



# Site Characterization and Monitoring Technical Support Center - FY16 Report

October 2015 - September 2016



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# **Site Characterization and Monitoring Technical Support Center**

## **FY16 Report**

October 2015 – September 2016

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## NOTICE / DISCLAIMER

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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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## SPECIAL ACKNOWLEDGEMENTS

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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.

We at SCMTSC would like to thank John McKernan, Director of the Engineering, Technical Support Center; Dave Burden, Director of the Groundwater, Technical Support Center; Teresa Shannon, National Coordinator for the Superfund Health Risk Technical Support Center and the Ecological Risk Assessment Support Center; and Karen Chu, of the ORD Sustainable and Healthy Communities Research Program for their cooperation and teamwork in providing high-quality technical support to the Regions. We also would like to thank the members of the Groundwater, Engineering, and Federal Facilities Forums for their support and cooperation with the technical support centers through the years.

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# CONTENTS

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Notice / Disclaimer ..... v

Special Acknowledgements ..... vi

Contents ..... vii

Figures ..... ix

Abbreviations and Acronyms ..... xi

Introduction..... 1

Technical Focus of SCMTSC ..... 2

FY16 Technical Support ..... 3

Short-Term Requests ..... 3

Region/Program Specific Long-Term Support ..... 4

Review of Technical Documents/Methods ..... 5

    R4 – Alaric Area Groundwater Plume Superfund Site ..... 5

    R7 – Main Street Site ..... 6

Source Attribution/Fingerprinting..... 6

    R3 – Lower Darby Creek Area (LDCA) Superfund Site ..... 7

Laboratory Support ..... 9

    R9 – Yurok Tribe (Klamath Basin)..... 9

Highly Complex Site Investigations/Models ..... 10

## Contents, *continued*

R4 – BF Goodrich.....	10
Geophysics Support .....	11
R2 – Seneca Army Depot .....	12
R10 – Warmhouse Beach Dump.....	12
Statistical Support .....	13
R9 – Abandoned Uranium Mines on the Navajo Nation .....	14
R10 – Bunker Hill Mining Site/Coeur d'Alene Basin.....	15
Background Analysis/Background Threshold Values .....	16
R2 – American Cyanamid (Bridgewater Township) .....	17
R2 – DuPont Pompton Lakes.....	18
Sample/Monitoring Plan Review/Development .....	20
R2 – Myers Property .....	20
R8 – Mystery Bridge Road .....	21
Training/ORD Support Capabilities .....	22
SCMTSC Case Study Webinar .....	22
State of Wisconsin and Region 5 ProUCL Training.....	23
Region 7 Tools Café .....	23
ProUCL.....	24
References.....	26





## FIGURES

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Figure 1.	Flow Chart for Requesting Technical Support.....	1
Figure 2.	EPA Region map.....	2
Figure 3.	FY16 SCMTSC Cross-Regional Support .....	4
Figure 4.	FY16 SCMTSC Activities by Project Type.....	4
Figure 5.	Aerial Photo of Alaric Groundwater Plume Site.....	5
Figure 6.	Alaric Electrical Resistance Heating Installation.....	6
Figure 7.	Geophysical survey line across Lower Darby Creek near Clearview Landfill .....	7
Figure 8.	Lower Darby Creek.....	7
Figure 9.	Darby Creek at Pine St, PA.....	7
Figure 10.	Map of Lower Darby Creek Area .....	8
Figure 11.	Warning sign.....	9
Figure 12.	2005 Algal Bloom Sampling at Klamath Copco Reservoir .....	9
Figure 13.	Map of the Klamath River Basin .....	10
Figure 14.	3-D model of groundwater contamination at BF Goodrich site.....	11
Figure 15.	Sampling under the Tennessee River.....	11
Figure 16.	Seneca Army Depot igloo storage bunker.....	12
Figure 17.	Seneca Army Depot .....	12

## Figures, *continued*

Figure 18.	White deer inside fence at Seneca Army Depot.....	12
Figure 19.	Aerial view of Warmhouse Beach Dump .....	13
Figure 20.	Map of Warmhouse Beach Dump .....	13
Figure 21.	Demolition of home contaminated with radiation.....	14
Figure 22.	Radiation Removal Sign .....	14
Figure 23.	Rebuilt home .....	14
Figure 24.	Map of Abandoned Uranium Mines.....	15
Figure 25.	Coeur d'Alene River .....	15
Figure 26.	Brown Trout .....	16
Figure 27.	Site map of American Cyanamid .....	17
Figure 28.	Flooding of American Cyanamid waste impoundments .....	18
Figure 29.	Flag marking where a soil sample was taken near the mouth of Acid Brook where it empties into Pompton Lake.....	19
Figure 30.	Typical well drilling equipment setup.....	19
Figure 31.	Aerial view of Dupont Site .....	20
Figure 32.	Abandoned well area - Cakepoulin Creek.....	21
Figure 33.	Old family barn housing Myers groundwater treatment plant .....	21
Figure 34.	Aerial view of Mystery Bridge Road Site .....	22



## ABBREVIATIONS AND ACRONYMS

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<b>AUMs</b>	Abandoned Uranium Mines
<b>BaP</b>	Benzo (a) pyrene
<b>BTVs</b>	Background Threshold Values
<b>CD</b>	Cultural Debris
<b>Cl<sub>2</sub></b>	Chlorine
<b>CVOC</b>	Chlorinated Volatile Organic Compound
<b>DMA</b>	Demonstration of Method Applicability
<b>DQOs</b>	Data Quality Objective
<b>DTS</b>	Distributed Temperature Sensing
<b>EM</b>	Electromagnetics
<b>EMMD</b>	Exposure Methods and Measurements Division
<b>EPC</b>	Exposure Point Concentrations
<b>ERA</b>	Ecological Risk Assessment
<b>ERH</b>	Electric Resistance Heating
<b>ETSC</b>	Engineering Technical Support Center
<b>FCRs</b>	Field Change Requests
<b>FDEM</b>	Frequency Domain EM
<b>FS</b>	Feasibility Study
<b>FY</b>	Fiscal Year
<b>GPR</b>	Ground Penetrating Radar
<b>GW</b>	Groundwater
<b>GWTS</b>	Groundwater Technical Support Center
<b>GOF</b>	Goodness of Fit
<b>HABs</b>	Harmful Algal Blooms
<b>HAO</b>	Hanlin-Allied-Olin

## Abbreviations and Acronyms, *continued*

<b>HCl</b>	Hydrogen Chloride
<b>HHRA</b>	Human Health Risk Assessment
<b>IDHW</b>	Idaho Department of Health and Welfare
<b>ISCO</b>	In-Situ Chemical Oxidation
<b>K-M</b>	<i>Kaplan-Meier</i>
<b>LDCA</b>	Lower Darby Creek Area
<b>MD</b>	Munitions Debris
<b>MPPEH</b>	Material Potentially Presenting an Explosive Hazard
<b>MQOs</b>	Measurement Quality Objectives
<b>NERL</b>	National Exposure Research Laboratory
<b>NJDEP</b>	New Jersey Department of Environmental Protection
<b>ND</b>	Non Detect
<b>OD</b>	Open Detonation
<b>OLEM</b>	Office of Land and Emergency Management
<b>ORD</b>	Office of Research and Development
<b>OSP</b>	Office of Science Policy
<b>P&amp;T</b>	Pump and Treat
<b>PAHs</b>	Polyromantic Hydrocarbons
<b>PDI</b>	Pre-Design Investigation
<b>PRP</b>	Potentially Responsible Party
<b>PVC</b>	Polyvinyl Chloride
<b>QAPP</b>	Quality Assurance Project Plan
<b>QA/QC</b>	Quality Assurance/ Quality Control
<b>Q-Q</b>	Quantile-Quantile
<b>RI</b>	Remedial Investigation
<b>RI/FS</b>	Remedial Investigation and Feasibility Study
<b>ROS</b>	regression on order statistics
<b>RPM</b>	Remedial Project Manager

## Abbreviations and Acronyms, *continued*

<b>RSL</b>	Regional Science Liaison
<b>SCMTSC</b>	Site Characterization and Monitoring Technical Support Center
<b>SOPs</b>	Standard Operating Procedures
<b>SRS</b>	Site-specific Remediation Standard
<b>STL</b>	Superfund and Technology Liaison
<b>TDEM</b>	Time Domain Electromagnetic Induction
<b>TDS</b>	Total Dissolved Solids
<b>TEQ</b>	Toxic Equivalents
<b>TEMTADS</b>	Time-domain Electromagnetic Multi-sensor Towed Array Detection System
<b>T-S</b>	Theil-Sen
<b>TSC</b>	Technical Support Center
<b>TSP</b>	Technical Support Project
<b>WDNR</b>	Wisconsin Department of Natural Resources
<b>XRF</b>	X-ray fluorescence
<b>YTEP</b>	Yurok Tribe Environmental Program
<b>UCL</b>	upper confidence limit
<b>UPL</b>	upper prediction limit
<b>UTL</b>	upper tolerance limit
<b>USGS</b>	United States Geological Survey
<b>U.S. EPA</b>	United States Environmental Protection Agency



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# INTRODUCTION

SCMTSC's primary goal is to provide technical assistance to regional programs on complex hazardous waste site characterization issues. This annual report illustrates the range and extent of projects that SCMTSC supported in FY 2016. Our principal audiences are site project managers, regional management, the Regional Forums and States through their Regional contacts. This report is also intended for our benefactors, Office of Land and Emergency Management (OLEM) and Office of Research and Development (ORD), to show that their generous financial investment and expertise are important components in cleaning up sites and protecting our communities. Our goal for this report is to demonstrate our capabilities and accomplishments so that project managers and technical support staff will continue to look to SCMTSC as a valuable resource in solving complex hazardous site investigation and cleanup issues.

