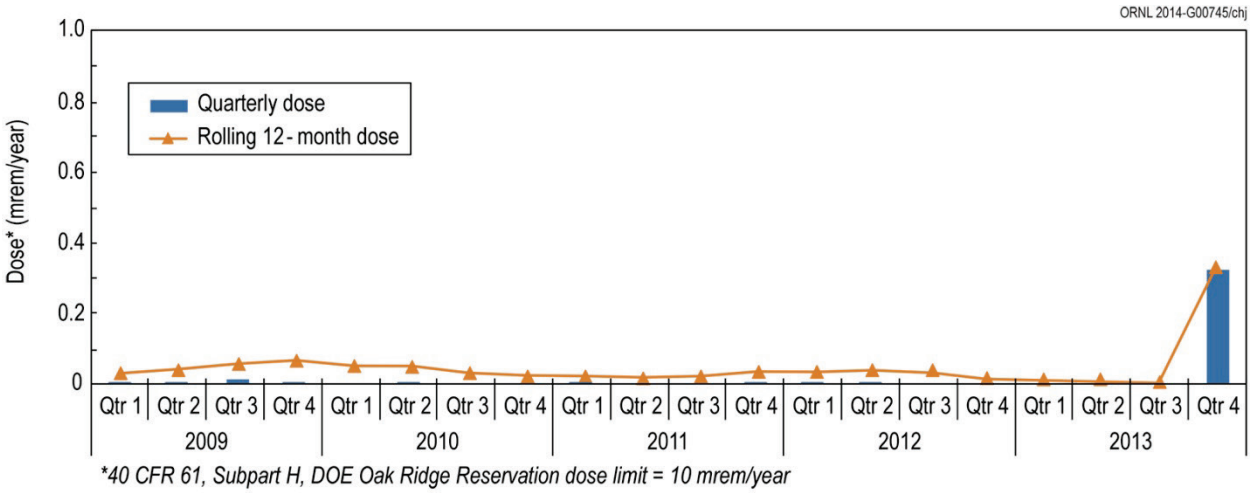


Fig. 3.10. East Tennessee Technology Park ambient air station K11 radionuclide quarterly and rolling 12-month effective dose results from January 2009 through December 2013.

Historically, the annual dose impact at ETTP ambient air sampling locations has been based on quarterly composites prepared from weekly samples. A comparison of ETTP results with data provided by TDEC using a colocated sampler at K11 indicated a reasonable correlation between the two data sets for the first three quarters of 2013 for both ^{99}Tc and the uranium isotopes. The uranium isotope results also correlated well for the fourth quarter. However, the ETTP fourth quarter K11 ^{99}Tc composite results did not show a good correlation with the TDEC results. The TDEC ^{99}Tc results were significantly higher. Both data sets indicated a significant increase in ambient air concentrations of ^{99}Tc at K11 during the fourth quarter, and both data sets yield dose modeling results well below the annual effective dose limit of 10 mrem. Because of this difference, biweekly composite samples of ETTP archived filter remnants were prepared and submitted for ^{99}Tc analysis. The biweekly time periods were very similar to those used by TDEC. The ambient air concentrations of ^{99}Tc based on the results of the ETTP biweekly composite samples were very consistent with the TDEC biweekly composite sample results.

A follow-up investigation of the original ETTP fourth quarter composite ^{99}Tc laboratory results identified an issue with a spike recovery percentage that was around 18% as compared to a more typical expectation of 100% recovery. The spike recovery for the ETTP biweekly fourth quarter laboratory results was within acceptable limits. Due to data quality concerns with potentially underreporting the ^{99}Tc dose contributions from the fourth quarter ^{99}Tc composite result, the ETTP biweekly ^{99}Tc results were used to represent the air concentrations at the K11 station for the fourth quarter of CY 2013. Follow-up corrective action discussions with the commercial laboratory conducting the ^{99}Tc analyses are ongoing.

Figure 3.10 provides the historical dose impact at K11 up through 2013. This sampling location is representative of the most impacted on-site member of the public from both point and fugitive airborne radionuclide emissions. The annual dose impact of about 0.3 mrem during the fourth quarter of 2013 is very significant compared to previous results. This impact represents only 3% of the annual limit of 10 mrem to any on-site or off-site member of the public. (Refer to Section 3.5.2 for additional sampling data and discussions of station K2, K6, and K11 results.)

3.5.1.3 Quality Assurance

QA activities for the Rad-NESHAPs program are documented in the *Quality Assurance Program Plan for Compliance with Radionuclide National Emission Standards for Hazardous Air Pollutants* (UCOR 2012d). The plan satisfies the QA requirements in 40 CFR 61, Method 114, 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

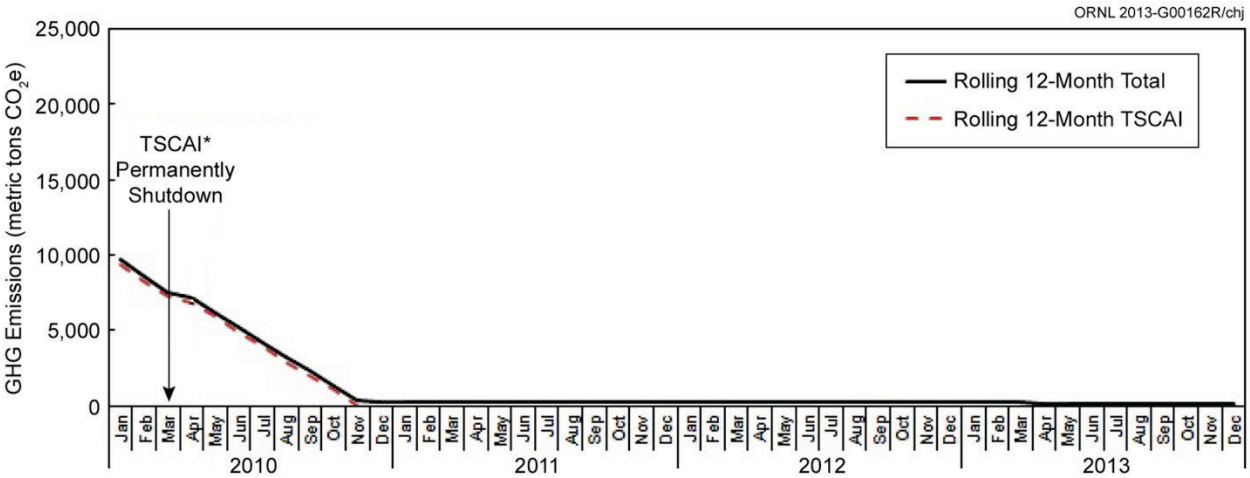
referenced in TDEC regulation 1200-3-11-08. The plan ensures the quality of ETTP radionuclide emission measurement data from continuous samplers and minor radionuclide release points. Only EPA preapproved methods are referenced through the *Rad-NESHAP Compliance Plan on the Oak Ridge Reservation* (DOE 2005).

3.5.1.4 Greenhouse Gas Emissions

The EPA mandatory GHG reporting rule was enacted September 30, 2009, under 40 CFR Part 98.2. According to the rule, in general, the stationary source emissions threshold for reporting is 25,000 metric tons or more of GHG emissions per year, reported as CO_2 equivalents (CO_2e) per year. The rule defines GHGs as

- carbon dioxide (CO_2),
- methane (CH_4),
- nitrous oxide (N_2O),
- hydrofluorocarbons,
- perfluorocarbons, and
- sulfur hexafluoride (SF_6).

A 2013 review was performed of ETTP processes and equipment categorically identified under 40 CFR 98.2 whose emissions must be included as part of a facility annual GHG report starting with the calendar year 2010 reporting period. Based on total GHG emissions from all ETTP stationary sources during 2013, 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 calendar year 2008 have not exceeded 12,390 metric tons. The decrease in stationary source emissions is due to the permanent cessation of waste processing at the TSCA Incinerator in 2009 and ongoing facility demolitions. The remaining sources are predominantly small comfort heating systems, hot water systems, and power generators. Figure 3.11 shows the historical trend of ETTP total GHG stationary emissions including contributions from the TSCA Incinerator. For the 2013 calendar year period, GHG emissions totaled only 201 metric tons.



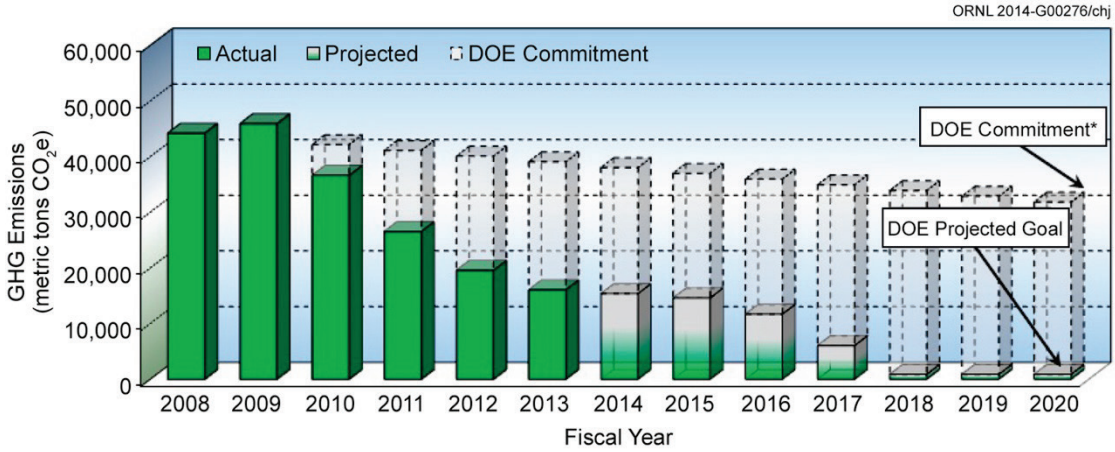
US Environmental Protection Agency mandatory reporting rule applicability limit: 25,000 metric tons GHGs per year (40 CFR 98).
**Toxic Substances Control Act incinerator*

Fig. 3.11. East Tennessee Technology Park tracking history for stationary source greenhouse gas (GHG) emissions [in CO_2 equivalents (CO_2e)] (rolling 12-month totals).

EO 13514, *Federal Leadership in Environmental, Energy, and Economic Performance,* was signed by President Obama on October 5, 2009. The purpose of this order is to establish policies for federal facilities that will increase energy efficiency; measure, report, and reduce GHG emissions from direct and indirect activities; conserve and protect water resources through efficiency, reuse, and storm water

management; eliminate waste; recycle; and prevent pollution at all such facilities. While the order deals with a number of environmental media, only it's applicability to GHGs is considered here. The executive order defines three distinct scopes for purposes of reporting. Scope 1 is essentially direct GHG emissions from sources that are owned or controlled by a federal agency; Scope 2 encompasses GHG emissions resulting from the generation of electricity, heat, or steam, including energy purchased by a federal agency; and Scope 3 involves GHG emissions from sources not owned or directly controlled by a federal agency but related to agency activities such as vendor supply chains, delivery services, and employee business travel and commuting.

Figure 3.12 displays the trend toward meeting the 28% total Scopes 1 and 2 GHG emissions reduction target by FY 2020 as stated in the DOE *Strategic Sustainability Performance Plan* (SSPP; DOE 2013). FY 2013 emissions totaled 16,065 metric tons CO_2e as compared to the target level of 31,847 metric tons CO_2e, which shows a 64% reduction to date as compared to the 2008 baseline year level of 44,232 metric tons.



**DOE Strategic Sustainability Performance Plan commits to a 28% reduction of Scope 1 and 2 GHG emissions by FY 2020.*

Fig. 3.12. East Tennessee Technology Park greenhouse gas (GHG) emissions trend and targeted reduction commitment [both in CO_2 equivalents (CO_2e)].

Figure 3.13 shows the relative distribution of ETTP FY 2013 GHG emissions for Scopes 1, 2, and 3. Total GHG emissions continue to decline as demolition and remediation efforts continue at ETTP. Much of the reduction is the result of lower combustion of fuels on the site (stationary and mobile sources), a drop in the consumption of electricity, and a smaller workforce.

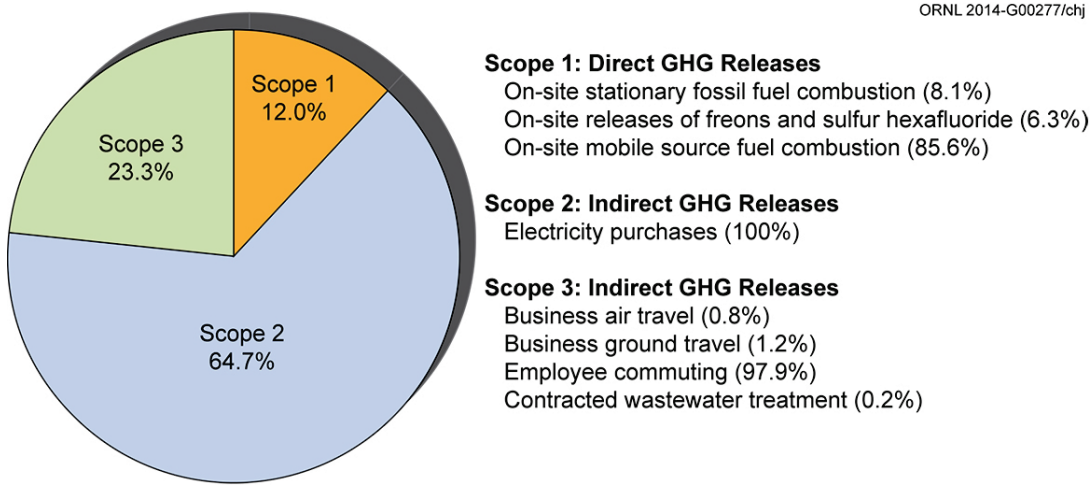


Fig. 3.13. CY 2013 East Tennessee Technology Park (ETTP) greenhouse gas (GHG) emissions distributed among the scopes defined in Executive Order 13514.

3.5.1.5 Source-Specific Criteria Pollutants

ETTP operations up until July 1, 2011, included only one functioning stationary source with permit restrictions for any form of criteria air pollutant emissions: the CNF VOC air stripper. This permit was surrendered following an updated potential to emit review that identified air pollutant emissions to be below any regulatory requirement for permitting. During December, 2011, the new CWTS began operations. This unit is equipped with an air stripper to remove VOCs from the effluent stream. All process data records and the calculated potential maximum VOC emission rates for the CNF and CWTS air strippers were well below levels that would require permitting. The calculated maximum VOC annual emissions for CNF and CWTS were only 6.5E-03 ton/year and 9.1E-03 ton/year, respectively, as compared to an emission limit of 5 ton/year. The annual potential emissions for these facilities would be well below the 5 ton/year limit assuming both operated at the maximum hourly emission rates continuously for the entire year. All other stationary sources were evaluated and determined to have emissions levels below the levels that require permitting.

New regulations became effective during 2013 that required UCOR to obtain permits for existing and new stationary RICEs used for emergency purposes at ETTP. To demonstrate compliance with requirements to assure allowable emission levels are not exceeded, prescribed maintenance routines must be followed and hours of nonemergency operations must be limited. The permit became effective on August 22, 2013. From the effective date through the end of 2013 none of the five permitted RICE units exceeded the 100 h/year limit for nonemergency operations. The highest operating time was incurred by the RICE emergency generator located at K-1007. The total hours recorded on this unit from the effective date of the permit was only 11.9. This time also includes operating during a plant wide power outage lasting 3.3 h. (The 3.3 h were categorized as an emergency event and not considered against the 100 h annual limit.) For the whole 2013 period, this same unit had the most operating hours; however, the total 2013 run time, 33.3 h, was well within regulatory limit of 100 h.

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

3.5.1.6 Hazardous Air Pollutants (Nonradionuclide)

Unplanned releases of hazardous air pollutants (HAPs) are regulated through the risk management planning regulations under 40 CFR 68. 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 Information System chemical inventories at ETTP with the risk management plan (RMP) threshold quantities listed in 40 CFR 68.130 was conducted. This is an ongoing action that documents the potential applicability for maintaining and distributing an RMP and ensures 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, Sect. 112(r), "Prevention of Accidental Releases." The results of this review indicated that all RMP-listed chemicals were less than 1% of their specific trigger threshold. Therefore, activities at ETTP are not subject to the rule. Procedures are in place 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:

- track long-term trends of airborne concentration levels of selected air contaminant species,

- measure the highest concentrations of the selected air contaminant species that occur in the vicinity of ETTP operations, and
- evaluate the impact of air contaminant emissions from ETTP operations on ambient air quality.

The sampling stations in the ETTP area are designated as base, supplemental, or ORR perimeter air monitoring (PAM) stations. Figure 3.14 shows the locations of all ambient air (monitoring) stations (AASs) in and around ETTP that were active during the 2013 reporting period. The base program consists of two locations using high-volume ambient air samplers. Supplemental locations are typically temporary, project-specific stations that use samplers specific to a type of potential emission. Samplers typically include high-volume systems, depending on the source emission evaluation of the project. All base, supplemental, and PAM samplers operate continuously with exposed filters collected weekly.

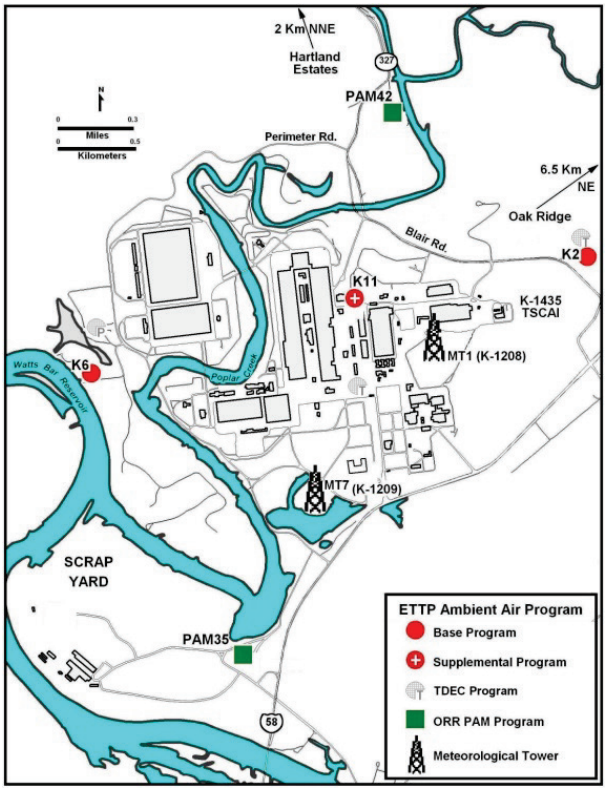


Fig. 3.14. East Tennessee Technology Park ambient air monitoring station locations.

The radiological monitoring results for samples collected at the two ETTP area PAM stations were provided by UT-Battelle staff and are included in the ETTP network for comparative purposes. Figure 3.14 shows the location of all AASs that were active during the 2013 reporting period. Figure 3.15 shows an example of a typical ETTP air monitoring station.

The analytical parameters were chosen with regard to existing and proposed regulations and with respect to activities at ETTP. Supplemental station K11 is located to demonstrate compliance with radiological emissions from demolition and remediation activities dose impact to on-site members of the public. Changes in emissions from ETTP will warrant periodic reevaluation of the parameters being sampled. Ongoing ETTP reindustrialization efforts also introduce new locations for members of the public that may require adding or relocating monitoring site locations. To ensure understanding of the potential impact on the public and to establish any required emissions monitoring and emission controls, a survey of all on-site tenants is reviewed every 6 months.

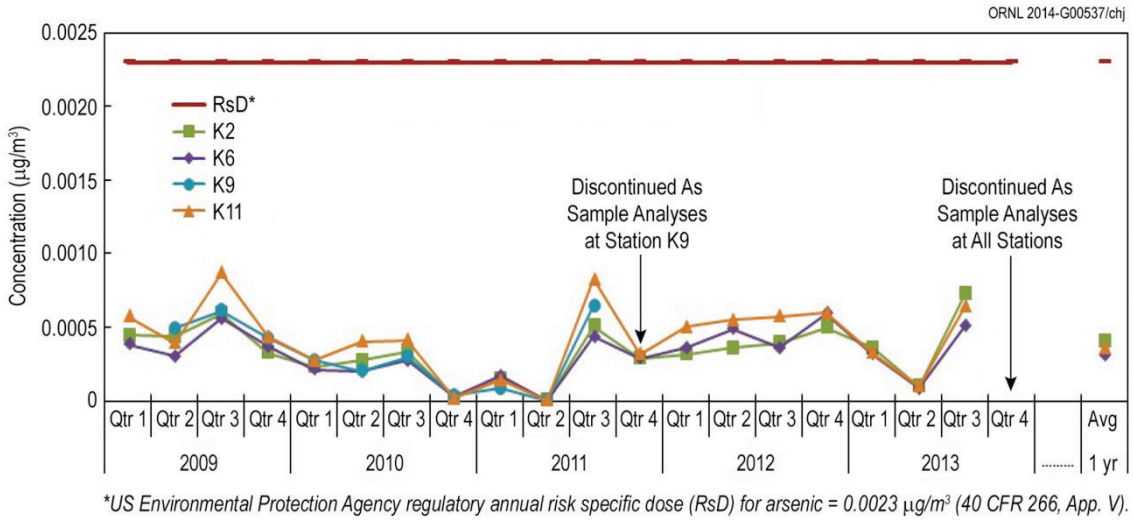
Fig. 3.15. East Tennessee Technology Park ambient air monitoring station.

All base and supplemental stations collect continuous samples for radiological and selected metals analyses. Inorganic analytical techniques were used to test samples for the following nonradiological pollutants: As, Be, Cd, Cr, Pb, and total uranium. Radiological analyses of samples from the ETTP stations test for the isotopes ^{237}Np, ^{238}Pu, ^{239}Pu, ^{99}Tc, ^{234}U, ^{235}U, and ^{238}U; ORR station sampling results for ^{234}U, ^{235}U, and ^{238}U provided by UT-B are included with ETTP results.

Figures 3.16 through 3.20 illustrate the ambient air concentrations of As, Be, Cd, Cr, and Pb for the past 5 years based on quarterly composites of weekly continuous samples. All samples were analyzed by the inductively coupled plasma–mass spectrometer (ICP-MS) analytical technique. The results are compared with applicable air quality standards for each pollutant. The annualized levels of As, Be, Cd, and Pb were well below the indicated annual standards. With the exception of chromium and lead results for station K11, 2013 annual averages were all generally similar to the data trends during 2012 at all sampling stations. Station K11 is in close proximity to major demolition and remediation activities on the site and showed slightly higher annual chromium and lead ambient air concentrations compared to the other sampling locations. Also, the K11 sampling results for chromium and lead historically have been more variable than those for the other stations. Stations K2 and K6 are representative of ambient air conditions at the ETTP boundary, with very similar measurement results. Variations in chromium data during 2013 follow historical trends that have been coincidental to the ETTP demolition activities that have included rubblizing large amounts of concrete. All chromium results are compared to the more conservative hexavalent chromium annual risk-specific dose standard. The large variation in lead concentration levels is coincidental to a large increase in diesel-powered motor vehicles and equipment used in the area of station K11.

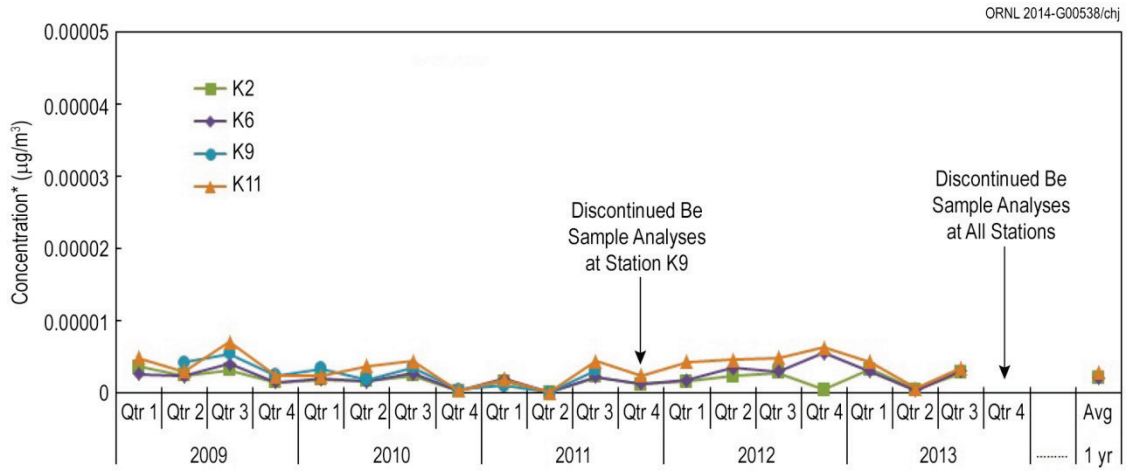
Following the permanent shutdown of the TSCA Incinerator, no on-site operation remained that could emit As, Be, and Cd at any measureable level. After several years of analyzing for these pollutants, the trends of pollutant concentrations were observed to be coincidental to background levels found in the ambient air. For these reasons, analyses for As, Be, and Cd were discontinued at the end of the third quarter of 2014. Total uranium analyses by ICP-MS were also discontinued as redundant to the isotopic analyses that are still being performed on all samples. Chromium and lead analyses are continuing due to on-site activities that have the potential to emit measureable levels of these pollutants into the ambient air.

Total uranium was measured as a quarterly composite of continuous weekly samples from stations K2, K6, and K11 during 2013. The total uranium mass for each sample was determined by ICP-MS. Station K9 was discontinued during 2011, but K9 results are included in the historical trend information. Uranium concentration measurements for all sites are presented in Table 3.4. Figure 3.21 illustrates the air concentrations of uranium for the past 5 years based on quarterly composites of weekly continuous samples. The highest 12-month average result (2.19E-05 μg/m^3) was measured at station K6. The highest result for the previous year was at K11 (5.44E-05 μg/m^3).



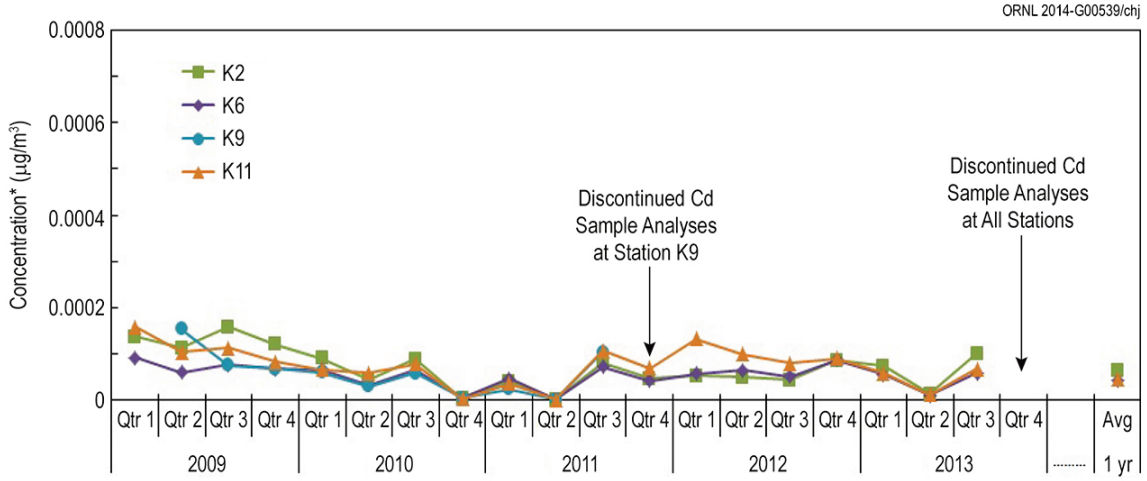
*US Environmental Protection Agency regulatory annual risk specific dose (RsD) for arsenic = 0.0023 μg/m^3 (40 CFR 266, App. V).

Fig. 3.16. Ambient air monitoring results for arsenic from January 2009 through December 2013.



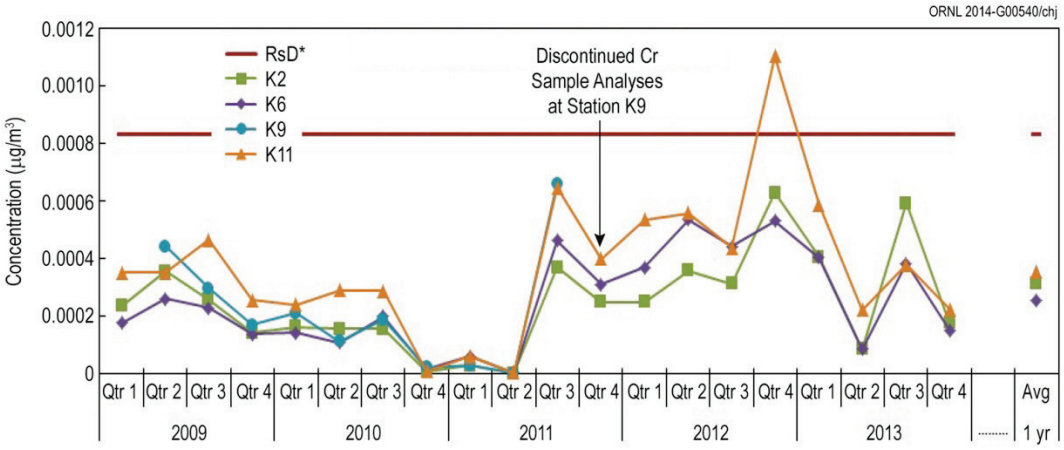
*US Environmental Protection Agency regulatory annual risk specific dose (RsD) for beryllium = 0.0042 μg/m³ (40 CFR 266, App. V).

Fig. 3.17. Ambient air monitoring results for beryllium from January 2009 through December 2013.



*US Environmental Protection Agency regulatory annual risk specific dose (RsD) for cadmium = 0.0056 μg/m³ (40 CFR 266, App. V).

Fig. 3.18. Ambient air monitoring results for cadmium from January 2009 through December 2013.



*US Environmental Protection Agency regulatory annual risk specific dose (RsD) for hexavalenet chromium = 0.00083 μg/m³ (40 CFR 266, App. V).

Fig. 3.19. Ambient air monitoring results for chromium from January 2009 through December 2013.

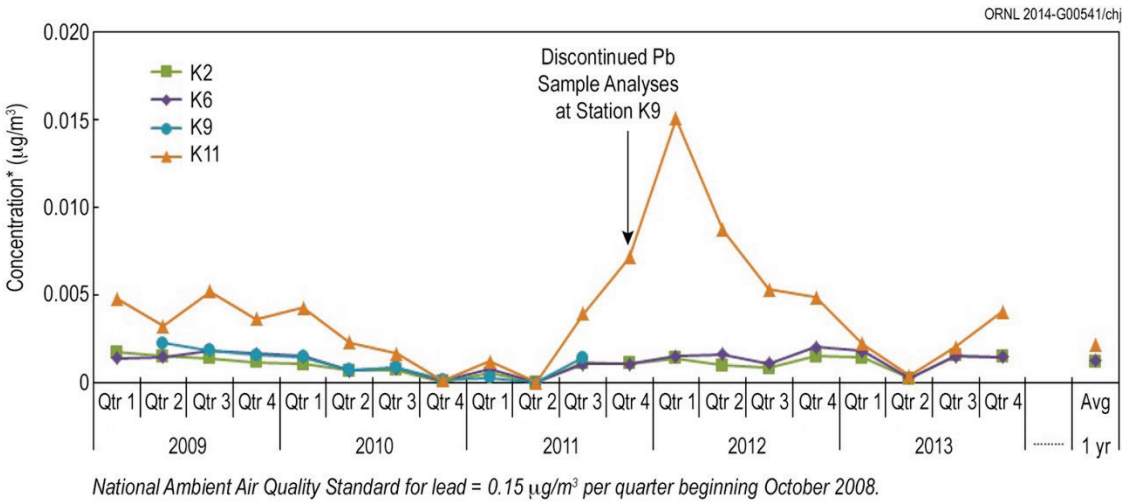


Fig. 3.20. Ambient air monitoring results for lead from January 2009 through December 2013.

Table 3.4. Total uranium in ambient air by inductively coupled plasma-mass spectrometer analysis at East Tennessee Technology Park, 2013

Station	Number of samples	Concentration[a]				Percentage of derived concentration guide[b]	
		(µg/m³)		(µCi/mL)		(%)	
		Average	Maximum[c]	Average	Maximum	Average	Maximum
K2	3	7.45E-06	1.28E-05	4.96E-18	8.56E-18	<0.01	0.01
K6	3	2.19E-05	5.68E-05	1.46E-17	3.79E-17	0.01	0.04
K11	3	1.68E-05	3.18E-05	1.12E-17	2.12E-17	0.01	0.02
ETTP total	9	1.54E-05		1.02E-17		0.02	

[a]Mass-to-curie concentration conversions conservatively assume a natural uranium assay of 0.717% ^{235}U.
[b]The DOE O 5400.5 derived concentration guide (DOE 1990) for naturally occurring uranium is an annual concentration of 1.03E-13 µCi/mL used as a more conservative conversion than the DOE O 458.1 derived concentration standard (DOE 2011a) values for uranium isotopes.
[c]Maximum individual sample analysis result with dose calculations conservatively assuming the value to be an annual concentration.

