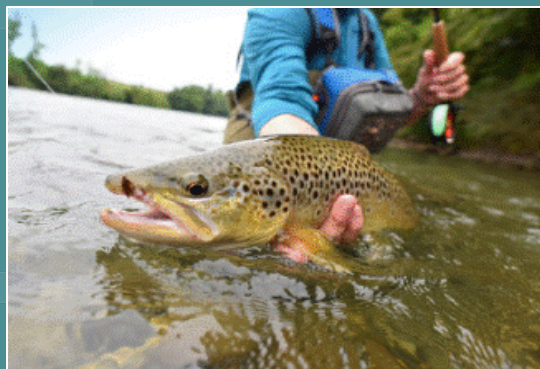


SITE CHARACTERIZATION AND MONITORING TECHNICAL SUPPORT CENTER

Annual Report Fiscal Year 2018



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Site Characterization and Monitoring Technical Support Center

Fiscal Year 2018 Annual Report

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Notice/Disclaimer

This report is intended to inform the public, Remedial Project Managers, On-Scene Coordinators, and Superfund Technology Liaisons of progress at the Site Characterization and Monitoring Technical Support Center (SCMTSC)-involved sites, cutting-edge investigative technologies, and SCMTSC operations.

This document has been reviewed by the U.S. Environmental Protection Agency, Office of Research and Development and approved for publication.

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Acknowledgements

The Site Characterization and Monitoring Technical Support Center (SCMTSC) is part of a core group of technical support centers and regional forums established and maintained under the Technical Support Project.

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Acronyms and Abbreviations

BHHRA	Baseline Human Health Risk Assessment
BTVs	Background Threshold Values
cPAH	Carcinogenic Polycyclic Aromatic Hydrocarbon
CMS	Compliance Monitoring Strategy
CSM	Conceptual Site Model
C-STARS	Contaminated Sites Scientific, Technical and Risk Support System
DUs	Decision Units
EPA	U.S. Environmental Protection Agency
EPC	Exposure Point Concentration
ERA	Ecological Risk Assessment
ERT	Environmental Response Team
ETSC	Engineering Technical Support Center
FS	Feasibility Study
FY	Fiscal Year
gw/sw	Ground Water-to-Surface Water
GWTC	Groundwater Technical Support Center
HHRA	Human Health Risk Assessment
ISM	Incremental Sampling Methodology
LTMP	Long-Term Monitoring Plan
KM	Kaplan-Meier
LDW	Lower Duwamish Waterway
MIS	Multi-Incremental Sampling
MK	Mann-Kendall
NERL	National Exposure Research Laboratory
NRDL	Naval Radiological Defense Laboratory
OLEM	Office of Land and Emergency Management
ORD	Office of Research and Development
OSP	Office of Science Policy
OSRTI	Office of Superfund Remediation and Technology Innovation
PCB	Polychlorinated Biphenyl
ProUCL	Statistical Software Package Developed By EPA
PRP	Potentially Responsible Party
RARE	Regional Applied Research Effort
RI	Remedial Investigation
RI/FS	Remedial Investigation and Feasibility Study
RIM	Radiologically Impacted Materials
ROD	Record of Decision
ROS	Regression on Order Statistics
RPM	Remedial Project Manager

SCMTSC	Site Characterization and Monitoring Technical Support Center
STL	Superfund and Technology Liaison
SU	Sampling Unit
TSP	Technical Support Project
UCL	Upper Confidence Limit
UPL	Upper Prediction Limit
UTL	Upper Tolerance Limit
VOC	Volatile Organic Compound

Executive Summary

The Site Characterization and Monitoring Technical Support Center (SCMTSC) provides short- and long-term sampling and investigative expert review and support to Regions and Program Offices focused on characterization and monitoring issues at contaminated sites and on use of the SCMTSC ProUCL statistical program. In fiscal year (FY) 2018, experts responded to more than 260 requests for short- and long-term support from Regions, regional contractors, states, and international practitioners. SCMTSC continued long-term support to 28 Superfund sites in 9 of the 10 U.S. EPA Regions (see **Figure 1**).

Five sites to which SCMTSC provided support were on the Administrator's 2017 list of Superfund sites targeted for immediate, intense attention. Four of these sites were removed from the list in 2018 after achieving the recommended goals.

Sites on the Administrator's 2017 List	Met Recommended Goals and Removed from 2018 List
▪ Centredale Manor Restoration Project (R1)	✓
▪ B.F. Goodrich (R4)	✓
▪ West Lake Landfill (R7)	✓
▪ Tar Creek (R6)	✓
▪ Anaconda Copper Mine (R9)	✓

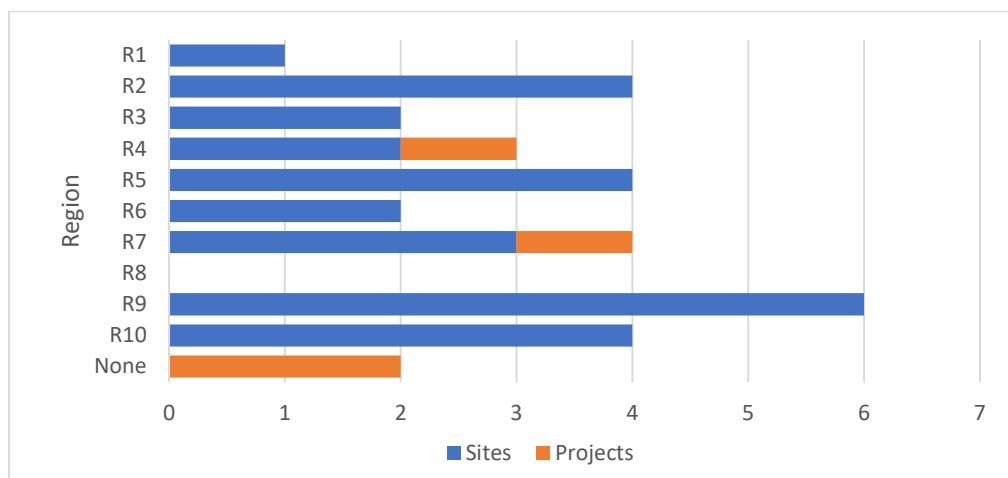


Figure 1. SCMTSC provided long-term technical support to 28 Superfund sites and 4 special projects across 9 EPA Regions in FY18.

Providing the most up-to-date science and information to help solve complex site issues.

SCMTSC has a suite of technical and statistical service offerings:

- statistical needs assessments for site characterization;
- field sampling and monitoring and contaminant measurement activity guidance (e.g., soil-gas measurements, site characterization technologies, contaminant fingerprinting);
- geophysics
- field sampling and measurement plan reviews;
- issue papers;
- nonroutine analytical services;
- vapor intrusion issues;
- environmental forensics;
- innovative site characterization and remediation technologies in conjunction with ETSC; and
- remote sensing technologies.