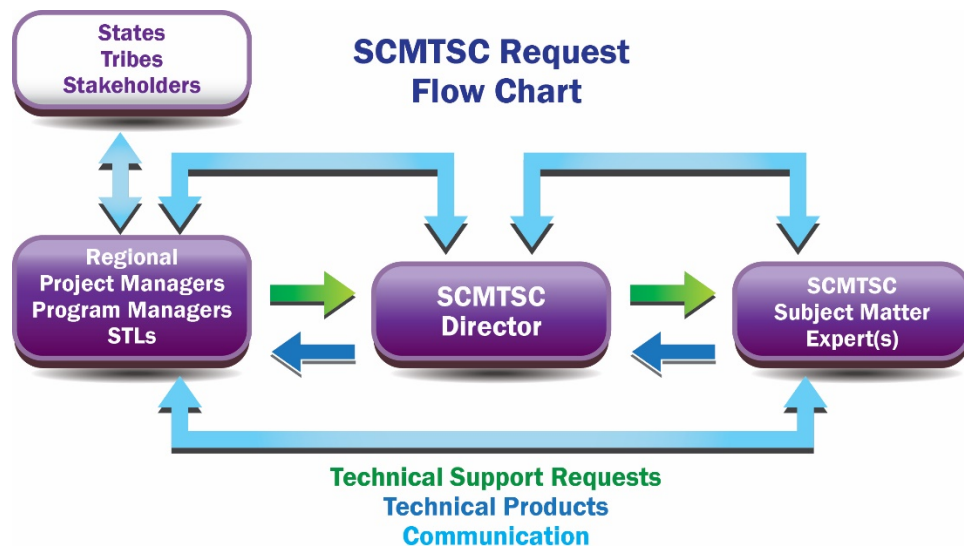


Figure 1. Flow chart for requesting technical support.

The SCMTSC is operated by members of ORD's Superfund and Technology Liaison (STL) Program and supported by staff in National Exposure Research Laboratory Exposure Methods and Measurements Division (NERL-EMMD) (<http://www.epa.gov/nerl/>). The process for requesting technical support is shown as a flow chart in Figure 1. The SCMTSC Director receives requests for technical support from STLs and EPA regional and headquarters waste program staff for their respective sites, states, and tribes. The Region's STL logs the request into the Site Technical Assistance Reporting System (STARS) database. Based on the information provided, the SCMTSC Director communicates with SCMTSC subject matter experts identifying if and how SCMTSC can address the technical support issue. Light-blue arrows show these and additional communication channels for identification, discussion, and development of the technical support needs/requests that ensure planned products are timely and relevant to the need. Green arrows indicate the specific request and dark blue arrows follow delivery of the technical support product. Products (review comments, data, reports, issue papers, etc.) are delivered from the ORD subject matter technical expert(s) to the SCMTSC Director for final approval and delivery to the client. If the product is sensitive or requires policy or peer review, the SCMTSC Director will coordinate additional reviews prior to delivery.

## Technical Focus of SCMTSC



Figure 2. EPA Region map.

SCMTSC provides waste program staff with the most up to date science and information to help solve complex issues at their sites. SCMTSC offers a suite of technical and statistical services, including:

- Assisting with statistical needs for site characterization
- Reviewing field sampling and monitoring and contaminant measurement activities, including:
  - soil-gas measurements
  - site characterization technologies (e.g., field portable X-ray fluorescence [XRF])
  - waste fingerprinting
  - geophysics
- Evaluating reports, models and work plans related to field sampling and measurement
- Developing issue papers and providing up-to-date information
- Performing non-routine analytical services
- Assessing vapor intrusion issues
- Performing environmental forensics
- Providing reliable and accurate information on innovative site characterization and remediation technologies
- Evaluating remote sensing technologies

# FY16 TECHNICAL SUPPORT

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October 1, 2015 – September 30, 2016

## Short Term Requests

On a weekly basis, SCMTSC addresses many short-term requests, including questions from states and local governments. SCMTSC provides short-term assistance on a number of topics, including: determining the most appropriate statistic(s) to estimate background threshold values (BTVs); addressing site geophysical questions, performing trend evaluations on groundwater (GW) monitoring data; providing sampling plan review comments and sampling method recommendations.

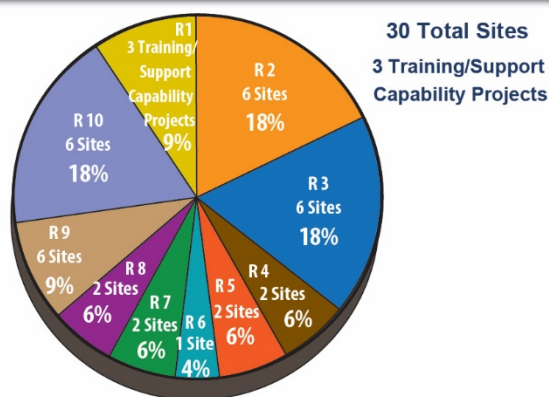
### *In FY-16 SCMTSC:*

- Addressed inquiries from Scott Miller of Idaho Department of Environmental Quality related to performing trend evaluations on data sets containing nondetect (ND) observations.
- Supported Region 4 personnel in addressing concerns about Potentially Responsible Party (PRP) contractor proposal to drill to determine the boundaries of a nearby sink hole at the Tower Chemical Site in Tampa, Florida. SCMTSC recommended considering geophysical methods, especially; electromagnetic induction, electrical resistivity, and induced polarization; and maybe microgravity as drilling would be expensive and inefficient.
- Performed statistical evaluations on a data set provided by Region 10, see figure 2, and addressed questions from the Region related to computing Upper Prediction Limits (UPLs) when entering additional observational data into ProUCL.
- Evaluated and extracted site-specific background data sets for arsenic and manganese collected from onsite areas of the AIW Frank Superfund Site in Exton, Pennsylvania and attended conference calls with Region 4 and Region 3 personnel to discuss and explain background data extraction results for the site.
- Assisted Region 3 with questions on labs capable of supporting the Region's efforts to use 42-day chronic toxicity tests in designing and performing a dose response study for Monongahela River sediments contaminated with coal tar derivatives at the Big John's Salvage Superfund site in Fairmont, West Virginia.
- Informed and distributed to the Regions a report based on a comparison study done at the Red River Army Depot concerning possible limitations on the use of HydraSleeve samplers for site investigations.
- In coordination with OLEM, provided review comments to Lon Kissinger in Region 10 on the Washington Department of Ecology analysis of background concentrations of contaminants in urban lake sediments in western Washington (*The Lake Washington Area Regional Background Sediment Characterization Draft Data Evaluation and Summary Report*).

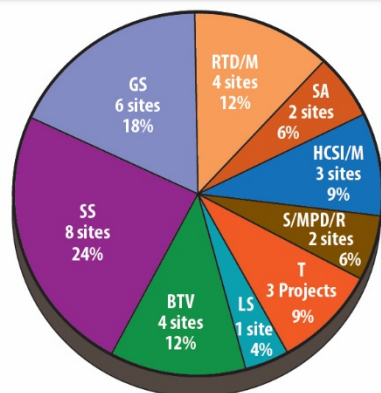
## Region/Program Specific Long - Term Support

In FY16, SCMTSC supported 30 sites in 9 EPA Regions by completing numerous individual tasks, including site-specific work, report reviews, sampling technology evaluations, presentations, meetings, and conference calls (see Figure 2). SCMTSC also provided training and materials on technical support capabilities and tools.

**SCMTSC FY16  
General, Cross-Region Support**



**SCMTSC FY16  
Site Technical Support by Project Type**



### LEGEND

RTD/M	Review of Technical Documents/Methods
SA	Source Attribution/Fingerprinting
HCSI/M	Highly Complex Site Investigations/Models
S/MPD/R	Sample/Monitoring Plan Development/Review and Improvement
T	Training/ORD Support Capabilities
LS	Laboratory Support
BTV	Background Analysis/Background Threshold Values
SS	Statistical Support
GS	Geophysics Support

Support for the State and Tribal Environmental Programs are provided through the Regions when possible (reference Figure 1), and there were a number of requests from the Regions for support of work on Tribal Lands in FY16.

SCMTSC organizes the site-specific request support by the type of work provided: Review of Technical Documents/Methods; Source Attribution/Fingerprinting; Laboratory Support; Highly Complex Site Investigations/ Models; Geophysics Support; Statistical Support; Background Analysis/Background Threshold Values; Sample/Monitoring Plan Review/Development; and Training/ORD Support Capabilities. Figure 3 is a pie chart categorizing these SCMTSC activities.

The figure illustrates that review documents, geophysics support, statistical support, and support for background and BTV determination were a significant portion of the technical support requests to the SCMTSC in FY16. Geophysics requests increased in FY16 and the need for that support is expected to continue in future years.

In the following sections, a select number of technical support requests/projects are highlighted as examples of the center's work.

Figures, from top left to bottom left.

Figure 3. FY16 SCMTSC General, Cross-Regional Support.

Figure 4. FY16 SCMTSC Activities by Project Type.



## Review of Technical Documents/Methods

SCMTSC can review internal and external (PRP, State, etc.) site documents or sampling methods. A center review performed by experts independent of the project provides a fresh look at old data related to complex site issues, and additional expert opinion not directly involved in the site work. 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 and result in time or cost savings.