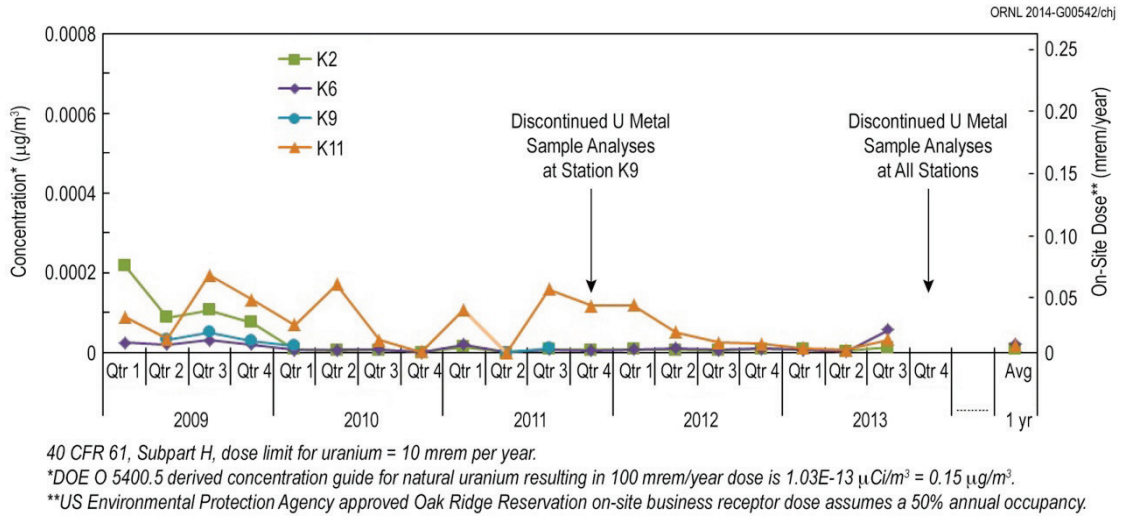


Fig. 3.21. Ambient air monitoring results for uranium from January 2009 through December 2013.

Quarterly radiochemical analyses are performed on composite samples collected at all stations. The selected isotopes of interest were ^{237}Np, ^{238}Pu, ^{239}Pu, ^{99}Tc, and isotopic uranium (^{234}U, ^{235}U, and ^{238}U). The sampling results for ambient air concentration, dose impact, and percent of the total dose for each radionuclide at each of the three stations are presented in Table 3.5 for the 2013 reporting period. The highest potential dose impact for an individual working on the site in the vicinity of Station K11 was about 0.33 mrem as compared to the annual limit of 10 mrem. The on-site location of Station K11 is in close proximity to major demolition and remediation activities that impacted radiologically contaminated materials. The added contribution by ^{99}Tc was also concurrent with the demolition of the section of the K-25 building most contaminated with this isotope. Historically, the primary isotopic dose contributor has been ^{234}U. However, during the fourth quarter of 2013 the percent dose impact from ^{99}Tc was significant at all three stations, as indicated in Table 3.5.

Table 3.5. Radionuclides in ambient air at East Tennessee Technology Park, January 2013 through December 2013

Station	*Concentration (µCi/mL)*							
	^{237}Np	^{238}Pu	^{239}Pu	^{99}Tc	^{234}U	^{235}U	^{238}U	Total
K2	ND	ND	ND	2.70E-15	2.85E-17	1.15E-18	5.37E-18	2.74E-15
K6	ND	ND	1.37E-18	4.43E-15	3.11E-17	ND	2.42E-18	4.46E-15
K11	ND	ND	ND	2.06E-14	1.62E-16	6.28E-18	2.89E-17	2.08E-14
Station	***40 CFR 61, Effective Dose[a] (mrem/year)***							
	^{237}Np	^{238}Pu	^{239}Pu	^{99}Tc	^{234}U	^{235}U	^{238}U	Total
K2	ND	ND	ND	0.08	<0.01	<0.01	<0.01	0.09
K6	ND	ND	<0.01	<0.01	<0.01	ND	<0.01	0.14
K11	ND	ND	ND	0.31	0.02	<0.01	<0.01	0.33
Station	***Percent of Total Dose***							
	^{237}Np	^{238}Pu	^{239}Pu	^{99}Tc	^{234}U	^{235}U	^{238}U	Total
K2	ND	ND	ND	95.4	3.9	0.1	0.6	100
K6	ND	ND	1.5	95.7	2.6	ND	0.2	100
K11	ND	ND	ND	91.6	7.1	0.2	1.1	100

[a]40 CFR 61, subpart H, effective dose limit = 10 mrem/year.
ND = Not detected.

Figure 3.22 shows the dose impact at each AAS that operated over the 5-year period from 2009 through 2013. Stations K2 and K6 are positioned near the ETTP fence line and conservatively represent a dose impact on an off-site residential member of the public. Station K11 is representative of the most impacted on-site member of the public. Each data point represents the accumulated dose over the previous four quarterly sampling results. All 2013 fourth quarter dose results show an increase. Dose results at K2 and K6 increased to a lesser degree due to being at a more distant sampling location from all possible point and fugitive sources of airborne releases of radionuclides. All data show potential exposures are well below the 10 mrem annual dose limit.

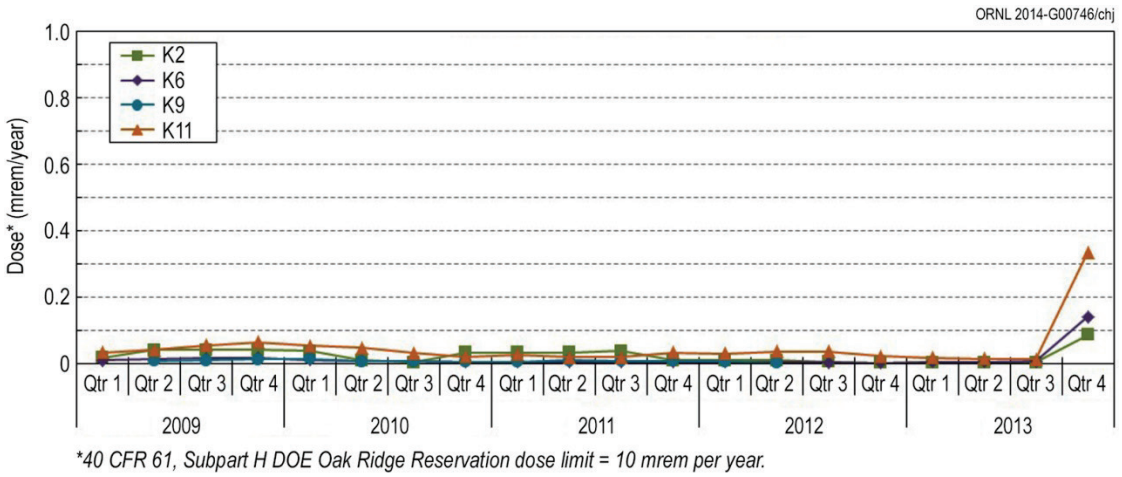


Fig. 3.22. East Tennessee Technology Park quarterly and rolling 12-month effective dose results for January 2009 through December 2013.

3.6 Water Quality Program

3.6.1 NPDES Permit Description—New NPDES Permit

Currently there are 108 NPDES-permitted storm water outfalls at ETTP. As part of the current NPDES permit, these storm water outfalls are listed in two groups based on the types of flows being discharged through the outfalls. A total of 32 storm water outfalls are sampled as being representative of these groups.

3.6.2 East Tennessee Technology Park Storm Water Pollution Prevention Program

The current ETTP NPDES permit includes a requirement to review and update, if necessary, the Storm Water Pollution Prevention (SWPP) Plan (SWPPP) at least annually. This requirement is met by publishing the ETTP SWPP Program Annual Update Report, which includes monitoring results, site inspection summaries, and other information for each fiscal year. Additionally, the SWPP Program baseline document serves as a reference document for implementing and conducting the required elements of the ETTP SWPPP. This document will continue to be used as part of the ETTP SWPP Program specified in the current ETTP NPDES permit. The baseline document is reviewed annually and updated as necessary.

3.6.3 Sampling for NPDES Permit Renewal Application

The ETTP NPDES permit renewal application was submitted to TDEC on June 20, 2013. In 2013, a portion of the SWPP Program was directed toward the collection of analytical data and field readings that were required to complete the EPA 2E and 2F forms that were submitted as part of the NPDES permit renewal application. Data collected in CY 2013 for the EPA 2F forms included field readings at storm water outfalls SD 382 and SD 660.

The sample collection requirements for each parameter are specified by the respective analytical method. Parameters that are designated to be collected as composite samples were collected by use of automatic samplers. If a composite sample could not be collected with automatic samplers due to location, volume, or time constraints, the sample was collected as a series of manual grab samples and then composited for analysis. Parameters designated to be collected by manual grab only were not collected by automatic compositor under any circumstances; however, other parameters that are designated simply as grab samples may have been collected either manually or with automatic samplers configured for grab sampling.

All storm water samples were collected from discharges resulting from a storm event greater than 0.1 in. in 24 h or less and which occurred at least 72 h after a discharge from any previous rainfall greater than 0.1 in. in 24 h.

None of the results from the sampling effort conducted in CY 2013 for completion of the ETTP NPDES permit application exceeded reference standards.

Several modifications to the current NPDES permit were suggested as part of the new NPDES permit application, including the following.

- Removal of 17 storm water outfalls that meet the removal criteria published in the NPDES permit rationale, section III.B.1.4, reducing the total number of outfalls covered by the NPDES permit to 91.
- Elimination of outfall SD 340 as a representative location because the inlet pipes to this outfall were grouted closed as part of the remediation of the K-25 building area and this outfall no longer produces a flow.
- Removal of the mercury sampling requirement for outfall SD 170 because mercury results for SD 170 and associated catch basins have been well below the ambient water quality criterion (AWQC) of 51 ng/L since July 2009.

3.6.4 Radiological Monitoring of Storm Water Discharges

As part of the SWPP Program, radiological monitoring of storm water discharges is routinely conducted to determine compliance with applicable dose standards. The "as low as reasonably achievable" (ALARA) process is applied to minimize potential exposures to the public. Sampling for gross alpha and gross beta radioactivity, as well as specific radionuclides, is conducted as part of the SWPP Program sampling efforts. In CY 2013 new radiological sampling results were obtained for eight storm water outfalls as part of the periodic radiological sampling effort. Table 3.6 shows the storm water outfalls sampled during CY 2013, and Table 3.7 lists the parameters that exceeded their respective reference standards. In addition, in CY 2013 radiological sampling was conducted as part of the SWPP Program during the demolition of the K-25 building (refer to Section 3.6.5.2).

Table 3.6. Storm water sampling for radiological discharges, 2013

Storm water outfall	Gross alpha/beta (composite sample)	Transuranics[a] (composite sample)	Isotopic U (composite sample)	^{99}Tc (composite sample)
SD 100	X	X	X	X
SD 124	X	X	X	X
SD 292	X	X	X	X
SD 724[b]	X	X	X	X
SD 730[b]	X	X	X	X
SD 740[b]	X	X	X	X
SD 750[b]	X	X	X	X
SD 760[b]	X	X	X	X

[a]Includes ^{237}Np, ^{238}Pu, and ^{239,240}Pu.

[b]Sampling at this storm drain was conducted after closure was completed at the K-770 Scrap Yard. The results were used for both decontamination and decommissioning and remedial action support and for the calculation of radionuclide discharges from East Tennessee Technology Park.

Table 3.7. Storm water pollution prevention routine dose modeling monitoring program results that exceeded the screening criteria in 2013
(Reference standard: 15 pCi/L[a])

Sampling location	Gross alpha (pCi/L)
SD 292	27.7
SD 724	41.9
SD 730	28

[a]This reference standard is shown in Table 3 of the *East Tennessee Technology Park Storm Water Pollution Prevention Program Sampling and Analysis Plan* (UCOR 2013b).

SD = storm water outfall/storm drain.

These analytical results are used with radiological results for other storm water outfalls from other years, along with calculated flows based on rain events in 2013, to estimate the total discharge of each radionuclide from ETTP via the storm water discharge system. Table 3.8 shows the total radionuclides released to surface waters from the ETTP storm water system.

Table 3.8. Radionuclides released to surface waters from the East Tennessee Technology Park storm water system, 2013

Radionuclide	Amount (Ci)
^{99}Tc	2.6E+00
^{234}U	1.0E-02
^{235}U	4.2E-04
^{238}U	4.4E-03

1 Ci = 3.7E+10 Bq.

3.6.5 Monitoring of Storm Water Runoff from East Tennessee Technology Park Decontamination and Decommissioning/Remedial Action Activities

Demolition of the K-25 building was initiated in 2008. Demolition of the west wing was completed in 2010, and the north tower was demolished in 2013. Initial demolition activities for the east wing of the K-25 building began in 2011 and were completed in the summer of 2013 (with the exception of the south portion of the east wing). The D&D of the final section of the K-25 building, the south portion of the east wing, began in the summer of 2013 and was completed in December 2013. Removal of building debris from the demolition area and disposition of the material will be completed in early 2014.

To closely monitor the storm water runoff from the K-25 building demolition activities, sampling was performed at regular intervals during the demolition process for each portion of the building. Initial sampling was performed to provide baseline data for conditions present before demolition began. Additional periodic monitoring was performed following the start-up of demolition. When required, modifications to storm water controls were made based on the results of this sampling effort.

3.6.5.1 Decontamination and Decommissioning of the North Tower of Building K-25—Follow-Up Sampling

Sampling was performed at storm water outfalls SD 230 and SD 240 to provide information on the quality of the storm water runoff from Building K-25 during demolition. Table 3.9 shows the results that exceeded the applicable reference standards for this sampling activity.

Table 3.9. Analytical results for storm water outfalls SD 230 and SD 240 that exceeded the radiological field evaluation screening level or chemical reference standard, 2013

Sampling location	Gross alpha (pCi/L)	^{233,234}U (pCi/L)	^{235,236}U (pCi/L)	Lead (µg/L)	Mercury (ng/L)	PCB-1254 (µg/L)	PCB-1260 (µg/L)
Reference standard[a]	**15**	**20**	**20**	**2.5**	**51**	**0.00064**	**0.00064**
SD 230	335	361	21.8				
SD 240				8.52	81.6	0.0754	0.0541

[a]These reference standards are shown in Table 3 of the *East Tennessee Technology Park Storm Water Pollution Prevention Program Sampling and Analysis Plan* (UCOR 2013b). For this analysis, specific radionuclides were compared to 4% of the derived concentration guide for that radionuclide in water, as listed in DOE O 5400.5, Chapter 3 (DOE 1990), as a field evaluation screening level.

SD = storm water outfall/storm drain.

After investigation, it was determined that demolition activities at the K-25 building may not have been the source of the mercury or PCBs identified in discharges from storm water outfall SD 240. The likely sources of the mercury and PCBs in discharges from SD 240 are historic operations conducted in the SD 240 drainage area.

Several possible sources for the elevated radiological results observed at storm water outfall SD 230 were also investigated. The most likely source of the elevated radiological results was determined to be a white substance within a small concrete settling basin/oil-water separator upstream of SD 230; the sediment and white material were removed and disposed.

In May 2013, sampling was conducted at SD 230 to determine whether the removal of the white material resulted in a reduction in the concentrations of radiological contaminants. The results of this sampling effort are shown in Table 3.10. As shown, the removal of the white material from the SD 230 drainage network has reduced the elevated radiological concentrations.

Table 3.10. Analytical results from follow-up sampling at storm water outfall SD 230, 2013

Gross alpha (pCi/L)	^{233,234}U (pCi/L)	^{235,236}U (pCi/L)
28.1	21.3	0.894

3.6.5.2 Decontamination and Decommissioning of the Technetium-Contaminated Portion of Building K-25

Demolition on the southern section of the east wing of Building K-25 was begun in July 2013 and was completed in December 2013. The removal of the debris from the demolition activities will be completed in 2014. The southern section of the east wing of Building K-25 was contaminated with ^{99}Tc, a slow-decaying radioactive isotope. The greatest concern in regard to storm water was the rain and dust control water that fell directly onto the debris pile during and after the demolition. Storm water controls were designed and implemented to prevent the transport of radiological and chemical contaminants, sediments, and other particulates away from the demolition area.

On May 28, 2013, surface water sampling was performed at the K-1007-P1 pond weir as part of the ETTP Environmental Monitoring Program (EMP). Analytical data from these samples indicated a gross beta radiation level of 57.1 pCi/L, which exceeds the field evaluation screening level of 50 pCi/L (Table 3.11). The field evaluation screening level is a value that has been established internally for the beta parameter as a measurement that is roughly comparable to 4% of the DOE O 5400.5 annual derived concentration guide (DCG). The ^{99}Tc level in this sample was 113 pCi/L, which is slightly elevated when compared to historic sampling results for ^{99}Tc at this location but well below the DCG value of

100,000 pCi/L. In an effort to identify the source of the elevated gross beta radiation, sampling was performed at storm water outfall SD 490 on June 25, 2013. The gross beta radiation level in the sample from SD 490 was 645 pCi/L and the ^{99}Tc level was 1,460 pCi/L.

The likely source for the elevated gross beta radiation and ^{99}Tc values in comparison to historical trends was determined to be the demolition preparation activities being conducted at the southern section of the east wing of the K-25 building. At the time of the June 25, 2013, sampling, intrusive work was under way that involved the removal of process gas system components contaminated with ^{99}Tc in the purge cascade units (K-311-1, K-310-3, and K-310-2). Due to the poor structural condition of the roof in this area, precipitation was infiltrating the building and the runoff was transporting ^{99}Tc to storm water catch basins in the SD 490 network. In response, a berm was installed around the demolition area to minimize storm water runoff. The removal of the process gas system components was performed in accordance with ALARA principles and radiological work permit controls to minimize the spread of contamination.

Additional sampling that was performed during the remainder of the demolition activities conducted at the south end of the east wing of the K-25 building confirmed that all discharge values were below annual DCG reference standards. The results from this monitoring that exceeded the field evaluation screening levels are shown in Table 3.11. As a result of this monitoring, elevated levels of ^{99}Tc were identified on several occasions at storm water outfalls SD 210 and SD 490, which are the primary ETTP storm water outfalls that transport drainage from the east wing of the K-25 building. In addition, investigative sampling performed in catch basins in the SD 490 drainage system showed elevated levels of ^{99}Tc. In all cases the individual ^{99}Tc results were below the annual DCG standards for radionuclide discharges.

On December 5, 2013, water was observed flowing from three electrical duct system manholes at the southwest corner of the Portal 4 parking area. The Portal 4 parking area is located south and downgradient from the K-25 building demolition. The water surfacing from the manholes in the Portal 4 area then flowed across the paved parking area and into a nearby storm water catch basin. The water was then discharged to the K-1007-P1 pond via storm water outfall SD 490.This flow from the duct system manholes occurred after a significant amount of rainfall.

Discharges from the electrical duct system manholes in the Portal 4 parking area were routinely noted after heavy rainfall events. Preliminary radiological surveys indicated fixed contamination (attached to asphalt pavement and concrete surrounding the manholes) in the parking lot at the water discharge area. Supplemental water sampling within the electrical duct system indicated the presence of elevated levels of ^{99}Tc. Access to the parking area where water was discharging was restricted after the discovery of the elevated ^{99}Tc levels.

The electrical duct system manholes in the Portal 4 parking area are part of an underground electrical duct network that once carried electrical power lines from the former powerhouse area to portions of ETTP. A large portion of the electrical duct network downgradient from Portal 4 was filled with grout in CY 2010; however, the placement of grout into this system was stopped immediately downgradient of the Portal 4 parking area manholes where the water discharge was observed. This portion of the duct system remained susceptible to inflow from groundwater and storm water.

It is estimated that ^{99}Tc contaminated storm water from the demolition of the southeastern portion of the K-25 building probably entered the electrical duct system from seepage through cracks or breaks in the concrete slab structure of the building and infiltrated the electrical network system that runs adjacent to the demolition field. The duct system eventually filled with water and then overflowed during heavy rainfall events.

Although the storm drain discharges were below the annual DCG reference standards, in January 2014, thirty eight electrical duct bank system manholes were filled with grout to maintain discharge levels at storm water outfall SD 490 to levels that were ALARA. This corrective action eliminated the discharges from the electrical duct system into the storm drain system.

Table 3.11. Analytical results that exceed the field evaluation screening level values internally established at 4% of the DCG[a] for the drainage areas associated with the Building K-25 ^{99}Tc Area, 2013

Sampling location	Parameter		
	Gross alpha (pCi/L)	Gross beta (pCi/L)	^{99}Tc (pCi/L)
Reference standard	**15[b]**	**50[b]**	**4,000[c]**
OUTFALL SD 210			
9/21/2013			
11/18/2013		57.9	
11/26/2013			
12/09/2013			
12/23/2013		116	
12/30/2013		86.3	
OUTFALL SD 490			
9/21/2013			
11/18/2013		6,510	10,600
11/26/2013		835	
12/09/2013		36,200	56,900
12/23/2013		39,700	59,200
12/30/2013		27,500	57,400
K-1007-B			
12/09/2013		802	
12/23/2013	23.9	765	
12/30/2013		1,510	

[a]The analytical results for specific radionuclides were compared to 4% of the derived concentration guide (DCG), as listed in DOE O 5400.5, Chapter 3, as a screening level for that radionuclide in water.
[b]Reference standard source: Title 40 *Code of Federal Regulations* Part 141.
[c]Reference standard source: DCG.

3.6.5.3 Remedial Actions at the K-1070-B Burial Ground—Follow-Up Sampling

Remediation of the K-1070-B burial ground was completed in FY 2012. In May 2013, follow-up sampling was performed at manhole 8002 (downgradient of the K-1070-B remediation area), manhole 8017 (upgradient of the K-1070-B burial ground remediation area), and storm water outfall SD 190 to determine the impacts of the remediation activities. Manholes 8002 and 8017 both carry flow that ultimately discharges to Mitchell Branch via SD 190. Samples from these three locations were collected as part of the same sampling event. Table 3.12 shows the analytical parameters that were sampled at each of these locations, and Table 3.13 shows the analytical results from this sampling effort that exceeded reference standards.

The *Record of Decision for Soil, Buried Waste, and Subsurface Structure Actions in Zone 2*, which was submitted in 2005, includes remedial actions (RAs) for unrestricted industrial use to a depth of 10 ft and for sources of groundwater contamination. Zone 2 was divided into 44 exposure units (EUs) for planning and evaluation purposes. The K-1070-B burial ground is located in EU30. The *PCCR for EU Z2-30 in Zone 2 (K-1070-B Burial Ground)* (DOE/OR/01-2521&D1) was submitted to the regulators on September 23, 2012. Additional evaluation of surface water and groundwater will be conducted in accordance with this report. In addition, land use controls will be implemented in this location to prevent exposure to residual contamination and to prevent residential use in the area.

Table 3.12. Surface water sampling to support remedial action activities at the K-1070-B burial ground, 2013

RA or D&D activity	Sampling location	Gross alpha/beta	Isotopic U, ^{99}Tc, transuranics[a]	PCBs	Metals[a]/ Mercury	VOCs
K-1070-B Burial Ground	MH 8002 (drains to SD 190)	X	X	X	X	X
	MH 8017 (drains to SD 190)	X	X	X	X	X
	SD 190	X	X	X	X	X

[a]Metals analysis includes Al, Ag, As, Ba, Be, B, Ca, Cd, Co, Cr, Cu, Fe, K, Mg, Mn, Na, Ni, Pb, Sb, Se, Tl, V, and Zn. Analysis for transuranics includes ^{237}Np, ^{238}Pu, and ^{239,240}Pu.

Acronyms
D&D = decontamination and decommissioning
PCB = polychlorinated biphenyl
RA = remedial action
SD = storm drain
VOC = volatile organic compound

Table 3.13. Analytical results over reference standards for K-1070-B burial ground monitoring, 2013

Sampling location	Copper (µg/L)	Selenium (µg/L)	Mercury (ng/L)	PCB-1254 (µg/L)	PCB-1260 (µg/L)
Reference Standard[a]	**9.0**	**5**	**51**	**0.00064**	**0.00064**
Manhole 8002	15.8			0.0553	
Manhole 8017		12.9	126	0.0933	0.0587
SD 190			75.4	0.0681	

[a]These reference standards are shown in Table 3 of the *East Tennessee Technology Park Storm Water Pollution Prevention Program Sampling and Analysis Plan* (UCOR 2013b).

Acronyms
PCB = polychlorinated biphenyl
SD = storm drain

3.6.5.4 Remedial Actions at the K-770 Scrap Yard Area—Follow-Up Sampling

Closure activities at the K-770 Scrap Yard have been completed; however, further project activities are currently pending. All of the large pieces of scrap metal in the yard have been removed and disposed. A radiological survey of the scrap yard was conducted to identify areas where residual radiological contamination was present. Soil was removed from these areas of radiological contamination. In addition, smaller pieces of scrap metal that were not identified during previous activities have been removed. Soil from several areas in the scrap yard where asbestos had been located have been removed and disposed; however, areas of the scrap yard are still contaminated with asbestos.

Sampling of the storm water runoff from the K-770 Scrap Yard area was conducted in CY 2013 to determine the effect of the remediation of the scrap yard on storm water quality. Radiological monitoring of the storm water outfalls in this area was completed at SDs 724, 730, 740, 750, and 760. The sampling results that exceeded radiological field evaluation screening levels or chemical reference standards are

presented in Tables 3.7 and 3.9. These results were used for both D&D and RA support and for the calculation of radionuclide discharges from ETTP.

A fairly large area of the K-770 Scrap Yard drains to a holding pond located on the north side of the scrap yard. Water that collects in this holding pond discharges to the Clinch River through storm water outfall SD 724. Due to inadequate erosion and sediment controls during the time the scrap yard was in use, a large amount of sediment has collected in this holding pond. Based on the operational history of the K-770 Scrap Yard, the sediment may contain radiological, heavy metals, and other types of contamination. Sediment sampling was performed in the holding pond in CY 2013 to identify the types and quantities of contaminants that might be present. Table 3.14 shows the parameters that were sampled as part of this investigation. Notable results from the sampling of the 724 holding pond sediments are presented in Table 3.15.

Table 3.14. Sediment sampling to support remedial action activities at the K-770 Scrap Yard, 2013

RA or D&D activity	Sampling location	Gross alpha/beta	Isotopic U, ^{99}Tc, transuranics[a]	PCBs	Metals[a]/ Mercury
K-770 scrap yard	Holding pond upstream of SD 724	X	X	X	X

[a]Metals analysis included Al, Ag, As, Ba, Be, B, Ca, Cd, Co, Cr, Cu, Fe, K, Mg, Mn, Na, Ni, Pb, Sb, Se, Tl, V, and Zn. Analysis for transuranics included ^{237}Np, ^{238}Pu, and ^{239,240}Pu.

Acronyms
D&D = decontamination and decommissioning
PCB = polychlorinated biphenyl
RA = remedial action
SD = storm drain

Table 3.15. Analytical results for contaminants of concern in 724 holding pond sediments, 2013

Sampling location	Pb (µg/g)	Cd (µg/g)	Cu (µg/g)	Zn (µg/g)	As (µg/g)	Hg (ng/g)	PCB-1242 (µg/g)	PCB-1254 (µg/g)	PCB-1260 (µg/g)	Gross alpha (pCi/g)
724 holding pond	26.1	0.283	16.1	135	26.8	124.7	0.11	0.0429	0.0146	33.6

PCB = polychlorinated biphenyl

Storm water outfall SD 724 and the 724 holding pond discharge to the K-770 embayment on the Clinch River. The *Action Memorandum for the Ponds at the East Tennessee Technology Park, Oak Ridge, Tennessee: K-1007-P Holding Ponds, K-901-A Holding Pond, K-720 Slough, and K-770 Embayment* (DOE 2007) states that no further action will be taken at the K-770 embayment. Land use controls will be implemented to restrict the use of and access to this area. Once it has been established that the area is safe for unrestricted industrial use, controls such as property record restrictions, property record notices, zoning notices, excavation permits, and less significant surveillance patrols will be used.

3.6.5.5 Monitoring at the K-731 Switch House–K-732 Switchyard Area

The K-731 switch house building and the K-732 switchyard were constructed in 1945 to serve the K-27 and K-29 cascades. After these operations shut down, these facilities served as the primary power center for ETTP until 2011, when the responsibility for supplying electrical power to the site was assumed by the City of Oak Ridge and the switchyard was shut down.

Several sumps are located in the K-731–K-732 area. These sumps accumulate storm water during wet weather conditions. Figure 3.23 shows the locations of these sumps. Two sumps are located in the basement of K-731. Sump S-053 discharges to sump S-054. Sump S-054 discharges to storm water outfall SD 430. An additional five sumps (sumps S-055, S-056, S-057, S-058, and S-059) are located in the K-732 switchyard. Sump S-055 collects water from valve vault 2 in the K-731 switchyard. Sump S-056 collects water from valve vault 3 in the K-731 switchyard. Sump S-057 collects water from synchronous condenser 101. Sump S-058 collects water from synchronous condenser 102. Sump S-059 collects water from synchronous condenser 103. All of these sumps discharge to storm water outfall SD 440. A portion of the south side of the switchyard discharges to SD 440 as well. This discharge to SD 440 includes surface runoff from paved sections of the switchyard area as well as infiltration through the gravel portion of the switchyard area. The K-731–K-732 sumps and the drainage system from this area to SDs 430 and 440 are shown in Fig. 3.23.

Water samples were collected from each of the sumps in the K-731–K-732 area during CY 2013. Results from these samples that exceeded reference standards are shown in Table 3.16.

All of the sumps located in the K-732 switchyard area were completely flooded. It is possible that the sumps in these locations may no longer be operational and that water continues to collect in the sumps without being discharged to the storm drain system.

In addition, storm water outfalls SD 430 and SD 440 were also sampled to determine the effects the discharges from the sumps in the K-731–K-732 area might be having on the quality of the discharge from the outfalls. No detectable PCBs or VOCs were found in samples collected from these locations.

Oil-water separators K-897-J and K-897-K provide containment for any oil or other types of spills that might occur in the K-731 switch house–K-732 switchyard area. Oil-water separator K-897-J is part of the storm water outfall SD 430 drainage system. Oil-water separator K-897-K is part of the SD 440 drainage system. Sediment samples were collected from oil-water separators K-897-J and K-897-K. This sampling was done to identify any contaminants present due to historical settling of sediments in the oil-water separator. Samples were collected for analysis for metals and PCBs as part of this effort. Sediment samples were collected in accordance with applicable EPA and sampling subcontractor procedures. Sediment samples were collected during a dry period when flow into the oil-water separator was low and any suspended materials present in the oil-water separator had settled out. Table 3.17 shows notable results from the K-732 area sampling effort.

The cleanup of the soils in the switchyard will be conducted as part of the CERCLA Zone 2 ROD. There are still several potential transformers and oil circuit breakers that contain regulated levels of PCB oils. In addition, five aboveground storage tanks currently store oils that were once used in the electrical equipment during the historic operation of the K-732 switchyard. Three of these tanks hold oils with less than 50 ppm PCBs.

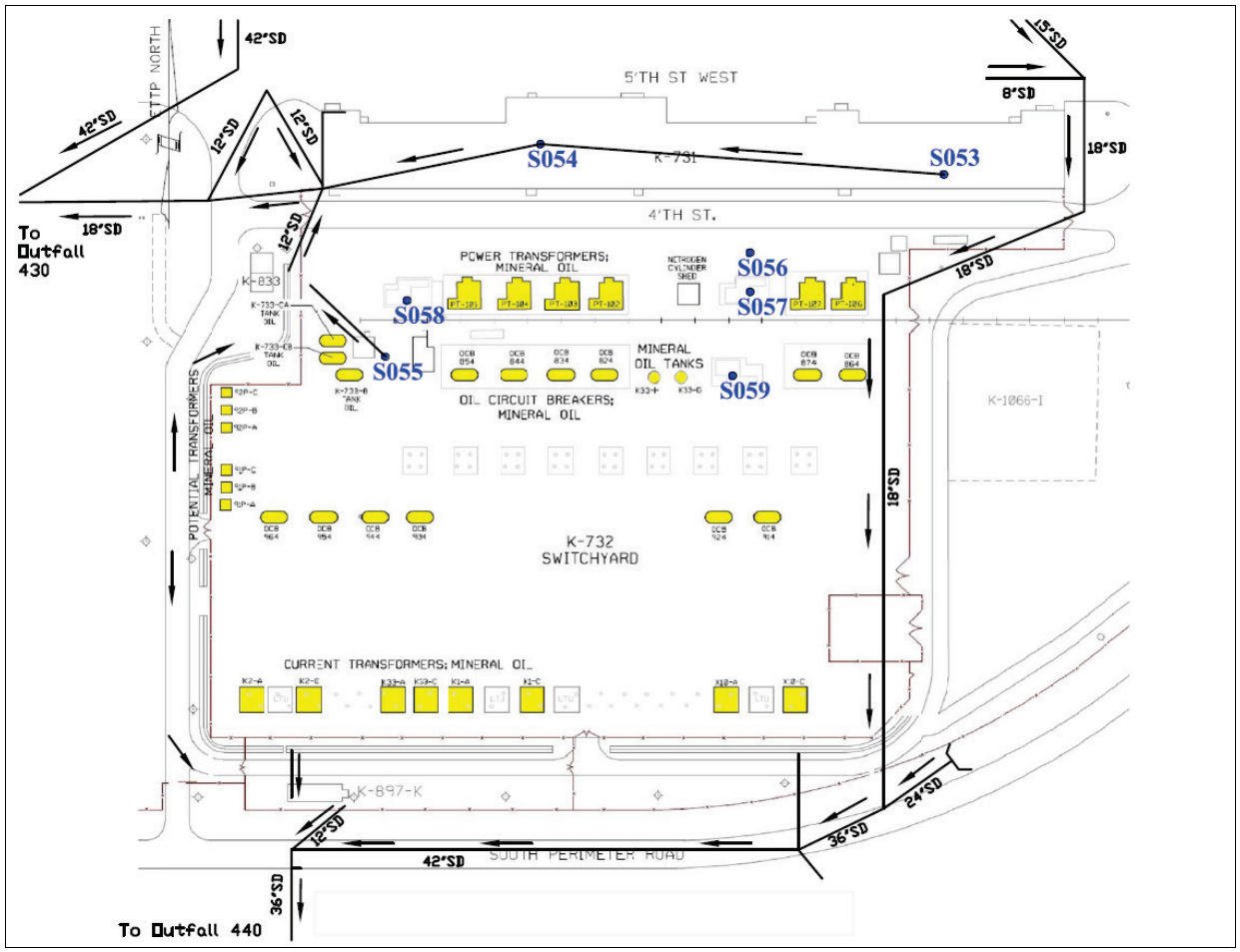


Fig. 3.23. K-731–K-732 sumps.