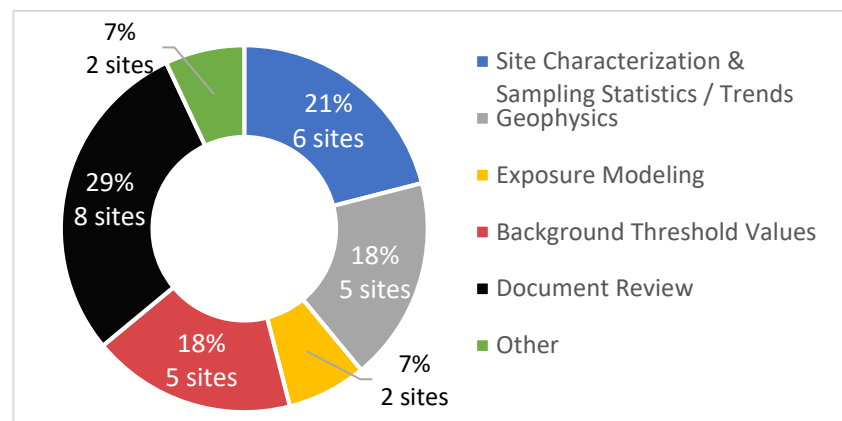


Figure 2. Technical requests in FY18.

Site-specific requests sought a variety of support and general technical inquiries as shown in **Figure 2**. The majority of support requested is categorized as Document Review (29 percent) and Site Characterization & Sampling, Statistics/Trends (21 percent). The “Other” category includes site document development, special laboratory analysis or quality assurance/quality control activities, technology development, unique statistical and trend evaluations, and other special characterization requests.

In FY18, SCMTSC supported four projects ranging from verification support for novel low-cost nitrogen sensors in septic systems to the analysis of mercury speciation related to the use of Epsom Salt solution in mercury spill mitigation. These special projects and select site-specific support are highlighted in this report (see the bolded names in **Table 1**).

Table 1. Categories of technical support provided across sites and projects in FY18

Category	Count	Site or Project Name and Region
Site Characterization & Sampling Statistics/Trends	6	▪ Bird Creek (R6); West Lake Landfill (R7)
		▪ BNSF Train Derailment (R7)
		▪ Hunters Point Naval Shipyard (R9)
		▪ Anaconda Co. Smelter (R9)
		▪ Lower Duwamish Waterway (R10)
Geophysics	5	▪ Enterprise Avenue (R5)
		▪ Tar Creek (R6)
		▪ Compass Plaza Well Trichloroethylene (R7)
		▪ Davis Chevrolet (R9)
		▪ Eastern Michaud Flats – FMC Operable Unit (R10)
Exposure Modeling	2	▪ Centredale Manor Restoration Project (R1)
		▪ Vo-Toys (R2)
Background Threshold Values (BTVs)	5	▪ Atlantic Fleet Weapons Training Area (R2)
		▪ Arsenic Mines of the Nimham Mountains (R2)
		▪ Chemours Pompton Lakes Works (R2)
		▪ G&H Industrial Landfill (R5)
		▪ U.S. Department of the Interior, Bureau of Land Management Red Devil Mine & Mercury Milling Processing Facility (R10)
Document Review	8	▪ North Penn Area 5 (R3)
		▪ C&R Battery Co., Inc. (R3)
		▪ LCP Chemicals Georgia – Mercury Cell Building (R4)
		▪ General Mills-Henkel Corp. (R5)
		▪ El Paso Natural Gas Mines (R9)
		▪ Northeast Church Rock Mine (R9)
		▪ Westinghouse Electric Corp. – Sunnyvale, CA Plant (R9)
		▪ Warmhouse Beach Dump (R10)
Other	2	▪ B.F. Goodrich (R4)
		▪ Pilsen Area Soil (R5)
Total	28	
Special Projects	4	▪ Prototype Septic Sensor Verification Project (R1 & R2)
		▪ Epsom Salt/Mercury in Concrete Remediation (R4)
		▪ Monitoring for Algal Bloom and Occurrence of Toxic Algae Project (R7)
		▪ Office of Superfund Remediation and Technology Innovation Collaborative Trend Analyses Project

Introduction

This annual report illustrates the range and extent of projects that the Site Characterization and Monitoring Technical Support Center (SCMTSC) supported in fiscal year (FY) 2018. The intended audiences for this report are site project managers, regional management, the Regional Forums, and states through their U.S. Environmental Protection Agency (EPA) Regional contacts. This report is also intended for SCMTSC's clients, including the Office of Land and Emergency Management (OLEM) and the Office of Research and Development (ORD), to show that their generous financial and intellectual investment is an important component in cleaning up sites and protecting our communities. The objective of this report is to demonstrate our accomplishments so that Superfund project managers can understand the benefits of reaching out to SCMTSC to address their most complex hazardous site investigation and cleanup challenges.

The SCMTSC's primary goal is to provide technical assistance to Regional programs on complex hazardous waste site characterization issues.

SCMTSC is operated by members of ORD's Office of Science Policy Superfund and Technology Liaison (STL) Program and supported by staff in the National Exposure Research Laboratory, Exposure Methods and Measurements Division. SCMTSC receives requests for technical support from STLs and regional/headquarters waste program and project managers for their respective sites and states, and then determines if and how the SCMTSC can address their technical support needs.

Requesting technical support is easy (see **Figure 3**). The Region's STL logs the request into the Contaminated sites Scientific, Technical and Risk Support system (C-STARS) database. The Director communicates with SCMTSC subject matter experts to identify if and how SCMTSC can address the technical support issue. Products (e.g., review comments, data, reports, issue papers) are delivered from the subject matter experts to the SCMTSC Director for final approval and delivery to the requestor. If the product is sensitive or requires policy or peer review, the SCMTSC director will coordinate this with the requestor as needed.

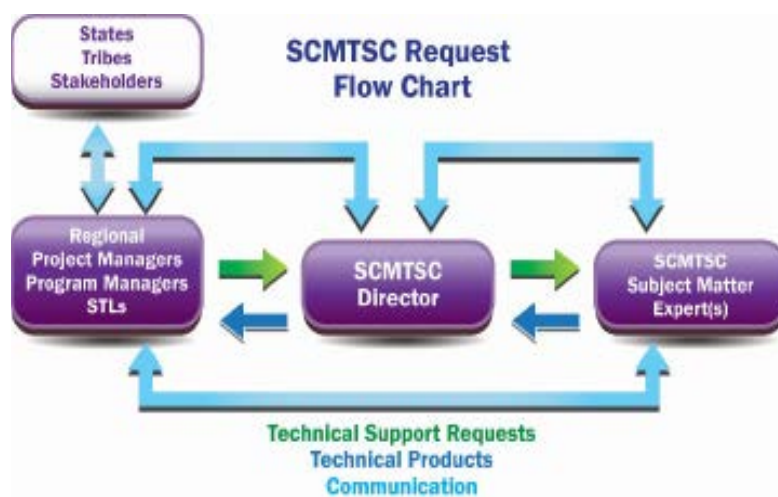


Figure 3. Process for requesting technical support from SCMTSC.

The remainder of this annual report highlights long- and short-term technical support provided by SCMTSC in FY18. Long-term support typically covers larger than discrete tasks, ranging in time from a week to several months. Short-term support is usually discrete tasks completed within a few days to weeks, which illustrate the SCMTSC's breadth and depth of expertise and ability to facilitate a quick response.

