EPA/600/R-15/132 | August 2015 | www.epa.gov/research

United States
Environmental Protection
Agency

Engineering Technical Support Center Annual Report Fiscal Year 2014

Office of Research and Development
National Risk Management Research Laboratory

EPA/600/R-15/132
August 2015

Engineering Technical Support Center Annual Report Fiscal Year 2014 Technical Support and Innovative Research for Contaminated Sites

by

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Office of Research and Development
National Risk Management Research Laboratory

Notice/Disclaimer Statement

This report is intended to inform the public, remedial project managers, on scene coordinators, and Superfund Technology Liaisons of progress at ETSC involved sites, cutting-edge remedial technologies, and ETSC operations.

This document received two ORD internal peer reviews preceding the institutional clearance process.

Disclaimer: Mention of company trade names or products does not constitute endorsement by the Agency and are provided as general information only.

Abstract

The Engineering Technical Support Center (ETSC) was created in 1987 as one of a number of technical support centers in the Technical Support Project (TSP) to provide engineering expertise to U.S. EPA program offices and remediation teams working at contaminated sites across the United States. The ETSC is operated within ORD's National Risk Management Research Laboratory (NRMRL) in Cincinnati, OH. ETSC's mission is to provide site-specific scientific and engineering technical support to remedial project managers (RPMs), on-scene coordinators and other remediation personnel at contaminated sites. ETSC's mission allows the responsible local, regional or national authorities to work more quickly, efficiently and cost-effectively, while also increasing the technical experience of the remediation team. Since its inception, ETSC has supported countless projects across all EPA Regions in almost all 50 states and Territories.

This report highlights significant projects that the ETSC has supported throughout fiscal year 2014. Projects have addressed an array of environmental scenarios, including but not limited to remote mining contamination, expansive landfill waste, sediment remediation by capping, and persistent threats from abandoned industrial sites. A major component of affecting meaningful remediation lies in constructing and testing new, innovative treatment technologies through pilot and field research. For example, ETSC teams have gone into the field to spearhead projects that are at the cutting edge of remediation research in the areas of bioremediation and ground water treatment, active sediment capping, in-situ stabilization, and sustainable site cleanup. ETSC organizes and reports significant developments in environmental engineering in the form of Engineering Issue Papers and peer-reviewed journal publications. ETSC has also taken on a selection of newer initiatives that focus on integrating sustainability into communities and land use plans. While ETSC's principal mission of bolstering technical expertise for site-specific remediation at contaminated sites remains a central focus, ETSC teams are reaching out to support other efforts in prevention thereby reducing EPA's burden from legacy sites in the future. NRMRL/LRPCD and the ETSC have evolved continually to meet the demands, as well as scientific and engineering needs of the EPA program offices and regional clients.

Foreword

The U.S. Environmental Protection Agency (EPA) is charged by Congress with protecting the Nation's land, air, and water resources. Under a mandate of national environmental laws, the Agency strives to formulate and implement actions leading to a compatible balance between human activities and the ability of natural systems to support and nurture life. To meet this mandate, EPA's research program is providing data and technical support for solving environmental problems today and building a science knowledge base necessary to manage our ecological resources wisely, understand how pollutants affect our health, and prevent or reduce environmental risks in the future.

The National Risk Management Research Laboratory (NRMRL) within the Office of Research and Development (ORD) is the Agency's center for investigation of technological and management approaches for preventing and reducing risks from pollution that threaten human health and the environment. The focus of the Laboratory's research program is on methods and their cost-effectiveness for prevention and control of pollution to air, land, water, and subsurface resources; protection of water quality in public water systems; remediation of contaminated sites, sediments and ground water; prevention and control of indoor air pollution; and restoration of ecosystems. NRMRL collaborates with both public and private sector partners to foster technologies that reduce the cost of compliance and to anticipate emerging problems. NRMRL's research provides solutions to environmental problems by: developing and promoting technologies that protect and improve the environment; advancing scientific and engineering information to support regulatory and policy decisions; and providing the technical support and information transfer to ensure implementation of environmental regulations and strategies at the national, state, and community levels.

This report highlights the happenings and accomplishments of the Engineering Technical Support Center in fiscal year 2014.