Table 3.16. Analytical results over reference standards for water from the K-731–K-732 sumps, 2013 (Reference Standard: 0.00064 µg/L[a])

Sampling location	PCB-1254 (µg/L)
S-057	0.489
S-058	1.57
S-059	14.6

[a]This reference standard is shown in Table 3 of the *East Tennessee Technology Park Storm Water Pollution Prevention Program Sampling and Analysis Plan* (UCOR 2013b).

PCB = polychlorinated biphenyl

Table 3.17. Analytical results for contaminants of concern in sediments from the K-732 switchyard oil-water separators, 2013

Sampling location	Pb (µg/g)	Cd (µg/g)	Cr (µg/g)	Cu (µg/g)	Zn (µg/g)	As (µg/g)	Ni (µg/g)	PCB-1254 (µg/g)	PCB-1260 (µg/g)
K-897-J	591	8.21	119	222	1750	10.9	149	0.314	0.264
K-897-K	57.8	1.74	41.4	91.3	1030	12.8	47.6	BDL	BDL

Acronyms
BDL = below detection limit
PCB = polychlorinated biphenyl

3.6.5.6 Sampling of Legacy Chromium Groundwater Plume Discharge

During FY 2007, hexavalent chromium was detected in surface water in Mitchell Branch at levels exceeding the applicable AWQC of 0.011 mg/L for the protection of fish and aquatic life. At Mitchell Branch kilometers (MIKs) 0.71 and 0.79, locations in Mitchell Branch immediately downstream from the storm water outfall SD 170 discharge point, hexavalent chromium levels were measured at levels as high as 0.78 mg/L. The source of the discharge was determined to be groundwater infiltration into the SD 170 piping as well as seep flows through the SD headwall. Figure 3.24 shows the locations where hexavalent chromium releases to Mitchell Branch were identified.

Because hexavalent chromium has not been used in process operations at ETTP for more than 30 years, the release of hexavalent chromium into Mitchell Branch is a legacy problem and not an ongoing, current operations issue. Therefore, DOE in coordination with EPA and TDEC determined that the appropriate response to this release was a CERCLA time-critical removal action. A *Removal Action Report for the Reduction of Hexavalent Chromium Releases into Mitchell Branch at the East Tennessee Technology Park, Oak Ridge, Tennessee* (DOE 2008) for the time-critical removal action was issued in July 2008. Subsequently a non-time-critical *Action Memorandum for the Long-Term Reduction of Hexavalent Chromium Releases into Mitchell Branch at the East Tennessee Technology Park, Oak Ridge, Tennessee* (DOE 2010) was issued, which led to the construction of CWTS.

Construction of CWTS was initiated in the spring of 2011 with final process installation completed in 2012. CWTS treats chromium- and hexavalent-chromium-contaminated groundwater pumped from a groundwater plume near storm water outfall SD 170 in accordance with the non-time-critical action memorandum mentioned previously (DOE 2010). During 2013, the chromium collection system wells operated during 100% of the days with only short duration periods where collection system pumping volumes were limited due to treatment facility operational constraints. The total volume of wastewater that was treated in CY 2013 was about 5.6 million gal.

High levels of calcium and magnesium in the groundwater plume continued to create scale buildup on the facility pumps, valves, and piping during CY 2013. This has been an operational issue from the start of the pump-and-treat operations. During CY 2013, CWTS operational changes were implemented to help address the scale buildup issues by installing the One-Flow Anti-Scaling System upstream of the air stripper in February 2013. The additional equipment in the treatment train seemed to reduce the rate of the scale buildup, but there was still a need for numerous pump replacements and repairs for both the air stripper and day tank pumps during the past year.

Pump scale buildup was the cause of a treatment system bypass that occurred in late August 2013 for a period of about 60 h. The volume of plume water that bypassed treatment for a direct discharge into the Clinch River was about 27,640 gal. On October 1, 2013, a second bypass began that consisted of about 22,000 gal and lasted about 46 h. These bypasses are authorized in accordance with the terms of the non-time-critical CERCLA action memorandum (DOE 2010) but require that notifications be provided to the CERCLA regulatory parties for a bypass that lasts longer than 4h. The notifications provided information on the causes of the events, volume of water bypassed, most recent quarterly sampling results, and points where the treatment unit pumps were repaired. There were no AWQCs exceedances in

the Clinch River as a result of these discharges. Facility modifications are being evaluated to determine whether cost-effective changes could be implemented to decrease the water scaling pump and valve maintenance issues.

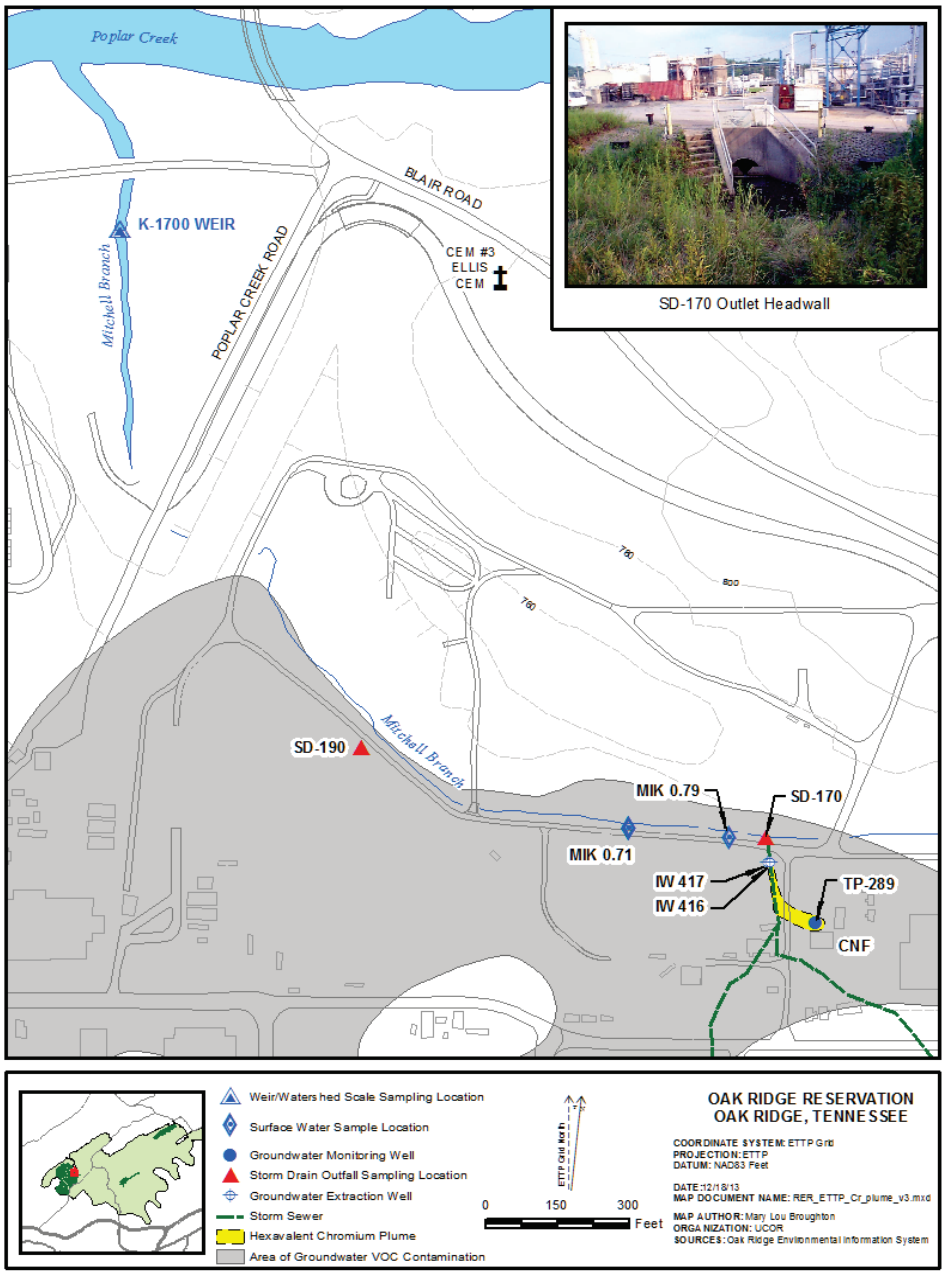


Fig. 3.24. Hexavalent chromium discharges into Mitchell Branch.
(CEM = cemetery, CNF = Central Neutralization Facility, IW = extraction well, MIK = Mitchell Branch kilometer, SD = storm drain, TP = piezometer, and VOC = volatile organic compound.)

To monitor both the continued effectiveness of the collection system and the effectiveness of CWTS, periodic monitoring was performed in CY 2013. Samples were collected at monitoring well-289, the chromium collection system wells, SD 170, and MIK 0.79. Samples collected at monitoring well 289 (TP-289) directly monitor the concentrations of chromium in the contaminated groundwater plume. Samples collected from the chromium collection system wells monitor the chromium in the water

recovered by the groundwater collection system. Samples collected at SD 170 monitor the concentrations of the chromium and hexavalent chromium plume being discharged directly to Mitchell Branch. Samples at MIK 0.79 are collected to allow monitoring of chromium and hexavalent chromium concentrations in Mitchell Branch. Requirements for this sampling effort are listed in Table 3.18. Figures 3.25 and 3.26 are graphs of the analytical data from this sampling effort.

The analytical data indicate that chromium levels may fluctuate slightly at TP-289 and the chromium collection system wells but are relatively consistent over the long term. Chromium values at storm water outfall SD 170 and MIK 0.79 have much more variability. This is most likely due to the greater variability in flow rates at these two locations.

Table 3.18. Monitoring requirements—Mitchell Branch subwatershed total and hexavalent chromium sampling locations

Location	Parameter	Measurement frequency	Sample type
MIK 0.79	Total chromium	1/quarter	Grab
MIK 0.79	Hexavalent chromium	1/quarter	Grab
Storm drain 170	Total chromium	1/quarter	Grab
Storm drain 170	Hexavalent chromium	1/quarter	Grab
Monitoring well 289 (TP-289)	Total chromium	1/quarter	Grab
TP-289	Hexavalent chromium	1/quarter	Grab
Cr collection system wells	Total chromium	1/quarter	Grab
Cr collection system wells	Hexavalent chromium	1/quarter	Grab

NOTE: Total chromium and hexavalent chromium will be collected during varying weather conditions (for example, samples will be collected during wet weather conditions one quarter and during dry weather conditions the following quarter).

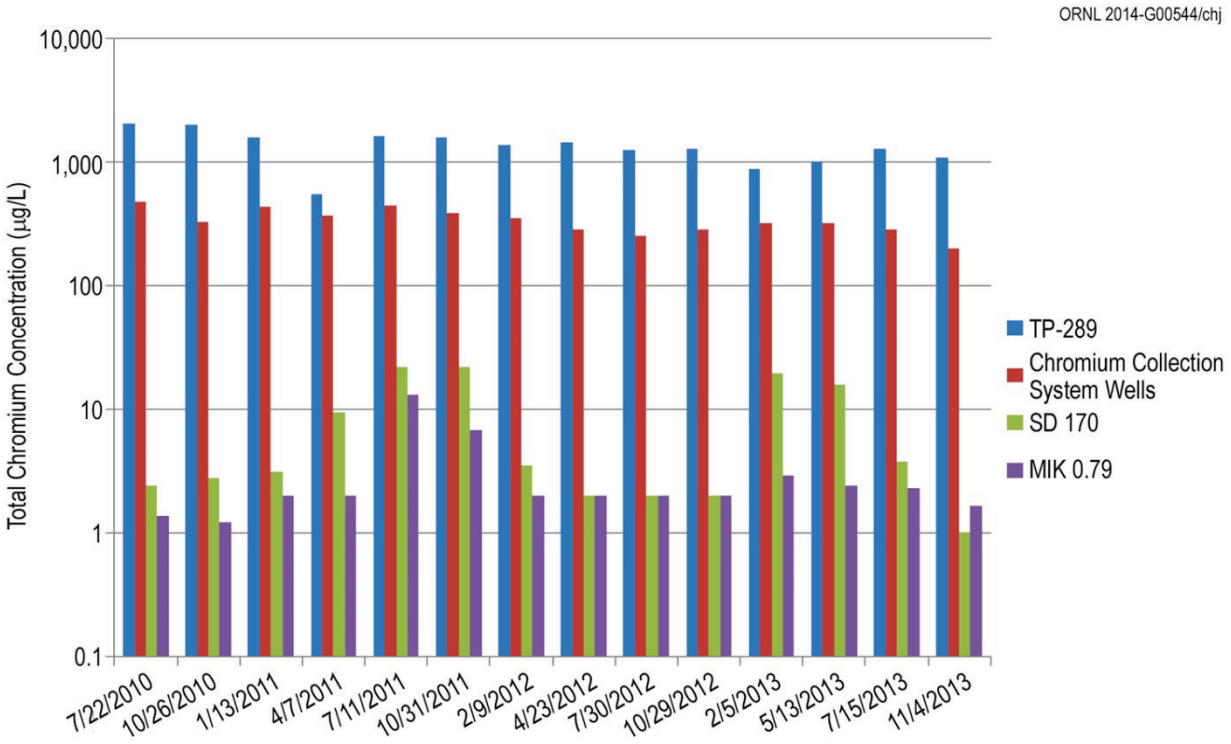


Fig. 3.25. Total chromium sample results for the chromium collection system.
(TP = piezometer, SD = storm drain, and MIK = Mitchell Branch kilometer.)

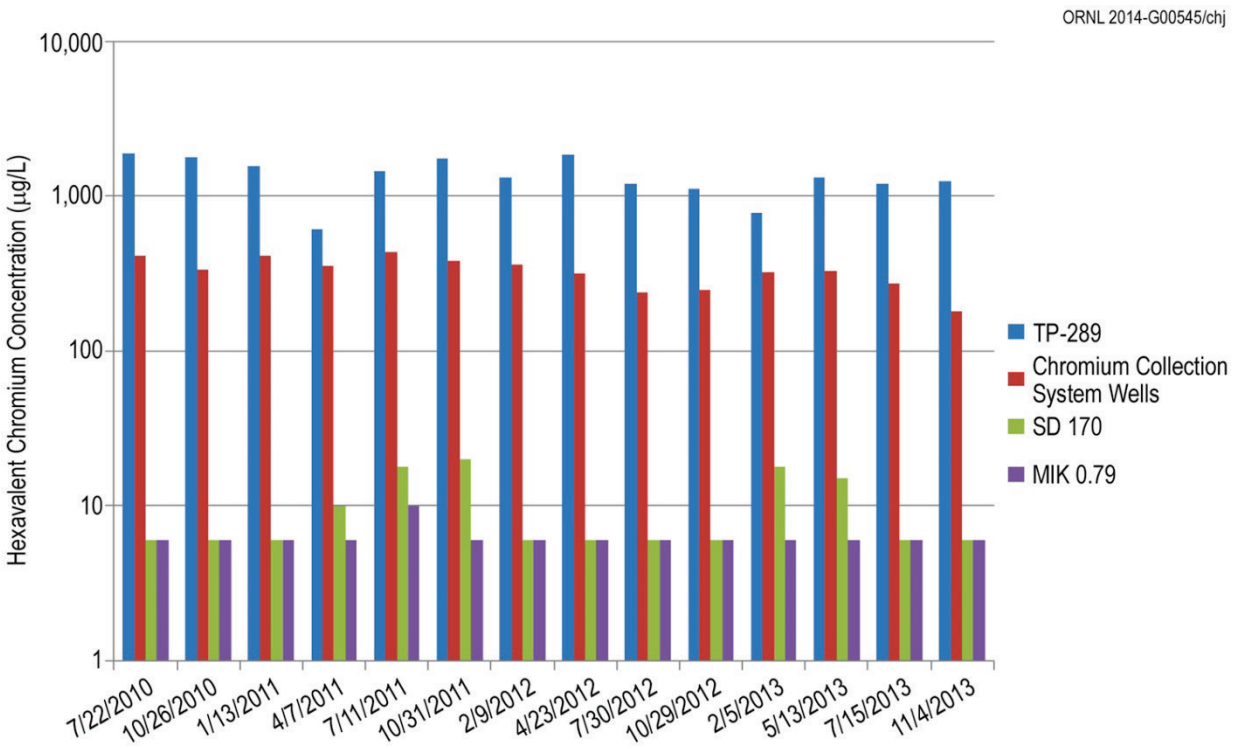


Fig. 3.26. Hexavalent chromium sample results for the chromium collection system.
(TP = piezometer, SD = storm drain, and MIK = Mitchell Branch kilometer.)

3.6.6 Investigation of Mercury at East Tennessee Technology Park

3.6.6.1 History of Mercury Use at ETTP

Mercury activities at ETTP included use, handling, and recovery operations. Mercury use and handling were common in such equipment as manometers, switches, mass spectrometers, mercury diffusion pumps, mercury traps, and laboratory operations. Process buildings contained many of these manometers, thermometers, and switches. Large quantities of mercury-bearing wastes from the on-site gaseous diffusion plant operations and support buildings, ORNL, and Y-12 were processed and stored at ETTP. Mercury from soils and spill cleanups were processed on-site as well.

3.6.6.2 Current NPDES Requirements for Mercury Monitoring

The current NPDES permit requires quarterly mercury sampling to be performed at storm water outfalls SD 170, SD 180, SD 190, and SD 05A. These four locations were selected because the permit application information indicated that mercury levels at these outfalls exceeded the AWQC level of 51 ng/L. SDs 170, 180, and 190 collect storm water from large areas on the north side of ETTP and discharge to Mitchell Branch. SD 05A, which is located on the east side of ETTP, is the discharge point for the former STP drainage basin into Poplar Creek. The quarterly mercury monitoring results as reported to TDEC are shown in Table 3.19.

Mercury results for SD 170 have been well below AWQCs since July 2009. SDs 180 and 190 appear to be the primary sources of mercury discharges into Mitchell Branch. Both the SD 180 network and the SD 190 network drain areas with historical mercury processes. Potential sources of mercury in the SD 180 drainage system are from the former K-1401, K-1301, and K-1303 building areas and from the K-1407-B pond area. Potential sources of mercury in the SD 190 drainage system are from the former K-1035, K-1401, and K-1413 building areas.

Table 3.19. Quarterly National Pollutant Discharge Elimination System mercury monitoring results as reported for CY 2013

Sampling location	First quarter (ng/L)	Second quarter (ng/L)	Third quarter (ng/L)	Fourth quarter (ng/L)
SD 170	5.32	4.6	9.3	2.75
SD 180	92.8	34.5[a]	39.9[b]	100
SD 190	279	203[c]	164[d]	38.5
SD 05A	130	690	351	223

[a]An unfiltered mercury result of 30.7 ng/L and a filtered mercury result of 19.6 ng/L were considered for this reporting period.
[b]An unfiltered mercury result of 24.1 ng/L and a filtered mercury result of 9.22 ng/L were considered for this reporting period.
[c]Unfiltered mercury results of 75.4 and 65.7 ng/L and a filtered mercury result of 27.3 ng/L were considered for this reporting period.
[d]An unfiltered mercury result of 119 ng/L and a filtered mercury result of 34.1 ng/L were considered for this reporting period.

The storm water outfall SD 05A compliance sampling point is the K-1203-10 sump. This sump was the discharge point for the former STP overflow during its years of operation. The STP was piped to the K-1203-10 sump to allow discharge of treated effluent by the lift pumps in the event high water in Poplar Creek prevented gravity discharge. Operations at the STP ceased in 2008. The K-1203-10 sump also serves as a collection sump for storm water. Currently, the K-1203-10 sump receives water influent from storm water flow as well as flow through the existing out of service STP piping. Potential sources of mercury in the discharge from SD 05A are currently under investigation.

Results for SDs 170, 180, 190, and 05A are shown in Figs. 3.27 through 3.30. Samples collected for compliance with the current NPDES permit were collected as manual grab samples.

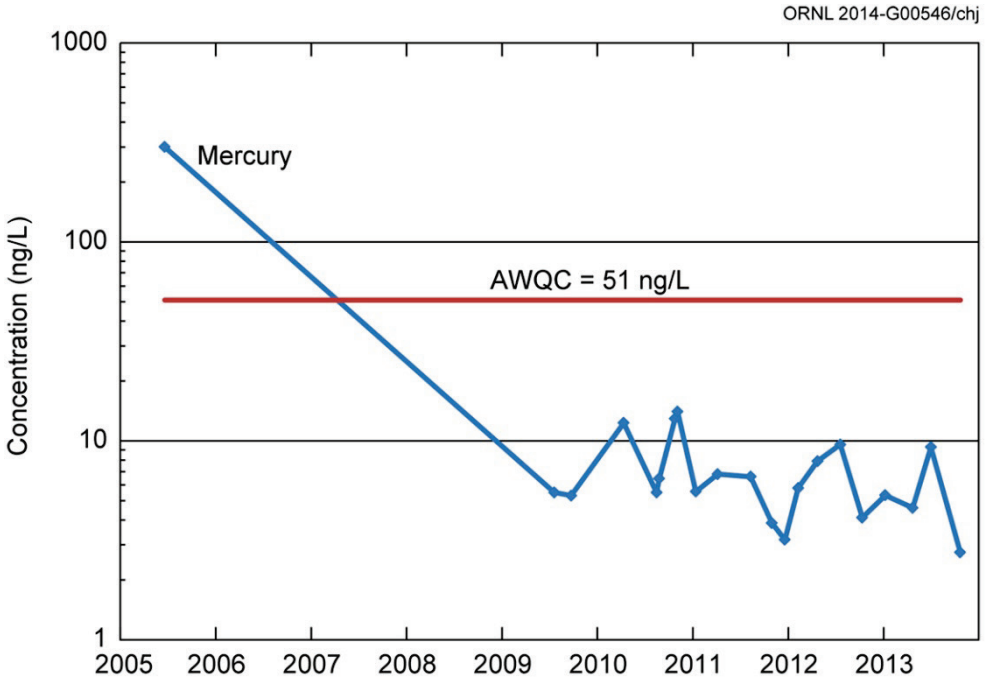


Fig. 3.27. Storm water outfall SD 170 mercury monitoring results.
(AWQC = ambient water quality criterion.)

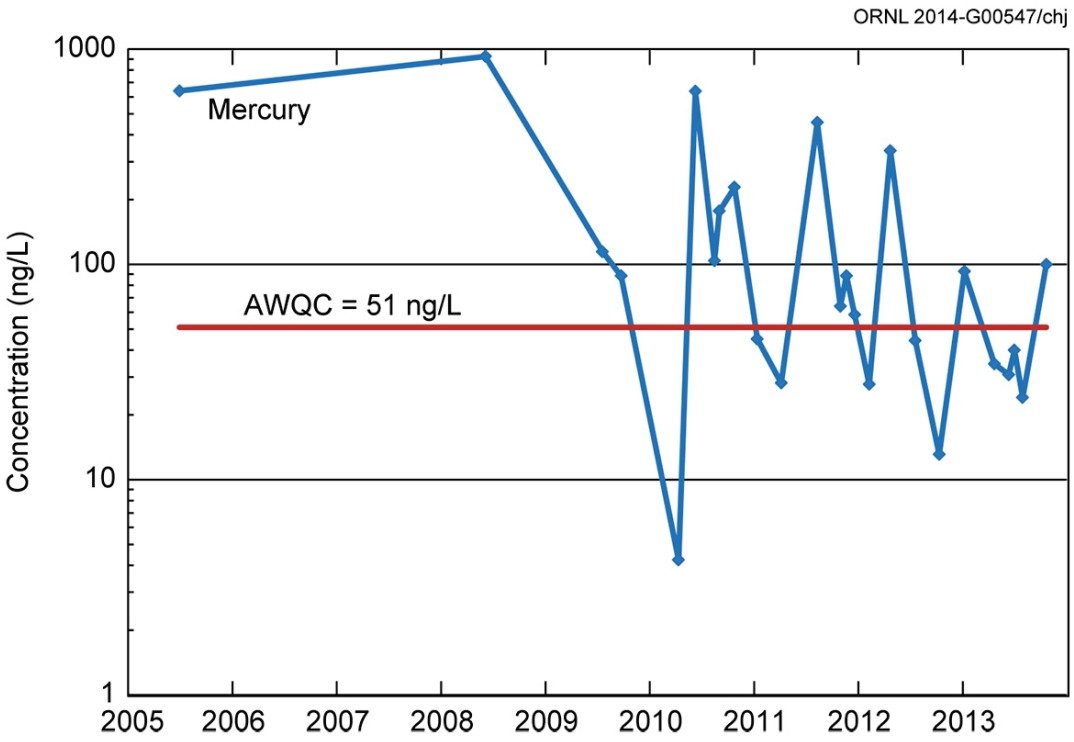


Fig. 3.28. Storm water outfall SD 180 mercury monitoring results. (AWQC = ambient water quality criterion.)

Fig. 3.29. Storm water outfall SD 190 mercury monitoring results. (AWQC = ambient water quality criterion.)

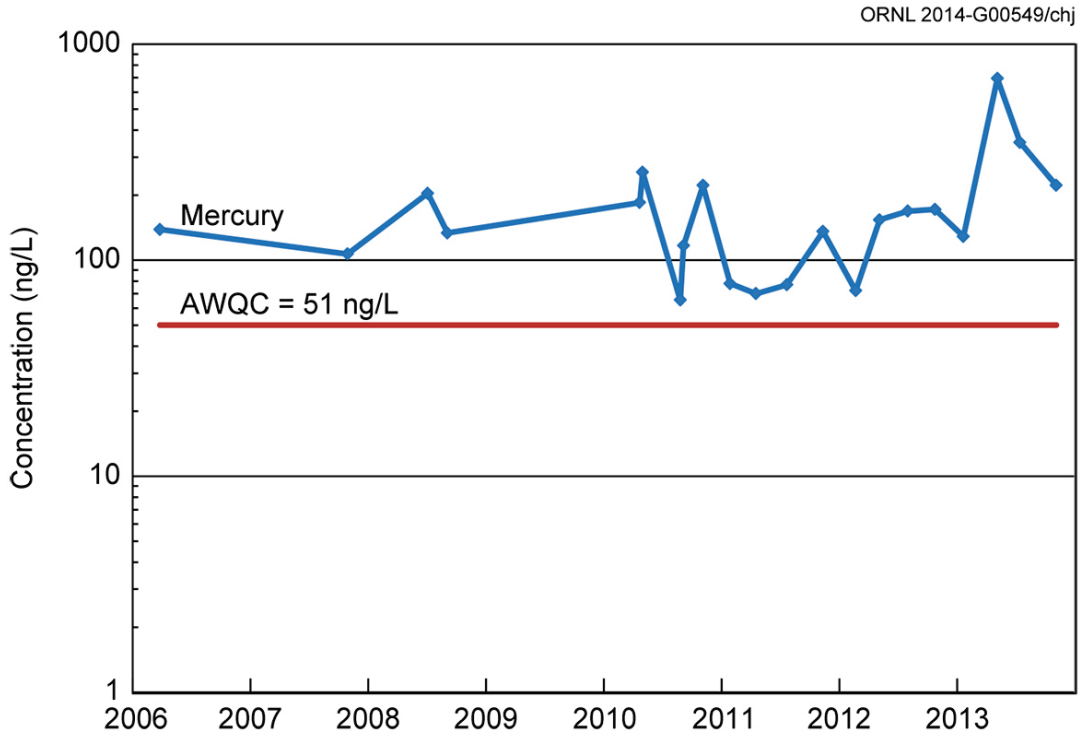


Fig. 3.30. Storm water outfall SD 05A mercury monitoring results. (AWQC = ambient water quality criterion.)

3.6.6.3 Additional Mercury Monitoring Activities

In an effort to obtain analytical data to identify how the discharges from the storm water outfalls might be affecting the water quality of Mitchell Branch, Poplar Creek, and associated waterways, mercury sampling has been performed at numerous storm water outfalls where mercury activities may have occurred within their watersheds. To identify specific areas of mercury contamination, sampling was performed in the storm water outfall networks in the Mitchell Branch subwatershed. Filtered and unfiltered samples were collected during wet weather in June 2013 and during dry weather in July 2013.

Wet weather samples were collected from flows resulting from a storm event greater than 0.1 in. in magnitude within 24 h that occurred at least 72 h after any previous storm event of 0.1 in. or more within 24 h. If an intermittent rainfall occurred over a period of 24 h and did not equal or exceed 0.1 in., it was not considered to be a storm event, and the 72 h delay until the next rainfall that could potentially be sampled was not in effect. Dry weather samples were collected at least 72 h after a storm event of 0.1 in. or more. All dry weather samples were collected by the manual grab sampling technique.

Mercury water samples were collected from the following locations in the storm water outfall SD 180 drainage network: SD 180 and manholes 8131, 13002, and 13141. Mercury water samples were collected from the following locations in the SD 190 drainage network: SD 190 and manholes 8002, 8017, 13037, 13048, and 13074. Mercury water samples were collected from the following locations in the SD 200 drainage network: SD 200 and manhole 3014. Finally, mercury samples were collected from the following locations in the SD 210 drainage network: SD 210 and manhole 3010. Table 3.20 shows the results of the wet weather mercury monitoring, and Table 3.21 shows the results of the dry weather mercury monitoring.

In addition, mercury sediment samples were collected from SDs 180, 190, and 210. Table 3.22 shows the mercury sediment sample results. Figure 3.31 shows the networks and sampling locations.

Table 3.20. Mercury results from wet weather monitoring conducted in the drainage networks of the Mitchell Branch storm water outfalls in June 2013

Sampling location	Unfiltered Hg (ng/L)	Filtered Hg (ng/L)
SD 180	30.7	19.6
MH 8131	3.94	3.06
MH 13002	5.5	1.93
MH 13141	0.571	<0.5
SD 190	**65.7**	27.3
MH 8002	**146**	20.5
MH 8017	**353**	**339**
MH 13074	**366**	**178**
MH 13037	**1130**	**495**
MH 13048	7.42	6.82
SD 200	3.55	3.01
MH 3014	3.27	2.44
SD 210	13.5	9
MH 3010	30.1	18

MH = manhole, SD = storm drain
Bold = above ambient water quality criterion of 51 ng/L.

Table 3.21. Mercury results from dry weather monitoring conducted in the drainage networks of the Mitchell Branch storm water outfalls in July 2013

Sampling location	Unfiltered Hg (ng/L)	Filtered Hg (ng/L)
SD 180	24.1	9.22
MH 8131	3.51	4.89
MH 13002	2.21	1.51
MH 13141	<0.5	<0.5
SD 190	**164**	34.1
MH 8002	**213**	38.6
MH 8017	**3450**	**678**
MH 13074	**708**	**610**
MH 13037	**793**	**628**
MH 13048	31.8	12.3
SD 200	NS	NS
MH 3014	NS	NS
SD 210	NS	NS
MH 3010	NS	NS

MH = manhole, NS = no sample collected due to lack of flow, and SD = storm drain.
Bold = above ambient water quality criterion of 51 ng/L.