Long-Term Technical Support Provided in FY18

In FY18 (October 1, 2017, to September 30, 2018), the SCMTSC supported 28 sites and 4 projects in 9 EPA Regions (see **Table 1**) by completing numerous individual tasks, including site analysis, report reviews, sampling technology evaluations, presentations, meetings, and conference calls. This support is organized into six categories:

- Site Characterization & Sampling Statistics/Trends
- Geophysics
- Exposure Modeling
- Background Threshold Values (BTVs)
- Document Review
- Special Projects and Other

The SCMTSC provided support in FY18 for five sites that were listed on the Administrator's 2017 list of Superfund sites targeted for immediate, intense action. Four of those sites were removed from the list in 2018, and the SCMTSC expects to remain involved with other sites on the current list in the future. Statistical and geophysical-based requests remain very strong on an annual basis, and support was also provided for several mining sites. In the following section, the types of long-term support provided by SCMTSC in FY18 are discussed in more detail, and a select number of the FY18 technical support sites and projects are highlighted as examples of the SCMTSC's work.

Site Characterization & Sampling Statistics/Trends

The SCMTSC supports Regions on sites with complex site characterization or remediation issues related to the size of the site, the number of PRPs involved, the complexity of conceptual site models, or the uniqueness of the contaminant or site characteristics. A variety of models, tools, and skills are used to address these requests, including the use of sampling statistics and trend analyses. In FY18, the SCMTSC provided support to six sites and the support for Bird Creek, West Lake Landfill and Hunter's Point is detailed in the section below:

- **Bird Creek (Region 6)**
- **West Lake Landfill (Region 7)**
- BNSF Derailment (Region 7)
- **Hunter's Point (Region 9)**
- Anaconda Copper Mines (Region 9)
- Lower Duwamish Waterway (Region 10)

Bird Creek – Total Dissolved Solids Monitoring (Region 6)

Bird Creek is a stream in northwestern Oklahoma. In August 2016, an oily sheen and dead fish and turtles were reported on North Bird Creek. An EPA investigation found saltwater bubbling up from the creek, and the source was determined to be secondary recovery of petroleum. The SCMTSC provided technical support on the development of a monitoring plan at Bird Creek, which was impacted by the hydraulic fracturing reagents. The potentially responsible party (PRP) is taking over monitoring efforts at this waterway.



Figure 4. The oily sheen observed at Bird Creek in Oklahoma resulted from nearby hydraulic fracturing activities (Louise Red Corn).

In July 2018, the SCMTSC engaged in several activities, including participation in three conference calls with Region personnel, to provide direction and recommendations for using statistics to determine adequate frequency and number of years of surface water sample collection from Bird Creek that would be needed to establish whether a decrease is occurring in the parameters of concern. The SCMTSC also recommended free and user-friendly statistical software packages, including ProUCL, that can be used to compute the frequency and length of sampling required to evaluate the presence and extent of trends of the measured parameters in the surface water.

Finally, the SCMTSC provided review comments on the PRP's plan and oral comments and recommendations on statistical-based sampling and trend analysis for site monitoring. In September 2018, the SCMTSC provided additional comments on the PRP's updated sampling proposal.

West Lake Landfill (Region 7)

From 1939 to 1985, limestone was quarried on the 200-acre site in Missouri. Beginning in 1962, parts of the site property were used for landfilling of municipal solid waste and construction debris. Two areas became radiologically contaminated in 1973 when soils mixed with uranium ore processing residues were used as daily cover in the landfilling operation (U.S. EPA, 2019a). In previous years, the SCMTSC developed a sampling plan for the outer area of the landfill using spatial statistical methods.

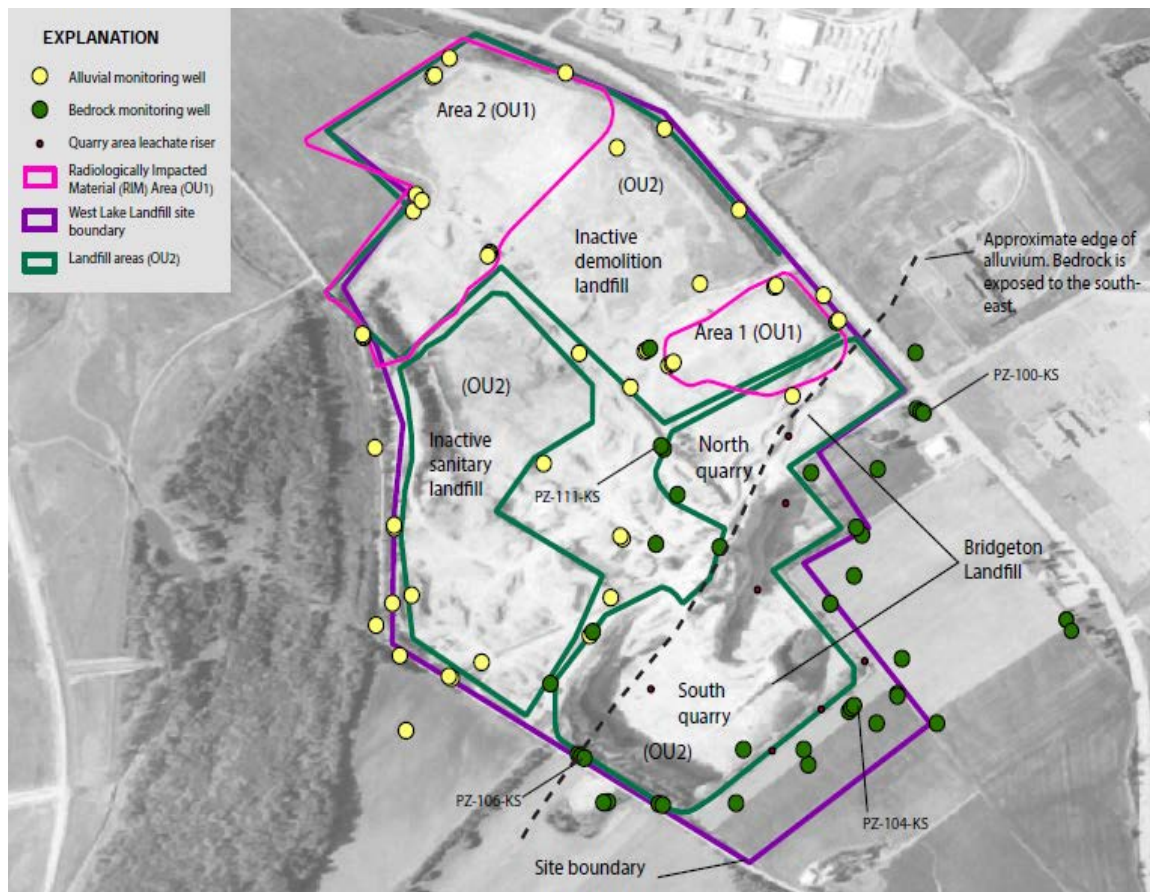


Figure 5. Aerial photograph (1974) of the West Lake Landfill site, former landfill areas, areas containing radiologically impacted material, and monitoring wells at the West Lake Landfill site (USGS, 2015).