Cynthia Sonich-Mullin, Director

National Risk Management Research Laboratory

Acknowledgements

The ETSC would like to acknowledge the contributions from ORD scientists for their efforts in support of ETSC's mission. The ETSC extends a thank you to our numerous clients in the Office of Science Policy, Office of Solid Waste and Emergency Response, Office of Superfund Remediation and Technology Innovation, and the EPA Regions, particularly the Superfund Technology Liaisons (STLs), the On Scene Coordinators (OSCs) and their management for their patronage and financial support. The ETSC would also like to recognize the exemplary support provided by our contractors this year, Battelle Memorial Institute and RTI International. Finally the ETSC extends special thanks to everyone that provides document reviews, responds to technical request phone calls, and provides all other manner of assistance.

Table of Contents

List of Acronyms

ARRA	American Reinvestment and Recovery Act
ASARCO	American Smelting and Refining Company Inc.
BCR	biochemical reactor
BLM	Bureau of Land Management
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
COC	contaminant of concern
CSCMD	Carpenter Snow Creek Mining District
CSIA	compound specific isotope analysis
EPA	U.S. Environmental Protection Agency
ET	evapotranspiration
ETSC	Engineering Technical Support Center
GWTSC	Ground Water Technical Support Center
LRPCD	Land Remediation and Pollution Control Division
MCHM	4-methylcyclohexane methanol
MIW	mining-influenced water
NCEA	National Center for Environmental Assessment
NPL	National Priorities List
NRMRL	National Risk Management Research Laboratory
OITA	Office of International and Tribal Affairs
ORD	Office of Research and Development
OSC	On Scene Coordinator
OSRTI	Office of Superfund Remediation and Technology Innovation
OSWER	Office of Solid Waste and Emergency Response

OU	operable unit
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCE	perchloroethylene or tetrachloroethene
RCRA	Resource Conservation and Recovery Act
RI, RI/FS	remedial investigation, remedial investigation/feasibility study
RPM	remedial project manager
SDS	safety data sheet
STARS	Site Technical Assistance Reporting System
STL	Superfund and Technology Liaison
SVE	soil vapor extraction
SVOC	semi-volatile organic compounds
TCE	trichloroethylene
TSC	Technical Support Center
TTPC	(Tri-n-butyl)-n-tetradecylphosphonium chloride
USGS	United States Geological Survey
VI	Vapor intrusion
VOC	volatile organic compounds

Figure Legends

Introduction

The ETSC is operated and staffed by ORD's National Risk Management Research Laboratory (NRMRL), Land Remediation and Pollution Control Division in Cincinnati, OH. Created in 1987, ETSC is part of the Technical Support Project (TSP), a partnership between ORD and the Office of Solid Waste and Emergency Response (OSWER). The TSP consists of a network of Regional Forums, the Environmental Response Team, and specialized Technical Support Centers. The Centers and Forums have evolved through time as Agency needs have changed. Currently, there are 5 active TSCs in the TSP.

- Engineering Technical Support Center (ETSC) in Cincinnati, Ohio
- Ground Water Technical Support Center (GWTSC) in Ada, Oklahoma
- Site Characterization and Monitoring Technical Support Center (SCMTSC) in Atlanta, Georgia
- Superfund Health Risk Assessment Technical Support Center (SHRATSC) in Cincinnati, Ohio
- Ecological Risk Assessment Support Center (ERASC) in Cincinnati, Ohio

Each center has a specific focus of expertise and is staffed with engineers and scientists that are eager to assist on the most difficult matters that are encountered at contaminated sites. ETSC's mission is to provide scientific and engineering knowledge and expertise in soil, surface waters, sediment, and mine remediation and technology to program offices and Regional clients for risk management decisions. The ETSC provides site-specific assistance, technical support, and conducts targeted research for EPA Regions and program offices. The center networks with EPA programs and other federal agencies to deliver the latest methods, approaches, and technologies needed to characterize, remediate, and manage risk at contaminated sites. Impacts across regions include but are not limited to: developing, evaluating and demonstrating bioremediation and ground water treatment technologies; evaluating capping and beneficial waste reuse technologies; providing engineering review and design assistance; recommending proven, viable technologies; conducting focused research on the sustainability of selected site remedies; and providing on-call technical assistance. In the past several years, ETSC staff have assisted in five-year Superfund site reviews and technology optimization studies, and completed applied research projects that support site-specific and more broadly applicable research for program office and regional technical assistance requests.