In FY16, SCMTSC performed reviews of internal and PRP-generated technical documents and methods for four sites:

- **Hanlin-Allied-Olin (HAO)**, Region 3, Moundsville, West Virginia;
- **Alaric Area Groundwater Plume**, Region 4, Tampa, Florida;
- **Main Street**, Region 7, Moscow, Kansas; and
- **Keyport**, Region 10, Kitsap County, Washington

This report includes examples of document/method review support at the Alaric Area Groundwater Plume Site in Region 4 and the Main Street Site in Region 7.

### *Alaric Area Groundwater Plume Superfund Site, Tampa, FL*

The Alaric Area Groundwater Plume Site is located near Tampa, Florida in a mostly commercial and industrial area. Several businesses have occupied the site since the early 1970s, including Alaric, Inc., which operated a plastics recycling facility. A septic tank, since removed, is believed to be the main source of chlorinated solvents contaminating the site.



Figure 5. Aerial Photo of Alaric Groundwater Plume Site.



Figure 6. Alaric Electrical Resistance Heating Installation.

EPA had been using the ISCO (In-Situ Chemical Oxidation) process to remediate the chlorinated solvents at the Alaric site. Additionally, pump and treat systems were employed to treat the groundwater from the upper and intermediate aquifers. These systems, after time, were found to be removing only a minimum amount of contamination while chlorinated solvent contamination levels in below-ground soils remained virtually unchanged. EPA determined it would be more effective to shut down the treatment systems and change the remediation technology to thermal treatment.

EPA Region 4 requested SCMTSC review the technical proposal of the thermal remediation contractor selected to implement the Electric Resistance Heating (ERH) technology at the site. SCMTSC reviewed the Summary of Activities and Recommendations document for the site, then reviewed the contractor's technical proposal to determine if the proposed technology was implementable and had a high likelihood of meeting remediation goals. SCMTSC determined that the proposal was reasonable from both technical and cost standpoints. SCMTSC then tightened the performance and monitoring objectives increasing the likelihood for remediation goals to be realized. The thermal treatment system has since been installed at the site.

## *Main Street Site, Moscow, KS*

Region 7 was involved in an investigation of pesticide application health concerns in the City of Moscow building on Main Street. During August 2015, pesticides including orthene were applied in the building, and because of suspected reactions, extensive clean-up activities occurred (e.g., carpets cleaned numerous times and walls washed numerous times). To protect public health, the Region determined it was necessary to sample the building for verification purposes and requested support on sampling methods for both wipe samples and air samples and analytical methods for the pesticide contaminants of concern. SCMTSC made recommendations regarding appropriate air sampling media, including a mixed sorbent tube the Region was considering. ORD NERL Research Triangle Park researchers assisted in providing existing Standard Operating Procedures (SOPs) as examples for collecting surface wipes and dust in observational exposure studies and information on analysis of surface wipe samples. The sample analysis allowed the Region to determine that the area was clear of high levels of the pesticides.

## Source Attribution/Fingerprinting

SCMTSC can assist in potentially identifying the source and spread of contamination through the media around a site. Source attribution and fingerprinting can be critical to determining remediation strategies and cost recovery actions.

In FY16, SCMTSC performed source identification and fate and transport support for two sites:

- **Lower Darby Creek Area**, Region 3, Philadelphia, Pennsylvania; and
- **Pilsen Site**, Region 5, Chicago, Illinois.

Read on for a source attribution technical support example at the Lower Darby Creek Area site.



## *Lower Darby Creek Area (LDCA) Superfund Site, Philadelphia, PA*



Figure 7. Geophysical survey line across Lower Darby Creek near Clearview Landfill.

Region 3 collected significant soils data from the Clearview Landfill portion of the Lower Darby Creek Area (LDCA) site in Philadelphia and Darby Township, PA; along with significant background data on multiple areas near the site and throughout Philadelphia. The Region asked the SCMTSC to assist in evaluating the data to determine if Polyaromatic Hydrocarbons (PAHs) from different data sets are from the Clearview Landfill and/or different sources including anthropogenic background sources (e.g. aerial deposition, flood events, combustible engine exhaust, asphalt and asphalt sealing compounds, etc.). Based on initial review of

Remedial Investigation results and Pre-Design Investigation (PDI) data, SCMTSC helped develop a sampling and analysis plan for an additional PAH “fingerprint” evaluation to attempt to determine if PAHs detected in the neighborhood soils were attributable to the site, some other source(s), or a combination thereof.



Figure 8. Lower Darby Creek.

SCMTSC analyzed more than 130 soil, 15 sediment, and several groundwater and seep samples. SCMTSC then evaluated the sampling data and provided review information which identified areas where the landfill did not likely contribute to the contamination due to non-landfill specific characteristics, wind, and flow directions. The review could not conclusively distinguish between specific landfill PAHs and many other historic or current anthropogenic urban sources. Although the analysis could not meet the goal to specifically delineate landfill vs. non-landfill related PAH contamination, the sampling and review information will still assist the project manager in confirming if the established PAH soil cleanup levels are appropriate and in determining the extent of remedial activities in the residential areas adjacent to the Landfill.



Figure 9. Darby Creek at Pine St. PA.

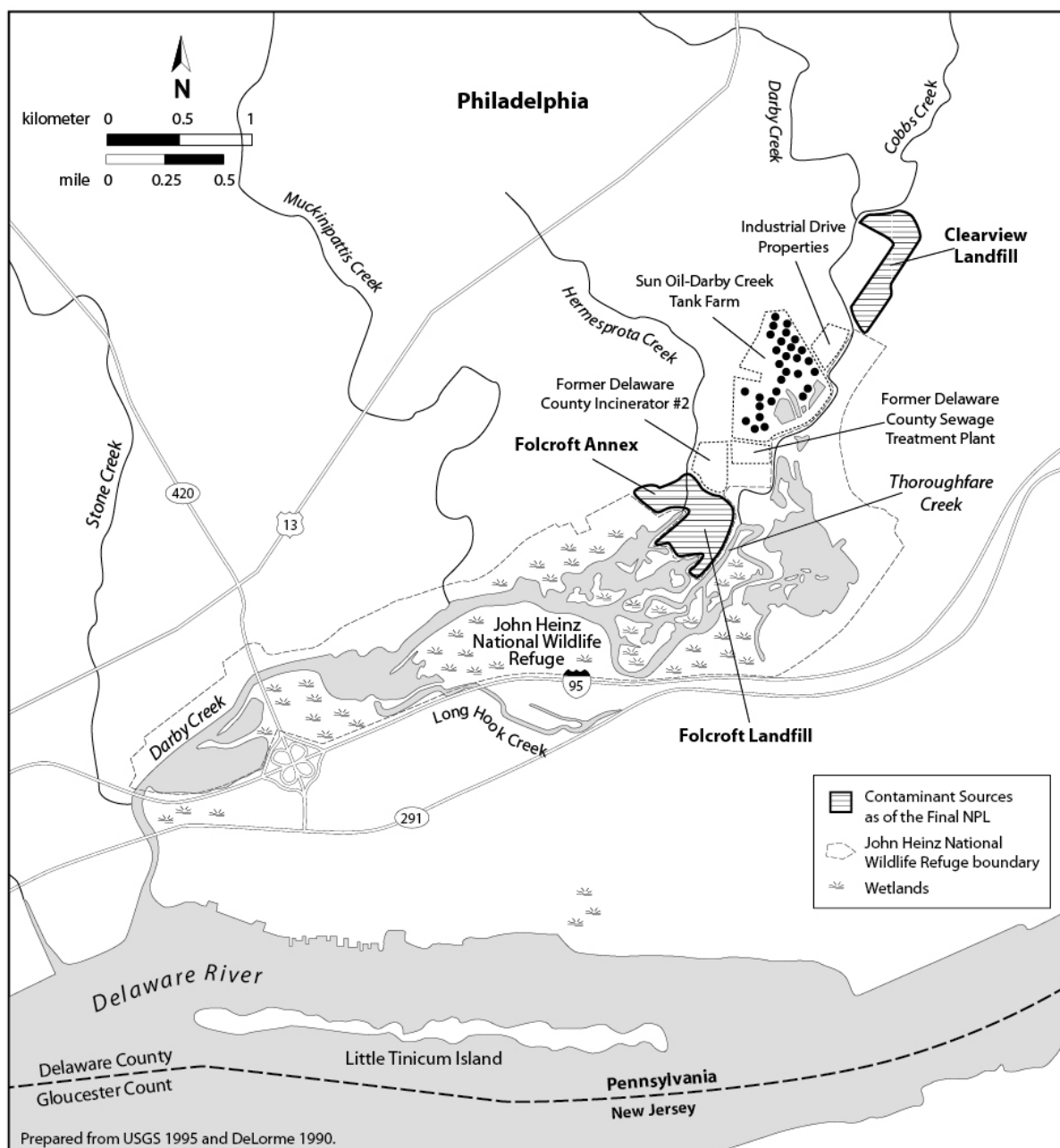


Figure 10. Map of Lower Darby Creek Area.

## Laboratory Support

SCMTSC can supply limited and unique laboratory analysis through the ORD NERL-EMMD laboratory or specific contract labs. SCMTSC can also evaluate laboratory analysis data to identify contaminants not commonly found or analyzed at hazardous waste sites. Uncommon, new, or unidentified contaminants in high concentrations or with possible undetermined risk can potentially be contaminants of concern. Remediation or health protection decisions may be affected by these contaminants once they are clearly defined.