The statistically valid sampling plan facilitated determination of the extent of contamination outside the landfill. After the sampling was complete, the SCMTSC was asked to review the data and reports as written by PRPs to determine key elements of these documents related to statistical analysis and to verify that the statistically developed findings are supported by site data. The PRPs provided additional information regarding their input files for the use of ProUCL, and the Region met with the PRPs to provide the data used to calculate exposure point concentrations (EPCs). The EPCs were ultimately used to determine the remediation areas for the site. The SCMTSC reviewed the PRPs' use of ProUCL and provided comments on the data sets that were used to generate these EPCs and provided support to the Region in developing comments related to available data that were not used in the draft document.

The SCMTSC's support aided Region 7 on how to direct the PRPs to account for the data. Specifically, on January 8, 2018, SCMTSC provided comments on the Revised Site Geostatistics Report entitled, "Estimated Three-Dimensional Extent of Radiologically Impacted Material," and on June 5, 2018, SCMTSC provided comments on the Geostatistical Technical Memorandum, "Analysis of Excavation Alternatives for Radiologically Impacted Material" and commented on revisions. A Record of Decision was signed on September 27, 2018. The Region is determining what monitoring support will be requested for the Remedial Decision/Remedial Action.

Hunters Point Naval Shipyard (Region 9)

The U.S. Navy's contractor was caught falsifying site data, and the Region requested assistance with oversight of the resampling and verification of the actual levels of contamination remaining on the site. This falsification of the base closure data has delayed the property turnover for reuse by the city. The SCMTSC provided review comments on the Navy's verification process, which indicated the potential for missing areas that may still need resampling to verify actual contamination and remediation. SCMTSC recommended a different approach using effective univariate and multivariate and multidimensional statistical and graphical methods to identify potential suspicious or anomalous patterns present in data sets collected from the various parcels of the site. In January 2018, based on the site team evaluations, the Navy confirmed that resampling of the entire area was necessary to protect public health.

The 866-acre Treasure Island Naval Station-Hunters Point Annex site in San Francisco, California, was home to a shipyard from 1945 to 1974 and the Naval Radiological Defense Laboratory (NRDL) from 1948 to 1960. NRDL activities contaminated soil, sediments, surface water, and ground water with petroleum fuels, pesticides, heavy metals, PCBs, VOCs, and radionuclides. Soil at the site contains naturally occurring asbestos and metals.

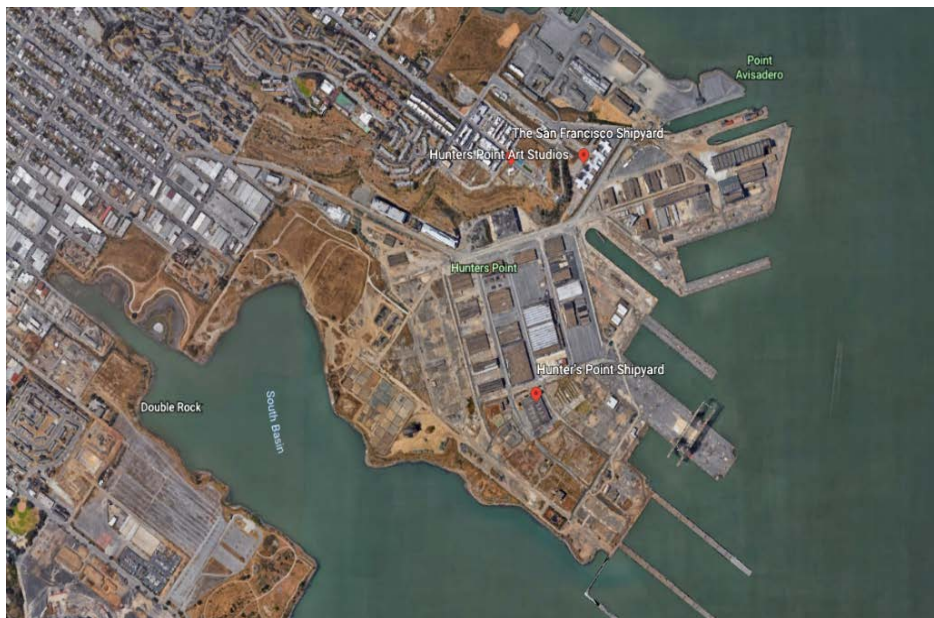


Figure 6. The 866-acre Hunter's Point Naval Shipyard near San Francisco has large redevelopment potential that has been delayed by a contractor's falsified monitoring data (U.S. EPA, 2019b).

The SCMTSC provided technical support for the sampling plans and data evaluation of the Navy's verification resampling process. On March 13, 2018, the SCMTSC provided comments on the "Proposed Work Plan for Radiological Survey and Sampling," and on May 30, 2018, the SCMTSC provided a determination of the number of soil survey unit samples from Parcel Area G that would need to be clean to achieve a 95% statistical confidence level that 95% of soil survey units in the entire parcel are clean. The SCMTSC is calculating the same for all parcels of soil survey units and fill units. Proper re-characterization of the site will ensure that the remediation of the property meets protective standards for human health in this highly desirable reuse area. In August 2018, SCMTSC provided a final technical memorandum on the Navy Work Plan for Parcel Area G.

Geophysics

The SCMTSC assists with developing or reviewing site geophysics and geophysical models. Models allow EPA Regions to integrate related site data into visual indicators of the dynamics between all or part of the site's media and contamination, allowing for a clearer understanding of the site and its associated risks. In FY18, SCMTSC provided geophysics technical support for five sites:

- Enterprise Todhunter (Region 5)
- **Tar Creek (Region 6)**
- Compass Plaza Well Trichloroethylene (Region 7)
- Davis Chevrolet Navajo and Hopi Site (Region 9)
- **Eastern Michaud Flats – FMC OU (Region 10)**

Examples of the geophysics support provided by the SCMTSC for Tar Creek and Eastern Michaud Flats are described below.

Tar Creek (Region 6)

The SCMTSC has provided support to the Groundwater Technical Support Center (GWTSC) to assist the site's Remedial Project Manager (RPM) identify potential investigative techniques that could be used to better understand the ground water-to-surface water (gw/sw) interactions at the site since early 2017. An SCMTSC geophysicist attended conference meetings, provided consultation for the site investigation activities, and recommended the gw/sw investigations use either thermal imaging or a fiber optic distributed temperature system. A site visit for all the parties occurred in early 2017, and the visit included stops at three locations of interest to test the ability of thermal imaging to aid in identifying areas of potential ground water discharge.

Regional field sampling activities began in July 2017 and ended in October 2017 in an area known to have mine discharge and where thermal imaging was able to distinguish this discharge from surface water. The purpose of the study was to identify appropriate tools to characterize gw/sw interactions related to chat piles adjacent to Tar Creek and assess or demonstrate the utility of these tools at the site. SCMTSC recommended the use of temporary piezometers, staff gauges, and sediment temperature monitoring probes to assess possible spatial and short-term temporal changes in seepage flux to the creek, and sediment temperature profiling coupled with limited hydrologic monitoring to determine seepage characteristics at the site.



Figure 7. Cleanup of chat piles at the Tar Creek Superfund site in Oklahoma (U.S. EPA, 2019c).

Based on the investigation results and coordination between the team members, the SCMTSC made recommendations in early 2018 on possible remediation technologies to be evaluated in the Feasibility Study (FS) with a goal of providing a more efficient cleanup strategy that uses fewer Superfund dollars while also delivering better community protectiveness.