Table 3.22. Mercury results from sediment sampling at select Mitchell Branch storm water outfalls in 2013

Sampling location	Date	Result (ng/g)
SD 180	9/9/2013	1,006.8
SD 190	9/9/2013	17,183.4
SD 210	9/9/2013	337.2

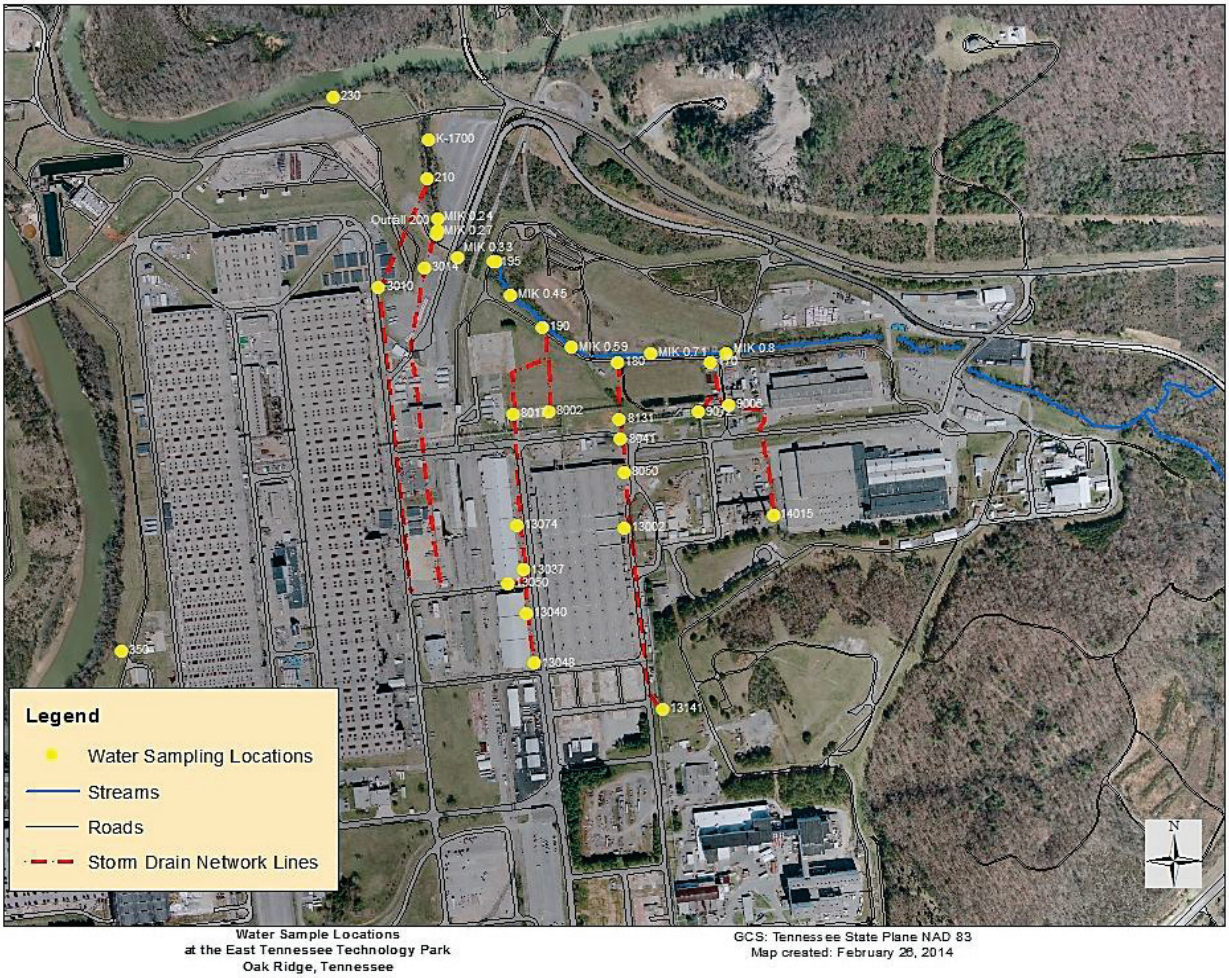


Fig. 3.31. Storm drain (SD) networks for SDs 170, 180, 190, 200, and 210.

3.6.6.4 K-1203 Sewage Treatment Plant

The mercury investigation at the K-1203 STP continues. The K-1203 STP was previously used to treat and process all sanitary sewage waste from ETTP. The plant was shut down on May 29, 2008, as a result of the transition of sewage treatment for ETTP to the City of Oak Ridge. The City of Oak Ridge expanded the Rarity Ridge STP (RRSTP) to include capacity to treat the waste from ETTP, and CROET constructed a new ETTP lift station and force main to RRSTP. Table 3.23 shows the mercury results from soil and sediment sampling conducted at the K-1203 STP area. Table 3.24 shows the mercury results from water sampling conducted at the K-1203 STP area. Figure 3.32 shows the sampling locations.

Table 3.23. Mercury results from soil/sediment sampling conducted in the K-1203 Sewage Treatment Plant area in 2013

Sampling location	Date	Result (ng/g)
K-1203-2 Imhoff tank—west	4/23/2013	40,684.7
K-1203-2 Imhoff tank—east	4/23/2013	5,053.1
K-1203-8 chlorine contact basin	4/23/2013	153,773.1
Storm drain 05A-A	4/18/2013	260.6
Storm drain 05A-C	4/18/2013	997.8
K-1203-10 sump	4/18/2013	6,570.1

Table 3.24. Mercury results of water sampling conducted in the K-1203 Sewage Treatment Plant area in 2013

Sampling location	Date	Result (ng/L)
K-1203 clarifier	4/29/2013	82.6
K-1203-2 Imhoff tank—west	4/8/2013	0.937
K-1203-2 Imhoff tank—east	4/8/2013	1.72
K-1203-2 Imhoff tank—west	9/23/2013	0.777
K-1203-2 Imhoff tank—east	9/23/2013	0.902
K-1203 SB manhole 2	9/21/2013	89.1
K-1203-12 sump	9/21/2013	27.2
K-1203-14 comminutor	9/21/2013	78.7
K-1203 aeration basin	9/23/2013	172
K-1203 inner clarifier	9/23/2013	4.11
K-1203 sludge holding basin	9/23/2013	4.48
K-1203 effluent channel	9/23/2013	4.53
Storm drain 05A-JCT	4/8/2013	73.1
Storm drain 05A-JCT	4/29/2013	55.6
Storm drain 05A-JCT	5/6/2013	80.3
Manhole 1	4/8/2013	35.5
Manhole 1	5/6/2013	8.79
Manhole 171	4/8/2013	21.1
Manhole 171	5/6/2013	17.1
Manhole 173	5/6/2013	27.4
Manhole 275	4/8/2013	1,860
Manhole 275	5/6/2013	5.4
Manhole 276	4/8/2013	350
Manhole 276	5/6/2013	5.5
Manhole 278	4/8/2013	56.8
Manhole 278	5/6/2013	3.98
Storm drain 05A-A	4/29/2013	6.97
Storm drain 05A-B	4/8/2013	11.7
Storm drain 05A-B	4/29/2013	20.1
Storm drain 05A-D	4/8/2013	32.1
Storm drain 05A-D	4/29/2013	51.5
Storm drain 05A-E	4/29/2013	14.3

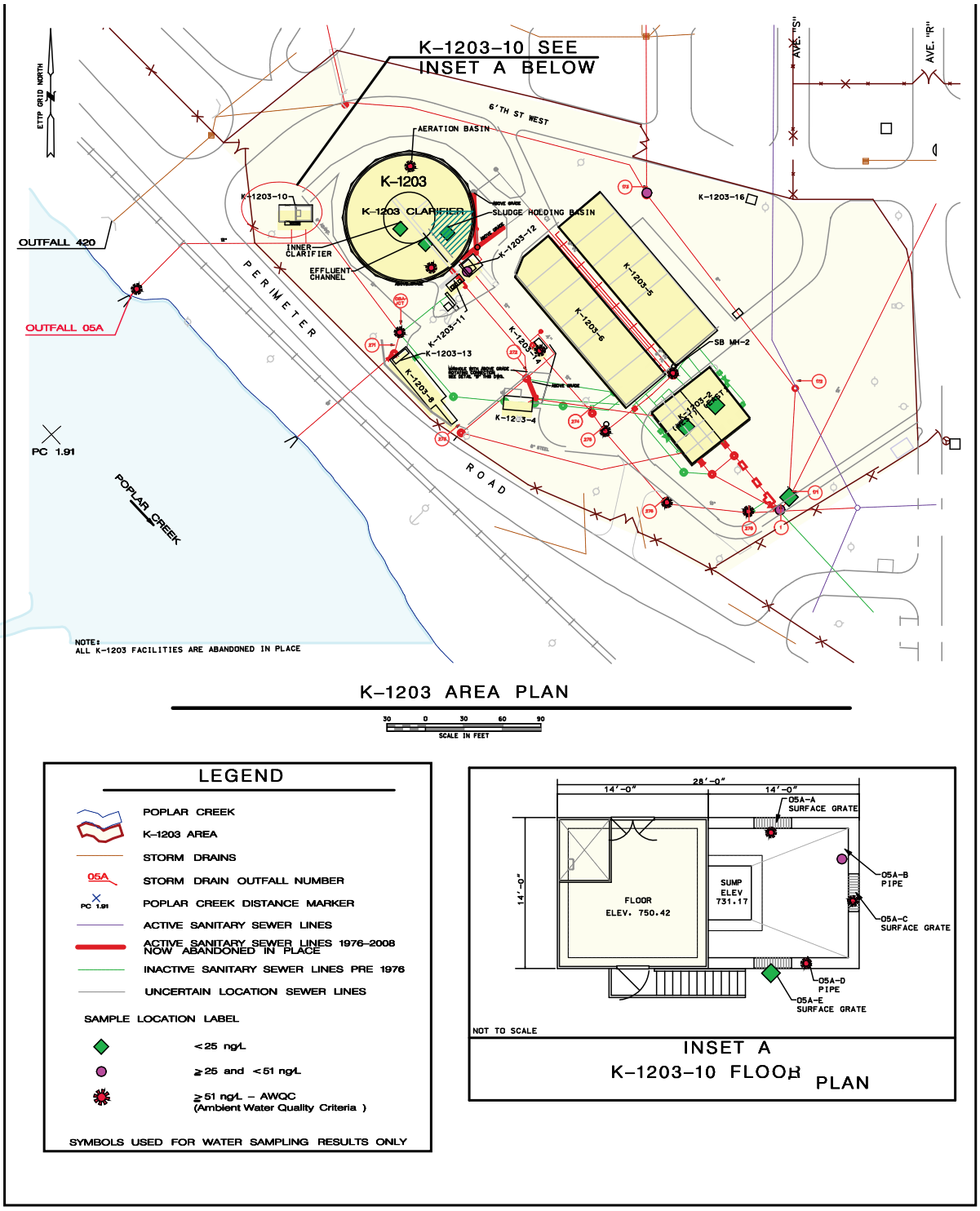


Fig. 3.32. Sampling locations at the K-1203 Sewage Treatment Plant area.

3.6.6.5 Decontamination and Decommissioning of the Technetium-99–Contaminated Portion of the East Wing of Building K-25

RA and D&D activities have continued across the site. In 2013, storm water outfalls affected by the demolition cleanup of the last section of the K-25 building were monitored for ^{99}Tc, mercury, and other contaminants. Table 3.25 shows the results of the mercury monitoring at outfalls SD 210 and SD 490 and manholes 17006 and 18102. Additional sampling results for ^{99}Tc are described in Section 3.6.5.2, which includes a summary table of results.

Table 3.25. Mercury results from storm water sampling activities associated with decontamination and decommissioning activities at the K-25 building

Date	Storm drain 210 Hg results (ng/L)	Storm drain 490 Hg results (ng/L)	Manhole 18102 Hg results (ng/L)	Manhole 17006 Hg results (ng/L)
9/21/2013	12.4	7.77	7.44	10.7
11/18/2013	7.46	8.92	15.4	8.9
11/26/2013	16.6	8.31	8.37	7.09
12/9/2013	8.62	6.4	8.02	8.01
12/23/2013	NA[a]	6.1	6.23	9.59
12/30/2013	NA[a]	4.83	5.54	11.1

[a]Samples were not collected for mercury analysis at this location on this date during the sampling period.

3.6.6.6 Remedial Actions at the K-1070-B Burial Ground

Remedial efforts at the K-1070-B burial ground were completed during FY 2012. Additional storm water sampling was performed in this area during 2013 in an effort to determine the impacts of the cleanup activities. Sampling was performed at manholes 8002 and 8017 (upgradient of the K-1070-B burial ground) and at SD 190 (downgradient of the K-1070-B burial ground). Samples were collected in CY 2013 for a suite of analytes, including mercury. Table 3.26 shows the mercury results from this sampling effort.

Table 3.26. Mercury results from storm water sampling activities associated with the remedial action activities at the K-1070-B burial ground

Sampling location	Date	Result (ng/L)
Storm drain 190	5/6/2013	75.4
Manhole 8002	5/6/2013	36.7
Manhole 8017	5/6/2013	126

3.6.6.7 Remedial Actions at the K-770 Scrap Yard Area

Closure activities at the K-770 scrap yard have been completed, and all of the large pieces of scrap metal in the yard have been removed and disposed. Much of the scrap yard drains to a holding pond on the north side of the scrap yard. Water that collects in this holding pond discharges to the Clinch River through storm water outfall SD 724. Sediment sampling was performed in the holding pond for a suite of analytes, including mercury. Table 3.27 shows the mercury result from this sampling effort.

Table 3.27. Mercury result from sediment sampling associated with the remedial action activities at the K-700 scrap yard area

Sampling location	Date	Result (ng/g)
724 holding pond	4/16/2013	124.7

3.6.6.8 Remedial Actions at the K-720 Coal Ash Pile

Runoff and leachate from the K-720 coal ash pile resulted in occasional low pH readings at storm water outfall SD 992 for several years. In addition, elevated levels of metals that are often found in coal, including arsenic and selenium, have been detected in storm water samples from the area. Investigative efforts performed as part of the ETTP SWPP Program demonstrated that the major source of concern for the low pH values measured at SD 992 was the channel that receives drainage from the coal ash sluice pond. This channel also receives drainage from a portion of the coal ash pond that was not completely covered with soil during the RAs that were conducted in the mid-1990s.

In an attempt to remediate the area near the ash sluice pond drainage channel and raise the pH of the flow in the channel, a series of actions were taken. Uncovered ash that had been pushed into the drainage channel during previous remedial activities was removed and placed onto a flat area of the coal ash pile. Rip-rap was placed along the area of the drainage channel where the ash had been removed. The area where the ash had been placed, as well as other areas where coal ash was exposed, was covered with clay to prevent infiltration of storm water into the ash. The clay layer was then covered with topsoil to provide a suitable medium for vegetation to grow back on the surface of the ash pile. The area was then seeded and covered with straw.

To collect additional information on the effectiveness of the RAs taken in the K-720 coal ash pile area, additional monitoring was conducted as part of the FY 2014 SWPP Program. Table 3.28 shows the results of this monitoring activity.

Table 3.28. Mercury result from water sampling associated with the remedial action activities at the K-720 coal ash pile

Sampling location	Date	Result (ng/L)
Storm drain 992	11/26/2013	12.5

3.6.6.9 Storm Water Outfall Sampling

The mercury investigation scope was broadened to encompass areas that have not been investigated before, have not been sampled recently, and/or warrant additional investigation due to operational history. Table 3.29 lists these mercury storm water sampling results by storm water outfall. These outfalls were selected for sampling because they drain areas where mercury may have been used as part of past site operations or because recent mercury analytical results are not available for them.

Table 3.29. Mercury results from storm water monitoring conducted in CY 2013

Storm water outfall	January (ng/L)	March (ng/L)
SD 220		12.3
SD 530	13.2	
SD 590	24.9	

3.6.6.10 Environmental Monitoring Program

As part of the EMP, mercury samples are collected at select surface water locations throughout ETTP. These mercury results are reported as part of the EMP as well as incorporated into the sitewide mercury investigation. The quarterly EMP sample results are shown in Table 3.30, and the semiannual EMP sample results are shown in Table 3.31. Figure 3.33 shows the EMP sampling locations. For additional information on the EMP, please refer to the surface water monitoring section (Section 3.6.8).

Table 3.30. East Tennessee Technology Park Environmental Monitoring Program quarterly surface water mercury results for CY 2013

Mitchell Branch location	First quarter (ng/L)	Second quarter (ng/L)	Third quarter (ng/L)	Fourth quarter (ng/L)
K-1700 weir	26.65	**115.9**	36.8	29.15
MIK 0.45	14.2	3.8	13.6	4.64
MIK 0.59	8.6	2.9	4.2	2.83
MIK 0.71	2.0	1.6	2.4	1.52
MIK 0.82	1.6	1.3	1.7	Not Sampled
MIK 1.4	1.8	1.4	2.1	0.5 (U)

Bold indicates results above Tennessee water quality criteria.
MIK values represent distance in Mitchell Branch from the downstream confluence with Poplar Creek.

Acronyms
MIK = Mitchell Branch kilometer
U = Nondetect result

Table 3.31. East Tennessee Technology Park Environmental Monitoring Program semiannual surface water mercury results for CY 2013

Sampling location	January–June (ng/L)	July–December (ng/L)
K-1007B	2.4	4.61
K-702-A	21.5	33.8
K-901-A	2.2	4.94
K-1710	**81.8**	47.9
K-716	**77.1**	15.1
CRK 16	12.3	6.41
CRK 23	1.7	0.587

Bold indicates results above Tennessee water quality criteria.
CRK = Clinch River kilometer

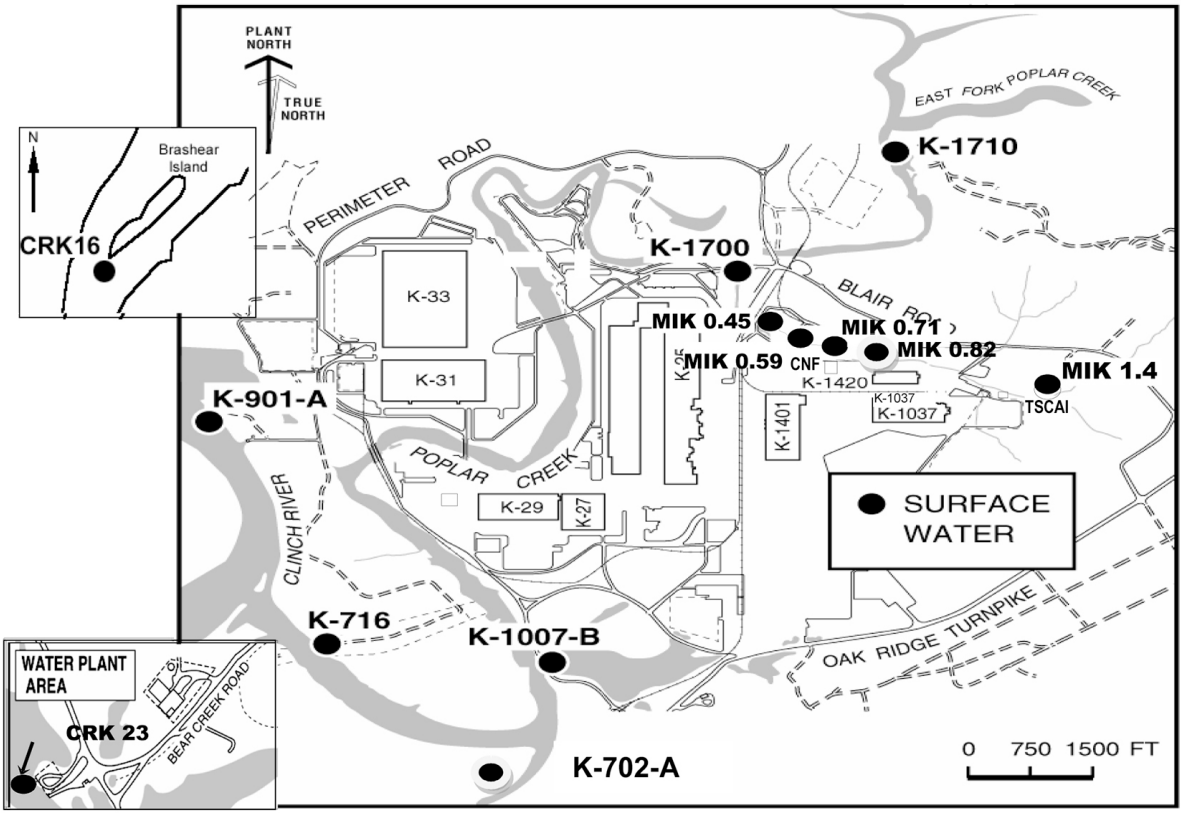


Fig. 3.33. East Tennessee Technology Park Environmental Monitoring Program sampling locations.

3.6.6.11 Additional Mitchell Branch Instream Sampling

Figure 3.34 shows that Mitchell Branch instream mercury concentrations for the period 2008–2013 increase significantly moving downstream toward the K-1700 weir. Figure 3.35 shows the historic mercury concentrations measured from routine surface water sampling at the K-1700 weir. At the K-1700 weir there was a significant increase in mercury concentrations from December 2009 to March 2010. Near this time frame several activities were under way with the potential to influence the mercury concentrations at the K-1700 weir such as the D&D activity at Building K-25, the remediation of the K-1070-B burial ground, and the D&D activity at Buildings K-1035 and K-1401. Figure 3.35 combines mercury sampling data from the Water Resources Restoration Program (WRRP) sampling events with results from EMP monitoring. Table 3.32 summarizes the WRRP mercury data for CY 2013.

In 2013, fish and caged clams from various locations at ETTP were analyzed for mercury. For details of this study, please see Section 3.7.

For information regarding the monitoring of mercury in the groundwater at ETTP, please see Sections 3.6.8 and 3.6.9.

Further monitoring for mercury has been proposed for 2014 for Mitchell Branch, the former K-1203 STP, and other locations as part of the NPDES permit compliance sampling program, SWPP Program, ETTP EMP, groundwater program, and Biological Monitoring and Abatement Program (BMAP). Historical documents continue to be researched and future monitoring proposed as part of the ongoing mercury investigation.

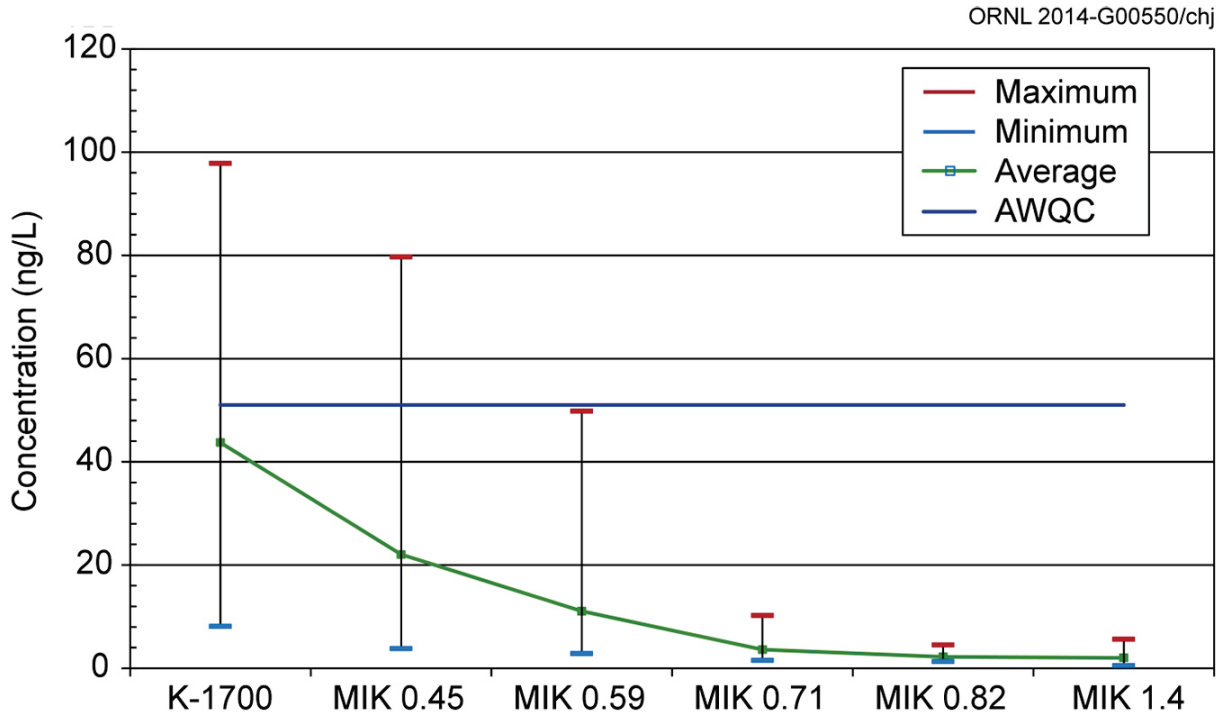


Fig. 3.34. Mitchell Branch instream mercury sampling results, 2008–2013. (AWQC = ambient water quality criterion, MIK = Mitchell Branch kilometer.)

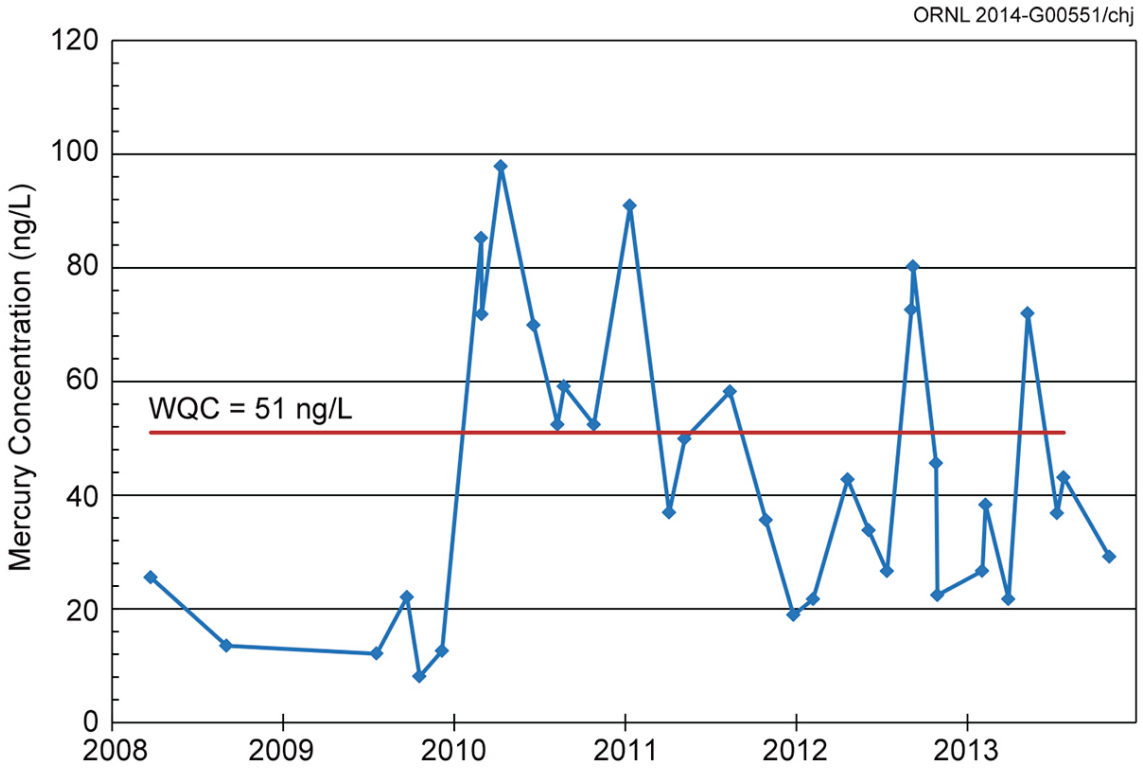


Fig. 3.35. K-1700 weir surface water mercury sampling results, 2008–2013. (WQC = water quality criterion.)

Table 3.32. Water Resources Restoration Program mercury sampling results for the K-1700 Weir in CY 2013

Date	Hg result (ng/L)	Field filtered
2/12/2013	38.3	No
4/2/2013	21.7	No
5/13/2013	28	No
5/13/2013	7.5	Yes
7/29/2013	43.1	No

3.6.7 NPDES Monitoring at the Central Neutralization Facility Wastewater Treatment System

Wastewater from CNF is discharged through storm water outfall SD 001 into the Clinch River. Nonradiological monitoring of CNF effluent was conducted according to the requirements of NPDES permit TN0074225. Monitoring requirements, frequencies, and sample types required under the permit changed during 2010 with the reissuance of the permit on December 1, 2010. During the permit renewal process, CNF was reclassified from the "Metal Finishing" category into the "Centralized Wastewater Treatment" category by the permit writer. This change in point source category was mainly responsible for the change in parameters between the previous permit and the renewed permit. The requirements for the 2010 permit are listed in Table 3.33.

As of December 15, 2012, CNF no longer accepted any external wastewater for treatment. CNF continued to discharge until August 22, 2013, when the final discharge from CNF occurred. Closure actions at CNF in 2013 included removal of the air stripper, pressure filters, and carbon adsorption units; sludge removal from and cleaning of the clarifier, sumps, dikes, and settling basins; backfill of sumps with flowable fill; and painting of some internal tank walls to fix radiation in place. Actions were completed to decommission CNF and ready it for demolition and remediation. RCRA clean closure information was submitted to TDEC and EPA in CERCLA phased construction completion reports on November 15, 2013. NPDES permit TN0074225 was allowed to expire on December 31, 2013.

Radiological sampling of effluent from CNF was conducted weekly according to the requirements of NPDES permit TN0074225. The weekly samples were then composited into a single monthly sample. Table 3.34 lists the total discharges in 2013 by isotope. The radiological results were compared with the DCG values from DOE O 5400.5 (DOE 1990). The rolling average sum of the fractions of the DCGs must be kept below 1.0. In practice, the effluent results rolling average sum of fractions of the DCGs from CNF were well below 1.0 until 2007, as indicated in Fig. 3.36. Figure 3.36 also shows the rolling 12-month average through August 2013. Monitoring results for 2013 showed a continuing decrease in the rolling 12-month average of the sum of the fractions of the DCGs from a high of 0.16 in January 2013 to 0.10 in August 2013.

Although uranium isotopes constitute a greater mass of radionuclides discharged from CNF, ^{99}Tc accounts for the greatest activity due to its much higher specific activity. Transuranic isotopes constitute a small fraction of the total in the rolling 12-month average of the sum of the fractions of the DCGs.

Table 3.33. National Pollutant Discharge Elimination System permit TN0074225 storm water outfall SD 001 monitoring requirements

Parameter	Measurement frequency	Sample type
Flow	Continuous	Recorder
pH	Continuous	Recorder
^{137}Cs	1/month	Monthly composite
^{234}U	1/month	Monthly composite
^{235}U	1/month	Monthly composite
^{236}U	1/month	Monthly composite
^{237}Np	1/month	Monthly composite
^{238}Pu	1/month	Monthly composite
^{238}U	1/month	Monthly composite
^{239}Pu	1/month	Monthly composite
^{99}Tc	1/month	Monthly composite
COD	1/month	24 h composite
Gross alpha radioactivity	1/month	Monthly composite
Gross beta radioactivity	1/month	Monthly composite
Oil and grease	1/month	Grab
Other radionuclides contained in wastewater[a]	1/month	Monthly composite
Total uranium	1/month	Monthly composite
2-4-6-trichlorophenol	1/quarter	24 h composite
Acetone	1/quarter	Grab
Acetophenone	1/quarter	24 h composite
ICP metals[b]	1/quarter	24 h composite
Methyl ethyl ketone (2-Butanone)	1/quarter	Grab
o-Cresol (2-methyl phenol)	1/quarter	24 h composite
p-Cresol (4-methyl phenol)	1/quarter	24 h composite
Phenol	1/quarter	24 h composite
Pyridine	1/quarter	24 h composite
Trichloroethylene	1/quarter	Grab
TSS	1/quarter	24 h composite
BOD	1/year	24 h composite
Chloroform	1/year	Grab
Methylmercury	1/year	Grab
Total mercury	1/year	24 h composite
PCBs	1/year	24 h composite

[a]No other radionuclides are currently being analyzed each month.
[b]ICP metals shall include, at a minimum, Sb, As, Cd, Cr, Co, Cu, Pb, Ni, Ag, Sn, Ti, V, and Zn per the permit and Al, Ba, Be, B, Ca, Fe, Mg, Mn, Mo, K, Se, Si, Na, and Tl.

Acronyms
BOD = biochemical oxygen demand
COD = chemical oxygen demand
ICP = inductively coupled plasma
PCB = polychlorinated biphenyl
TSS = total suspended solids

Table 3.34. Isotopic discharges from the Central Neutralization Facility Wastewater Treatment System, 2013

Isotope	Discharge (Ci)	Isotope	Discharge (Ci)
^{137}Cs	1.1E-6	$^{233/234}U$	3.6E-5
^{237}Np	1.8E-7	^{235}U	3.5E-6
^{238}Pu	2.4E-7	^{236}U	3.5E-6
$^{239,240}Pu$	2.6E-7	^{238}U	4.2E-5
^{99}Tc	1.2E-3		

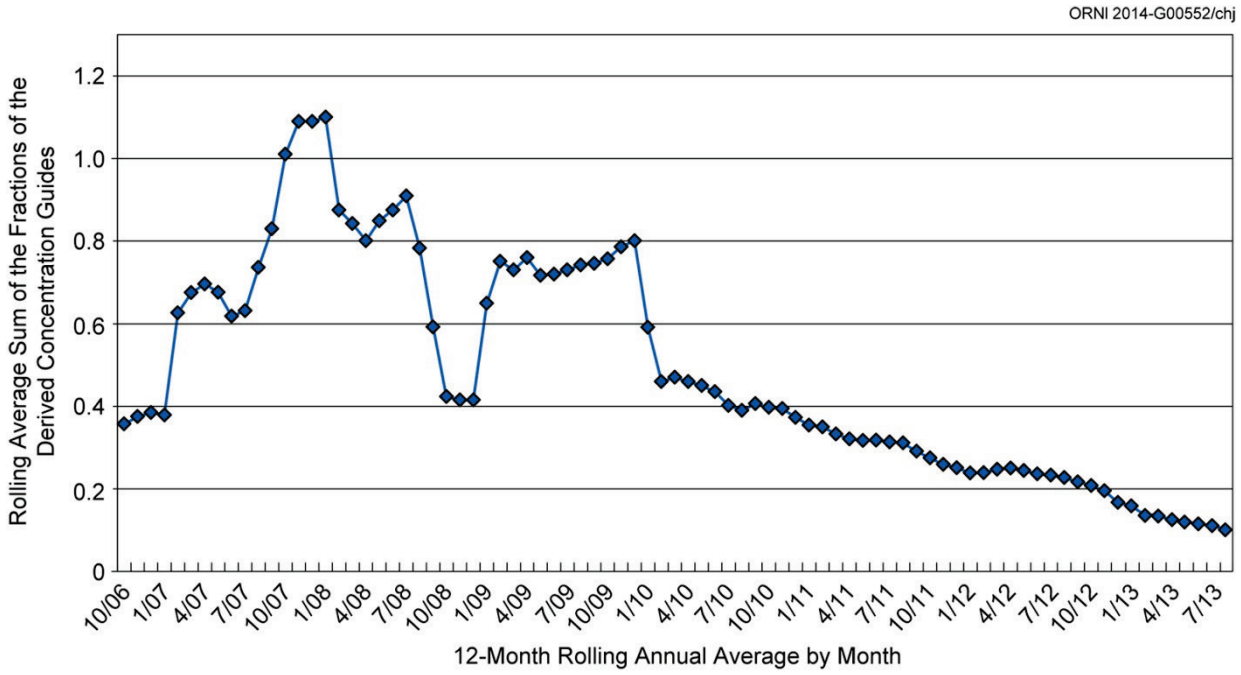


Fig. 3.36. Central Neutralization Facility–K-1435 Wastewater Treatment System radionuclide liquid discharges.