ETSC is primarily staffed with scientists and engineers from the LRPCD. Additional assistance was provided by other Divisions or ORD Laboratory personnel, as well as external contractors and consultants. In FY 2014, ETSC responded to approximately 270 technical support requests from over 120 contaminated sites in all 10 EPA Regions, Territories (Puerto Rico) and internationally (Vietnam and China). Seventy-five percent of the Superfund site requests were National Priority List (NPL) sites.

The following is an overview of how the ETSC carries out technical support, a small selection of its written outputs, a select list of high impact technical support projects, and a visual breakdown of technical support provided in fiscal year 2014.

Receiving Technical Support for Contaminated Sites

The flow chart below provides a basic understanding of how ETSC addresses technical support requests (Figure 1). Typically, the process begins with a problem encountered at a contaminated site. An RPM, OSC or other decision-maker associated with the site contacts ETSC through their Regional ORD liaison or can directly contact the ETSC Director. The request is logged in the ETSC Site Technical Assistance Reporting System (STARS) database, and an EPA subject-matter expert is consulted simultaneously. Once an EPA expert is identified, the request is then serviced by that individual through three general channels of action: research, new technology or knowledge gap identification. Once the appropriate contaminated site need is determined, the subject-matter expert undertakes the appropriate actions from the flow chart below to address the contaminated site need. The expert then develops deliverables related to the request that are sent to the client and the ETSC Director when completed. The feedback arrows between RPM, OSC, STL and the center director signifies the timeliness and quality of the technical assistance that helps the center to evaluate and provide better service to its clients.