Eastern Michaud Flats – FMC Plant OU (Region 10)

The Eastern Michaud Flats Superfund site covers approximately 2,530 acres northwest of Pocatello, Idaho. It includes two adjacent phosphate ore processing facilities. The FMC OU, one of three OUs, consists of approximately 1,450 acres. The FMC Corporation operated its elemental phosphorus facility within the FMC OU from the 1940s until December 2001. While operating, FMC disposed of elemental phosphorus containing wastes in ponds. The ground water is contaminated primarily with phosphorus compounds and arsenic and is a source of contamination to the Portneuf River, and the soil is contaminated from spills and releases from elemental phosphorus and other hazardous substances. (U.S. EPA, 2017a).

Region 10 requested assistance to evaluate potential non-intrusive geophysical technologies to refine the conceptual site model and better understand subsurface contaminant architecture below the old furnace building. The SCMTSC participated in several conference calls and several one-on-one calls, facilitated obtaining a detailed estimate for a geoelectrical approach, and facilitated an estimate from the U.S. Geological Survey (USGS) for possible field work to differentiate site contamination from surrounding soil. Both estimates were forwarded to the site RPM in April 2018. The Region evaluated the estimates and proposed approaches to determine investigative next steps.

Exposure Modeling

An exposure assessment attempts to answer several questions for a substance or chemical, including the following (U.S. EPA, 2017a):

- How much of the chemical will be released to the environment during manufacturing, processing, and using the substance?
- What environmental pathways (indoor air, indoor dust, indoor surfaces, outdoor air, drinking water, surface water, etc.) are relevant for general population and environmental exposure?
- What routes of human exposure (inhalation, ingestion, dermal, fetal) are relevant?

Assessments typically use a combination of monitoring data and modeled estimates where reliable measured data are lacking. In FY17, SCMTSC provided exposure modeling technical support to two sites as specified below:

- Centredale Manor Restoration Project, North Providence, Rhode Island (Region 1); and
- Vo-Toys, Harrison, New Jersey (Region 2)

Centredale Manor Restoration Project (Region 1)

The Centredale Manor Restoration Project includes the Centredale Manor site located in North Providence, Rhode Island, and contaminated areas of the river downstream of the site. The area is contaminated with dioxin and other contaminants from chemical production and drum reconditioning that took place on site from the 1940s to the 1970s. As a result of past site operations, chemicals were released directly to the ground, buried, and emptied directly into the river, resulting in contamination of soil, ground water, surface water, and sediment in the adjacent and downstream river and ponds. Over time, contamination from the source area of the site entered the river and contaminated sediment in ponds and streams. In December

2017, the EPA Administrator included this site on a list of Superfund sites targeted for immediate and intense attention, and in July 2018, the U.S. Department of Justice, EPA, and the Rhode Island Department of Environmental Management announced that two subsidiaries of a former site owner—Emhart Industries Inc. and Black & Decker Inc.—agreed to clean up dioxin contaminated sediment and soil at the site. The excavated sediment and soil were originally slated to be disposed in a newly constructed landfill, but EPA proposed modifications and Region 1 requested the SCMTSC assess exposure risks from disposal of the contaminated soil and sediment to landfill workers.

The SCMTSC reviewed site documents that relate to the level of contaminants, amount of material, production rates, and duration of transport and disposal off-site in an upland construction and demolition landfill for the selected remedy (e.g., Baseline Human Health Risk Assessment (BHHRA), Feasibility Study, 2012 ROD). The SCMTSC then (1) evaluated available risk assessment tools relevant for landfill worker exposure; (2) evaluated available studies on incidental ingestion rates; (3) used available agreed-upon models and tools to evaluate potential risk to a typical landfill worker; and (4) provided sensitivity analyses of key assumptions related to hazard and exposure in these models by performing risk calculations to determine associated risk to a typical landfill worker from this site's waste material. The findings supported an expansion of the options for the disposal of the excavated contaminated sediment and floodplain soil to allow for disposal in an existing solid waste landfill which avoided the need for construction of a new landfill.

Vo-Toys (Region 2)

The Vo-Toys site was an industrial complex located in Harrison, New Jersey, dating from the early 1900s, where several companies used mercury in their work processes. Recently, developers wanted to redevelop the site into residential units, but three of the buildings (Buildings A, B, and C)—an entire city block—are contaminated with elevated levels of mercury vapor. Redevelopment work ceased, and the buildings are now vacant. Region 2 is looking into building removal because of the concern for mercury exposure if the buildings were to catch fire and requested technical support related to exposure risk to surrounding communities and the environment.

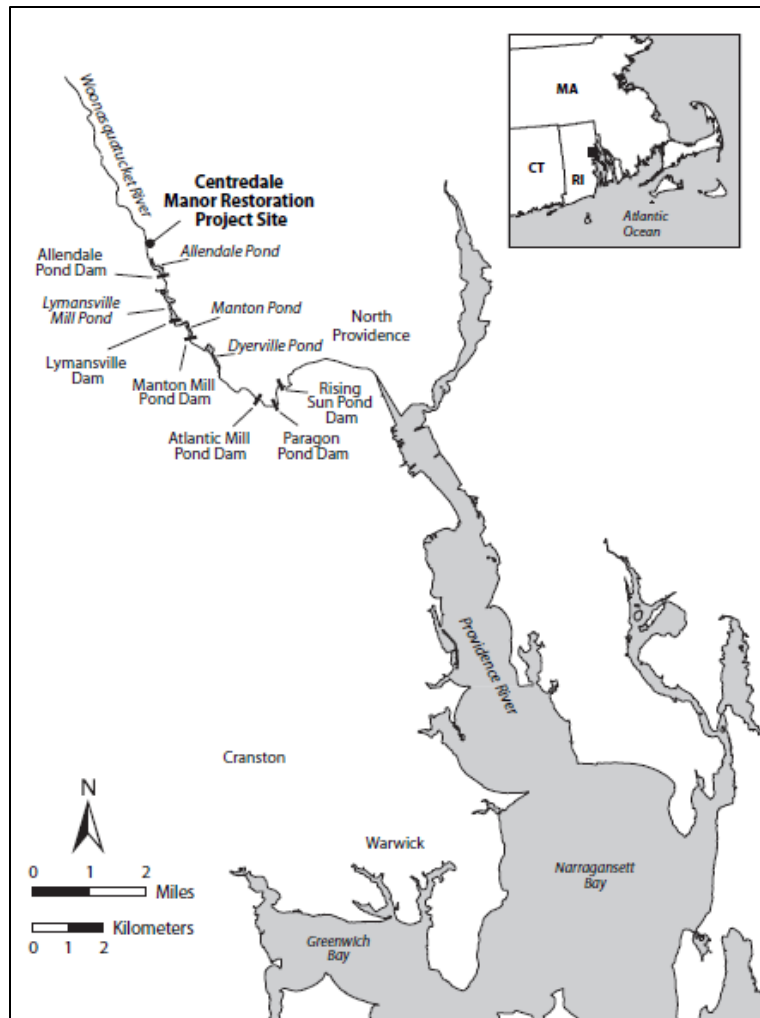


Figure 8. Regional map of the Centredale Manor Restoration Project, Rhode Island (Gardiner et al., 2005).