3.6.8 Surface Water Monitoring

During 2013, ETTP EMP personnel conducted environmental surveillance activities at 13 surface water locations (Fig. 3.37) to monitor groundwater and storm water runoff (K-1700, K-1007-B, and K-901-A) or ambient stream conditions (CRKs 16 and 23; K-1710; K-716; K-702-A slough; and MIKs 0.45, 0.59, 0.71, 0.8, and 1.4). Monitoring at MIK 0.8 ceased in July 2013. Depending on the location, samples were collected and analyzed quarterly for radionuclides (K-1700 and MIKs 0.45, 0.59, 0.71, 0.8, and 1.4) or semiannually (remainder of locations). Results of radiological monitoring were compared with the DCGs. Radiological data are reported as fractions of DCGs for reported radionuclides. If the sum of DCG fractions for a location exceeds 100% for the year, a source investigation is required. Sources exceeding DCG requirements would need an analysis of the best available technology to reduce the sum of the fractions of the radionuclide concentrations to their respective DCGs to less than 100%. Comparisons with DCGs are updated regularly to maintain an annual average. The monitoring results at the majority of locations were less than 1% of the allowable DCG (Fig. 3.38). The exceptions were K-1700 and three locations on Mitchell Branch, as indicated by the sums of the fractions of the DCGs for these locations: K-1700—1.8%, MIK 0.45—1.8%, MIK 0.59—1.7%, and MIK 0.71—1.5%.

The percentage of the DCGs at K-1700 (1.8%) was greater than the percentage of the 2012 monitoring results (1.0%). The percentage of the DCGs at MIK 0.45, MIK 0.59, and MIK 0.71 also increased slightly from the 2012 results.

Depending on the monitoring location, water samples may be analyzed for pH, selected metals, and VOCs. In 2013, results for most of these parameters were well within the appropriate Tennessee state water quality criteria (WQCs).

Exceptions were exceedances for mercury at K-716, K-1700, and K-1710; for zinc at MIK 0.59; and for lead at K-716 and K-1710 (the Poplar Creek monitoring locations) and a failure to meet the minimum level for dissolved oxygen at K-716 and K-1710. The elevated levels of lead in Poplar Creek are within the range of historical results at these locations but are an order of magnitude greater than what has been seen at the same locations in the last several years. Due to the wide drainage area and the diversity of operations in the Poplar Creek drainage basin and the fact that levels of lead are elevated upstream as well as downstream of ETTP, it is difficult to determine the source. The cause of the elevated zinc levels at MIK 0.59 is unknown but appears to be an anomaly as levels of zinc in samples collected both upstream and downstream of MIK 0.59 were within normal ranges, and subsequent sample results were also well within the WQC.

The WQC for dissolved oxygen in streams and ponds is a minimum level of 5 mg/L. On three occasions during the 2013 monitoring dissolved oxygen levels at several of the surface water monitoring locations fell below this level. The lowest levels (4.4 mg/L and 4.5 mg/L) were measured at K-716 and K-1710, respectively, in June. Levels at K-1700 were also measured at less than 5 mg/L at one point during 2013 (4.7 mg/L in November). No obvious signs of distress (e.g., dead fish) were observed to be associated with any of these measurements in 2013. Low levels of dissolved oxygen are not uncommon in area streams and are usually associated with higher temperatures (and the associated elevated levels of biological activity) and low rainfall and stream flow. Late summer and fall of 2013 had very low rainfall.

The WQC for mercury is 0.051 µg/L. On three occasions in 2013 levels of mercury were measured above this level. In May, levels of mercury in the sample from K-1700 (in Mitchell Branch) were measured at 0.12 µg/L. In June, water collected from K-716 and K-1710 contained levels of mercury of 0.077 and 0.082 µg/L, respectively. Both of these locations are in Poplar Creek, with K-716 being the monitoring location downstream of most of the ETTP influence and K-1701 being the monitoring location upstream of most of the ETTP influence. It should be noted that both locations are within the reach of Poplar Creek that occasionally experiences reverse flow, so the difference between the two locations is not as well defined as might be expected. For details, please see the discussion of the sitewide mercury investigation given in Section 3.6.6.

Figures 3.39 and 3.40 illustrate the concentrations of TCE (trichloroethene/trichloroethylene) and total 1,2-DCE (dichloroethene, cis-1,2-dichloroethylene, trans 1,2-dichloroethylene) from the K-1700 weir (which is used to monitor Mitchell Branch), the only surface water monitoring location where VOCs are regularly detected. Concentrations of TCE and total 1,2-DCE are below the Tennessee WQCs for recreation, organisms only (300 µg/L for TCE and 10,000 µg/L for trans 1,2-DCE), which are appropriate standards for Mitchell Branch. Moreover, the standards for 1,2-DCE apply only to the "trans" form of 1,2-DCE; almost all of the 1,2-DCE is in the cis-isomer. In addition, vinyl chloride has sometimes been detected in Mitchell Branch water (Fig. 3.41). 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; however, storm drain network monitoring generally has not detected these compounds in the storm water discharges. When detected, the concentrations are lower than in the stream. Therefore, it appears that the primary source of these compounds is contaminated groundwater.

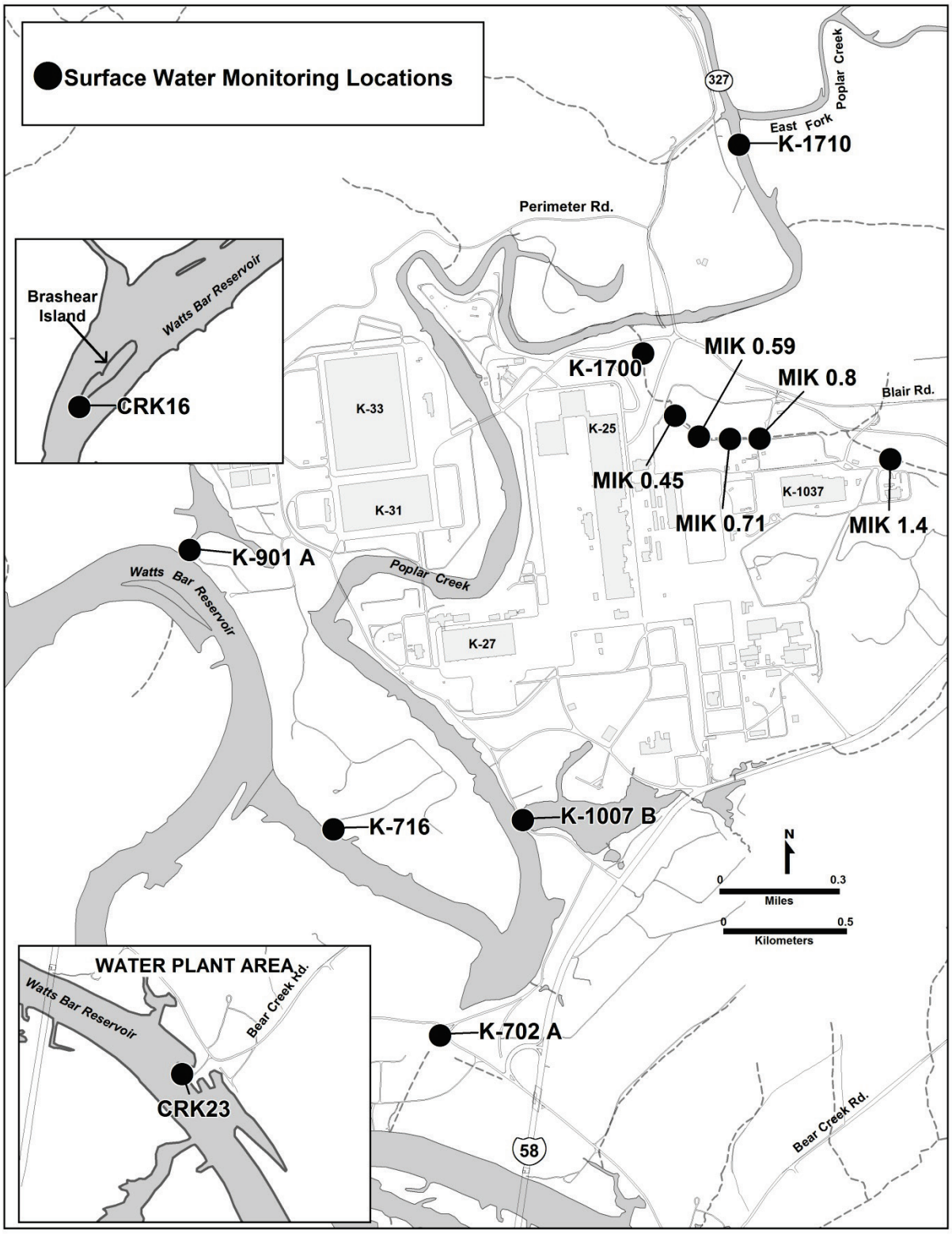


Fig. 3.37. East Tennessee Technology Park Environmental Monitoring Program surface water monitoring locations.

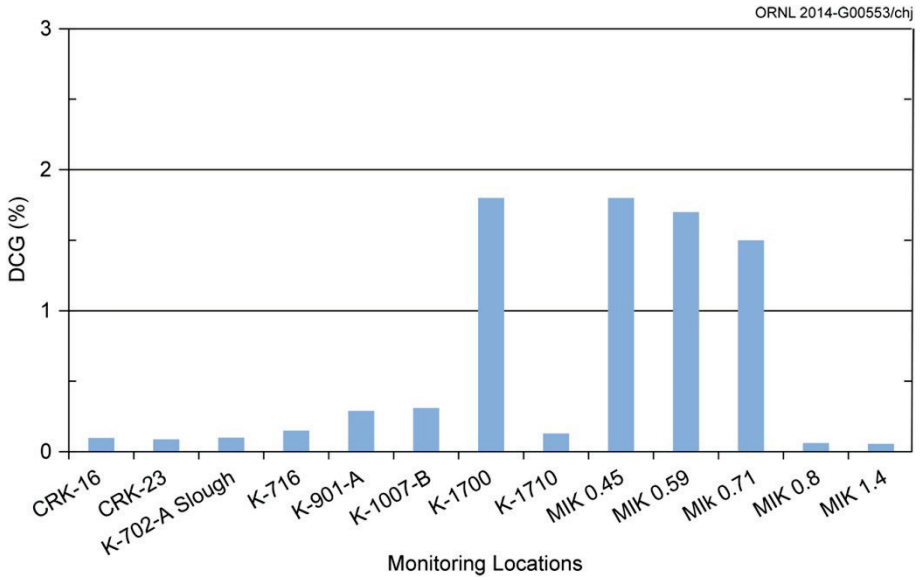


Fig. 3.38. Percentage of derived concentration guides (DCGs) at surface water monitoring locations, 2013. (CRK = Clinch River kilometer; MIK = Mitchell Branch kilometer.)

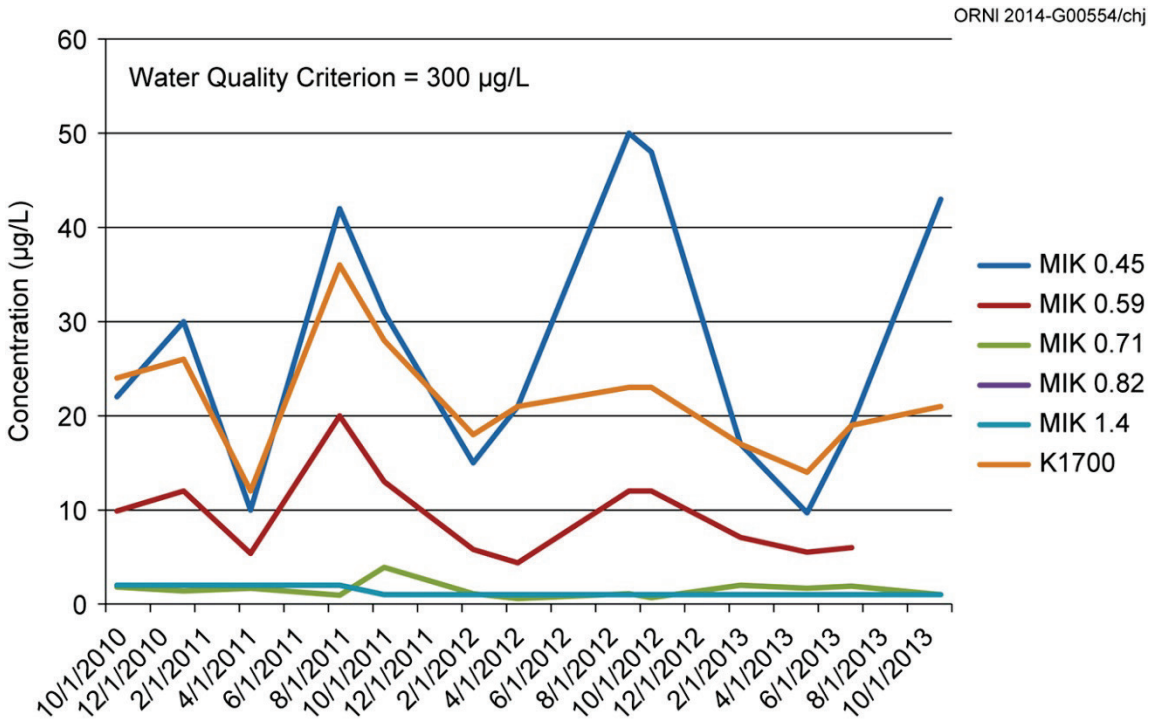


Fig. 3.39. Trichloroethene concentrations in Mitchell Branch. (MIK = Mitchell Branch kilometer.)

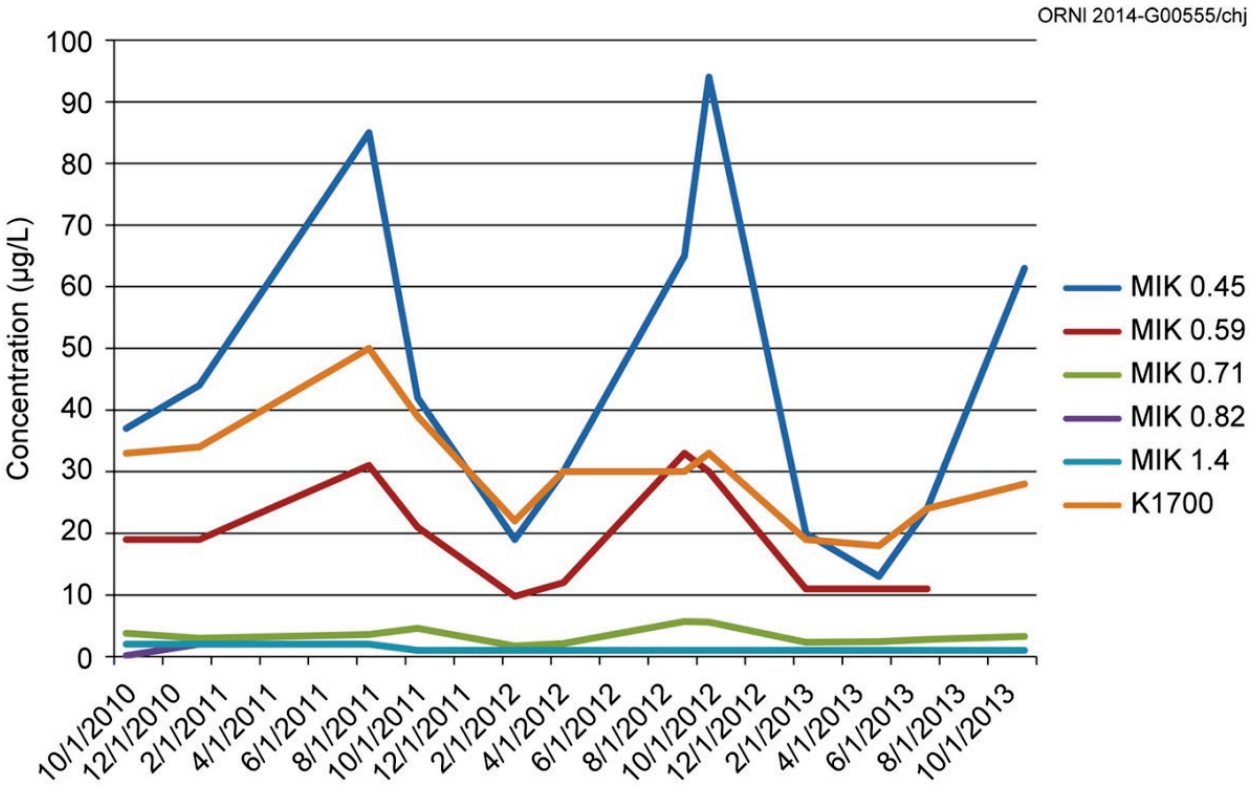


Fig. 3.40. 1,2-dichloroethene concentrations in Mitchell Branch. (MIK = Mitchell Branch kilometer.)

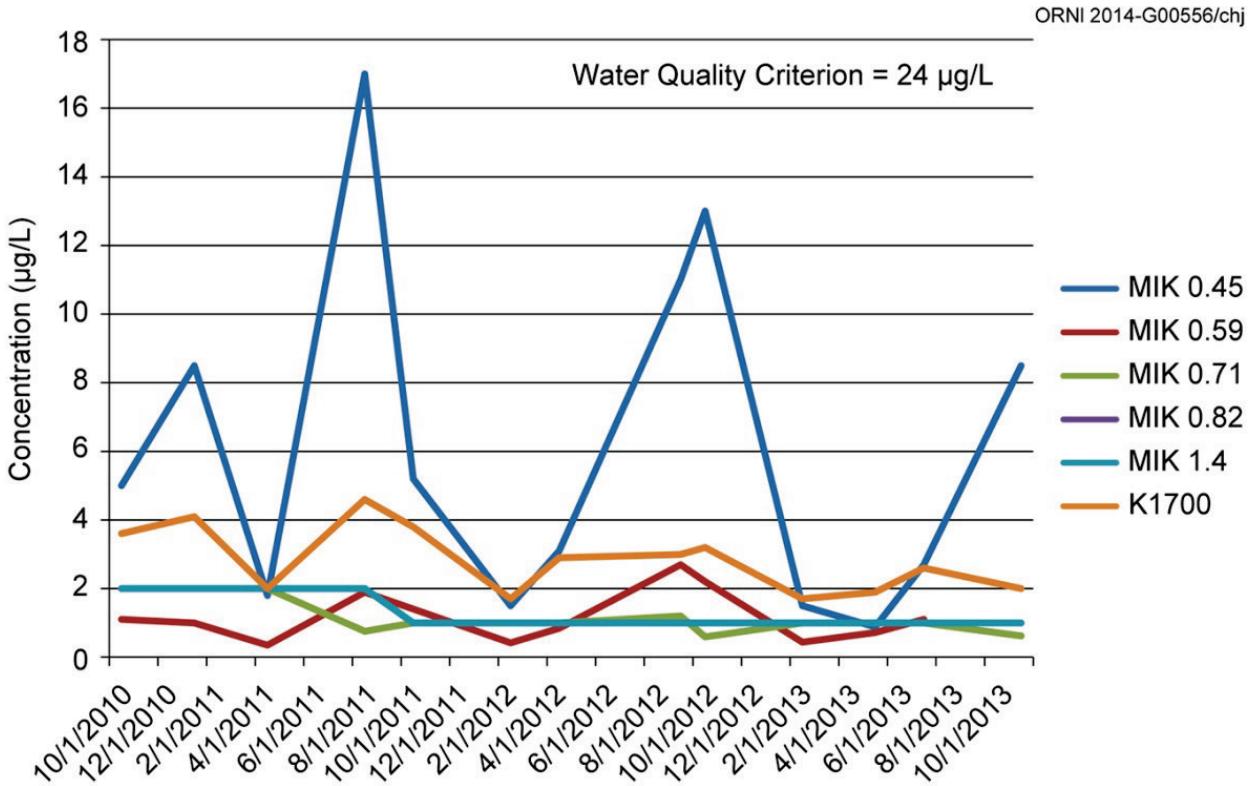


Fig. 3.41. Vinyl chloride concentrations in Mitchell Branch. (MIK = Mitchell Branch kilometer.)

Surface water has been routinely sampled by DOE contractors and TDEC for several years as part of EMPs. The DOE contractor surface water sampling program is conducted in accordance with DOE order surveillance program guidance. In data collected as part of the DOE contractor's sampling effort, dry weather levels of total chromium over the past 10 years (Fig. 3.42) have been shown to be generally less than 10 µg/L or, in some instances, at nondetectable levels. Results from routine surface water monitoring conducted in fall 2006 showed a significant increase in the total chromium level in Mitchell Branch, but it was still below the WQC for total chromium. Sampling performed in the spring of 2007 by DOE contractors and TDEC indicated that chromium levels had increased above the levels found in the fall 2006 sampling. A chromium collection system using two extraction wells and pumps was installed to pump water from the vicinity of storm water outfall SD 170 for treatment at CNF. Since this system was installed, chromium levels in Mitchell Branch have dropped dramatically, with levels of total chromium being routinely measured at less than 3 µg/L.

Samples from Mitchell Branch locations are also analyzed for hexavalent chromium. In 2013, hexavalent chromium levels in Mitchell Branch were all below the detection limit of 6 µg/L.

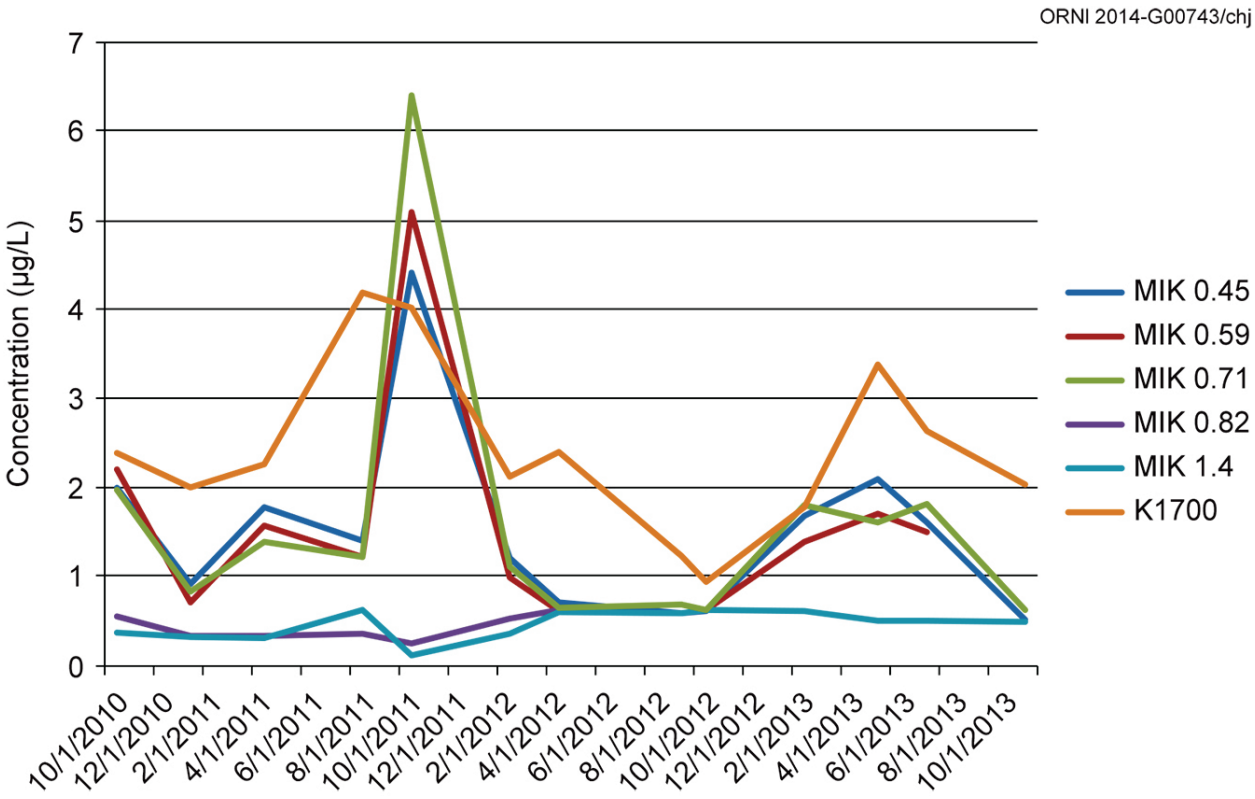


Fig. 3.42. Total chromium concentrations at K-1700. [The water quality criterion for Cr(III), which is hardness dependent, is 74 µg/L, based on a hardness of 100 mg/L. The water quality criterion for Cr(IV) is 11 µg/L. (MIK = Mitchell Branch kilometer.)]

3.6.9 Groundwater Monitoring

3.6.9.1 East Tennessee Technology Park Groundwater Monitoring at Major Site Contaminant Plumes

Extensive groundwater monitoring at the ETTP site has identified VOCs as the most significant groundwater contaminant on the site. To analyze the groundwater contaminant issues at ETTP, the remedial investigation/feasibility study (RI/FS) subdivided the site into several distinct areas—the Mitchell Branch watershed, K-1004 and K-1200 areas, K-27–K-29 area, and K-901 area (Fig. 3.43). The groundwater in each of these areas has significant VOC contamination. The principal chlorinated

hydrocarbon chemicals that were used at ETTP were tetrachloroethene (PCE), TCE, and 1,1-dichloroethane (1,1-DCA).

Figure 3.43 shows the distribution and generalized concentrations of the primary chlorinated hydrocarbon chemicals and their transformation products. Several plume source areas are identified within the regions of the highest VOC concentrations. In these areas, the primary chlorinated hydrocarbons have been present for decades and mature contaminant plumes have evolved. The degree of transformation, or degradation, of the primary chlorinated hydrocarbon compounds is highly variable across the site. In the vicinity of the K-1070-C–K1070-D source, a high degree of degradation has occurred, although a strong source of contamination still remains in the vicinity of the "G-Pit" where about 9,000 gal of chlorinated hydrocarbon liquids were disposed in an unlined pit. Other areas where transformation is significant include the K-1401 acid line leak site and the K-1407-B pond area. Transformation processes are weak or inconsistent at the K-1004 and K-1200 areas, K-1035, K-1413, and the K-1070-A burial ground, and little transformation of TCE is observed in the K-27–K-29 source and plume area.

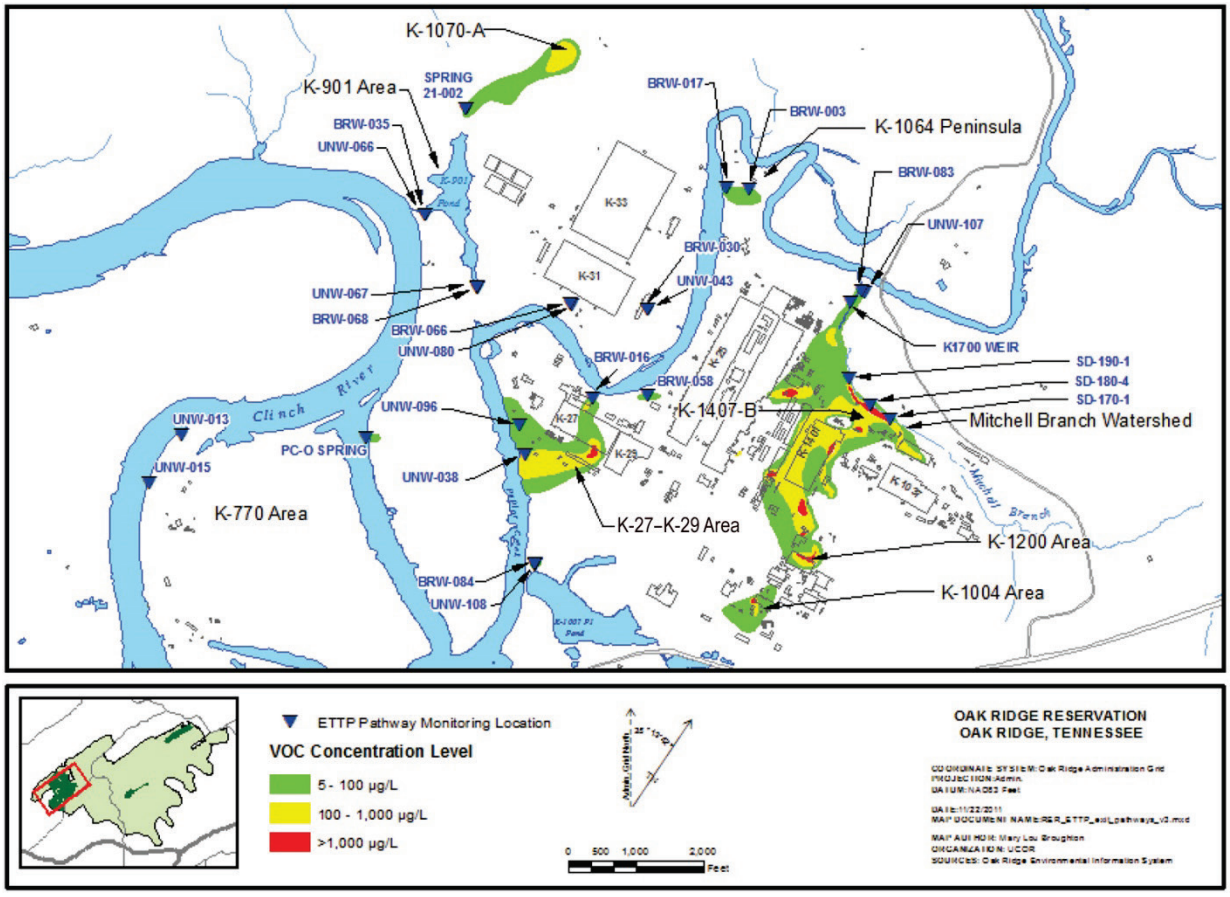


Fig. 3.43. East Tennessee Technology Park exit pathway monitoring locations and associated volatile organic compound (VOC) concentration levels. (BRW = bedrock well, SD = storm drain, and UNW = unconsolidated well.)

3.6.9.2 Exit Pathway Monitoring

Groundwater exit pathway monitoring sites are shown in Fig. 3.43. Groundwater monitoring results for the exit pathways are discussed below starting with the Mitchell Branch exit pathway and then progressing in a counterclockwise fashion.

The Mitchell Branch exit pathway is monitored using surface water data from the K-1700 Weir on Mitchell Branch and two wells: bedrock well 83 (BRW-083) and unconsolidated well 107 (UNW-107). BRW-083 and UNW-107, both located near the mouth of Mitchell Branch (Fig. 3.43), have been

monitored since 1994. Table 3.35 shows the history and concentrations of VOCs detected in the groundwater. 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. No chlorinated VOCs were detected in BRW-083 or UNW-107 during FY 2013.

Table 3.35. Volatile organic compounds detected in groundwater in the Mitchell Branch exit pathway[a,b]

Well	Date	cis-1,2-Dichloroethene	Tetrachloroethene	Trichloroethene	Vinyl chloride
BRW-083	8/29/2002	ND	**5**	**28**	ND
	3/16/2004	0.69	2.2	**9.9**	ND
	8/26/2004	2	4.7	**20**	ND
	3/14/2007	5	**9**	**28**	ND
	3/20/2008	ND	ND	ND	ND
	8/21/2008	ND	ND	ND	ND
	3/12/2009	ND	ND	1.31 J	ND
	8/3/2009	ND	2.66	**14.2**	ND
	3/3/2010	ND	ND	ND	ND
	8/30/2010	3.6	**5.1**	**18**	ND
	3/15/2011	2.8	**6.7**	**22**	ND
	8/10/2011	ND	ND	**ND**	ND
	3/1/2012	ND	ND	ND	ND
	8/16/2012	ND	ND	ND	ND
UNW-107	8/3/1998	ND	ND	3	ND
	8/26/2004	4.7	ND	3.6	ND
	8/21/2006	3.4	**14**	2	1.2
	3/13/2007	25	2 J	**23**	2[c]
	8/21/2007	17	ND	**30**	0.3 J
	3/5/2008	ND	ND	ND	ND
	8/18/2008	ND	ND	ND	ND
	3/12/2009	ND	ND	ND	ND
	7/30/2009	ND	ND	ND	ND
	3/4/2010	ND	ND	ND	ND
	7/28/2010	ND	ND	ND	ND
	3/16/2011	ND	ND	ND	ND
	8/11/2011	ND	ND	ND	ND
	3/20/2012	ND	ND	ND	ND
	9/12/2012	ND	ND	ND	ND

[a]All concentrations in micrograms per liter (µg/L).
[b]**Bold** table entries exceed Safe Drinking Water Act maximum contaminant level screening values (tetrachloroethene and trichloroethene = 5 µg/L, cis-1,2- dichloroethene = 70 µg/L, vinyl chloride = 2 µg/L).
[c]Detection occurred in a field replicate. Constituent not detected in regular sample.