In FY16, SCMTSC provided in-house laboratory support for one site:

- **Klamath Basin, Region 9, Yurok Tribe, California.**

### *Klamath Basin, CA – Yurok Tribe*

The lower part of the Klamath River runs through Yurok Tribal lands in California and into the Pacific Ocean. Microcystins and Anatoxin from algal blooms have been reported in the Klamath River and other nearby rivers at levels that exceed public health thresholds adopted by the Yurok Tribe, those established by the World Health Organization, and at levels triggering posting of warnings at recreational waters as developed by the California CyanoHAB Network, part of the California Monitoring Council. In recent years tribal and community members have complained of an increase in the frequency and severity of skin rashes and have brought their concerns to the Yurok Tribe Environmental Program (YTEP) <https://www.epa.gov/nutrient-policy-data/cyanohabs>.

In response, YTEP already samples for microcystin as part of their public health monitoring but had no capability to obtain analysis for Anatoxin-a. YTEP contacted the Region 9 Tribal Liaisons, and SCMTSC requesting support to run Anatoxin-a analysis if

a suspected harmful algal bloom did occur. Equipment recently obtained in the NERL Las Vegas laboratory was used to perform the analysis. Technical support included review of the Tribal sampling procedures, quality control, scheduling to meet the Tribal sampling already planned for the late summer when the issue is of highest concern, and the actual sample analysis. SCMTSC received the samples in September, ran the analysis, and provided the Tribe with a report on the results in December of 2016.

The technical support allowed YTEP to expand their health monitoring activities at several locations and assisted the Tribe in assessing and determining actual levels and possible future protection activities for their members and the regional community.



Figure 11. Warning sign.



Figure 12. 2005 Algal Bloom Sampling at Klamath Copco Reservoir.





## Highly Complex Site Investigations/Models

SCMTSC supports regions on sites with complex site characterization or remediation issues. These issues can be related to the size of the site, the number of PRPs involved, complex conceptual site models, or the uniqueness of the contaminant or site characteristics.

In FY16, SCMTSC provided technical support for three highly complex site investigations/models:

- **BF Goodrich**, Region 4, Calvert City, Kentucky;
- **JH Baxter**, Region 10, Arlington, Washington; and
- **Kodiak Island Coast Guard Station**, Region 10, Kodiak Island, Alaska.

An example of complex site investigation model technical support for the BF Goodrich site is included.

*B.F. Goodrich, Calvert City, KY*

Several chemical plants that operated along the south side of the Tennessee River since the mid-1950s comprise the B.F. Goodrich Superfund site. One of the primary chemical products was a vinyl chloride monomer used in the production of polyvinyl chloride.

Contamination has been found at depth in and beneath the Tennessee River next to the site. The PRPs conducted the initial field investigation, but EPA took over the preparation of the Remedial Investigation (RI) in January 2014 when the PRPs could not agree on a technical approach.

Region 4 requested assistance from SCMTSC to help develop the site documents by providing specific subsurface expertise. Tasks included project planning, supporting community relations, evaluating groundwater modeling, performing treatability studies and developing and screening Remedial Action Alternatives to select an appropriate range of waste management options.

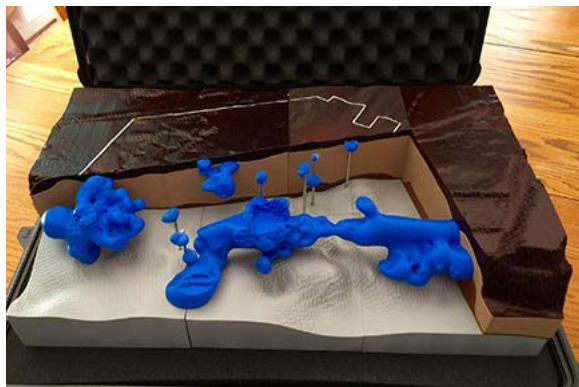


Figure 14. 3-D model of groundwater contamination at BF Goodrich site.

SCMTSC developed a Final Remedial Investigation Report, Human Health Risk Assessment and Ecological Risk Assessment in August 2015. In July 2016, SCMTSC provided a 3-D model of the subsurface contaminant plume to aid in understanding the extent of the remediation requirements and provide visual context for regulators and stakeholders. Increased understanding of the contaminant distribution and subsurface properties is necessary for selection of a comprehensive remediation strategy. The 3-D model was used as part of the remediation review for the site. The model was further made available for public meetings to provide a visual and tactile understanding of the site and relevance to the selected remedy.

SCMTSC also prepared Phase II sampling maps for continuation of the offshore investigation. This additional sampling effort under the Tennessee River was conducted in October 2016. SCMTSC prepared the QAPP and provided field sampling support, assisting in the collection of environmental samples and

preparing the soil boring logs from the core samples. SCMTSC continues to assist EPA and the State of Kentucky in developing a remediation strategy to protect public health and environmental receptors.



Figure 15. Sampling under the Tennessee River.

## Geophysics Support

SCMTSC can assist with developing or reviewing site geophysics and geophysical models for a site. Models allow the regions to integrate related site data into visual indicators of the dynamics with all or part of the site media and contamination, allowing for a clearer understanding of the site and its associated risks.

In FY16, SCMTSC provided geophysics technical support for six sites:

- **Seneca Army Depot**, Region 2, Romulus, New York;
- **Atlantic Fleet Weapons Training Area**, Region 2, Culebra, Puerto Rico;
- **Clearview Landfill**, Region 3, Delaware and Philadelphia Counties, Pennsylvania;
- **Enterprise-Todhunter Propane/AK Steel**, Region 5, Middletown, Ohio;
- **Wilcox Oil**, Region 6, Bristow, Oklahoma; and
- **Warmhouse Beach Dump**, Region 10, Neah Bay, Washington.

Two examples (Seneca Army Depot and Warmhouse Beach Dump) of Geophysics Support are provided.

## *Seneca Army Depot, Romulus, NY*



Figure 16. Seneca Army Depot igloo storage bunker.

The Seneca Army Depot Activity site is located in Romulus, New York, covers 10,587 acres and was once one of the largest ordinance storage depots in the US. The Open Detonation (OD) Grounds at the Depot were used to destroy munitions. After demolition was completed, explosively displaced portions were reconstructed by bulldozing displaced and native soils back into the central earthen mound.

Geophysical surveys were conducted to investigate the vertical deposition of munitions debris (MD), material potentially presenting an explosive hazard (MPPEH), and other cultural debris at the site. The region requested a geophysical expert review the data to ensure that the approach taken and the conclusions made are scientifically sound, facilitating the full and safe removal of munitions items at the site.



Figure 17. Seneca Army Depot.

Review comments were provided in March 2016, and based on the geophysical data within the report the conclusions seem well founded and accurate. This technical review aided in confirming site contamination and allowed the Region to move forward with site remediation actions.



Figure 18. White deer inside fence at Seneca Army Depot.

## *Warmhouse Beach Dump, Neah Bay, WA*

The Warmhouse Beach Dump Superfund Site is within the Makah Indian Reservation. It is located about three miles northwest of Neah Bay, the northwest corner of the Olympic Peninsula, in Clallam County, WA. It is an inactive dump used by the Makah Air Force Station, Indian Health Services, U.S. Coast Guard, the Makah Tribe and tribal members, other local and non-local residents, and other entities such as the Cape Flattery School District. Municipal solid and hazardous wastes were disposed at the site from the early 1970s until 2012.

Region 10 requested review of a geophysical resistivity report on the site. The review noted that the report was of good quality; however, highlighted the limitations of the conclusions when relying on one geophysical method and little to no ground truth (i.e., borehole data, excavations, etc.).





Figure 19. Aerial view of Warmhouse Beach Dump.

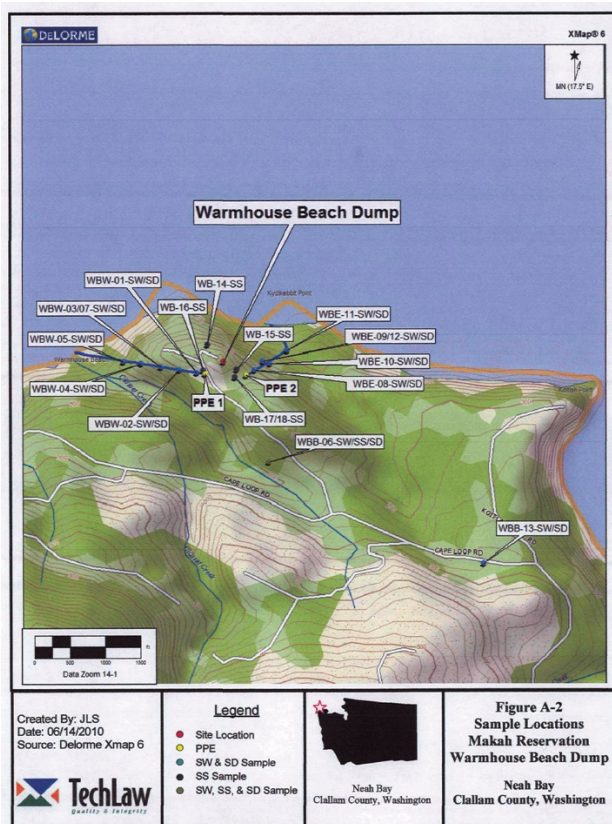


Figure 20. Map of Warmhouse Beach Dump.