The SCMTSC worked with another National Risk Management Research Laboratory (NRMRL) support center, Engineering Technical Support Center (ETSC), to perform a two-phase study approach to assist the Region in determining the risk from a building-wide fire. In phase 1, ETSC and SCMTSC conducted ambient exposure modeling for releases during combustion to assist in determining the potential risk from the site to neighboring communities should a fire occur. The SCMTSC refined the SCREEN3 dispersion model to identify maximum downwind mercury exposures in the event of a building fire and presented the findings to Region 2 in early May 2018.



Figure 9. Mercury air monitoring activities in Building C at the Vo-Toys site (U.S. EPA OSC Response, 2017).

Phase 2 consists of turning the knowledge gained from modeling activities into action. The first responders, with guidance from SCMTSC, will use the modeling results to determine response and community protective measures in the event of a building fire. In July and August 2018, the SCMTSC supported Region 2 emergency response planning with local officials and fire and police departments for evacuation and firefighting based on the modeling results. The SCMTSC also provided technical support and model results criteria at a planning meeting on October 18, 2018, at the Vo-Toys site for first responders.

Background Threshold Values (BTVs)

SCMTSC investigates complex sites to determine background concentrations and background threshold values (BTVs), which are used by project managers to determine areas of contamination, complete the site risk assessment, and develop the FS for site remediation. Establishing BTVs at large industrial sites can be complicated by naturally occurring or urban background concentrations and requires specialized skills and experience.

In FY18, SCMTSC provided support for establishing background concentrations and determining BTVs for five sites. Chemours Pompton Lakes and the Arsenic Mines of Nimham Mountain are discussed below:

- **Chemours Pompton Lakes, New Jersey (Region 2)**
- Atlantic Fleet Weapons Training, Vieques, Puerto Rico (Region 2)
- **Arsenic Mines of the Nimham Mountain Mine Site, Kent, New York (Region 2)**
- G&H Landfill, Utica, Michigan (Region 5)
- Red Devil Mine, Red Devil, Alaska (Region 10)

Chemours Pompton Lakes Work Site (Region 2)

E.I. DuPont De Nemours & Co. manufactured explosives on this 570-acre site at the north end of Pompton Lakes, New Jersey, from 1902 to 1994. Land use in the vicinity is primarily residential and commercial but also includes undeveloped areas, an interstate highway (Route 287), and state-owned forest. Historical operations of a DuPont facility involved the manufacture of munitions, and waste management practices during the facility's operation resulted in contamination of surface water, soil and sediment, and ground

water both on and off site. Dredging of approximately 40 acres of Pompton Lakes was required to remove the primary component of concern, mercury, although lead and copper are also present (U.S. EPA, 2018).



Figure 10. Dredging activities in Pompton Lakes, New Jersey, to remove contaminated sediment. (U.S. EPA. 2018a).

The SCMTSC previously provided statistical review and comments on this site for establishing background concentrations and threshold values in 2016. The SCMTSC also provided observations on the PRP's "Response to Comments, NJDEP/USEPA Supplemental Comments on CMS And Documents Supporting CMS Correspondence" in October 27, 2017. Region 2 then requested a review of the 2016 draft long-term monitoring plan (LTMP) related to the dredging of Pompton Lake with special emphasis on verifying the statistical rigor of the proposed sampling.

The SCMTSC delivered the final technical memorandum identifying strengths and areas of improvement for the LTMP on July 25, 2018. Region 2 provided additional funding to the SCMTSC for continued technical support as they prepare a response and engage with the responsible party.

Arsenic Mine Site (Region 2)

This historic mine, containing arsenopyrite, a metal ore that was used in pesticides, pigments, and other industries, was operated from the mid-1800s through approximately 1918 in Kent, New York. The mine has also been known as Pine Pond Mine, Silver Mine, and Nimham Mountain Mine. In 1987, nearby residents were hospitalized for arsenic poisoning, resulting in the installation of a water collection system on a homeowner's property in the late 1980s. In 2016, the homeowner called EPA to inquire about assistance for this system as sediments entering the system were later found to contain high levels of arsenic. Follow-up assessments were also conducted at the impacted property and neighboring properties. The assessment found arsenic levels as high as 56,000 mg/kg in the soils. EPA conducted soil sampling events in 2017 and 2018 to depths of 2 feet in various areas near Pine Pond and found arsenic levels are as high as 1,600 times the EPA screening level (U.S. EPA, 2017b). Elevated concentrations were also found at the mine entrance and downhill from the mine entrance.



Figure 11. Area under investigation for elevated arsenic levels in the soil at the Arsenic Mine site in Kent, New York (NYSDoH, 2019).

Because of the site's complexity and high projected cleanup cost, it was recommended that cleanup areas be prioritized based on use. Therefore, Region 2 requested SCMTSC provide technical support to develop statistically defensible background values that could be used to guide a Removal Action in the residential area adjacent to the mine site. Several values that could be applied to different areas depending on their use are being investigated (e.g., a higher background value for low-use areas and a lower background value for high-use areas). SCMTSC provided the final technical memorandum on recommended background values to Region 2 on July 25, 2018.

Document Review

SCMTSC provides critical reviews of internal and external (e.g., developed by potentially responsible parties, state government) site documents or sampling methods. A review performed by experts independent of the project provides a fresh look (and additional expert opinion) at data and information related to complex site issues. The SCMTSC can evaluate different methods or technologies to determine if they will provide useful site data in a more efficient and effective manner. New or old methods and technologies used in an innovative way may improve site actions through time or cost savings.

In FY18, SCMTSC provided critical document reviews for eight sites, and activities conducted for C&R Battery, General Mills and Warmhouse Beach Dump are highlighted in this report:

- North Penn – Area 5, Montgomery Township, Pennsylvania (Region 3)
- **C&R Battery Co., Chesterfield County, Virginia (Region 3)**
- LCP Chemicals – Mercury Cell Building, Brunswick, Georgia (Region 4)
- **General Mills – Henkel Corp., Minneapolis, Minnesota (Region 5)**
- El Paso Natural Gas Mines, Cameron, Arizona (Region 9)
- Northeast Church Rock Mine, Church Rock, New Mexico (Region 9)
- Westinghouse Electric Corp. (Sunnyvale Plant), Sunnyvale, California (Region 9)
- **Warmhouse Beach Dump, Neah Bay, Washington (Region 10)**

C&R Battery Co., Inc. (Region 3)

The eleven-acre C&R Battery Company site is located near the James River in Chesterfield County, Virginia. Between the early 1970s and 1985, C&R Battery Co., Inc. used the site to dismantle batteries from cars, trucks, and commercial applications to recover lead and lead oxide. The process involved cutting open batteries and draining acid into on-site ponds, which contaminated the soil, sediment, and surface water with lead and other hazardous chemicals (U.S. EPA, 2019e).

SCMTSC was requested by the Region to review documents regarding the overall approach taken at the site to reduce lead concentrations above the action level and to determine if, from the data available, lead contamination above the action level is still present at the site.

A report detailing the review of documents and drawings depicting the SCMTSC's best determination of the state of the site with respect to lead contamination was delivered to Region 3 on April 24, 2018.