Acronyms and Abbreviations
BRW = bedrock well
J = estimated value
ND = Not Detected
UNW = unconsolidated well

BRW-003 and BRW-017 (Fig. 3.43) monitor groundwater at the K-1064 peninsula burn area. Figure 3.44 shows the history of VOC concentrations in groundwater from these wells from FY 1994 through FY 2013. TCE concentrations have declined in both wells over that time period. TCE was present at concentrations less than the maximum contaminant level (MCL) during FY 2013 at BRW-017 and was not detected in either sample from well BRW-003. 1,1,1-trichloroethane (TCA) also declined to undetectable concentrations in BRW-003. Cis-1,2-DCE was detected at concentrations much less than its MCL in both semiannual samples in BRW-017.

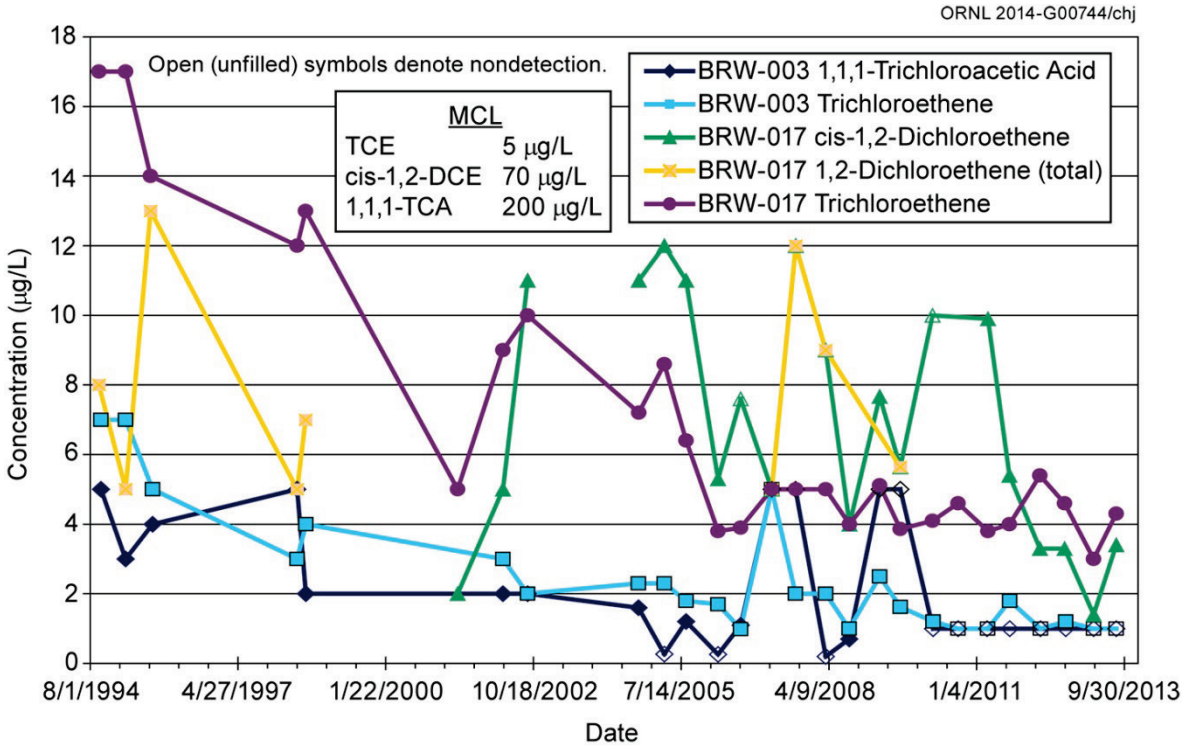


Fig. 3.44. Volatile organic compound concentrations in groundwater at the K-1064 peninsula area. (BRW = bedrock well, DCE = dichloroethene/dichloroethylene, MCL= maximum contaminant level, TCA = trichloroethane, TCE = trichloroethene/trichloroethylene.)

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, as shown on Fig. 3.43. VOCs are not contaminants of concern (COCs) in this area; however, leaks of recirculated cooling water in the past have left residual subsurface chromium contamination. Figure 3.45 shows the history of chromium detection in wells in the K-31–K-33 area. UNW-043 exhibits the highest residual chromium concentrations of any of the wells in the area. Chromium concentrations in UNW-043 correlate with the turbidity of samples, and acidification of unfiltered samples that contain suspended solids often causes detection of high metals content because the addition of acid preservative releases metals that are adsorbed to the solid particles at the normal groundwater pH. During FY 2006, an investigation was conducted to determine whether groundwater in the vicinity of the K-31 and K-33 buildings contained residual hexavalent chromium from recirculated cooling water leaks. The data indicated the chromium in groundwater near the leak sites was essentially all the less toxic trivalent species. From FY 2008 through FY 2012, field-filtered (i.e., dissolved) and unfiltered samples were collected from UNW-043. Chromium concentrations in the field-filtered samples were consistently much less than the MCL. During FY 2013, both field-filtered and unfiltered samples were collected from BRW-066, UNW-043, and UNW-080. In FY 2013, the chromium concentrations in unfiltered samples from UNW-080 decreased significantly and were nearly the same as concentrations in the filtered sample. Chromium was not detected in the August 2013 filtered samples from UNW-043. Chromium was not detected in any samples from well BRW-066.

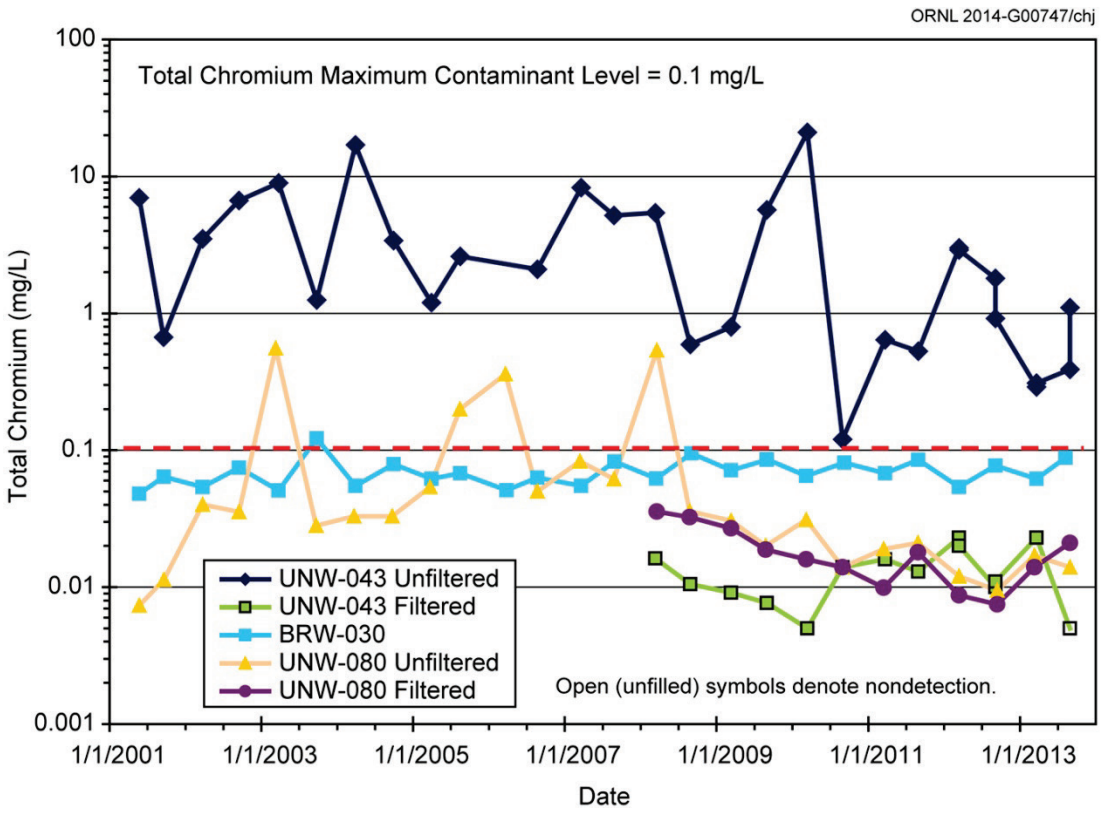


Fig. 3.45. Chromium concentrations in groundwater in the K-31–K-33 area.
(BRW = bedrock well and UNW = unconsolidated well.)

Several exit pathway wells are monitored in the K-27–K-29 area, as shown on Fig. 3.43. Figure 3.46 provides concentrations of detected VOCs in wells both north and south of K-27 and K-29 through FY 2013. The source of VOC contamination in BRW-058 is not suspected to be from K-27–K-29 area operations. With the exception of cis-1,2-DCE in well BRW-058, which appears stable to slightly increasing but remains less than its MCL, the VOC concentrations in this area show slowly declining concentrations. At BRW-016, TCE was detected in one of two samples at a concentration of 1 µg/L, levels of cis-1,2-DCE are much less than the MCL, and vinyl chloride has not been detected since 2009. TCE levels in well UNW-038 fluctuate between 10 to 20 times the MCL and continue a gradual decreasing trend.

BRW-084 and UNW-108 are exit pathway monitoring locations at the northern edge of the K-1007-P1 holding pond (see Fig. 3.43). These wells were monitored intermittently from 1994 through 1998 and semiannually from FY 2001 through FY 2013. The first detections of VOCs in these wells occurred during FY 2006 with detection of low (~10 µg/L or less) concentrations of TCE and cis-1,2-DCE. The source area for these VOCs is not known. VOCs were not detected in either of these wells during FY 2013. Metals have been detected in the past associated with the presence of high turbidity in the samples. During FY 2013, a single arsenic detection (5.7 µg/L) occurred in a filtered aliquot collected from BRW-084 in August. Cadmium was detected (< 1 µg/L) in both the filtered and unfiltered aliquots collected from UNW-108 in August. Aluminum exceeded its secondary MCL in the unfiltered sample from BRW-084 in March and from the unfiltered aliquots from both sample dates at UNW-108. Aluminum was not detectable in any of the filtered aliquots during FY 2013, which indicates turbidity in the samples was the source. Iron exceeded its secondary drinking water standard in one of the unfiltered aliquots from both wells during FY 2013 semiannual sampling events but was not detectable or did not exceed the secondary standard in the field-filtered aliquot. Manganese exceeded its secondary drinking water standard in both the filtered and unfiltered samples from UNW-108 in the fourth quarter sampling

event. No other primary or secondary MCLs for metals were exceeded in sample aliquots that were field-filtered before acid preservation during FY 2013.

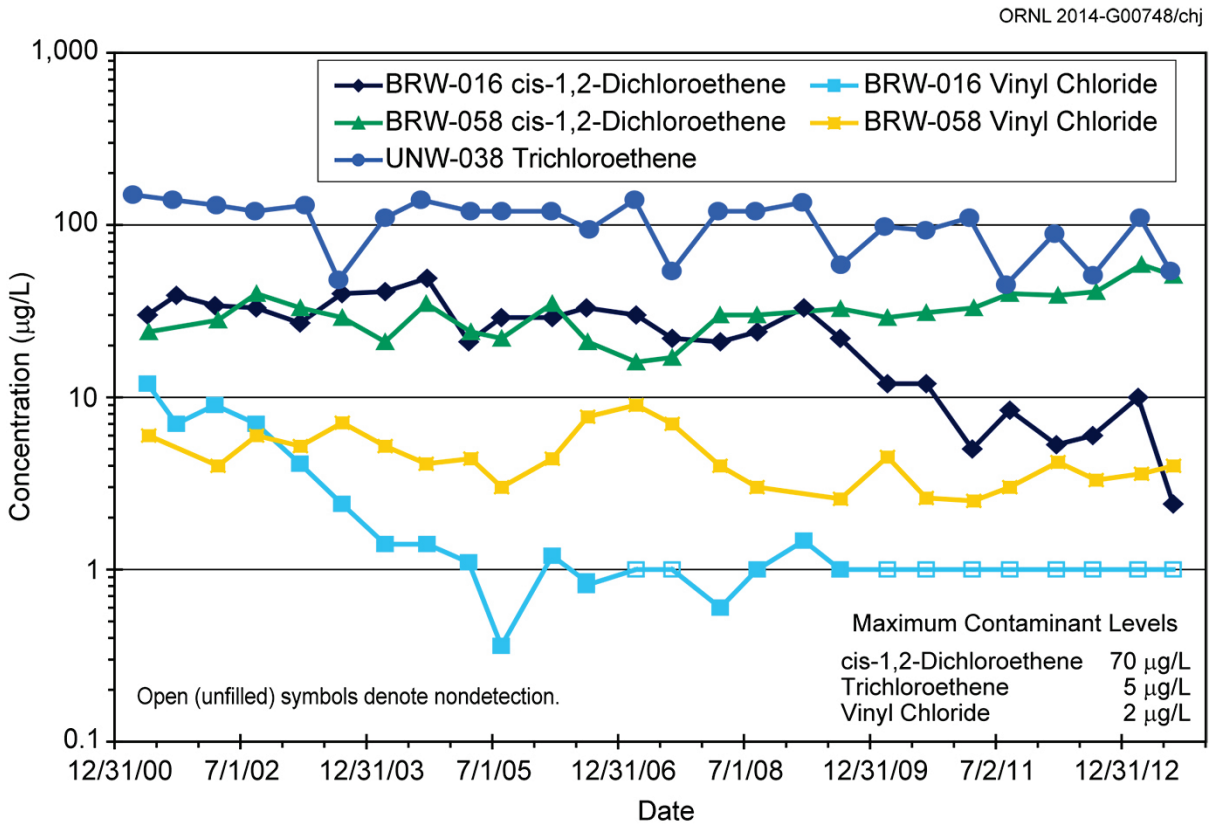


Fig. 3.46. Detected volatile organic compound concentrations in groundwater exit pathway wells near K-27 and K-29. (BRW = bedrock well and UNW = unconsolidated well.)

Exit pathway groundwater in the K-901-A holding pond area (see Fig. 3.43) is monitored by four wells (BRW-035, BRW-068, UNW-066, and UNW-067) and two springs (21-002 and PC-0). Very low concentrations (< 5 µg/L) of VOCs are occasionally detected in wells adjacent to the K-901-A holding pond. However, these contaminants are not persistent in groundwater west and south of the pond. No VOCs were detected in the K-901-A holding pond exit pathway wells during FY 2013. Alpha activity in UNW-066 was about 25 pCi/L in the March 2013 sample but was not detected in the July sample. Beta activity levels were less than the 50 pCi/L screening level.

TCE is the most significant groundwater contaminant detected in the springs, and the historic TCE concentrations are shown in Fig. 3.47. Spring PC-0 was added to the sampling program in 2004. During the spring through autumn seasons, spring PC-0 is submerged beneath the level of Watts Bar Lake, so this location is accessible for sampling only during winter when the lake level is lowered by TVA. The contaminant source for the PC-0 spring is presumed to be disposed waste at the K-1070-F site. The TCE concentrations in PC-0 have varied between about 9 and 26 µg/L and appear to have decreased from their highest measured value in 2006 to concentrations about 2 times the drinking water standard. At spring 21-002, 1,1,1-TCA, 1,2-DCE, carbon tetrachloride, and TCE are sometimes present at concentrations typically less than 5 µg/L. The TCE concentration at spring 21-002 tends to vary between 5 and about 25 µg/L, and this variation appears to be related to variability in rainfall, which affects groundwater discharge from the K-1070-A VOC plume. During FY 2013, TCE was detected below its MCL in the March sample and at about twice the MCL in the August sample. Alpha activity was not detected in either sample, and beta activity was present at less than 10 pCi/L. Technetium-99 was not detected in either sample during FY 2013.

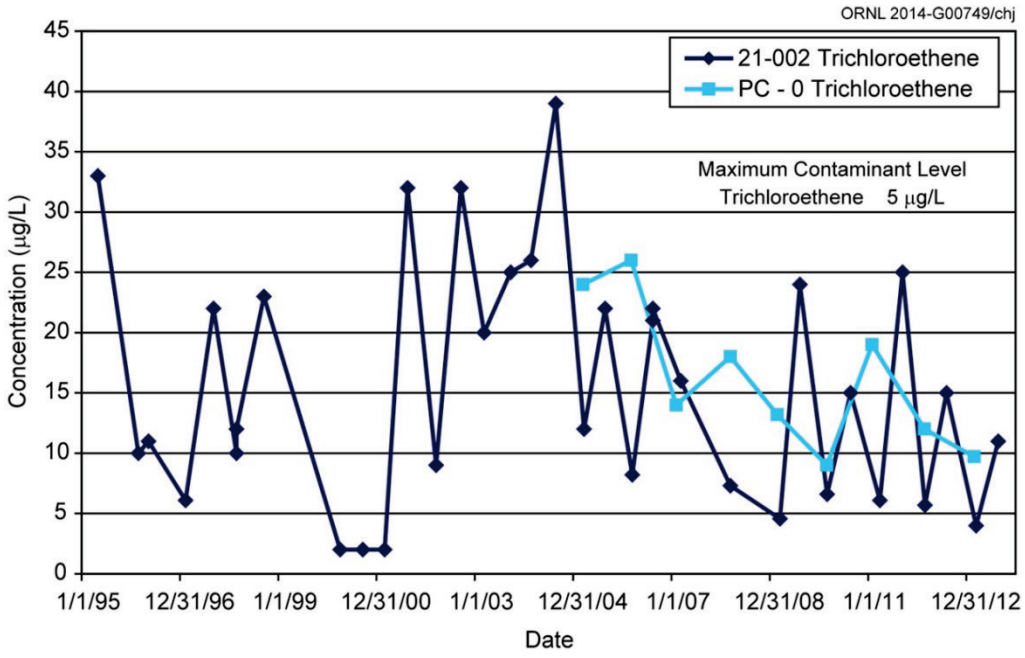


Fig. 3.47. Trichloroethene concentrations in K-901 area springs.

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 (see Fig. 3.43). Site access to UNW-015 was restored during FY 2013. Measured alpha and beta activity levels were below MCL levels during FY 2013. Figure 3.48 shows the history of measured alpha and beta activity in this area. Analytical results indicate that the alpha activity is largely attributable to uranium isotopes, and UNW-013 historically contained ^{99}Tc, a strong beta-emitting radionuclide responsible for the elevated beta activity in that well. The alpha and beta activity levels in well UNW-015 show a significant decrease since the most recent previous sample collected in 2010.

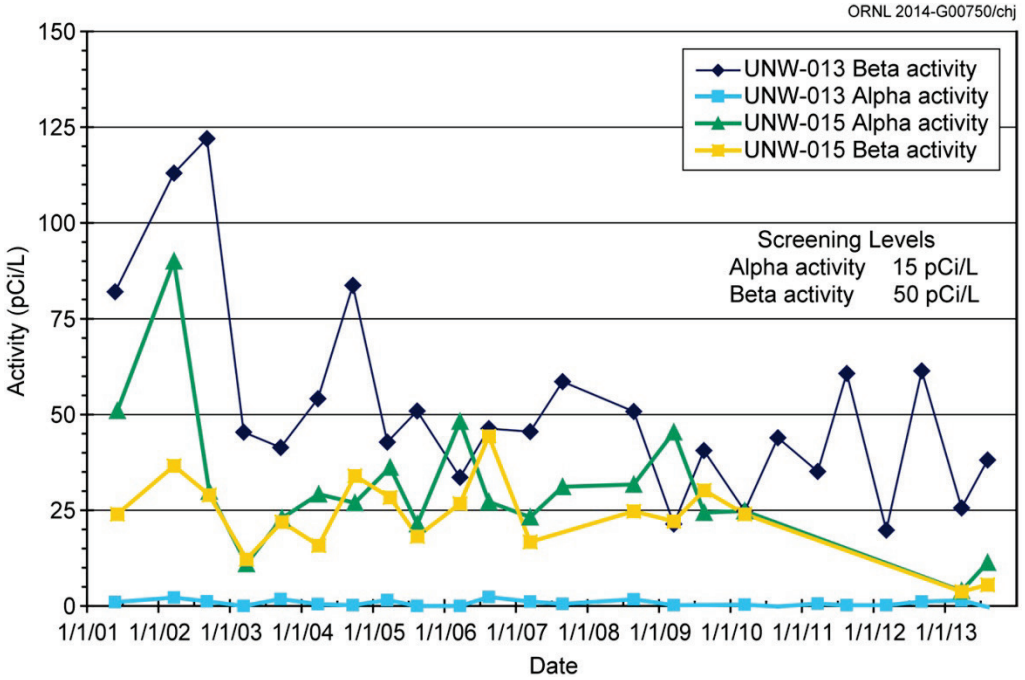


Fig. 3.48. History of measured alpha and beta activity in the K-770 area.
(UNW = unconsolidated well.)

3.6.9.3 Groundwater Sampling Adjacent to Potential Source Areas

Additional monitoring of groundwater adjacent to potential sources of groundwater contamination, including the K-1070-C/-D burial ground, was conducted to monitor trends (DOE 2005). Monitoring will continue until a final Zone 2 ROD is approved.

3.6.9.4 Groundwater Sampling in the K-1407-B and K-1407-C Ponds Area

The *Remedial Action Report for the K-1407-B Holding Pond and the K-1407-C Retention Basin, Oak Ridge, Tennessee* (DOE 1995) proposes semiannual groundwater monitoring for nitrate, metals, and selected radionuclides, including gross alpha and beta activity, ^{99}Tc, ^{90}Sr, ^{137}Cs, ^{230,232}Th, and ^{234,238}U. However, VOCs are the primary groundwater contaminant in the Mitchell Branch area of ETTP. Remediation target concentrations were not established in the CERCLA decision documents for use in post-remediation monitoring. As recommended by EPA, with concurrence from TDEC, performance monitoring is conducted in wells UNW-003, UNW-009, and the Mitchell Branch weir (K-1700 weir), shown on Fig. 3.49.

The primary groundwater contaminants in the K-1407-B and -C ponds area are VOCs, which are widespread in this portion of ETTP, including contaminant sources upgradient of the ponds. Groundwater samples were collected at UNW-003 and UNW-009 in March and August/September 2013. Monitoring results for FY 2013 at the wells are generally consistent with results from previous years. Although VOC concentrations remain high in UNW-003, located downgradient of the former K-1407-B Pond, the FY 2013 concentrations were somewhat lower than those measured during FY 2012. Significant concentrations of parent compounds PCE (210 to 300 µg/L) and TCE (1,800 to 2,400 µg/L) and the degradation products 1,1-DCE (360 to 480 µg/L), 1,1-DCA (380 to 590 µg/L), cis-1,2-DCE (1,000 to 1,700 µg/L), and VC (27 to 55 µg/L) were detected at UNW-003 in FY 2013. The detection of VOCs at concentrations well above 1,000 µg/L and the steady concentrations over recent years suggest the possible presence of dense nonaqueous phase liquids (DNAPLs) in the vicinity of UNW-003. The Zone 2 final ROD will address groundwater contamination present in the area of the former ponds.

Gross alpha activity was detected at 4.51 pCi/L in March and at 5 pCi/L in August at UNW 003 and was not detected at UNW 009 in either the March or September sampling events. Gross beta activity ranged from 14.4 to 19.1 pCi/L at UNW 003. Gross beta activity was detected at 5.24 pCi/L in March and at 4.28 pCi/L in September at UNW 009. The radionuclide 99Tc was detected at 13.1 pCi/L in March and at 15.1 pCi/L in August in UNW-003 and was not detected in either sampling round at UNW-009. Uranium 234 and uranium-238 were not detected at UNW-009 in either sampling round and were not detected in March at UNW-003 but were detected at 4.69 pCi/L and 1.79 pCi/L in August. None of the metals having primary drinking water standards exceeded those levels. Iron was elevated above its secondary drinking water standard in both filtered and unfiltered samples from UNW-009 and in only the unfiltered samples from UNW 003. Manganese exceeded its secondary drinking water standard in both filtered and unfiltered aliquots from both wells during both sampling events. The elevated manganese and iron levels are likely caused by chemical reduction in the local groundwater induced by reductive dehalogenation of VOCs.

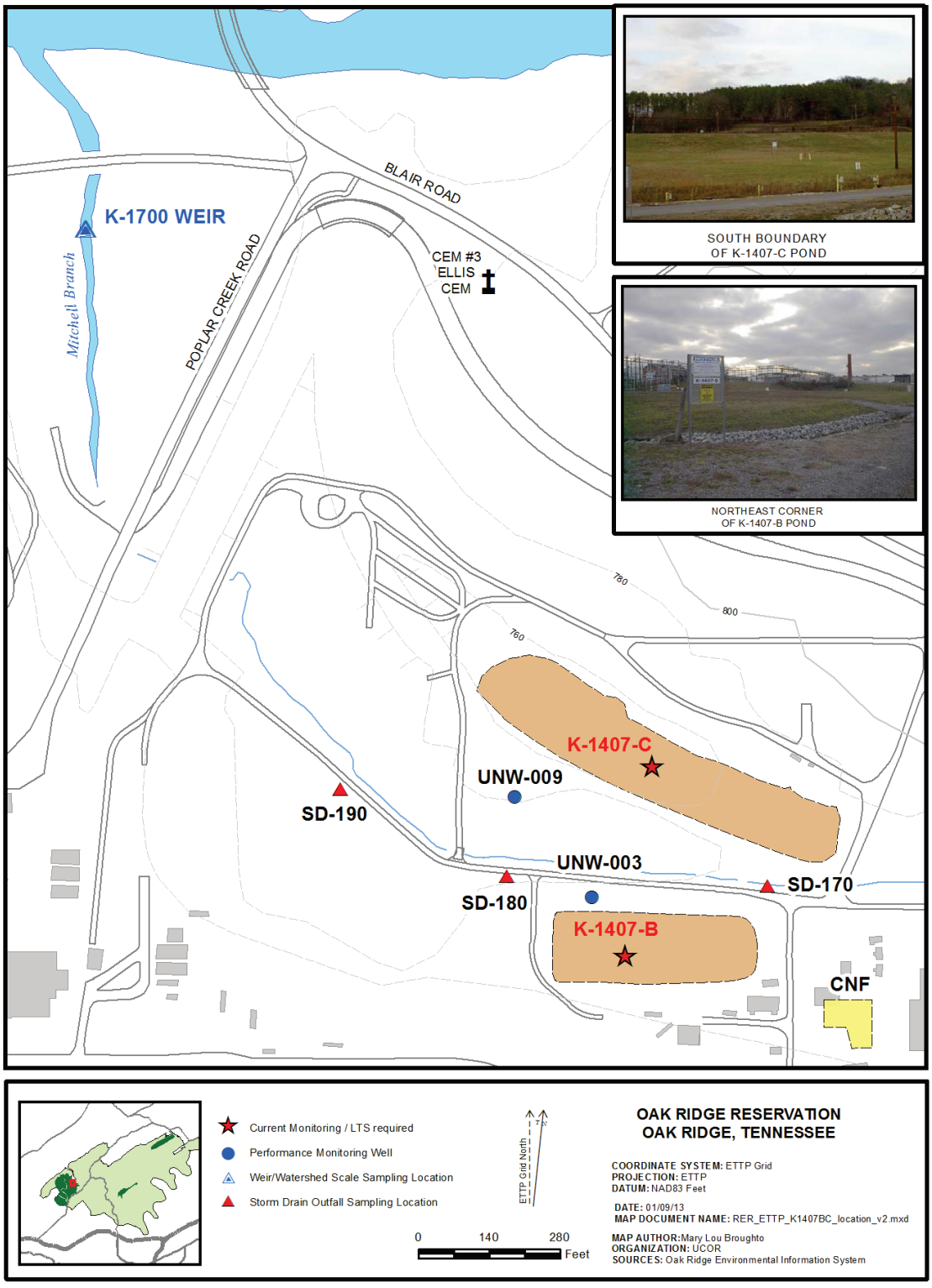


Fig. 3.49. Location of K-1407-B and K-1407-C ponds. (CEM = cemetery, CNF = Central Neutralization Facility, SD = storm drain, and UNW = unconsolidated well.

3.6.9.5 Groundwater Sampling Summary

Groundwater monitoring results in FY 2013 are generally consistent with the results from previous years. VOC concentrations well above 1,000 µg/L and the steady concentrations over recent years suggest the presence of DNAPLs in the vicinity of UNW-003. None of the metals having primary drinking water standards exceeded those values. Some of the iron and manganese concentrations exceeded secondary drinking water standards, possibly the result of chemical reduction induced by reductive dehalogenation of VOCs.

3.7 Biological Monitoring

The ETTP BMAP consists of three tasks designed to evaluate the effects of ETTP operations on the local environment, identify areas where abatement measures would be most effective, and test the efficacy of the measures. These tasks are (1) toxicity monitoring of effluent and ambient waters from several locations within Mitchell Branch, (2) bioaccumulation studies, and (3) instream monitoring of biological communities. Figure 3.50 shows the major water bodies at ETTP, and Fig. 3.51 shows the BMAP monitoring locations along Mitchell Branch.

In spring (April–May) and fall (October–November) of 2013, survival and reproduction toxicity tests using the water flea *Ceriodaphnia dubia* (Fig. 3.52) were conducted at five ambient locations in Mitchell Branch. At the same time, survival and reproduction toxicity tests using *C. dubia* were conducted on effluent from storm water outfalls SD 170 and SD 190. In none of the 2013 tests was toxicity demonstrated (Table 3.36). This continues the trend of the last several tests, where toxicity has been greatly reduced or absent entirely.

The bioaccumulation task includes monitoring of caged clams (*Corbicula fluminea*) placed at selected locations around ETTP and the collection and analysis of fish from Mitchell Branch and three major ponds on the site. Both clams and fish from uncontaminated off-site locations are also analyzed as points of reference. While historically the primary COC for the bioaccumulation task at ETTP has been PCBs, in recent years mercury has been added to the list of COCs at selected locations.

In 2013, the clams (Fig. 3.53) were allowed to remain in place for 4 weeks and were then analyzed for total PCBs (Table 3.37) and, in a subset of clams, for total mercury and methyl mercury (Table 3.38). In 2013, the greatest concentrations of PCBs were found in the clams from storm water outfall SD 190 and downstream of that location in Mitchell Branch.

Clams from the Mitchell Branch watershed were analyzed for mercury (both total mercury and methyl mercury) in 2013 (Table 3.38). The highest mean total mercury concentrations were found in the clams from the K-1203-10 sump (318.3 ng/g). Clams from the section between K-1700 and storm water outfall SD 190 also had higher levels, with concentrations of total mercury in the caged clam composite samples ranging from a low of 87.7 ng/g to a high of 210.7 ng/g. At other sites mercury concentrations in clams ranged from at or near reference values to twofold higher (~25 to 50 ng/g).

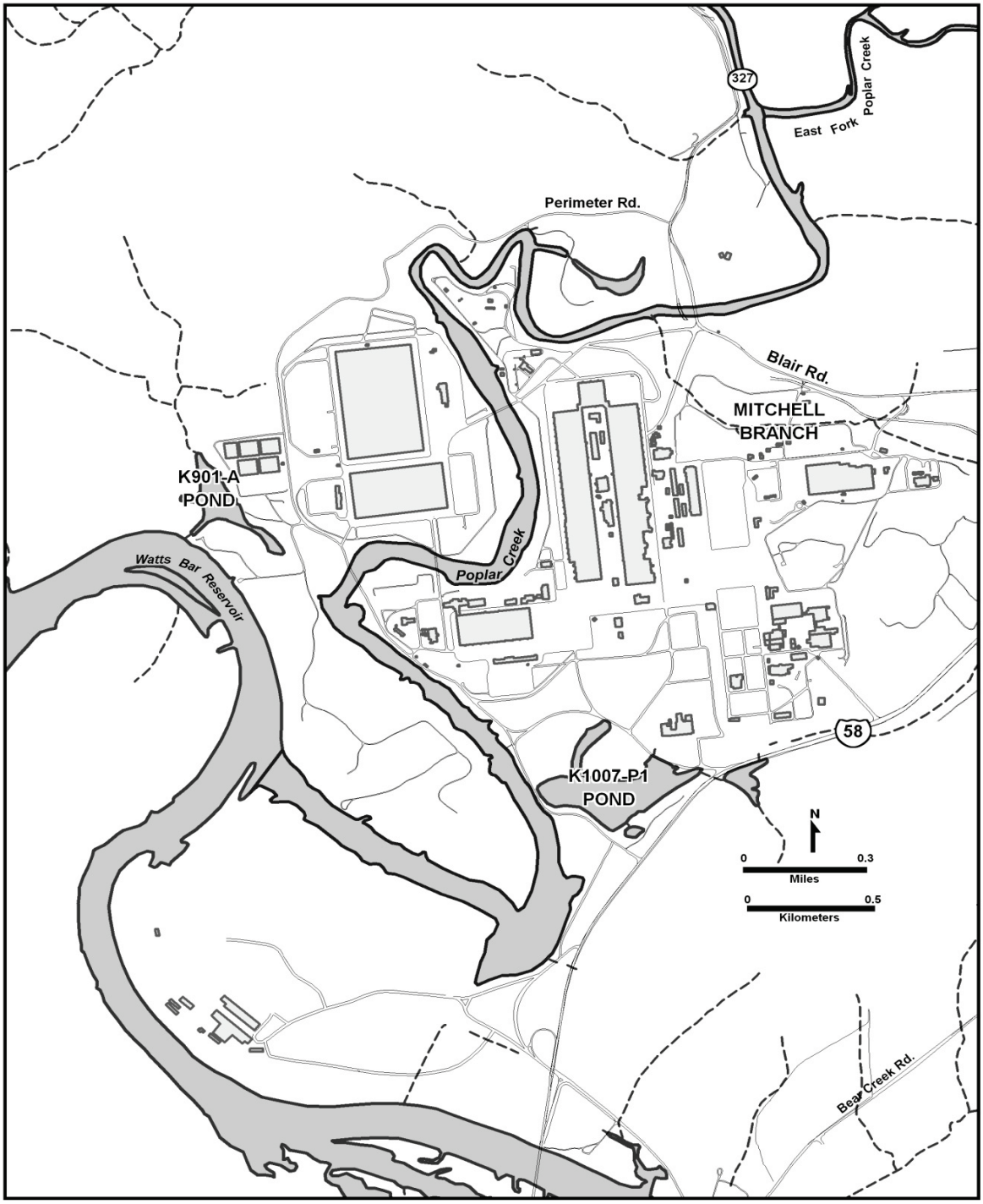


Fig. 3.50. Water bodies at the East Tennessee Technology Park.