Other geophysical methods; such as magnetics, time domain electromagnetic induction (TDEM) and frequency domain EM (FDEM) would help

constrain the resistivity interpretations and aid in further characterization prior to, or complementary to, ground truth investigations. The Region was able to use the review to strengthen the site investigation.

## Statistical Support

SCMTSC can evaluate site data to help determine final sampling needs or risk decisions, perform trend analysis to determine if actions are meeting remediation goals, develop statistically valid sampling plans, and verify confidence levels for data sets. Statistical expertise is often not directly available to the regional programs and yet can be a necessity to evaluating data and site risk to determine appropriate actions.

In FY16, SCMTSC supplied statistical support for eight sites:

- **New Town Creek**, Region 2, Brooklyn, New York;
- **AIW Frank**, Region 3, Exton, Pennsylvania;
- **West Lake Landfill**, Region 7, Bridgetown, Missouri;

- **US Magnesium**, Region 8, Toole County, Utah;
- **El Paso Natural Gas Mines**, Region 9, Western Navajo Nation, Arizona;
- **Abandoned Uranium Mines**, Region 9, Navajo Nation, Arizona; and
- **Bunker Hill Mining Site**, Region 10, Coeur d'Alene, Idaho; and
- **Rainier Commons**, Region 10, Seattle, Washington.

Two examples (Abandoned Uranium Mines on the Navajo Nation and Bunker Hill Mining Site/Coeur d'Alene) of statistical technical support are provided.

### *Abandoned Uranium Mines on Navajo Nation, AZ*

The Navajo Nation is situated on a geologic formation rich in radioactive ores including uranium. Beginning in the 1940's, widespread mining and milling of uranium ore for national defense and energy purposes on the Navajo Nation led to a legacy of abandoned uranium mines (AUMs). Some Navajo residents may have elevated health risks due to the dispersion of radiation and heavy metal contamination in soil, water and dust in homes. Since 2010, Region 9 has assessed and cleaned up numerous yards and buildings and will continue this process for at least 3 more years.

<https://www.epa.gov/navajo-nation-uranium-cleanup>.



Figure 21. Demolition of home contaminated with radiation.



Figure 22. Radiation Removal.

In order to determine if a building is contaminated and should be demolished, EPA collects gamma dose measurements and compares each

measurement location to an action level. This action

level was based on a background threshold level established for the entire site area which covers huge tracts of land. However, sampling over the years has shown that background gamma dose measurements in different site areas differ significantly; therefore, Region 9 requested assistance from SCMTSC to establish a sampling protocol to better screen residential gamma samples for false positives. To address both false positive and false negative error rates due to these varying background levels, it is important to compute separate background sub-populations to represent the actual background number in specific areas.



Figure 23. Rebuilt home.

False positives (levels at background and not caused by mining contamination) cause the region to engage in relocation of residents for extended periods, demolition of residences, disposal of wastes and costly rebuilding efforts that could be avoided. SCMTSC evaluated the areas based on the sampling data and recommended the use of four separate area background action levels for use in driving future sample (measurement) planning and decision-making.



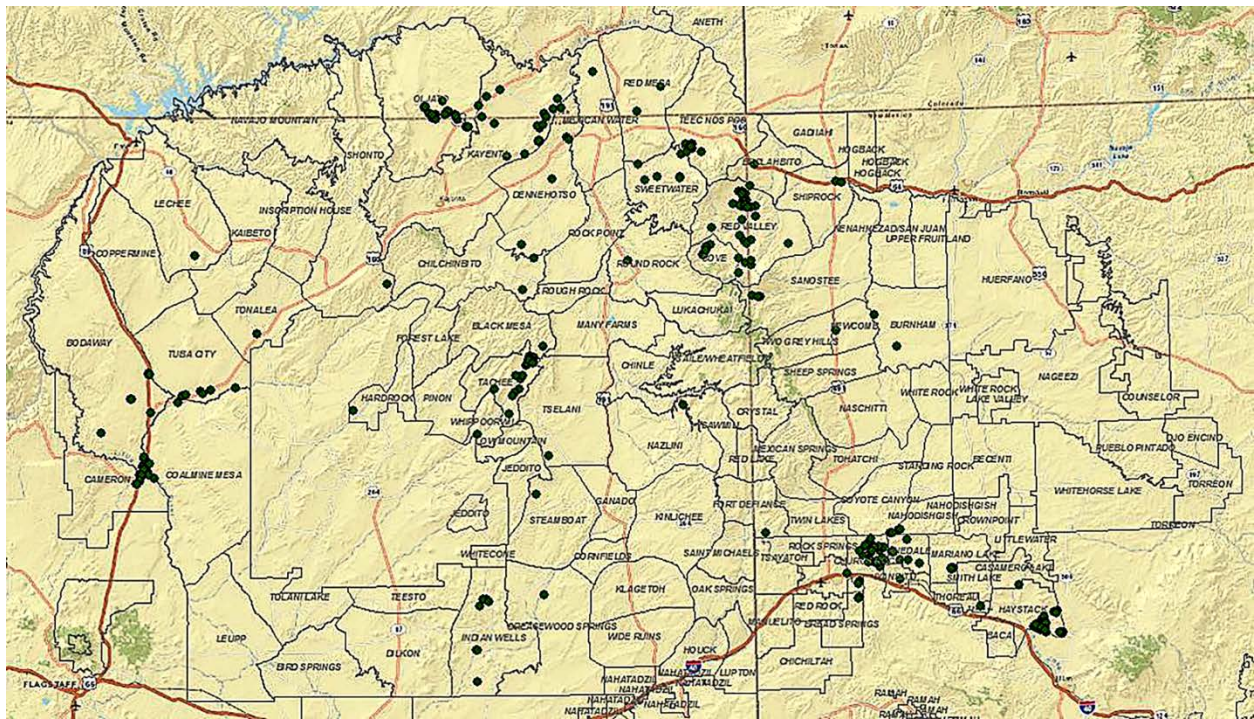


Figure 24. Map of Abandoned Uranium Mines.

### *Bunker Hill Mining Site/Coeur d'Alene Basin, Coeur d'Alene, ID*



Figure 25. Coeur d'Alene River.

The Bunker Hill Mining and Metallurgical Complex Superfund Site, also known as the Coeur d'Alene (CDA) Basin (Site) is located in northern Idaho. Historical mining practices at the CDA Basin (Operable Unit # 3) have resulted in contamination of soil, sediment, surface water, and groundwater with heavy metals including arsenic (As), cadmium (Cd),

lead (Pb), and mercury (Hg). Past investigations in the mid-1990s led Idaho Department of Health and Welfare (IDHW) and the Coeur d'Alene Tribe to issue a health advisory and recommend fish consumption guidelines for Coeur d'Alene Lake. Data collection, cleanup and remedial activities for the site including updated fish consumption advisories at the Lake have been going on since 2001; however, there are no specific fish consumption advisories for the Coeur d'Alene River, chain lakes, South Fork Coeur d'Alene River, or Spokane River (within Idaho). Fish tissues in these areas need to be fully sampled and evaluated.

The Coeur d'Alene Lake Monitoring Program began in the spring of 2007 conducted by the Coeur d'Alene Tribe within tribal reservation waters and the Idaho Department of Environmental Quality (IDEQ) within State jurisdictional waters. As a result of this program, IDEQ is working on the Idaho Fish Consumption Advisory Project (IFCAP) plan. The project plan is to collect fish samples which can be used to improve the fish consumption advisory. IDEQ's planned fish sampling was

drafted to target 10 individual (discrete) fish per species & location. Based upon chronic health effects, IDEQ planned to use a 90 percent (%) upper confidence limit (UCL90) of mean on the discrete samples as described in Idaho Guidance.

Region 10 requested assistance in looking for ways to advise IDEQ on optimizing the sampling design to reduce uncertainties in fish tissue concentration estimates without increasing costs. SCMTSC conducted a statistical evaluation using historical site data to investigate whether compositing fish samples could assist in optimizing the sampling plan. The analysis showed discrete data sets tend to have higher variability and follow skewed distributions. Even though the historical data set size of 60 was large enough, due to higher variability, the UCL95 based upon the discrete data set was higher than all other UCL95s computed from composite samples. SCMTSC recommended that it is feasible instead to collect 4 to 5 composite fish samples. The processing and analysis of a small number (4 to 5) of composite fish samples for each species in each area will be less costly in comparison to collecting and analyzing 10 or more individual fish samples. The 4 composite samples collected should be made up of 5 individual fish samples and all individual samples in a composite sample should come from the same location. Every effort should be made to composite fish of same species, size and type. Also, based upon composite samples, it is conservatively suggested that the UCL95 instead of the UCL90 be used to assess chronic exposure to fish consumption for protecting public health. SCMTSC's analysis provided verification of and concurred with the Region's recommendation of considering using composited fish tissue to increase sample numbers, while limiting analytical costs and capacity. Data from the sampling effort will be used by the IDHW to support fish advisories based on chronic health effects in the Lake area.



Figure 26. Brown Trout.

## Background Analysis/ Background Threshold Values

SCMTSC can help establish and evaluate background concentrations for complex sites to determine background concentrations and/or Background Threshold Values (BTVs). Establishing background concentrations at large industrial sites can be complicated by naturally occurring or urban background concentrations. BTVs are used by project managers to determine areas of contamination, complete the site risk assessment, and develop the Feasibility Study for site remediation.