The SCMTSC's review assisted the RPM in establishing final actions and protective restrictions at the site. The 2018 Five-Year Review (U.S. EPA, 2018b) states that the current remedy is protective in the short term because, as result of the cleanup, no one is currently exposed to contamination that could pose an unacceptable risk. However, land use restrictions are necessary to ensure the remedy remains protective of human health and the environment over the long term.

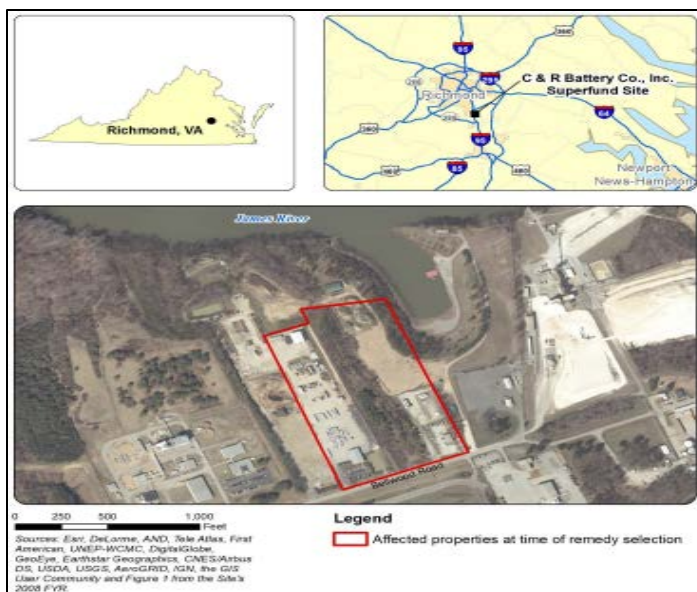


Figure 12. C&R Battery Co., Inc. site includes soil, sediment, and surface water contaminated with lead and other hazardous chemicals from battery dismantling (U.S. EPA. 2018b).

General Mills-Henkel Corp. (Region 5)

The General Mills-Henkel Corp. site in Minneapolis, Minnesota, was used as a food research facility beginning in 1930 and was then used for chemical research from 1947 to 1977. Waste disposal operations between 1947 and 1962 contaminated soil and ground water with hazardous chemicals (U.S. EPA, 2019f). After industrial operations ceased in the 1980s a new property owner renovated existing buildings, and the site is now home to several small businesses.

An extensive program of vapor intrusion mitigation and long-term ground water monitoring is ongoing. Related to this, Region 5 requested a review of the existing background data for the site and two specific documents—EPA Technical Review and PRP Soil—to provide an expert opinion on regional site issues and concerns. Two key questions guided the review:

1. Can ratios of concentrations of various chlorinated VOCs (cVOCs) in soil with similar properties to one another be expected to lead to similar ratios of concentrations, relative to one another, in ground water?



Figure 13. The 7-acre General Mills-Henkel Corp., considered a Superfund redevelopment success, sits in the northeastern part of Minneapolis, Minnesota (U.S. EPA, 2014).

2. Is it possible to use the provided data to model concentrations of relative ratios of various cVOCs that would have likely been present in the ground water if this soil was the only source of contamination (i.e., no contribution from other upgradient sources)? Furthermore, if such modeling is possible, would the results obtained (as ranges of concentrations or ratios for various cVOCs relative to one another) provide reasonable confidence in such results?

The site documents were reviewed, and discussions were held with all parties. A final Technical Memorandum providing the chemical and physical properties of the site VOCs, modeling estimates, and technical opinions on the VOC concentration data for use in evaluating additional remediation options was delivered September 2018.

Warmhouse Beach Dump (Region 10)

The Warmhouse Beach Dump Superfund site is located within the Makah Indian Reservation at the northwestern tip of the Olympic Peninsula in Washington. The site includes a former open dump on top of a ridge about 3 miles northwest of Neah Bay and two streams that originate within the dump and flow to East Beach and Warmhouse Beach. Municipal and household solid and hazardous wastes were disposed of at the dump from the 1970s until 2012 when the Makah Tribe began operating a solid waste transfer station on the reservation. Elevated levels of metals, perchlorate, and PCBs have been found in soil at the dump and in sediment in both creeks (U.S. EPA, 2019g).



Figure 14. The Warmhouse Beach Dump sits 800 feet inland and 260 feet above the Strait of Juan de Fuca in Washington (U.S. EPA, 2016).

The SCMTSC reviewed site materials for derivation of background concentrations of carcinogenic polycyclic aromatic hydrocarbons (cPAHs), metals, and dioxin. Multi-incremental sampling (MIS) was performed on background decision units (DUs) and was compared with site DU MIS. The SCMTSC commented that the background data set collected was not considered a representative background data set for two reasons. First, not enough background incremental sampling methodology (ISM) samples were collected and second, replicate ISM samples were collected from the background samples. Comments were provided to Region 10 in March 2018, and the SCMTSC met separately with the site team and PRPs afterwards.

For better characterization of site background, the SCMTSC recommended identifying many background sampling units each of the same size to the site sampling units. From a statistical point of view, a minimum

selection of six (8 to 10 are preferable) background SUs were endorsed to compute reasonable and representative BTVs. Replicate samples were not required from background SUs if it could be confirmed that selected SUs indeed represented background SUs. It was also recommended that one could optionally collect some replicate samples (no more than three) from one of the background DUs to evaluate the performance of the analytical method used. This could be done when collecting replicate samples from site SUs. Following these recommendations would result in a representative background ISM data set. As described in the March 2, 2018 technical memorandum, the background data set could then be used to compute a representative 95%-95% upper tolerance limit (UTL) for performing site versus background comparisons.

Other and Special Projects

The Other category of projects covers site document development, special laboratory analysis or QA/QC activities, technology development, unique statistical and trend evaluations, and other special characterization requests. Beyond hazardous waste site characterization, SCMTSC special requests encompass waste and ecological characterization, monitoring, and investigative issues including ones related to RCRA sites, facility discharges, Brownfields, spills, stream, lake, groundwater, and drinking water quality, air quality, septic, and underground storage tanks. In FY18, SCMTSC provided technical support to two sites and four special projects. Support provided for the site and project names bolded in the table below are summarized in this section.

Support Provided by SCMTSC	Site or Project Name
Site document development	B.F. Goodrich Site, Calvert City, Kentucky (Region 4)
Special laboratory analysis and QA/QC activities	Pilsen Area Soil Site Chicago, Illinois (Region 5) Epsom Salt/Mercury in Concrete Remediation Research Project (Region 4)
Technology development	Prototype Septic Sensor Verification Project (Region 1 & 2)
Unique statistical evaluations	Algal Bloom and Occurrence of Toxic Algae Project (Region 7)
Trend evaluations	OSRTI Collaborative Trend Analyses Project

B.F. Goodrich Site (Region 4)

The SCMTSC is continuing support at the Region 4 B.F. Goodrich site. SCMTSC developed a Final Remedial Investigation Report, Human Health Risk Assessment (HHRA), and Ecological Risk Assessment (ERA) in August 2015. Additionally, the SCMTSC created a three-dimensional model of the subsurface contamination to clarify visually where known contamination is entering the Tennessee River. Phase 2 sampling maps for continuation of the offshore investigation in the river were also prepared prior to a sampling event conducted in mid-October 2016.