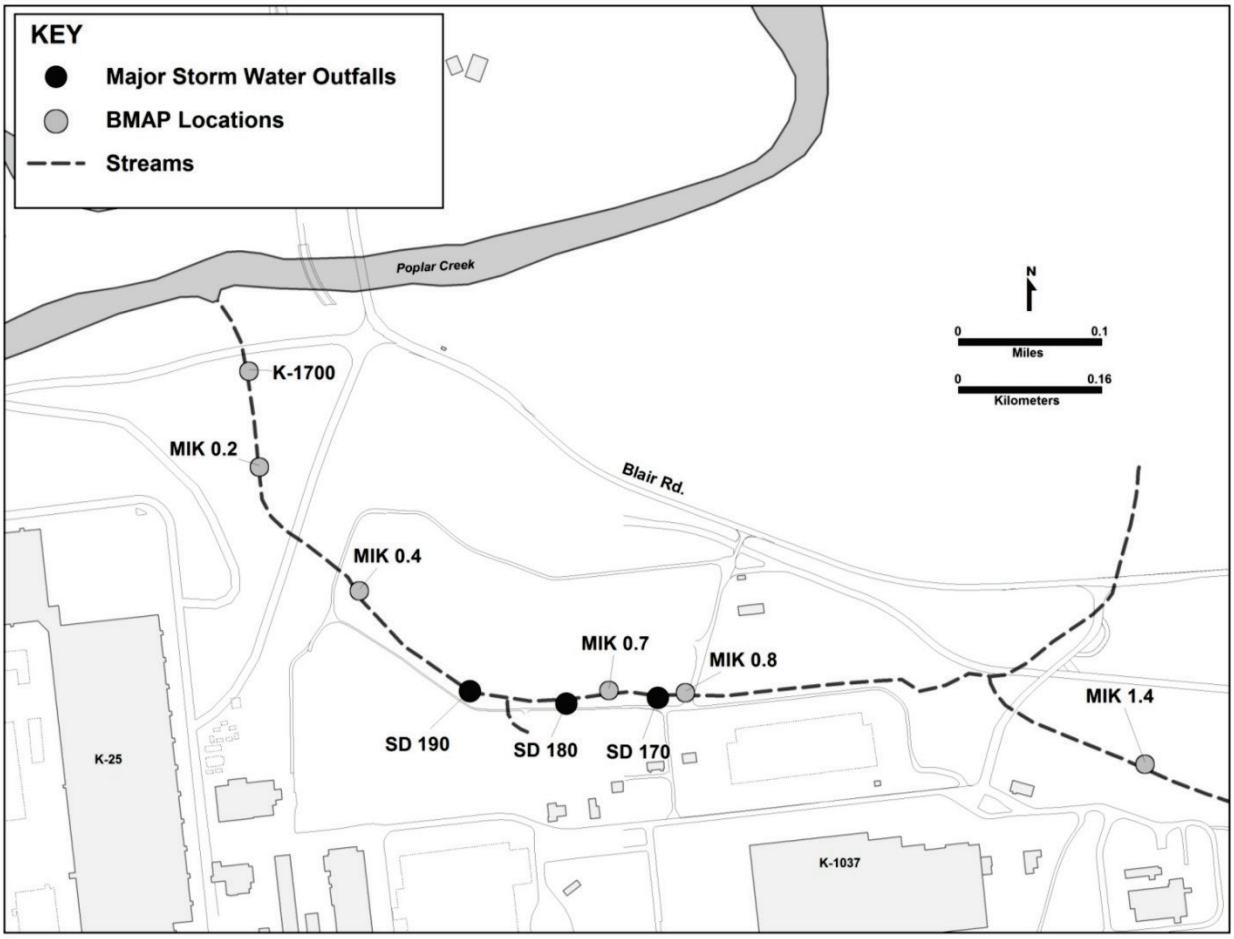


Fig. 3.51. Major storm water outfalls and biological monitoring locations on Mitchell Branch. (BMAP = Biological Monitoring and Abatement Program, MIK = Mitchell Branch kilometer, and SD = storm drain.)

Fig. 3.52. Water flea *(Ceriodaphnia dubia)*.

Table 3.36. Toxicity test results for Mitchell Branch and associated storm water outfalls, 2013 (no-observed-effects concentrations)[a]

Season	Test	MIK 1.4	MIK 0.8	SD 170	MIK 0.7	SD 190	MIK 0.4	MIK 0.2
Spring	*Ceriodaphnia dubia* survival (%)	100	100	100	100	100	100	100
	C. dubia reproduction (%)	100	100	100	100	100	100	100
Fall	*C. dubia* survival (%)	100	100	100	100	100	100	100
	C. dubia reproduction (%)	100	100	100	100	100	100	100

[a]Highest tested concentrations of effluent or stream water that had no effect on either survival or reproduction of *C. dubia* in three-brood static renewal tests (EPA test method 1002.0).

Acronyms
MIK = Mitchell Branch kilometer
SD = storm drain

Fig. 3.53. Asiatic clam (*Corbicula fluminea*).

Table 3.37. Compiled data for polychlorinated biphenyl concentrations (µg/g, wet weight) in caged Asiatic clams (*Corbicula fluminea*), 2009 to 2013

Site	Basket[a]	2009	2010	2011	2012	2013
		Mitchell Branch				
MIK 0.8 (above SD 170)	A	0.09	0.12	0.11	0.04	0.05
	B	0.11	0.13	0.15	0.04	0.04
SD 170	A	0.27	0.21	0.16	0.08	0.12
	B	0.25	0.28	0.16	0.15	0.13
MIK 0.7 (below SD 170)	A	0.18	0.15	0.13	0.08	0.07
	B	0.15	0.13	0.17	0.07	0.09
MIK 0.5 (below SD 180)	A	0.25	0.15	0.13	*b*	0.09
	B	0.20	0.17	0.16	*b*	0.11

Table 3.37. (continued)

Site	Basket[a]	2009	2010	2011	2012	2013
SD 190	A	2.07	1.22	2.36	0.84	2.13
	B	1.98	1.09	1.70	*b*	2.51
MIK 0.4 (below SD 190)	A	0.90	1.28	1.71	0.41	1.70
	B	0.78	2.69	1.82	0.5	2.00
SD195	A	—	—	—	0.37	—
	B	—	—	—	0.31	—
MIK 0.3	A	—	2.93	6.74	2.52	1.80
	B	—	3.42	4.56	2.74	2.20
MIK 027	A	—	—	4.42	—	—
	B	—	—	4.94	—	—
MIK 0.2	A	2.43	2.15	5.33	0.96	2.20
	B	2.42	2.13	4.82	1.41	2.40
K-1700	A					2.10
	B					2.30
SD 992	A	—	2.93	—	—	—
	B	—	3.42	—	—	—
		Poplar Creek				
K-1203 sump	A	—	—	—	0.34	0.20
	B	—	—	—	0.29	0.23
		K-1007-P1 Pond				
SD 100 (upper)	A	0.96	0.29	2.25	1.69	0.10
	B	0.69	0.22	1.75	1.70	0.09
SD 100 (lower)	A	1.32	0.72	5.95	*b*	0.42
	B	1.72	0.80	4.50	1.92	1.35
SD 120	A	0.34	3.06	0.75	0.11	0.28
	B	0.57	1.18	0.97	0.16	0.34
SD 490	A	0.40	0.37	0.39	0.19	0.18
	B	0.46	0.47	0.46	0.17	0.18
K1007 P1 outfall	A	0.91	—	—	—	1.29
	B	0.85	—	—	—	1.30
P1	A	0.86	0.99	1.38	1.48	—
	B	1.17	0.91	1.68	1.57	—
		K-901-A Pond				
K-901-A outfall	A	0.14	0.06	0.30	0.07	0.11
	B	0.16	0.05	0.20	0.07	0.16
		Reference Site				
Sewee Creek	A	0.02	0.01	0.00	0.01	0.004
	B	0.02	0.01	0.01	0.003	0.002

[a]Sample result is the reported concentration in the composited clam sample from each cage, where A and B denote replicates. Data were extracted from tables within the 2009, 2010, 2011, 2012, and 2013 East Tennessee Technology Park Biological Monitoring and Abatement Program fiscal year reports.

[b]Insufficient numbers of clams survived to provide a suitable sample size for analysis.

MlK = Mitchell Branch kilometer, SD = storm drain.

Table 3.38. Compiled data for mercury concentrations (ng/g, wet weight) in caged Asiatic clams (*Corbicula fluminea*), 2010 to 2013

Site	Basket[a]	2011	2012	2013 Total Hg	2013 Methyl Hg
		Mitchell Branch			
MIK 0.8 (above SD 170)	A	37	31.9	33.5	7.6
	B	46.9	32.2	32.1	7.8
SD 170	A	67.2	88.7	34.2	3.9
	B	80.7	62.3	38.9	5.9
MIK 0.7 (below SD 170)	A	37.7	46.2	33.5	6.5
	B	64.8	48.8	33.3	4.8
MIK 0.5 (below SD 180)	A	97.2	51.4	48.7	8.9
	B	154.8	*b*	49.6	8.7
SD 190	A	109.9	127.8	187.8	4.3
	B	80.7	270	210.7	7.9
MIK 0.4 (below SD 190)	A	114	85	113.1	18.2
	B	102.3	104.8	107.1	13.3
SD 195	A		88.1	—	
	B		79.5	—	
MIK 0.3	A		311.7	116.6	12
	B		322.6	125.8	15.3
MIK 0.2	A	166.3	115.9	100.1	13.8
	B	187.9	136.6	105.9	18.2
K-1700	A			87.7	14.4
	B			88.3	16.7
		Poplar Creek			
K-1203-10 sump	A	—	472.3	298.8	14.0
	B	—	336.2	337.8	10.6
		K-1007-P1 Pond			
P1	A	23	25.6	19.0	
	B	22.6	14.5	22.4	
		K-901-A Pond			
K-901-A outfall	A	33.1	17.4	18.9	
	B	46.4	27.6	25.8	
		K-1203-10			
SD 05A	A		472.3		
	B		336.2		
SD 992	A				
	B				
		Reference Site			
Little Sewee Creek	A	19.6	25.2	24.4	
	B	27.2	19.1	26.7	

[a]Sample result is the reported concentration in the composited clam sample from each cage, where A and B denote replicates. Data are extracted from tables within the 2010, 2011, 2012, and 2013 East Tennessee Technology Park Biological Monitoring and Abatement Program fiscal year reports.

[b]Insufficient numbers of clams survived to provide a suitable sample size for analysis.

MlK = Mitchell Branch kilometer, SD = storm drain.

Bioaccumulation monitoring in the K-1007-P1 pond, K-901-A pond, K-720 slough, and Mitchell Branch involves sampling of fish (Fig 3.54) and analyzing the tissues for PCB concentrations (Table 3.39). Typically, fillets of game fish are used as a monitoring tool to assess human health risks, while whole body

composites of forage fish are used to assess ecological risks associated with exposure to PCBs. Target species vary from site to site depending upon the ecological conditions and, thus, the available species. The target species for bioaccumulation monitoring in 2013 in the K-1007-P1 pond was bluegill sunfish (*Lepomis macrochirus*) (Fig. 3.55). In Mitchell Branch, the target species was the redbreast sunfish (*Lepomis auritus*). In the K-901-A pond and the K-720 slough, the target species were the gizzard shad (*Dorosoma cepedianum*) and largemouth bass (*Micropterus salmoides*). As there were not enough largemouth bass, carp (*Cyprinus carpio*) and smallmouth buffalo (*Ictiobus bubalus*) were also collected.

Fig. 3.54. Fish bioaccumulation sampling at K-1007-P1 pond.

Table 3.39. Polychlorinated biphenyl levels (mg/kg)[a] in fish samples at East Tennessee Technology Park, 2009 to 2013[b]

Site	Fish species	2009	2010	2011	2012	2013
Mitchell Branch	Redbreast sunfish	0.99 + 0.47	1.17 + 0.13	1.12 + 0.21	1.67+ 0.16	1.29+ 0.38
K-901-A pond	Largemouth bass	0.48 + 0.12	--	0.50 + 0.08	0.72+ 0.10	1.40+ 0.19
K-901-A pond	Common carp	—	0.71 + 0.20	2.06 + 0.25	3.08+ 0.20	2.94+ 0.33
K-901-A pond	Gizzard shad				4.82+0.38	8.86+0.58
K-1007-P1 pond	Largemouth bass	14.85 + 5.44	0.30 + 0.05	—	—	—
K-1007-P1 pond	Bluegill sunfish	—	2.13 + 0.16	1.85 + 0.31	2.16+ 0.26	0.70+ 0.08
K-1007-P1 pond	Bluegill sunfish (whole body composites)				9.25+0.05	4.45+0.25
Hinds Creek	Redbreast sunfish	0.0007 + 0.0004	0.09 + 0.05	0.06 + 0.001	<0.06	<0.06
K-720 slough	Largemouth bass	—	—	0.24 + 0.02	0.22+ 0.10	0.14+ 0.02
K-720 slough	Smallmouth buffalo	—	—	0.77 + 0.19	0.68+ 0.19	0.44+ 0.10
K-720 slough	Common carp	—	—	0.96 + 0.21	0.31+ 0.03	0.45+ 0.12
K-720 slough	Gizzard shad (whole body composites)					0.57+0.04

[a]Milligrams per kilogram (mg/kg) are equivalent to micrograms per gram (μ/g), used in the text.
[b]Data were extracted from tables within the 2009, 2010, 2011, 2012, and 2013 East Tennessee Technology Park Biological Monitoring and Abatement Program fiscal year reports.

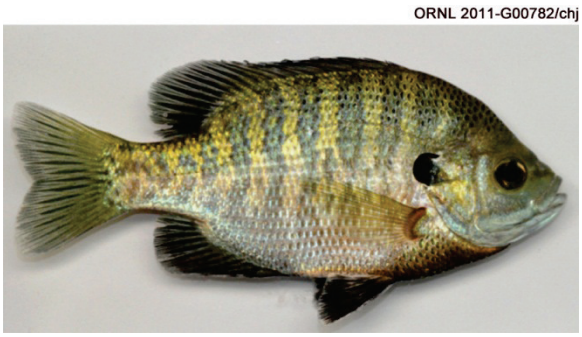


Fig. 3.55. Bluegill sunfish (*Lepomis macrochirus*).

Whole body composites (six composites of 10 bluegill per composite) and fillets from 20 individual bluegill were analyzed for PCBs to assess the ecological and human health risks associated with PCB contamination in the K-1007-P1 pond. Average PCB levels in whole body composites from the K-1007-P1 pond averaged 4.45μg/g, down from 9.25 μg/g in 2012. Fillets averaged 0.7 μg/g total PCBs, a significant decrease compared to levels seen in 2012 (2.16 μg/g). Average PCB concentrations in sunfish collected in Mitchell Branch were 1.29 μg/g, slightly lower than the levels seen in 2012 (1.67 μg/g). The concentrations observed in fillets of largemouth bass from the K-901-A pond (1.4 μg/g) and gizzard shad whole body composite samples (8.86 μg/g) saw a significant increase from the concentrations seen in the 2012 monitoring, 0.72 μg/g and 4.82 μg/g, respectively. Levels of PCBs in bass from the K-901-A pond have been climbing in recent years and are believed to be linked to the relative abundance of gizzard shad in the pond. Gizzard shad readily bioaccumulate PCBs and are a major food source for bass. Levels of PCBs in bass, gizzard shad, and carp from the K-720 slough (0.14 μg/g, 0.57 μg/g, and 0.45μg/g, respectively) were considerably lower than for the same species from the K-901-A pond.

In addition to being analyzed for PCBs, the sunfish collected from Mitchell Branch (MIK 0.2) were analyzed for total mercury (Table 3.40). Previous studies have shown that methyl mercury accounts for more than 95% of the total mercury in fish, so a separate analysis for methyl mercury was not conducted. The EPA's recommended limit for mercury in fish fillets is 0.3 μg/g. The mean mercury concentration in fish collected at MIK 0.2 was 0.52 μg/g in 2013, higher than last year. However, mercury concentrations in fish in Mitchell Branch in recent years have averaged about 0.3 to 0.5 μg/g with about 10%–20% variability within the annual collection (Table 3.40). Consequently, it is not certain there has been a significant change in fish mercury concentrations in 2013, and changes in sampling season (from spring to fall) starting in 2012, as well as fish size differences between years, may also be factors affecting mercury levels. Future monitoring efforts are necessary to evaluate whether the recent indication of higher mercury concentrations is a long-term trend.

In April 2013, the benthic macroinvertebrate community at four Mitchell Branch locations (MIKs 0.4, 0.7, 0.8, and 1.4) was sampled using standard quantitative techniques; MIK 1.4 was the reference location. Results of monitoring in 2013 using the ORNL protocols show little change at the three uppermost locations (MIKs 1.4, 0.8, and 0.7). At MIK 0.4, the 2013 study showed an increase in the number of pollution-intolerant species compared to 2012 (Fig. 3.56). This increase followed several years of declining pollution-intolerant species richness and brings the numbers of species back to levels last seen in 2006. However, the number of pollution tolerant species makes up a much larger percentage of the total fauna at MIK 0.4 than at any of the other locations. Otherwise, results at MIK 0.4 generally mirrored those at MIKs 0.7 and 0.8. In recent years, the benthic macroinvertebrate community at MIK 0.7 and MIK 0.8 has shown no major persistent change in trends of either the mean number of taxa (taxonomic richness of all taxa) or the mean number of pollution-intolerant taxa [i.e., the taxonomic richness of the Ephemeroptera, Plecoptera, and Trichoptera (EPT)]. These results show that the benthic community at MIK 0.4 continues to be negatively impacted while the results for MIKs 0.7 and 0.8 suggest that the macroinvertebrate community at those sites is also impacted but to a lesser degree.

Table 3.40. Mercury levels (mg/kg)[a] in fish fillet and whole body samples at East Tennessee Technology Park, 2009 to 2013[b]

Site	Fish species	2009	2010	2011	2012	2013
Mitchell Branch	Redbreast sunfish	0.49 + 0.09	0.35 + 0.059	0.34 + 0.04	0.37 + 0.05	0.52 + 0.09
K-901-A Pond	Gizzard shad (whole body)		0.086 + 0.021			
K-1007-P1 Pond	Paddlefish (1 sample)		0.07			
K-1007-P1 Pond	Bluegill sunfish		0.085 + 0.008			
Hinds Creek	Redbreast sunfish		0.08 + 0.01	0.07 + 0.01	0.058 + 0.005	0.07+0.01
K-720 Slough	Gizzard shad (whole body)		0.067 + 0.006			

[a]Milligrams per kilogram (mg/kg) are equivalent to micrograms per gram (μ/g), used in the text.
[b]Data are extracted from tables within the 2009, 2010, 2011, 2012, and 2013 East Tennessee Technology Park Biological Monitoring and Abatement Program fiscal year reports.

Since August 2008, TDEC protocols, which assess both community and habitat characteristics, have also been used at the MIK 0.4, 0.7, and 0.8 monitoring locations. Beginning in August 2009, the use of TDEC protocols was expanded to include MIK 1.4 as well (Fig. 3.57). In 2013, the biotic index (Fig. 3.58) indicated that the community at MIK 0.4 was moderately impaired, the community at MIK 0.7 was slightly impaired, and the communities at MIKs 0.8 and 1.4 were unimpaired. The total number of taxa at all four locations is similar (ranging from 31 to 34), and differences between the sites are within the normal range of fluctuation from year to year. However, the community at MIK 1.4 was richer in pollution-intolerant species (11 species as compared to 5 to 9 species at the other three locations), a situation which has been consistent since the studies were begun in 2008. The habitat assessment (which primarily considers the physical aspects of the stream to determine its suitability to support biological communities) indicated that not all sampling locations along Mitchell Branch met the habitat goals for this region. In 2013, habitat at MIKs 0.7 and 0.8 met the habitat goals while MIKs 0.4 and 1.4 scored as being moderately impaired. However, the habitat score at MIK 1.4 failed to meet the goal by only a small margin, primarily due to the low flow rates, low substrate quality, and erosion of the stream bank at that location. At MIK 0.4, multiple issues influenced the habitat score. Overall, results using TDEC's semiquantitative protocols and ORNL's quantitative protocols since 2008 have been in general agreement that the habitat at MIK 0.4 scores from slightly to severely impaired and that the habitat at MIKs 0.7 and 0.8 scores from moderate impairment to unimpaired.

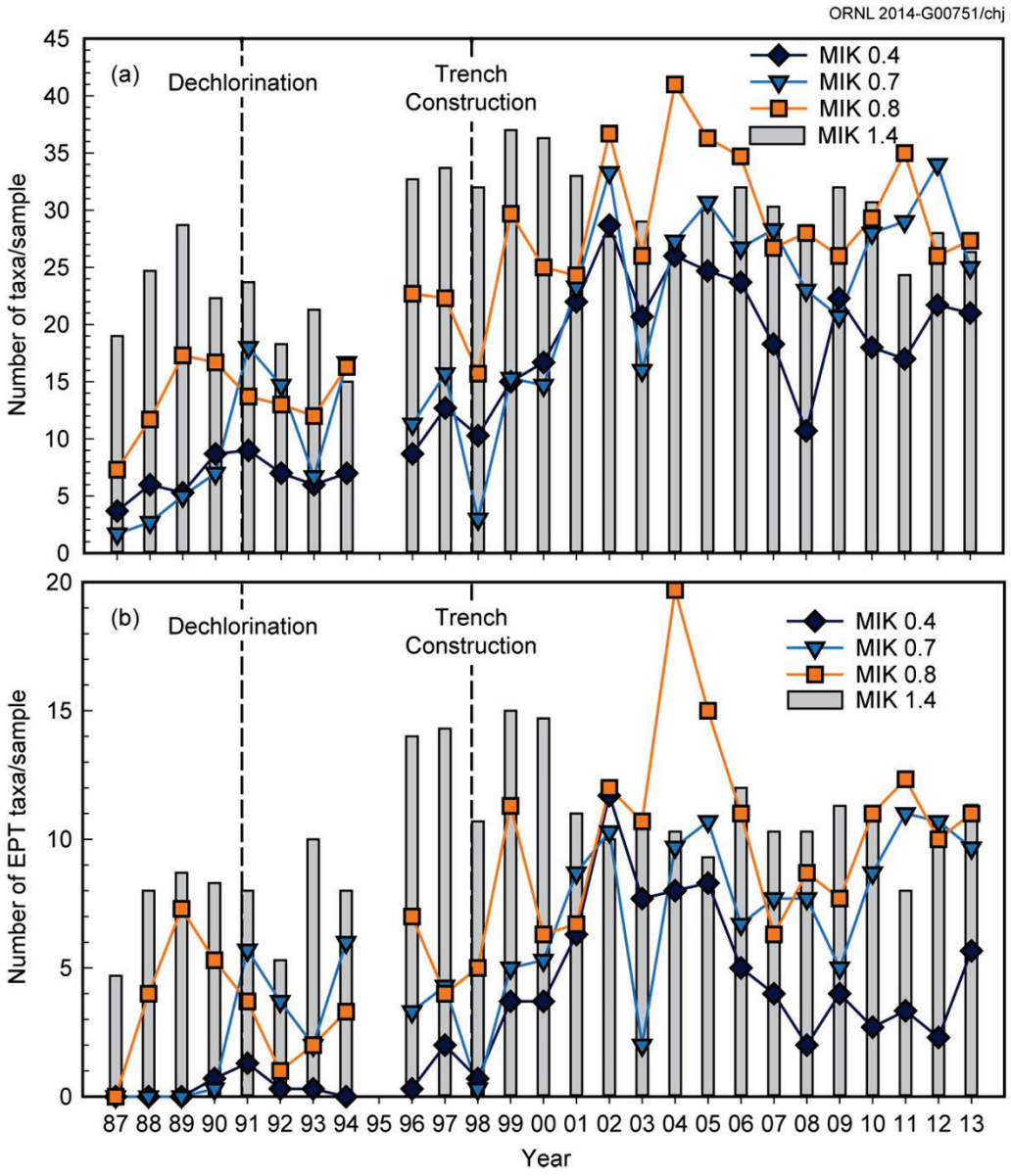


Fig. 3.56. Mean taxonomic richness in Mitchell Branch, 1987–2013: (a) number of all taxa and (b) number of pollution-intolerant Ephemeroptera, Plecoptera, and Trichoptera (mayflies, stoneflies, and caddisflies or EPT) taxa per sample.

Samples were not collected in April 1995, as indicated by the gap in the lines. (MIK = Mitchell Branch kilometer.)

Fig. 3.57. Benthic macroinvertebrate sampling using Tennessee Department of Environment and Conservation protocols.

Fish communities in Mitchell Branch (MIKs 0.4 and 0.7) and at local reference sites were sampled in 2013. Species richness, density, and biomass were examined (Figs. 3.59 and 3.60). Results for 2013 showed only minor changes from 2012. The number of species decreased by one at MIK 0.7 and increased by one at MIK 0.4. All of the species found during the community studies sampling tend to be more tolerant of less than optimal conditions. Both MIK 0.4 and 0.7 had an increase in biomass and density from 2012. Variations in these three parameters are typical of streams that have been severely impacted and are still recovering. While the condition of the fish communities over the last several years has been relatively stable, they have yet to reach conditions typical of less impacted streams in the area, and the stream is still dominated by more tolerant fish species. However, during sampling for the bioaccumulation task at MIK 0.2, five species of fish were collected that have not been collected at the two upper fish community sites in Mitchell Branch. These included the snubnose darter (*Etheostoma simoterum*), the spotted sucker (*Minytrema melanops*), and the rock bass (*Ambloplites rupestris*), all three of which are considered to be pollution sensitive species. This seems to indicate that stream conditions may be able to support additional fish species (at least seasonally) in downstream sections and potentially upstream as well if water quality and habitat conditions improve.

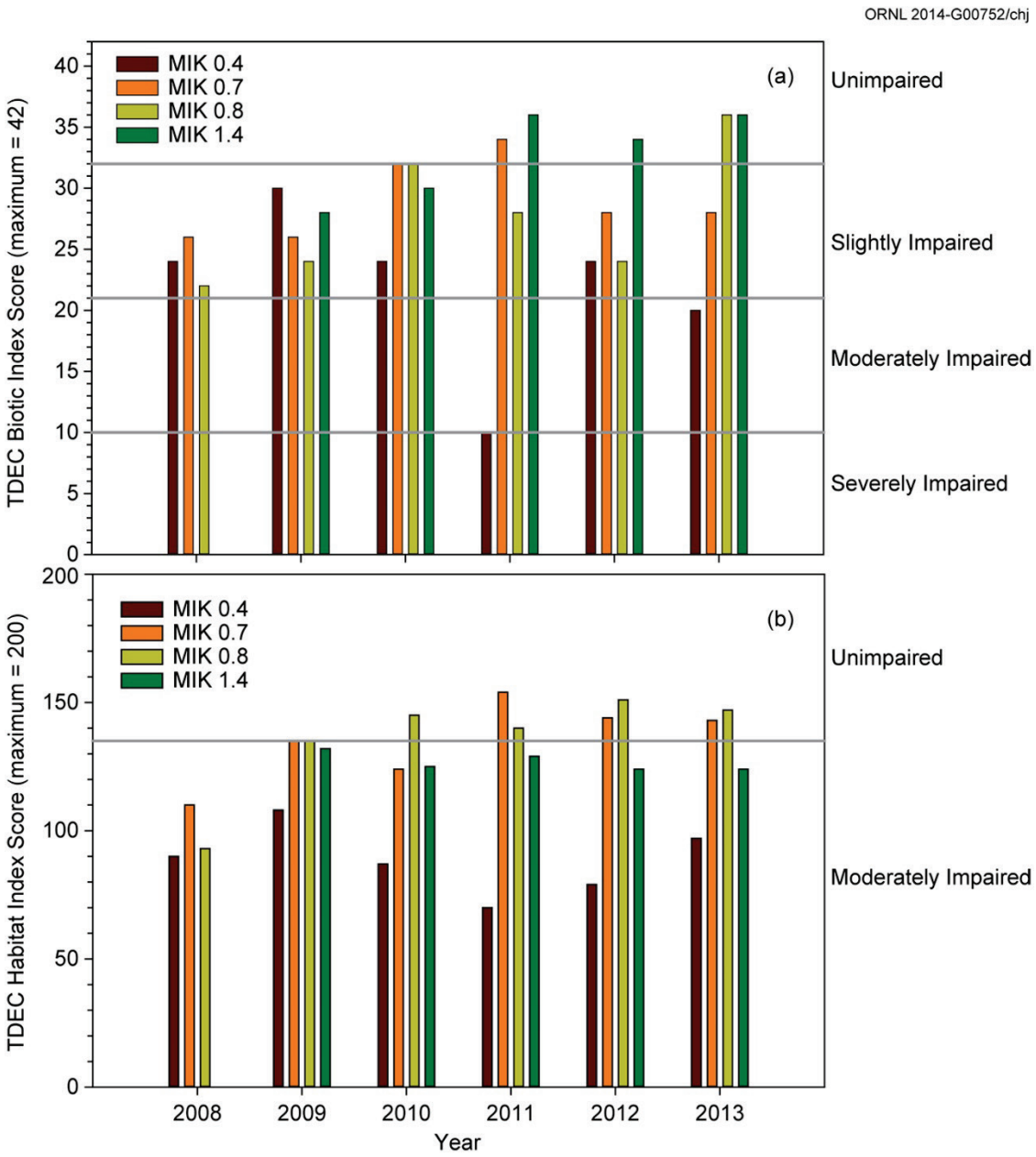


Fig. 3.58. Temporal trends in Tennessee Department of Environment and Conservation (TDEC) Benthic Macroinvertebrate Biotic Index (a) and Stream Habitat Index (b) scores for Mitchell Branch, August 2008 to 2013. Horizontal lines in both graphs show the lower thresholds for narrative index ratings; respective narrative ratings for each threshold are shown on the right side of each graph. (MIK = Mitchell Branch kilometer.)

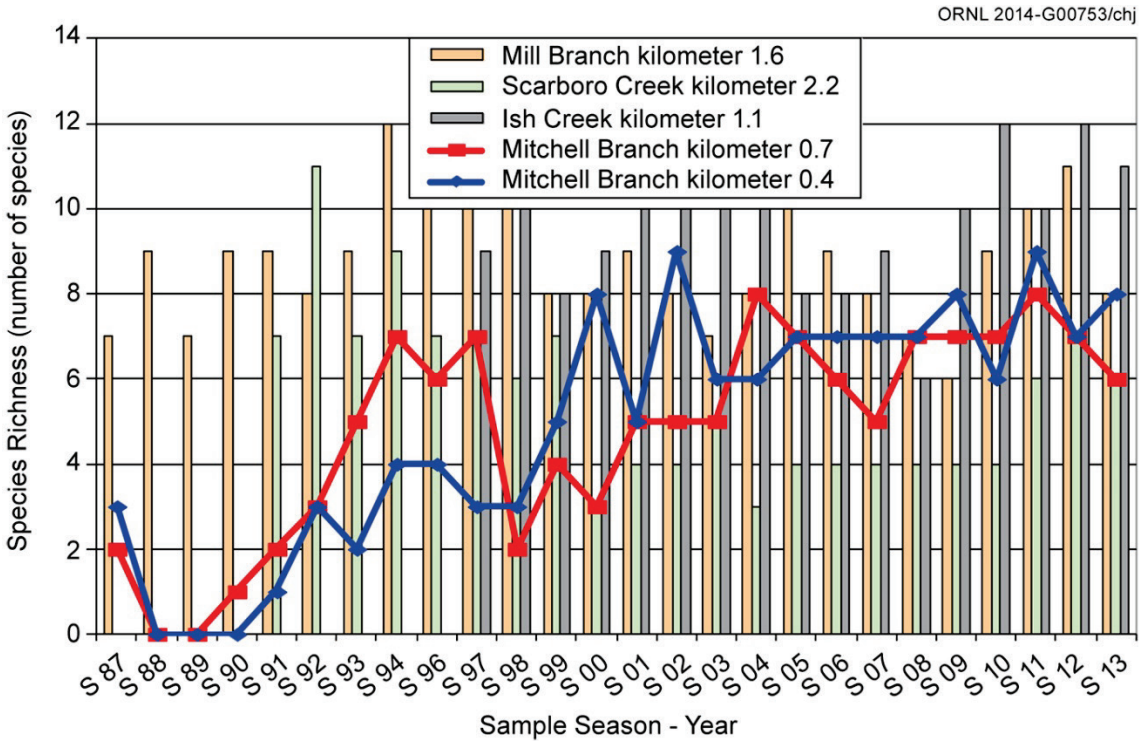


Fig. 3.59. Species richness for fish communities.