In FY16, SCMTSC supplied support for establishing background concentrations and determining BTVs for four sites:

- **American Cyanamid**, Region 2, Bridgewater Township, New Jersey;
- **DuPont Pompton Lakes**, Region 2, Pompton Lakes, New Jersey;
- **Peck Iron**, Region 3, Portsmouth, New Jersey; and
- **C&R Battery**, Region 3, Chesterfield County, Virginia;

Two examples (American Cyanamid and DuPont Pompton Lakes) of Background and BTV determination technical support are provided.



## *American Cyanamid, Bridgewater Township, NJ*

The American Cyanamid Superfund site is located next to the Raritan River above the Brunswick Aquifer - New Jersey's second largest source for drinking water. The area had been used for manufacturing chemicals and as a disposal site of chemical sludge and other wastes. The PRP is in the design phase for the groundwater remedy at the site, which includes the extraction of groundwater from the overburden and bedrock aquifers, along with reinjection of treated groundwater into the bedrock aquifer. The PRP collected an additional round of data from wells in the Injection Area in July/Aug of 2015. In addition,

New Jersey Department of Environmental Protection (NJDEP) requested that up to 4 rounds of data be collected from wells that will be used as reinjection compliance monitoring wells to strengthen the dataset for the compliance monitoring wells. The PRP completed 2 of those 4 requested sampling events, and provided EPA and NJDEP with re-calculated Background Threshold Values (BTVs) for 6 constituents (sulfate, manganese, chloride, sodium, hardness, and TDS) that are naturally present above federal/state standards in the bedrock aquifer. There were some significant changes to the BTVs with the inclusion of the new data, particularly the sodium BTV.

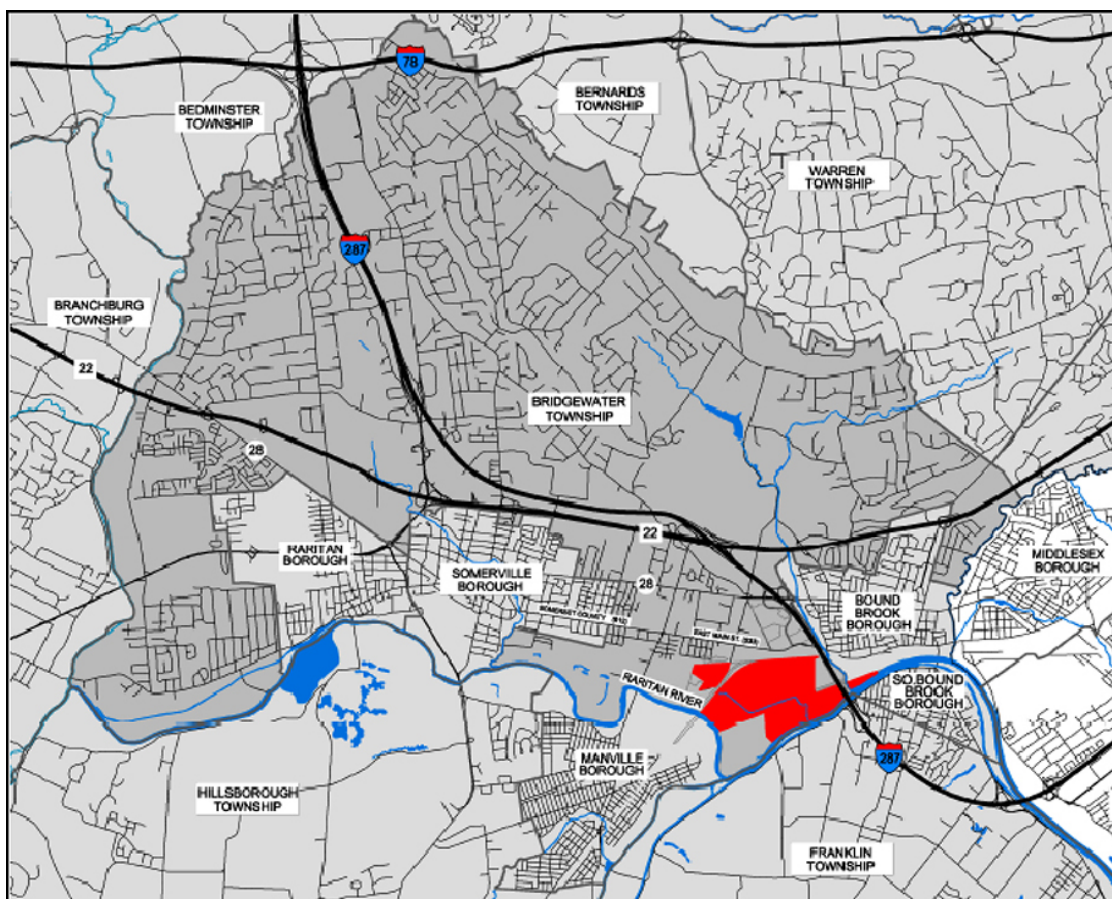


Figure 27. Site map of American Cyanamid.



Figure 28. Flooding of American Cyanamid waste impoundments.

SCMTSC reviewed the calculations for all 6 parameters to ensure that outliers were identified appropriately and the correct distribution was used. SCMTSC also responded to a number of questions the Region and State wished to have answered about the statistical evaluation to assist with the review of the remedy design for the site. Once finalized, the BTVs will be used by NJDEP in establishing a permit equivalence for discharge to groundwater and compliance monitoring to ensure that the reinjection does not cause concentrations of these parameters to increase above background levels.

### *DuPont, Pompton Lakes, NJ*

E.I. DuPont De Nemours & Company manufactured explosives on this 570-acre site at the north end of Pompton Lakes, New Jersey from 1902-1994. 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.

Wastes included lead salts, mercury compounds, explosive powders, chlorinated solvents, waste wire drawing solution and detonated blasting caps. Primary contaminants in the soil and sediments are metals. Land use in the vicinity is mostly residential and commercial, but also includes undeveloped areas, an interstate highway (Route 287) and state-owned forest.

Cleanup of the facility is required under a NJDEP order, NJDEP ground water permit and an EPA permit.

Region 2 requested a review of the PRP conducted background soil study for arsenic in relation to the NJDEP guidance [http://www.nj.gov/dep/srp/guidance/srra/soil\\_in\\_v\\_si\\_ri\\_ra.pdf](http://www.nj.gov/dep/srp/guidance/srra/soil_in_v_si_ri_ra.pdf) and to address the Region's and



the State of New Jersey's concerns about the study. SCMTSC reviewed the data and made recommendations on developing a site-specific remediation standard (SRS) for arsenic. It was noted that the data indicates that there is a higher level of contamination in surface soils as

compared to subsurface. A scientifically sound SRS will limit remediation cost as much as possible while remaining protective of human health.



Figure 29. Flag marking where a soil sample was taken near the mouth of Acid Brook where it empties into Pompton Lake.



Figure 30. Typical well drilling equipment setup.

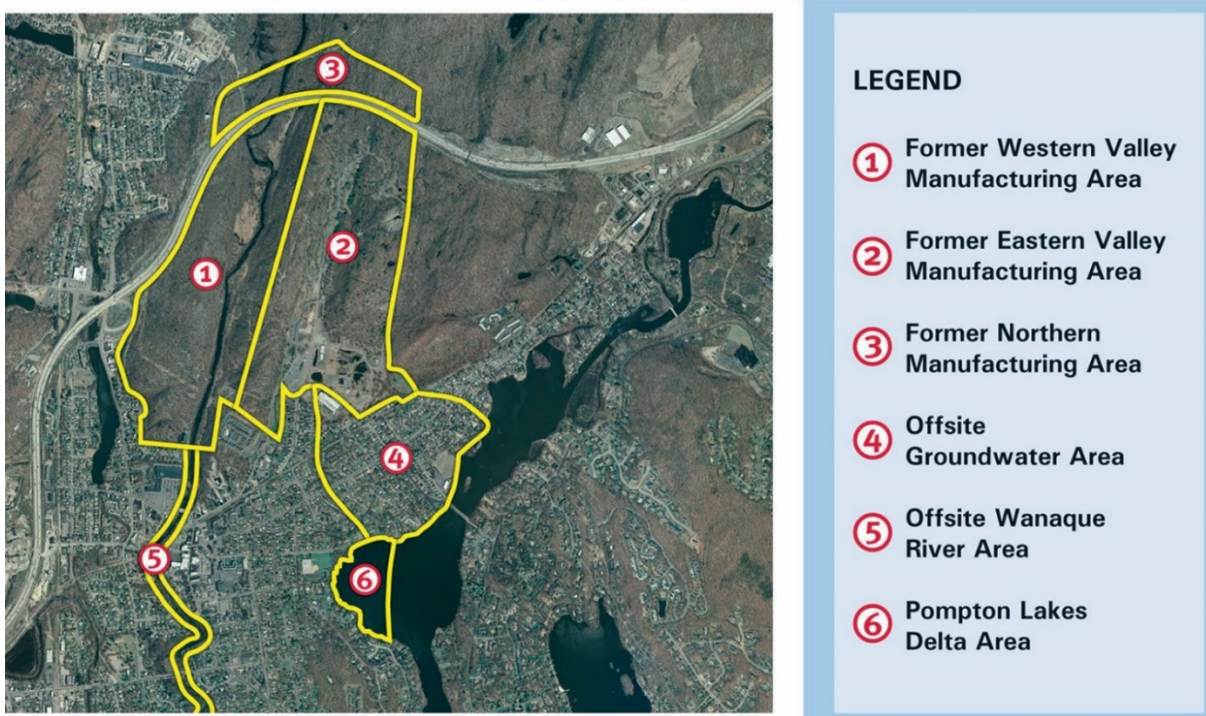


Figure 31. Aerial view of DuPont Site.