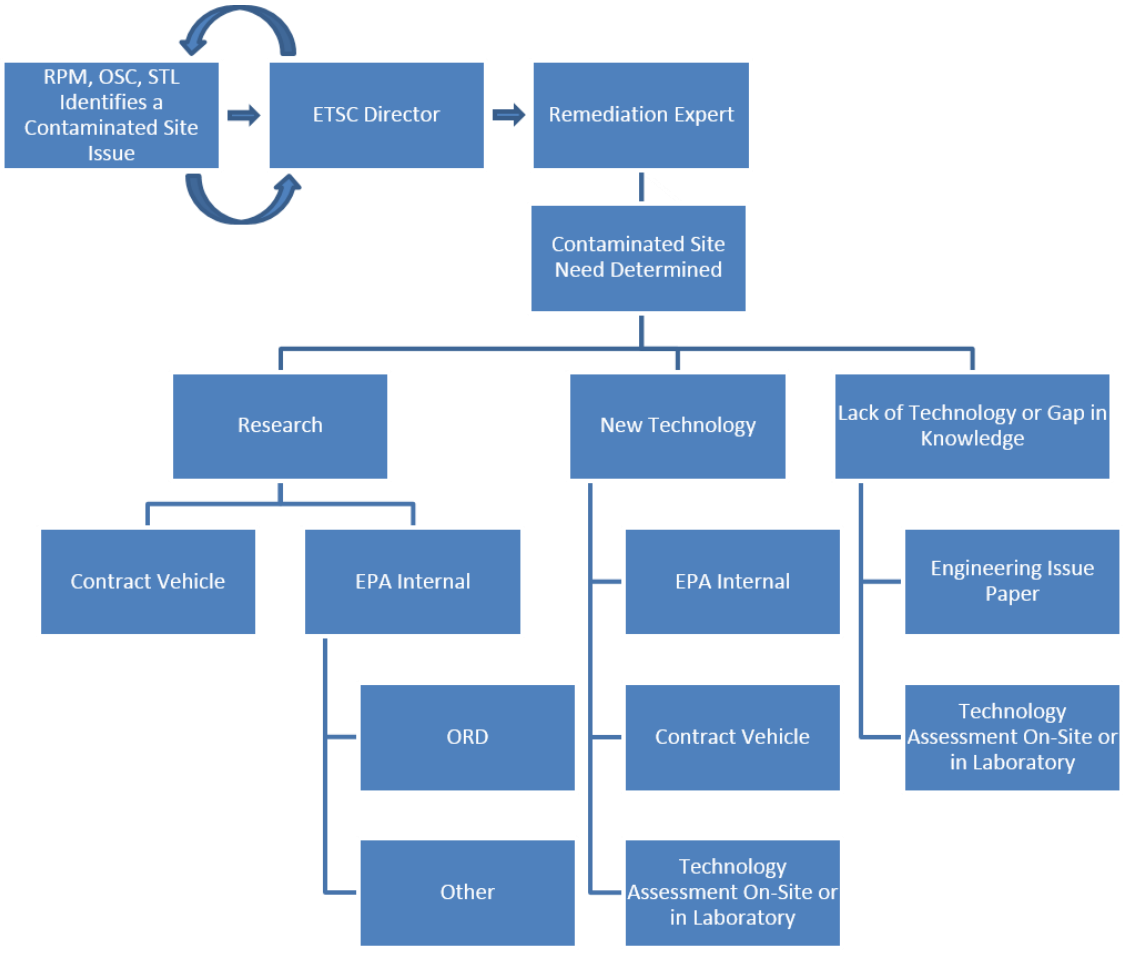

Figure 1 : Engineering Technical Support Request Flow Chart

New in 2014: Technical Support Request SharePoint Site

In FY 2014, ETSC began construction of a Microsoft Office-based SharePoint site to catalogue and track technical support requests submitted to the ETSC, GWTSC, and SCMTSC in a web-based environment. The pilot process of the SharePoint site will be tiered; initially, technical support requests from the STARS database will be imported into SharePoint and records made accessible to managers, RPM's, OSC's and STL's. Secondly, a form to submit new requests will be made available to RPM's, OSC's and STL's which will be routed to the center director and handled in a manner similar to that described in the previous section (see Figure 1). The Technical Support Centers (TSCs) SharePoint site is permission-based, meaning that users must be invited to the site. This serves to keep data on the site confidential, and allows authorized users to view or edit requests.

Below is a screen shot (Figure 2) of the homepage of the TSC SharePoint site where users will begin their request. Following the homepage, Figure 3 provides the actual form where requests will be entered by RPM's, OSC's and STL's. The form collects valuable TSC data including the name and location of the site, nature of technical support, and who is submitting. The site also has data entry fields for contaminants encountered and types of contaminated media. Once the form is submitted, the SharePoint site will notify the center director(s) and other personnel of the request and it will be serviced appropriately.

Figure 2. SharePoint site homepage for the three Sustainable and Healthy Communities-related Technical Support Centers.

Though early in its implementation, the SharePoint site has many potential upgrades possible in the out years. To this point, a detailed query system is being developed to empower site users with the tools needed to answer question concerning what types of technical support the ETSC provides, where it has been conducted, and who is available to contact when help is needed. Managers will also have the capability to export SharePoint data into Microsoft Excel and perform their own analyses. We also plan on a site module where RPM's, OSC's, STL's and ETSC personnel can collaborate on documents related to technical support requests. When fully functional, we hope to service all technical support requests through this single, user friendly site, eliminating the burden of email correspondence in recent years. We expect this site to be fully implemented by FY 2016.