Models and maps were updated, and after discussions with the state, PRPs, and Office of Land and Emergency Management (OLEM), the SCMTSC prepared the FS which contributed to Region 4's preparation of a proposed plan. Nearly 300 pages of public comments were received on the proposed plan.

The SCMTSC assisted with the response to technical comments on the Proposed Plan and provided technical information for the ROD signed on September 5, 2018.

Prototype Septic Sensor Verification Project (Region 1 & 2)

In early 2017, EPA, in partnership with The Nature Conservancy, the USGS and others, launched the “Advanced Septic System Nitrogen Sensor Challenge” to spur the development and design of a low-cost nitrogen sensor package that could measure and monitor the performance of advanced nitrogen removal in septic systems.

Phase 1 winning designs were announced at the June 2017 Sensor Showcase Day event. Region 1 and the ORD partnership team were awarded ORD funding for a Regional/State Innovation Project to support Phase 2: Prototype Performance Testing. The partnership team requested technical assistance from the SCMTSC in developing and implementing the verification protocols and testing the sensors. The second round of prototype pilot testing and field testing began in October 2018.

Epsom Salt/Mercury in Concrete Remediation Research Project (Region 4)

Region 4 is performing an ORD and Office of Science Policy Superfund and Technology Liaison Research—(STLR) supported applied research project on the use of Epsom Salt (magnesium sulfate) solution in mercury spill mitigation. The study involves the application of Epsom Salt solution after gross removal of elemental mercury to mitigate residual mercury contamination on concrete surfaces to reduce mercury vapors within work or residential air spaces to below risk-based concentrations. The Region requested assistance with the specific mercury speciation analysis required to perform the study and review comments on the study project plan. SCMTSC, ETSC, and the U.S. EPA Environmental Response Team (ERT) provided review comments in May 2018, and the report was finalized. The laboratory work was performed in early September 2018, and the sample analyses were completed in the fall of 2018.

Monitoring for Algal Bloom and Occurrence of Toxic Algae Project (Region 7)

The Region 7 project team for the Regional Applied Research Effort (RARE) Program—Development of Strategies and Methods for Monitoring for Algal Bloom and Occurrence of Toxic Algae Using Next Generation Sequencing qPCR and PhyloChip Microarrays—requested statistical analysis of the project sample data. The SCMTSC determined the best data analysis techniques for data produced by generation sequencing qPCR and PhyloChip microarrays. After receiving data from Region 7, the SCMTSC reviewed its format and ultimately determined original laboratory electronic data deliverables were needed for the evaluation. For an efficient analysis, the data were put into an Access® database for querying. The SCMTSC developed a data evaluation plan to investigate the relationships among the water quality, cyanobacteria, chemical analysis, and lake/weather condition data. SAS programming was used to evaluate the multivariate correlation and principal component analyses. The data set includes interval, ratio, binary, and categorical data.

Office of Superfund Remediation and Technology Innovation (OSRTI) Collaborative Trend Analyses Project

The SCMTSC is assisting OSRTI in identifying trends in the development and deployment of environmental investigation and remediation technologies by analyzing large data pools related to the topic. The overall goal of tracking this information is to identify opportunities for future investments in solutions and in capturing and communicating technical and performance information for key environmental technologies.

Short-Term Technical Support Provided in FY18

In addition to the continuous support provided to Superfund sites, the SCMTSC addresses many short-term requests on a weekly basis, including questions from state and local governments. Selected topics for short-term assistance include determining the most appropriate statistics to estimate BTVs, addressing site geophysical questions and selection of remediation options, performing trend evaluations on monitoring data, and providing sampling plan review comments and sampling method recommendations. Examples of the short-term assistance provided in FY18 include the following:

- Addressed a professional geologist's inquiries about computing BTVs based upon data sets with low frequency of detected observations and later reviewed data sets in question and provided guidance for a lead-contaminated site in Delaware.
- Provided reference documents for determining background concentrations to the Central Chemical Site RPM in Region 3.
- Reviewed site data and addressed statistical questions of a Region 9 toxicologist about identifying outliers and computing BTV estimates for analytes of interest at the Leviathan Mine site.
- Assisted the Fulton Site RPM in Region 2 with identifying technical support options, including assessing site biodegradation with isotopic degradation and modeling, determining possible sources of trichloroethylene (TCE), and determining ground water flow dynamics in the study area for OU 2.
- Assisted the Lawrence Livermore Site RPM in Region 9 with determining support needs for interpretation of Background Reference Area study results, including depleted uranium at the Lawrence Livermore Site 300.

ProUCL Support

The Superfund cleanup process is complex, frequently requiring technical assistance to address statistical issues associated with various projects on polluted sites. Establishing and implementing appropriate cleanup plans is a long-term process that involves a team of decision makers from across EPA and external stakeholders. Since 2001, the SCMTSC has helped these decision makers make statistically defensible decisions through the free ProUCL software (<https://www.epa.gov/land-research/proucl-software>).

The SCMTSC provides short-term ProUCL assistance, including guidance on extracting site-specific background data from broader pooled on-site data sets; determining the most appropriate statistics to estimate BTVs; teaching differences between upper confidence limit (UCL) of mean and a two-sided confidence interval of mean; illustrating the differences between various decision statistics, like a 95% UCL of mean, a 95% upper prediction limit (UPL95), and a 95%-95% upper tolerance limit (UTL95-95); computing correct estimates of exposure point concentration (EPC) terms for moderately skewed and highly skewed data sets; and performing proportion tests and interpretation of test statistics, trend evaluations, trend graphs, and trend test statistics.

ProUCL

As the fourth most downloaded ORD tool on the EPA Website, ProUCL helps users compute rigorous and defensible statistics and use graphical tools to analyze environmental data.

ProUCL allows users to:

- address site evaluation issues like comparing background data sets,
- perform hypotheses tests,
- establish background-level contaminant concentrations,
- estimate EPCs,
- perform trend evaluations, and
- identify outliers and unusual observations present in environmental data sets.

Examples of short-term ProUCL support provided in FY18 include the following:

- Assisted North Carolina Department of Environmental Quality – Division of Water Resources (Region 4) on how to deal with duplicates when performing outlier tests, Dixon, or Rosner tests.
- Addressed RCRA contractor inquiries about use of the continuity correction factor for normal approximation to binomial distribution when using a One-Sample Sign Test.
- Addressed Michigan Department of Environmental Quality inquiries about the use of 99% UCLs suggested by ProUCL.
- Addressed a Colorado graduate student's questions concerning using ProUCL to impute nondetect values using a lognormal Regression on Order Statistics.
- Addressed an international (India) graduate teaching assistant's questions concerning data results using the Mann-Kendall test (MK Test) in ProUCL.
- Assisted a Laser Safety Officer at the Lawrence Berkeley National Laboratory with using ProUCL to aid in developing a radiological release and clearance program.

ProUCL remains relevant and heavily used over a decade past its initial development. It was one of the top five downloadable tools in FY18 on ORD's Tool Tracking Index. Future efforts to maintain ProUCL and support EPA users and external customers include additional training and a program update scheduled for FY20.

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