## Sample/Monitoring Plan Review/Development

SCMTSC can help regions in the review and development of site sampling and monitoring plans. Sampling and monitoring plans are a critical part of the site remediation process. Well-developed sampling plans designed to meet clear data quality objectives provide for accurate information about the site and limit the cost of additional sampling. Monitoring plans provide verification that selected remedies are performing as expected to cleanup sites and protect public health and the environment.

In FY 16, SCMTSC provided technical support for sample plan review and development for two sites:

- **Myers Property**, Region 2, Franklin Township, New Jersey; and
- **Mystery Bridge Road**, Region 8, Evansville, Wyoming.

### *Myers Property, Franklin Township, NJ*

The Myers Property Superfund site is an old chlorinated volatile organic compound (CVOC) contaminated groundwater plume in a fractured sedimentary rock environment. Four companies used parts of the site for pesticide and chemical handling and manufacturing activities. The Myers family purchased the property in 1971 and used it for residential and farming purposes until selling the site in 1993.

When the site was first identified, various drummed materials, as well as uncontrolled asbestos, were present along with several buildings including a mill dating back to 1927. The building remediation was completed in January 1998, removing five buildings and miscellaneous surface debris. The soil/sediment part of the remedy was completed in June 2005, and a final groundwater treatment remedy was selected in September 2005.





Figure 32. Abandoned well area - Cakepoulin Creek.

The PRPs are currently operating the pump and treat remedy at the site. A monitoring well cluster next to a creek was abandoned last year due to erosion of the adjacent creek. These wells had groundwater concentrations exceeding regulatory standards. The first attempt at downgradient replacement wells were found to be non-detect. EPA Region 2 requested that SCMTSC provide technical recommendations on how the PRPs could best collect data and information to determine the extent of the groundwater plume and potential discharge areas. These recommendations would outline, if and where, the PRPs should install replacement wells near the areas of known higher level groundwater contaminant concentrations as well as how to best obtain information on the location of the contamination within the top of the rock layer and where the contamination might be migrating from there. SCMTSC provided a final report indicating where replacement wells could be placed. The report also provided recommendations on additional survey work to be conducted to further characterize the plume.



Figure 33. Old family barn housing Myers groundwater treatment plant.

### *Mystery Bridge Road, Evansville, WY*

The 410-acre Mystery Bridge Rd/U.S. Highway 20 site is located in Evansville, Wyoming. Kinder Morgan Energy Partners and the Dow Chemical Company used the area for industrial operations from the 1950s through 1965. Site activities and waste disposal practices contaminated soil and groundwater with solvents and oils. Following cleanup, operation and maintenance activities are ongoing.

The Region requested SCMTSC provide statistical support and review the existing Dow monitoring plan for recommendations as to its validity given the plan was older than recent OLEM guidance. It was determined the plan was not statistically sound and recommendations were made to update the existing monitoring plan. The Region requested additional support in how to address the PRPs' response which did not follow EPA recommendations and proposed another monitoring plan. The SCMTSC supported the Region's position that the recommendations for updating the existing plan be followed, or if the PRPs propose a different option, that monitoring plan must be consistent with the most recent OLEM guidance. Both options provide a sound scientific basis for verifying the completion of the site remediation and protecting public health.

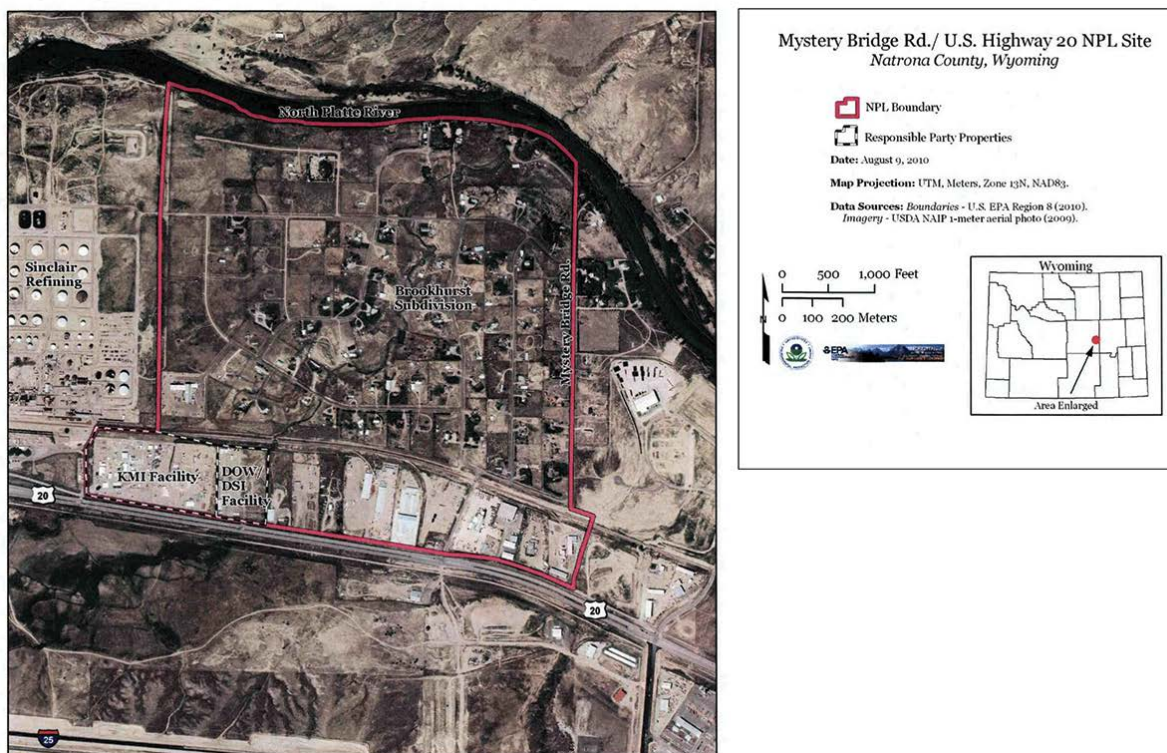


Figure 34. Aerial view of Mystery Bridge Road Site.

## Training/ORD Support Capabilities

In FY 16, SCMTSC performed or supported 3 training activities concerning SCMTSC and ORD support capabilities for Regional and State stakeholders. These activities included:

- Case study webinar,
- ProUCL training, and
- Region 7 ORD Tools Café.

SCMTSC developed and provides support for the ProUCL environmental statistical program which is free for download and use on the EPA website.

### SCMTSC Case Study Webinar

SCMTSC conducted a webinar on August 2, 2016 to illustrate the types of support available through the SCMTSC. The webinar featured



case studies on conceptual site models, statistical sampling plans, vapor intrusion and groundwater modeling. The webinar included information on how to request technical support through the Technical Support Centers (TSCs). The target audiences for the webinar were the Technical Support Program (TSP) Forum Members (Groundwater Forum, Federal Facilities Forum, Engineering Forum and their state members), Remedial Project Managers, Federal Facility Project Managers, On Scene Coordinators and Superfund Technical Support Staff.



Each case study described the project, provided a description of the technical support needed, showed the scope of work completed, provided the output from the technical support, and what outcome or impact the support had on the overall objectives of the site. The presentation was archived for EPA and invited attendees at [https://clu-in.org/conf/tio/SCMTSC\\_080216/](https://clu-in.org/conf/tio/SCMTSC_080216/). The link also contains additional SCMTSC information and material on the Center's laboratory support and trend analysis capabilities and work.

## State of Wisconsin and Region 5 ProUCL Training

At the request of and supported by the state of Wisconsin, the SCMTSC contract statistician was asked to provide training on ProUCL at a Wisconsin Department of Natural Resources (WDNR) training session for their Remediation and Redevelopment Program staff. The SCMTSC statistician led a presentation on general statistics and use of the ProUCL program and methods on the morning of November 4<sup>th</sup>, 2015 and was available during the afternoon session for specific and/or more detailed questions. Due to expressed interest and the general proximity of the WDNR meeting and the Region 5 offices, the statistician also provided the Region 5 staff with a three hour training course on ProUCL the afternoon of November 5<sup>th</sup>. The presentation included an introduction to ProUCL, a short ten minute demo, case studies of SCMTSC work using ProUCL to develop different products (BTVs, UPLs, data confidence levels, box plot comparisons, trend analysis, sampling plan development), and a question and answer session.

## Region 7 Tools Cafe

Region 7 and ORD with support from the Region 7 Regional Science Liaison (RSL) and STL, developed and coordinated an EPA Tools Café on ORD products for the Region 7 states on December 9<sup>th</sup>, 2015. SCMTSC, ETSC, and GWTSC provided a poster on the Technical Support available to the Regions through the

TSCs and OSP provided speakers and a poster on the STL program. SCMTSC also provided a poster and contacts for the statistical tool ProUCL which can be downloaded by the States.