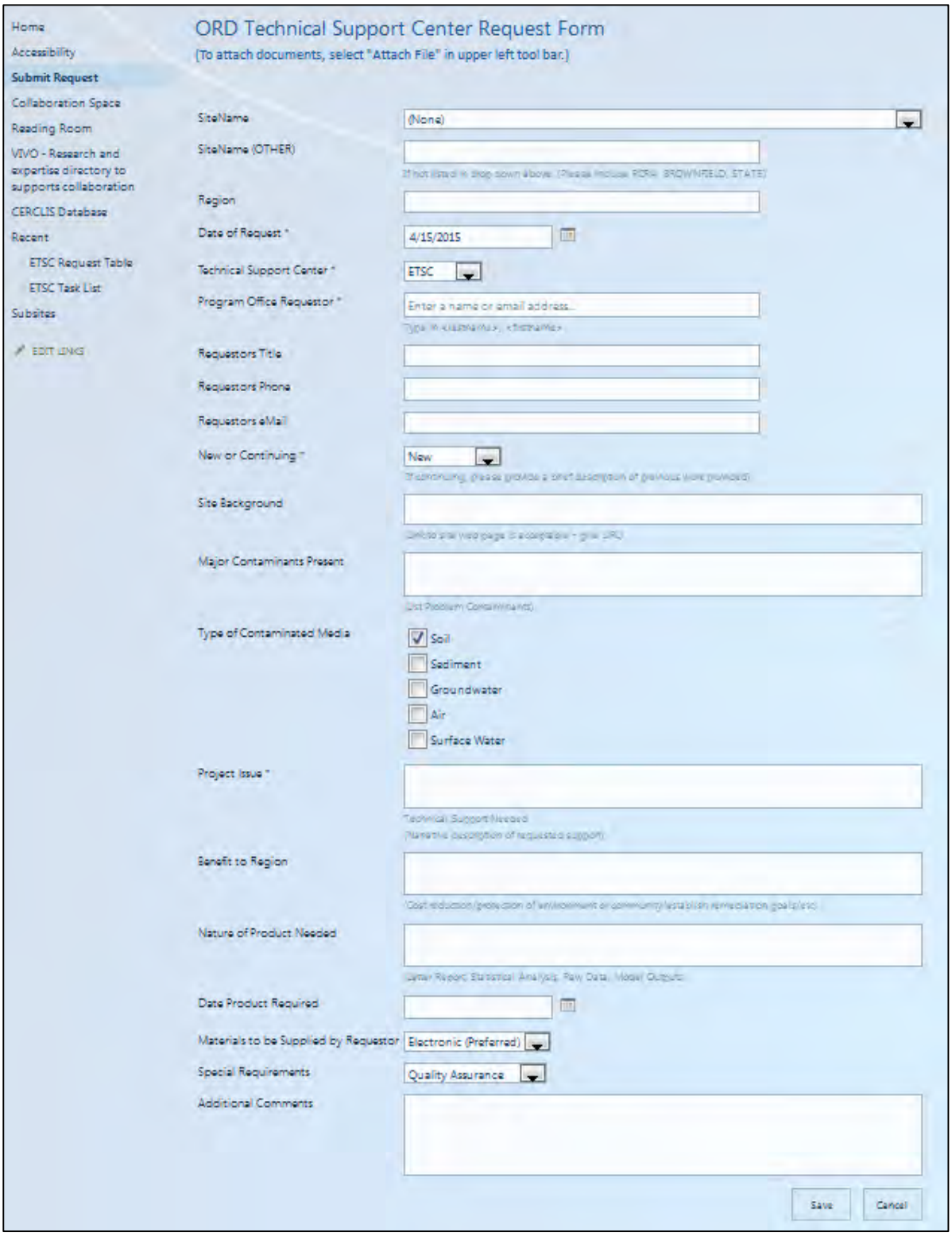

Figure 3. Technical Support Center; technical assistance/support request form.

Engineering Issue Papers

Engineering issue papers (EIPs) are prepared when gaps in existing knowledge on a technical subject are found. To support office, RPM, OSC, or Regional decisions on what technologies to utilize at a contaminated site, ETSC can review the current understanding of the theory, design and implementation of various remedial or treatment technologies. EIPs are the product of an extensive literature review, consultation with leading edge engineers and scientists, inside ORD, and in the contracting community.

Listed and described below are a selection of engineering issue papers that were initiated in FY 2014 and targeted for completion in FY 2015.

Biotransformation Pathways of Dimethylarsinic (Cacodylic) Acid in the Environment

Historically, Agent Blue or Dimethylarsinic (Cacodylic) Acid DMA(V) and its salts have been used as herbicides and defoliants and became one of the most popular herbicides used worldwide in terms of volume (Figure 4). It is estimated that during the 1970s and 1980s, 10 to 12 million acres were treated annually with 2.1 million kg of monomethylarsonic acid MMA(V) and DMA(V) in the United States. In 2012, the application of DMA was banned in the United States. The use of DMA(V) was thought to lead to appreciable arsenic concentration in apples and rice. In response to growing interest in arsenic remediation and DMA(V), ETSC prepared an EIP summarizing the state of the science regarding the biotransformation of DMA(V). The EIP was developed from peer-reviewed literature, scientific documents, EPA reports, Internet sources, input from experts in the field, and other pertinent sources. The EIP also includes a review of the current understanding of biologically-mediated transformation of DMA(V) and its metabolites.