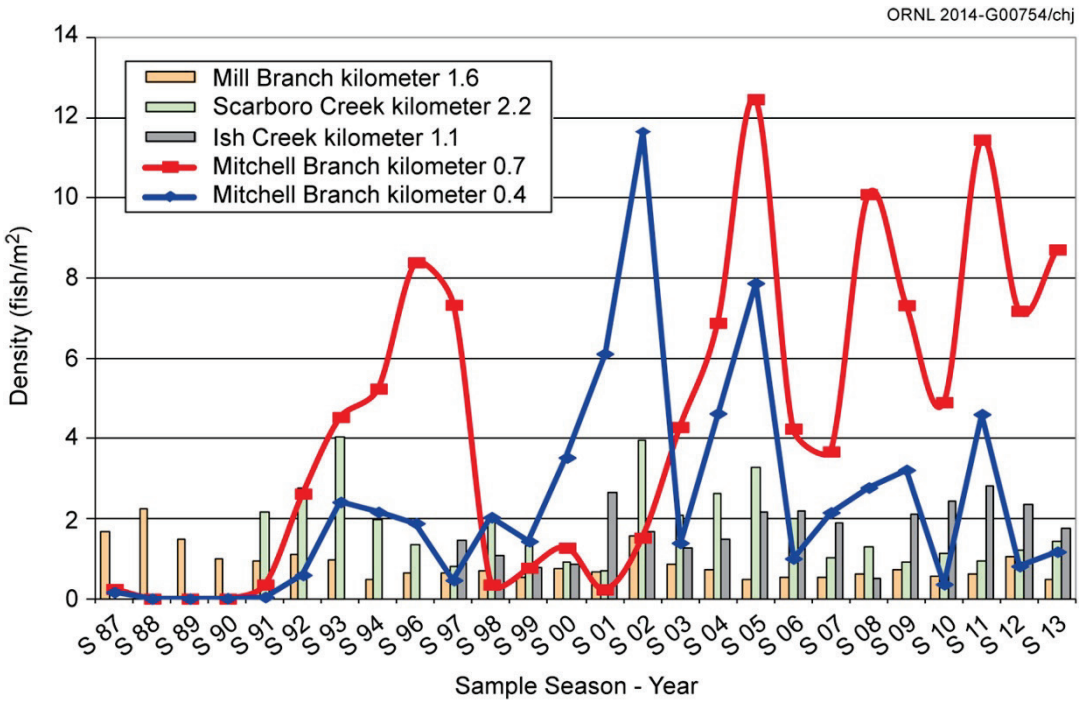


Fig. 3.60. Density for fish communities.

3.8 Environmental Management and Waste Management Activities

3.8.1 Waste Management Activities

Restoration of the environment, D&D of facilities, and management of the legacy wastes constitute the major operations at ETTP.

The TSCA Incinerator located at ETTP was shut down permanently on December 2, 2009, after treating 35.6 million lb of liquid and solid waste over a 19-year period. The TSCA Incinerator was a one-of-a-kind thermal treatment unit. It played a key role in treating radioactive PCBs and hazardous wastes (mixed wastes) from ORR and other facilities across the DOE complex, thus, facilitating compliance with regulatory and site closure milestones. The certified closure report was submitted to TDEC and EPA in June 2011. Efforts to encapsulate remaining PCB and radioactive contamination, to minimize water management actions, and to reduce the cost of ongoing S&M continued through 2012. The S&M program was initiated in 2013 and will be used to manage the facility until its final demolition.

EMWMF, located in Bear Creek Valley west of the Y-12 Complex, is an engineered landfill that accepts waste generated from cleanup activities on ORR. It currently consists of six disposal cells with a total disposal capacity of 2,180,000 yd^3. In addition, leachate storage tanks, contact water storage ponds, and contact water storage tanks provide the facility's water management capability. EMWMF accepts low-level radioactive and hazardous wastes that meet specific waste acceptance criteria developed in accordance with agreements with state and federal regulators. Waste types that qualify for disposal include soil, dried sludge and sediment, solidified wastes, stabilized waste, building debris, scrap equipment, and personal protective equipment. During FY 2013, EMWMF operations collected, analyzed, and disposed of about 5.1 million gal of leachate at the ORNL Liquid and Gaseous Waste Operations Facility. An additional 16.7 million gal of contact water was collected, analyzed, and released to the storm water retention basin after it was determined that it met the release criteria. EMWMF received about 7,096 truckloads of waste accounting for about 80,070 tons during FY 2013. Projects that have disposed of waste at EMWMF during the year include the following.

- K-25 Building Demolition Project
- K-33 Building Demolition Project
- Several ORNL demolition projects

EMWMF began operations in 2002 to provide on-site waste disposal capacity from remediation efforts across ORR. Although it has been expanded to its maximum capacity, EMWMF will not be able to handle all of the waste expected to be generated from reservation cleanup activities.

Further expansion at EMWMF is constrained by physical limitations of the site. Therefore, in FY 2010 DOE began evaluating disposal alternatives for future reservation waste cleanup. In September 2012, DOE issued an RI/FS that evaluated the following alternatives.

- No action
- On-site disposal (constructing and operating a new disposal facility on the reservation)
- Off-site disposal (shipping to an off-site facility)

The on-site disposal alternative would provide consolidated disposal of most future-generated CERCLA waste in a newly constructed, engineered facility referred to as the Environmental Management Disposal Facility (EMDF). This alternative would require permanent commitment of land and has the potential to impact environmental resources. EMDF would also be less costly than the off-site disposal alternative and would provide a greater level of certainty that long-term disposal capacity would be available.

The off-site disposal alternative would involve transporting future CERCLA waste for disposal in approved disposal facilities in Nevada and Utah. This alternative would isolate waste more effectively due to the arid climate and the presence of fewer receptors.

In FY 2013, comments received from EPA and TDEC were incorporated into a second draft report that was submitted to regulators on June 20, 2013. A workshop was held in August 2013 to evaluate current and future on-site disposal on ORR.

CNF was a complex of 49 buildings, structures, containment and storage tank facilities, and support trailers. The facility was ETTP's primary wastewater treatment facility and processed both hazardous and nonhazardous waste streams arising from multiple waste treatment facilities and remediation projects. CNF ceased accepting waste in December 2012 in order to begin the decommissioning process.

Decommissioning activities at CNF included sludge removal and disposal; chemical removal and disposal; material, media, and equipment removal and disposal; oil removal and disposal; equipment rinsing and pressure washing; and characterization and filling of some tanks, basins, containment dikes, and subsurface facilities. The decommissioning process was completed in 2013.

CWTS is a smaller water treatment unit for chromium-contaminated groundwater that sits within the existing CNF footprint. CWTS came online in late 2012 and handles purge water from groundwater monitoring as well as the chromium collection system water. Effluent from CWTS discharges to the Clinch River through an existing CNF discharge line.

At ORNL, about 126 million gal of wastewater was treated and released at the Process Waste Treatment Complex. In addition, the liquid low-level waste evaporator at ORNL treated 218,900 gal of such waste. A total of 2.2 billion m^3 of gaseous waste was treated at the ORNL 3039 Stack Facility.

These waste treatment activities supported both EM and Office of Science mission activities in a safe and compliant manner during FY 2013. NNSA at the Y-12 Complex treated more than 116 million gal of contaminated ground/sump water at the Groundwater Treatment Facility, Central Mercury Treatment System, Big Spring Water Treatment System, and East End Volatile Organic Compounds Plume Treatment System.

The Big Spring Water Treatment System treated more than 100 million gal of mercury-contaminated groundwater. The East End Volatile Organic Compounds Plume Treatment System treated more than 11 million gal of VOC-contaminated groundwater. The West End Treatment Facility and the Central Pollution Control Facility at the Y-12 Complex processed more than 826,000 gal of wastewater, primarily in support of NNSA operational activities. The Central Pollution Control Facility processed about 46,000 gal of wastewaters containing oil, chemicals, and radiological materials. The Central Mercury Treatment System treated more than 2 million gal of mercury contaminated sump water from the Alpha 4 building. The Liquid Storage Facility and Groundwater Treatment Facility treated more than 2 million gal of leachate from burial grounds and well purge waters from remediation areas.

In FY 2013, about 36,435 yd^3 of industrial wastes and construction/demolition debris was disposed in the landfill. Operation of ORR landfills generated about 1.1 million gal of leachate that was collected, monitored, and discharged to the Y-12 Complex sanitary sewer system, which discharges to the Oak Ridge sewer system under an industrial sewer user permit.

3.8.2 Environmental Restoration Activities

ETTP operated as an enrichment facility for four decades during which time many of the buildings became contaminated with radionuclides, heavy metals, and toxic organic compounds. In addition, large quantities of wastes were generated, much of which was stored on the site.

ETTP's Environmental Management Program was created with the goal of demolishing all unnecessary facilities and restoring the site to a usable condition. The safety and health of employees and the public is a constant focus. Cost-effectiveness is also a major consideration in the cleanup operations.

DOE has signed two of three key CERCLA RODs with the State of Tennessee and EPA authorizing environmental restoration of about 890 ha (2,198 acres) of land at ETTP. The area encompasses 567 ha (1,400 acres) outside the main plant security fence (Zone 1) and 324 ha (800 acres) inside the fence within the former plant production area (Zone 2). The main objectives of the two decisions are to protect future industrial workers and the underlying groundwater from contamination that remains in soil, slabs, and subsurface structures. The Zone 1 interim ROD was signed in November 2002 and covers the 567 ha (1,400-acre) area surrounding ETTP outside the main plant perimeter. In FY 2013, EPA and TDEC provided comments on the RI/FS, and an agreement was reached to initiate a Zone 1 final soils ROD and defer a Zone 1 final surface water and groundwater ROD to a future decision.

The Zone 2 ROD was signed in April 2005 and covers about 324 ha (800 acres) in the main plant area. In FY 2013, remediation of the 13 ha (32-acre) footprint of Building K-33 was completed with the excavation and disposal of the slab and associated soil. EPA and TDEC approved the documents that detail the K-1070-B burial ground cleanup; two subsurface sumps at the TSCA Incinerator were remediated, and several subsurface facilities at CNF were characterized to determine whether remediation would be required before backfill. Based upon the results of the characterization, the facilities were

backfilled with flowable fill and concrete to eliminate safety hazards and to aid in the management of storm water.

From the time cleanup operations began through FY 2013, 378 facilities have been demolished, 1.88 million yd^3 of waste has been removed from the site, and 567 ha (1,400) acres of land have been cleared for unrestricted use. In addition, about 7,000 uranium hexafluoride cylinders were removed from the site.

When ORR was established, a buffer zone was also included between the three major facilities and areas open to the public. This area, about 8,100 ha (20,100 acres) in extent, has little or no process-related history. However, with the listing of ORR on the NPL in 1989, the possibility of contamination had to be investigated. Beginning in 2008, DOE initiated a process to achieve FFA party consensus that the buffer parcels require no further investigation and to modify the FFA appendixes to better represent the known contaminated areas. ORAU was contracted to complete the verification activities (initiated in the late 1990s as a footprint reduction project), including review of historical documents, sampling and analysis, risk analysis, and reporting of study results, with recommendations for no further investigation where appropriate. The first Environmental Baseline Survey Report (EBSR), addressing five parcels around ETTP totaling about 1,863 ha (4,600 acres), was submitted in September 2011, and regulator comments were received in 2012. The second EBSR, addressing 14 parcels of about 6,277 ha (15,500 acres) around ORNL and Y-12, was submitted in September 2012. Based upon these reports, a total of 7,816 ha (19,300 acres) could be approved for no further investigation. In 2013, a total of 7,649 ha (18,900 acres) was approved for no further investigation.

3.8.2.1 Building K-25 Demolition

Building K-25 (Fig. 3.61), built during the Manhattan Project, occupied about 16 ha (40 acres) and contained more than 3,000 stages of gaseous diffusion and associated auxiliary equipment. Each stage consisted of a converter, two compressors, two compressor motors, and associated piping. Workers had previously cut through a portion of the east wing to segregate a portion of the building contaminated with ^{99}Tc from the rest of the demolition area. Predemolition activities in that area included characterization, vent, purge, drain, inspection, and foaming of components to stabilize contaminants in place; asbestos removal; and draining of lubricants and coolants. In addition, materials such as uranium-containing monoliths, sodium fluoride traps, and high risk equipment that had been stored in the area had to be removed. In 2013, demolition of the north tower was completed and work began on demolishing the final six units of the east wing. The monoliths and high risk equipment in the east wing were moved from the building to an area where the uranium could be safely removed for disposal. Depending on the nature of the resultant material, debris from the demolition project was sent either to EMWMF for disposal or to the appropriate off-site disposal facility.

Fig. 3.61. Building K-25 in late 2013.

3.8.2.2 Building K-27 Demolition

Building K-27 is a multistory building that was built as a uranium enrichment process building. The building is about 900 ft long, 400 ft wide, and 58 ft high. In 2013, predemolition work included inventory management; characterization of process equipment; vent, purge, drain, and inspection of process equipment; and the removal of high-hazard sodium fluoride traps. Sodium fluoride traps used sodium fluoride pellets to trap uranium as part of the final uranium removal process. These particular traps still contained uranium materials from when the facility was shut down.

3.8.2.3 Building K-33 Remediation Completed

Building K-33 was a multistory building that was built in 1954 as a uranium enrichment process building. The building covered 13 ha (32 acres) and contained more than 1.4 million yd^3 of concrete and steel. The building had been largely decontaminated under an earlier project. Remediation of the building's 13-ha footprint was completed with the removal of the tie lines that connected K-33 with K-31, removal and disposal of the concrete slab and associated soil, and backfilling and seeding of the area.

3.8.2.4 Fire Water Tank Demolished

The 116 m (381 ft) tall, 1.5 mil L K-1206-F fire water tank tower was built in 1958 to service the site's fire protection system. In 2013, it was drained, disconnected, and permanently taken out of service. Although it was not originally scheduled to be demolished in 2013, the deteriorating condition of the tank

led UCOR and DOE to accelerate the schedule for demolition. In August 2013, a controlled explosive demolition was performed, and the resultant debris was shipped for disposal.

3.8.2.5 Commemoration of the K-25 Site

DOE and historic preservation agencies agreed upon commemorative measures that will preserve the Oak Ridge K-25 Site's historic contributions to the World War II Manhattan Project. Planning for the commemorative measures continues. In 2013, a prequalification process for the Professional Site Design Team (PSDT) and museum professional design subcontract was conducted. Nine small business architectural and engineering and museum planning partnering teams competed. The K-25 slab was retained pending results of the slab feasibility study. Bricks from the powerhouse were retained for possible use in the PSDT's wayside exhibits design. The PSDT and museum professional request for proposal for the commemorative facilities was published, and the associated pre-bid meeting and site orientation were conducted. For additional information, please refer to Section 3.3.4, which describes the MOA stipulations that have been established.

3.8.2.6 Central Neutralization Facility Shutdown Completed

Shutdown and decommissioning of CNF was completed. CNF ceased accepting waste in December 2012 to begin the decommissioning process. In FY 2013, activities at CNF included sludge removal and disposal; chemical removal and disposal; material, media, and equipment removal and disposal; oil removal and disposal; equipment rinsing and pressure washing; and characterization and filling of tanks, basins, containment dikes, and subsurface facilities. The decommissioning process was completed in FY 2013.

3.8.2.7 Soil, Burial Ground, and Exposure Unit Remediation Activities

The soil at ETTP is to be remediated to a level that protects a future industrial workforce and the underlying groundwater. RODs detailing the selected cleanup methods are in place and address soil, slabs, subsurface structures, and burial grounds for both zones.

Remediation of the soils in Zone 1 was completed in 2011. In 2012, a final RI/FS was prepared to support development of a final Zone 1 ROD. The first draft RI/FS was transmitted to the regulators in March 2012; regulator comments were received in August 2012.

General land use covenants for Zone 2 remained in place during FY 2013 and protected human health and the environment from residual contamination. Short-term restrictions were maintained for government-controlled industrial land use. Signs were maintained to control access, and surveillance patrols conducted as part of routine S&M inspections were effective in monitoring access by unauthorized personnel. Required mowing was maintained as part of the ETTP S&M program. Additionally, signs and access controls at the K-1070-C/-D burial ground were inspected annually as part of the ETTP S&M program.

3.8.3 Reindustrialization

The DOE Oak Ridge Reindustrialization Program continued the transformation of ETTP into a private-sector business/industrial park in FY 2013 (Fig. 3.62).

Babcock Services purchased 1 ha (2.5 acres) of Parcel ED-10 from CROET and completed construction of a 1,060 m^2 (11,400 ft^2) facility. The facility is used to manage, recover, and refurbish radioactively contaminated components from commercial nuclear power plants and is projected to create more than 100 jobs.

In spring 2013, a 59 kW photovoltaic solar farm at ETTP was completed. The system consists of seven ground-mounted geo-trackers that rotate to follow the sun. Each tracker holds 30 solar panels and is expected to generate enough electricity to power 15 homes. This project, led by Vis Solis, LLC, required collaboration with TVA, the German Energy Agency, DEGERenergie (Germany's leading solar manufacturer), and CROET.

The new $35 million Carbon Fiber Technology Facility (CFTF) at Oak Ridge's Horizon Center began production in FY 2013.This advanced materials facility will allow researchers to develop and demonstrate the commercial viability of low-cost carbon fiber products for several industry sectors. Although carbon fiber has long been considered a desirable lightweight substitute for steel and other materials, its use has been limited due to high production costs. The development of low-cost production methods is expected to create new possibilities for carbon fiber use in a wide array of applications such as building structures, industrial products, and wind turbines.

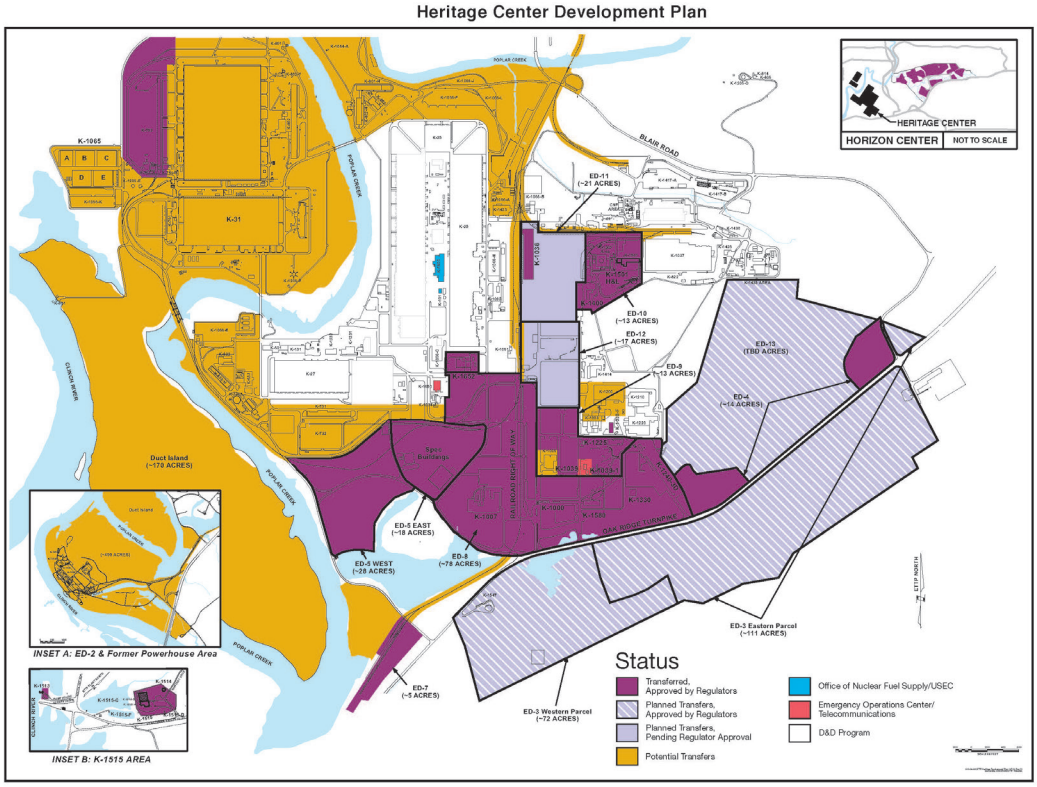


Fig. 3.62. East Tennessee Technology Park reindustrialization status, 2013.

3.8.4 Biosolids Program

Under the Biosolids Program, treated municipal sludge (biosolids) from the City of Oak Ridge (the city) publicly owned treatment works (POTW) is applied to six approved sites on ORR as a soil conditioner and fertilizer. UCOR provides oversight for the program (BJC 2006), which operates under a land license agreement between DOE and the city. The city has applied biosolids on ORR since 1983.

3.8.4.1 Biosolids Fields on the Oak Ridge Reservation

The biosolids land application sites are located on ORR in Oak Ridge, Tennessee (Fig. 3.63). Four of the active sites are in the vicinity of Bethel Valley Road, while the remaining active sites, Watson Road 1 and 2, are located on Highway 95 near the Horizon Center. Table 3.41 lists the six application sites and the tons of biosolids applied to each site in CY 2013.

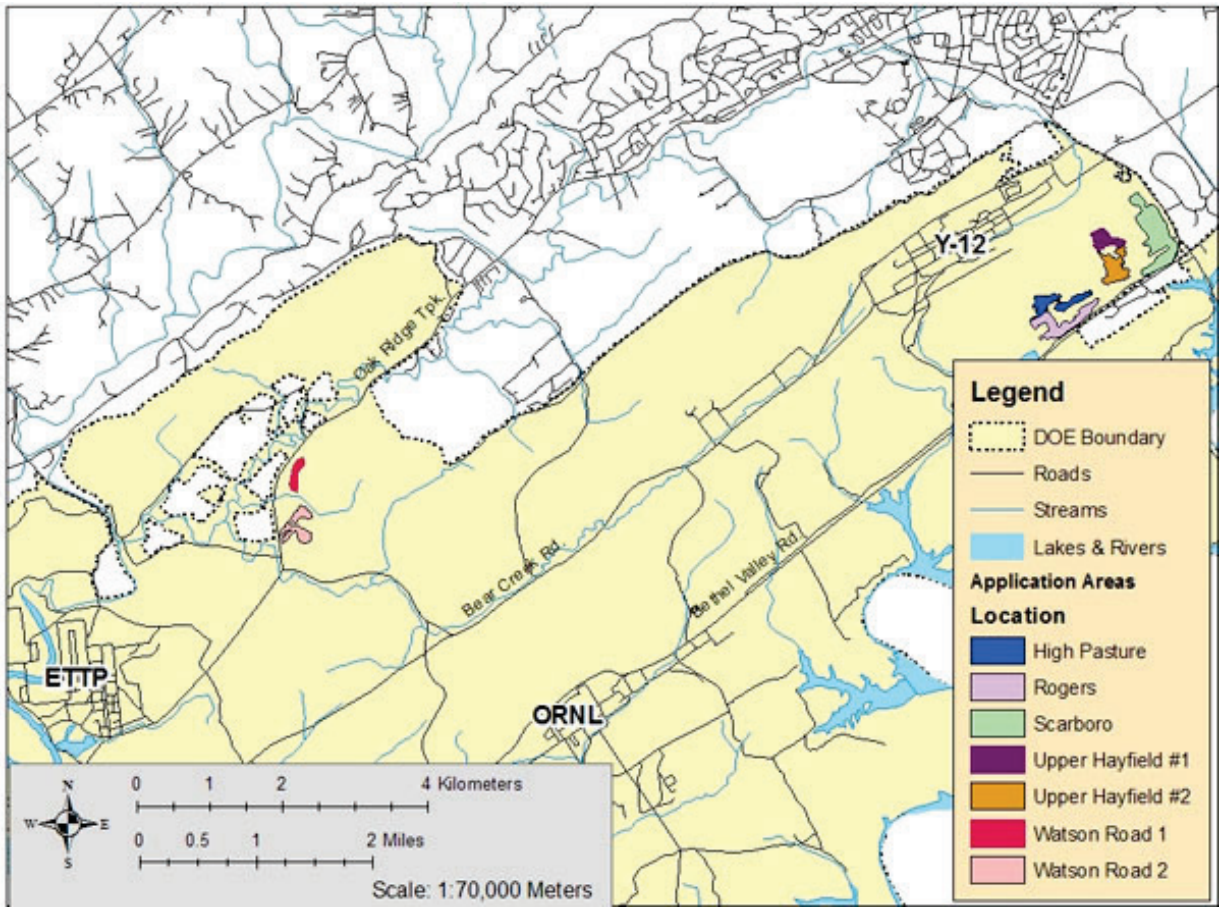


Fig. 3.63. Biosolids application areas on the Oak Ridge Reservation.

Table 3.41. Biosolids applied on the Oak Ridge Reservation in CY 2013 by the City of Oak Ridge (Tons)

Bethel Valley				Watson Road	
Upper Hayfield	High Pasture	Rogers	Scarboro	Watson Road 1	Watson Road 2
41.3	50.9	19.5	6.7	0	0

3.8.4.2 Current Program

The city POTW near Turtle Park in Oak Ridge, Tennessee, processes about 30 million gal/day of wastewater. The plant receives wastewater from a variety of industrial, commercial, and residential generators in the Anderson County–Roane County area. DOE contributes about 20% of the influent to the POTW directly from the Y-12 Complex. Currently the Rarity Ridge Sludge is not part of the Biosolids Program; it is disposed to the municipal landfill. All industrial generators are required by Oak Ridge city ordinance 5-09 to obtain an industrial discharge permit from the city, which prescribes discharge limits and monitoring/reporting requirements.

3.8.4.3 Current Status

Under rulemaking effective June 30, 2013, TDEC enacted legislation governing the land application of Class B biosolids in the state of Tennessee under Chapter 0400-40-15 entitled "Biosolids Management." Before this legislation, land application programs in Tennessee operated as self-implementing, without EPA permit, under the EPA 40 CFR 503 regulations. The city, which currently

produces Class B biosolids, has completed the required notice of intent and will be grandfathered into the general permit, which is projected for issuance in April 2014 with an effective date of 30 days after issuance. The TDEC regulations include all 40 CFR 503 requirements with the addition of specific agronomic limits and setbacks more protective of surface water and groundwater.

As part of the surveillance program, UCOR successfully completed sampling for the High Pasture site in 2013. Cumulative metal loading is monitored for each site for compliance with limits set in 40 CFR 503. Tables 3.42 through 3.51 present these data for each site and the percentage of the regulatory limit that has been attained for each application area.

The site sampling effort has been eliminated by DOE EM in favor of preapplication monitoring through analysis of the biosolids. UCOR has provided radiological analyses for the biosolids since 2010. The radiological analyses will continue as a feature of the new preapplication monitoring metric.

Table 3.42. High Pasture Field 1

Heavy metal	2013 (kg/ha)	Cumulative loading as of 12/13/2013 (kg/ha)	40 CFR 503 cumulative loading limits (kg/ha)	Percentage of 503 limits attained
As	0.00	0.54	41	1.3
Cd	0.00	0.94	39	2.4
Cr	0.00	13.22	N/A	N/A
Cu	0.00	91.10	1,500	6.1
Pb	0.00	7.78	300	2.6
Hg	0.00	1.16	17	6.8
Mo	0.00	1.68	N/A	N/A
Ni	0.00	11.95	420	2.8
Se	0.00	2.92	100	2.9
Zn	0.00	201.44	2,800	7.2

Table 3.43. High Pasture Field 2

Heavy metal	2013 (kg/ha)	Cumulative loading as of 12/13/2013 (kg/ha)	40 CFR 503 cumulative loading limits (kg/ha)	Percentage of 503 limits attained
As	0.00	0.49	41	1.2
Cd	0.00	0.91	39	2.3
Cr	0.00	13.12	N/A	N/A
Cu	0.00	90.00	1,500	6.0
Pb	0.00	7.67	300	2.6
Hg	0.00	1.15	17	6.8
Mo	0.00	1.64	N/A	N/A
Ni	0.00	11.82	420	2.8
Se	0.00	2.85	100	2.9
Zn	0.00	198.15	2,800	7.1

Table 3.44. Upper Hay Field 1

Heavy metal	2013 (kg/ha)	Cumulative loading as of 12/13/2013 (kg/ha)	40 CFR 503 cumulative loading limits (kg/ha)	Percentage of 503 limits attained
As	0.00	0.26	41	0.6
Cd	0.00	0.44	39	1.1
Cr	0.09	7.89	N/A	N/A
Cu	1.93	37.96	1,500	2.5
Pb	0.08	5.05	300	1.7
Hg	0.01	0.78	17	4.6
Mo	0.02	1.22	N/A	N/A
Ni	0.06	3.61	420	0.9
Se	0.04	0.53	100	0.5
Zn	2.75	108.11	2,800	3.9

Table 3.45. Upper Hay Field 2

Heavy metal	2013 (kg/ha)	Cumulative loading as of 12/13/2013 (kg/ha)	40 CFR 503 cumulative loading limits (kg/ha)	Percentage of 503 limits attained
As	0.01	0.30	41	0.7
Cd	0.00	0.51	39	1.3
Cr	0.05	8.60	N/A	N/A
Cu	1.03	39.9	1,500	2.7
Pb	0.04	5.22	300	1.7
Hg	0.00	0.88	17	5.2
Mo	0.01	0.73	N/A	N/A
Ni	0.03	3.27	420	0.8
Se	0.02	2.06	100	2.1
Zn	1.45	119.72	2,800	4.3

Table 3.46. Scarboro Field 1

Heavy metal	2013 (kg/ha)	Cumulative loading as of 12/13/2013 (kg/ha)	40 CFR 503 cumulative loading limits (kg/ha)	Percentage of 503 limits attained
As	0.01	0.33	41	0.8
Cd	0.00	0.54	39	1.4
Cr	0.02	8.48	N/A	N/A
Cu	0.32	43.94	1,500	2.9
Pb	0.01	5.02	300	1.7
Hg	0.00	0.95	17	5.6
Mo	0.01	1.07	N/A	N/A
Ni	0.01	4.64	420	1.1
Se	0.01	1.96	100	2.0
Zn	0.46	127.06	2,800	4.5

Table 3.47. Scarboro Field 2

Heavy metal	2013 (kg/ha)	Cumulative loading as of 12/13/2013 (kg/ha)	40 CFR 503 cumulative loading limits (kg/ha)	Percentage of 503 limits attained
As	0.00	0.32	41	0.8
Cd	0.00	0.54	39	1.4
Cr	0.01	8.47	N/A	N/A
Cu	0.08	43.70	1,500	2.9
Pb	0.00	5.01	300	1.7
Hg	0.00	0.95	17	5.6
Mo	0.00	1.06	N/A	N/A
Ni	0.01	4.64	420	1.1
Se	0.00	1.95	100	2.0
Zn	0.11	126.71	2,800	4.5

Table 3.48. Rogers Field 1

Heavy metal	2013 (kg/ha)	Cumulative loading as of 12/13/2013 (kg/ha)	40 CFR 503 cumulative loading limits (kg/ha)	Percentage of 503 limits attained
As	0.00	0.45	41	1.1
Cd	0.00	1.01	39	2.6
Cr	0.00	22.51	N/A	N/A
Cu	0.00	100.59	1,500	6.7
Pb	0.00	13.85	300	4.6
Hg	0.00	1.97	17	11.6
Mo	0.00	4.28	N/A	N/A
Ni	0.00	10.23	420	2.4
Se	0.00	1.31	100	1.3
Zn	0.00	249.62	2,800	8.9

Table 3.49. Rogers Field 2

Heavy metal	2013 (kg/ha)	Cumulative loading as of 12/13/2013 (kg/ha)	40 CFR 503 cumulative loading limits (kg/ha)	Percentage of 503 limits attained
As	0.00	0.47	41	1.2
Cd	0.00	1.01	39	2.6
Cr	0.00	22.55	N/A	N/A
Cu	0.00	101.25	1,500	6.7
Pb	0.00	13.91	300	4.6
Hg	0.00	1.97	17	11.6
Mo	0.00	4.29	N/A	N/A
Ni	0.00	10.30	420	2.5
Se	0.00	1.35	100	1.3
Zn	0.00	251.41	2,800	9.0

Table 3.50. Watson Road Field 1

Heavy metal	2013 (kg/ha)	Cumulative loading as of 12/13/2013 (kg/ha)	40 CFR 503 cumulative loading limits (kg/ha)	Percentage of 503 limits attained
As	0.00	0.61	41	1.5
Cd	0.00	0.82	39	2.1
Cr	0.00	13.22	N/A	N/A
Cu	0.00	92.94	1,500	6.2
Pb	0.00	8.97	300	3.0
Hg	0.00	1.27	17	7.4
Mo	0.00	1.88	N/A	N/A
Ni	0.00	10.93	420	2.6
Se	0.00	2.83	100	2.8
Zn	0.00	213.10	2,800	7.6

Table 3.51. Watson Road Field 2

Heavy metal	2013 (kg/ha)	Cumulative loading as of 12/13/2013 (kg/ha)	40 CFR 503 cumulative loading limits (kg/ha)	Percentage of 503 limits attained
As	0.00	0.61	41	1.5
Cd	0.00	0.82	39	2.1
Cr	0.00	13.22	N/A	N/A
Cu	0.00	92.94	1,500	6.2
Pb	0.00	8.97	300	3.0
Hg	0.00	1.27	17	7.4
Mo	0.00	1.88	N/A	N/A
Ni	0.00	10.93	420	2.6
Se	0.00	2.83	100	2.8
Zn	0.00	213.10	2,800	7.6

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