**Site Characterization and Monitoring Technical Support Center (SCMTSC)**

The SCMTSC provides site characterization assistance to Waste Program project managers by supporting the use of state-of-the-science methods and technologies for identifying contaminants, determining levels and concentrations, and identifying geographic extent. More information about the SCMTSC is available at: <http://www.epa.gov/osp/hstl/tsc/tsc.htm>

**Technical Focus of the SCMTSC**

Providing Geostatistics Statistical Design, Analysis and Expertise.  
Conducting field sampling and/or monitoring and contaminant measurement activities, including:

- Site Characterization Technologies (e.g. field portable X-ray fluorescence)
- Fingerprinting of Wastes
- Geophysics
- Evaluating reports, models, and work plans related to field sampling and measurement approaches.
- Soil-gas measurements

Developing issue papers and provide state-of-the-science information.  
Providing reliable and accurate information on innovative site characterization and remediation technologies.  
Performing Special Analytical Services  
Providing GIS and Data Interpretation

**Contact Information**

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**What are TSCs?**

ORD's Technical Support Centers are specialized resource centers which provide technical expertise to address high priority hazardous waste issues in EPA Regional Offices. The TSCs can be accessed directly or by contacting the regional Superfund and Technology Liaison (STL). More information about the TSCs is available at: <http://www.epa.gov/research/landscience/land-tech-centers.htm>

**Technical Support Highlights**

**DANANG AIR FORCE BASE - REGION 10**

USEPA in partnership with the Government of Vietnam (Academy of Science and Technology) is evaluating bioremediation technologies for treatment of dioxin-contaminated soil sites due to Agent Orange usage during the Vietnam conflict. The SCMTSC reviewed and performed statistical trend analysis of dioxin sampling data to determine if any of the pilot studies showed downward trends. EPA's objective was to demonstrate the best methods for sharply reducing the levels of Agent Orange and dioxins in the soil in cost effective manner given bio-remediation can be less expensive over a large area than other more labor intensive technologies. The analysis showed that there was a consistent downward trend in dioxin concentrations based upon one EPA aerobic treatment and trend decreases in all the aerobic treatments. The DaNang cleanup will assist Vietnam in expanding the former airbase into an international airport.  
Contact: [harry.allen@epa.gov](mailto:harry.allen@epa.gov)

**FORMER UNITED ZINC AND ASSOCIATED SMELTERS - REGION 7**

The SCMTSC statistically assessed the geographic (spatial) patterns of surface soil lead levels and overlaid those patterns with four historical smelter locations that once operated at this site in the early 1900s. Identifying a geographic pattern in lead contamination at the site will assist EPA with establishing a cost recovery case with the successor companies for the smelting operations in the local area.  
Contact: [bahnke.don@epa.gov](mailto:bahnke.don@epa.gov)

**science in ACTION**  
INNOVATIVE RESEARCH FOR A SUSTAINABLE FUTURE

**ProUCL: Statistical Support Software for Site Investigation and Evaluation**

**Background**  
ProUCL is a comprehensive statistical software package initially developed by EPA for computing statistical intervals to respond to concerns at a specific Superfund site. With significant interest, use, and user feedback on the software from the remediation community, EPA has updated the software adding new tools and statistical methods.

EPA regions, states, contractors, and other stakeholders use ProUCL to establish background levels, determine outliers in data sets, and compare background and site sample data sets for site evaluation and risk assessment.

monitoring include single and two-sample hypotheses tests, ANOVA, regression, trend evaluation, outlier, and goodness-of-fit tests.

**Ease of Use**  
ProUCL requires no formal background in statistics, but some statistical training is helpful to understand the assumptions and input requirements for statistical tests used in decision making. Input data sets are straightforward, requiring columns of detected values for contaminants and if each value is a direct or a nondetect at the quantization limit. The user can also add variables to provide grouping data, regression variables, or sample dates. Desired statistical tests can be selected from drop-down menus, and relevant options from subsequent menus. Results from within the program may be exported to an Excel spreadsheet and graphs can be inserted in documents. Data can be evaluated for fit to normal, lognormal, or gamma distributions. Outputs include recommendations, cautions, and cited references.

**User Support and Training**  
The EPA Site Characterization and Monitoring Technical Support Center (SCMTSC) provides user support for ProUCL when possible. This may include developing or reviewing statistical sampling plans or background/risk numbers for EPA Superfund project managers or technical staff. SCMTSC also provides short term technical support to both internal and external users. The SCMTSC Annual Report documents this support and can provide a snapshot of ProUCL use.

The SCMTSC developed and presented webinar training classes

ProUCL version 5.1.00 (May 2016) is the most recent update. Users can download the software free of charge from the USEPA Regional Science Program (RSP) webpage <https://www.epa.gov/land-research/procl-software>

through CLU-IN on the use of ProUCL. These courses can be viewed at: [http://www.clu-in.org/edu/ProUCLBasics\\_090911/](http://www.clu-in.org/edu/ProUCLBasics_090911/) and [http://www.clu-in.org/edu/ProUCLAdv\\_011611/](http://www.clu-in.org/edu/ProUCLAdv_011611/)

Additional training will be considered and announced dependent on budget considerations.

**ProUCL 5.1 Modifications**  
SCMTSC updated ProUCL to version 5.1 in May of 2016. ProUCL now includes:

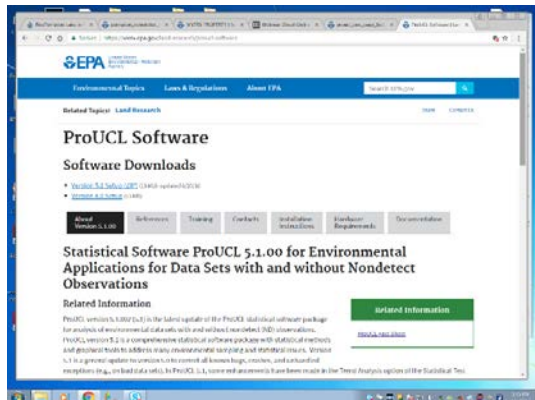
- Windows 8 compatibility
- Updated guidance and support documents
- UCLs/ETPCs and Upper Limits/BTVs modules enhancements
- an upper simultaneous limit (USL) statistic

**CONTACTS:**

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# ProUCL



The Superfund cleanup process is complex, requiring technical assistance to address statistical issues associated with the various polluted site projects. 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, SCMTSC developed, then enhanced and supported the ProUCL software to help site managers including EPA, state, local and contractor project managers make statistically defensible decisions.

EPA uploaded the latest version (5.1.002) to the EPA website on June 20, 2016. The latest version included enhancements in the Trend Analysis option of the Statistical Test module. ProUCL 5.1 computes and outputs residuals for the non-parametric Theil-Sen (T-S) trend line which may be helpful to compute a prediction band around the T-S trend line. In addition to generating Q-Q (Quantile-Quantile) plots based upon detected observations, the Goodness of Fit Tests (GoF) option of the Statistical Tests module of 5.1 generates censored probability plots for data sets with NDs. Some changes have also been made in the decision table used to make suggestions for Upper Confidence Limit (UCL) selection based upon a gamma distribution to the unhandled exceptions for data

sets without any detected data.

<https://www.epa.gov/land-research/proucl-software>

With this software, site managers and technical support personnel can compute rigorous and defensible statistics and uses graphical tools to help analyze environmental data. It helps address many site evaluation issues such as comparing background data sets; performing hypotheses tests; establishing background level contaminant concentrations; estimating Exposure Point Concentrations (EPCs); performing trend evaluations, and identifying outliers and unusual observations present in environmental data sets. Federal and non-federal users can download ProUCL at no cost. Many states recommend or use ProUCL in their own waste management programs.

During FY16, SCMTSC addressed statistical and ProUCL software related inquiries of many scientists, practitioners, researchers, and students from USEPA, USGS, State Agencies, consulting firms and academia. Several requests from international users of the ProUCL software were also addressed. SCMTSC helped over 80 users with ProUCL related inquiries and requests and information provided included guidance on extracting site-specific background data sets from broader pooled onsite data sets; determining the most appropriate statistic(s) to estimate BTVs, teaching differences between upper confidence limit of mean and a two-sided confidence interval of mean, and illustrating the differences between the various decision statistics such as a 95 percent (%) upper confidence limit (UCL95) of mean, a 95% upper prediction limit (UPL95), and a 95%-95% upper tolerance limit (UTL95-95); and interpretation of test statistics, trend evaluations, trend graphs and trend test statistics.

Some FY 16 examples of SCMTSC ProUCL support are listed here:

- Addressed questions from Tim Fredrick of EPA Region 4 about statistics displayed on a generated box plot
- Responded to inquiries from Heather Clark of the Georgia Environmental Protection Division related to unhandled exceptions when importing/loading Excel files
- Responded to questions from Dr. James Callegary of United States Geological Survey (USGS) about percentiles (for data sets with NDs) computed by Stats/Sample Sizes module
- Addressed several inquiries of Bonnie Brooks and other staff of the Minnesota Pollution Control Agency about computing TEQ equivalents based upon Kaplan-Meier (KM) sums, computation of KM statistics in raw and log scale using the Stats/Sample Size Module, and performing proportion tests and interpreting derived results, and
- Responded to inquiries from Scott Miller of the Idaho Department of Environmental Quality related to performing trend evaluations on data sets containing non-detect observations
- Addressed questions from Ryan Evans of the Kentucky Department of Environmental Protection about imputation of nondetects using ROS methods
- Addressed determination of sample sizes differences between UCL95 and 95% percentile inquiries of Dr. Norka E. Paden of the Idaho Department of Environmental Quality
- Addressed questions about t-value used to compute one-side UCLs from David Sampson of the Population Health Unit, Canada
- Responded to statistical inquiries of Kristina Delidjakova, from the Toronto and Region Conservation Group, Canada, about methods to deal with data sets with nondetects and using methods applicable to right-censored data sets in biomedical studies
- Answered questions on the availability of QA/QC data sets from Andrew McQueen, Clemson University
- Addressed Mann-Kendall and Theil-Sen trend tests related inquiries of Dr. Yu Tabayashi of University of Tsukuba, Japan



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