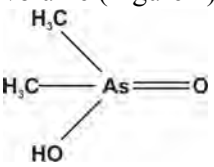

Figure 4. Chemical structure of DMA(V) (Agent Blue)

Passive Samplers for Investigations of Air Quality: Method Description, Implementation, and Comparison to Alternative Sampling Methods

Requests received by ETSC for vapor intrusion issues have increased over the past few years and led to identifying a gap in knowledge concerning the newest technology to assess and quantify exposure pathways. Traditional methods of quantifying indoor exposure to volatile and semi-volatile organic compounds from vapor intrusion situations include energy intensive pumping of indoor air through sorbents or canisters. While this method is effective, costs can sometimes prove prohibitive. In an effort to disseminate information on more cost effective solutions, ETSC commissioned an EIP summarizing the latest technology on less energy intensive and more cost effective passive sampling techniques.

The EIP summarizes the "state of the science" regarding the use of passive air samplers for investigating subsurface vapor intrusion (VI) to indoor air. It also covers the basics of passive sampler design, compares passive samplers to conventional methods of air sampling, and discusses considerations when implementing a passive sampling program. The EIP also discusses field sampling and sample analysis considerations to ensure data quality is adequate, and interpretations based on the passive sample data can be supported.

Vapor Intrusion Pathway Screening for Soil Excavation Remedies

Related to the EIP above, this EIP provides information pertinent to monitoring soil excavation remedies for volatile organic compounds (VOCs) in the subsurface, particularly with respect to using bulk soil sampling to address future potential vapor intrusion (VI) risks. Bulk soil sampling and analysis is a conventional method for assessing the completeness of soil excavation remedies, but information is lacking on how to use soil sampling and analysis results to determine whether a soil excavation remedy for VOC contamination has been completed to a degree that is protective of human health and the environment.

International Endeavors

China Ministry of Science and Technology (MOST) Collaboration.

EPA and Chinese officials are working on a collaborative effort to identify parallel environmental issues in both countries and engage EPA and Chinese scientists to solve the problem together. There are six projects in total. One is a collaboration with the ETSC that will provide additional information on metal uptake in sediments.

Vietnam

Issues of pesticide and dioxin contamination have been encountered at historic U.S. military installations in Vietnam. In FY 2014, ETSC collaborated with the Joint Advisory Committee for Vietnam, U.S. State Department, U.S. Department of Human Health Services/Center for Disease Control, and internal EPA entities ORD/NERL, and OITA to help guide in the selection of the best remedial solutions military sites. The ETSC provided Vietnamese officials with presentations that outlined dioxin chemistry and bioremediation techniques, and is preparing an EIP that summarizes the available scientific and technical information on bioremediation techniques for dioxin.

Selected FY 2014 Technical Support Projects

In FY 2014 alone, the ETSC received approximately 270 technical support requests from over 120 contaminated sites all across the U.S. and its Territories along with two international requests. Due to the large volume of technical support requests received annually by the ETSC, only a selected number of technical support projects will be discussed in the following sections. They are organized by four types of work involved: mining, landfills, materials management, and sustainability and emergency response. Each site includes the EPA Region from which the request originated.

ETSC Impacts at Mining Sites

Black Butte Mine and Cottage Grove Reservoir (Region 10)

The Black Butte Mine (BBM)[1] is a historic mercury (Hg) mine located in the Willamette Valley of Oregon that was active between the 1890s and 1960s producing approximately 635,000 kg of Hg. The Cottage Grove Reservoir is located 15 km downstream of the mine site (Figure 5) and contains fish with Hg concentrations above safe consumption levels. Despite public health fish consumption advisories that have been in place since 1979, fishing (and fish consumption) remains a popular reservoir activity. The site was added to the National Priorities List (NPL) in 2010 in part due to the local community's concern about fish Hg levels in the reservoir. The vast majority of the Hg that accumulates in the fish is an organic form of mercury (methylmercury-MeHg); however almost all of the Hg exported from the mine site is inorganic Hg. Following NPL listing of the site, an Optimization Review was completed (2012), which highlighted the main knowledge/data gaps at the site. One of the main recommendations of the report was to identify the variables controlling the production of MeHg in the reservoir. Shortly thereafter, Region 10 began working with

Figure 5. Black Butte Mine in the Upper Coast Fork Willamette River Watershed. Metal rich, mine influenced water enters the Cottage Grove Reservoir increasing Hg concentration in sediments over time.

[1] http://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=1001865 Accessed 7/24/2015

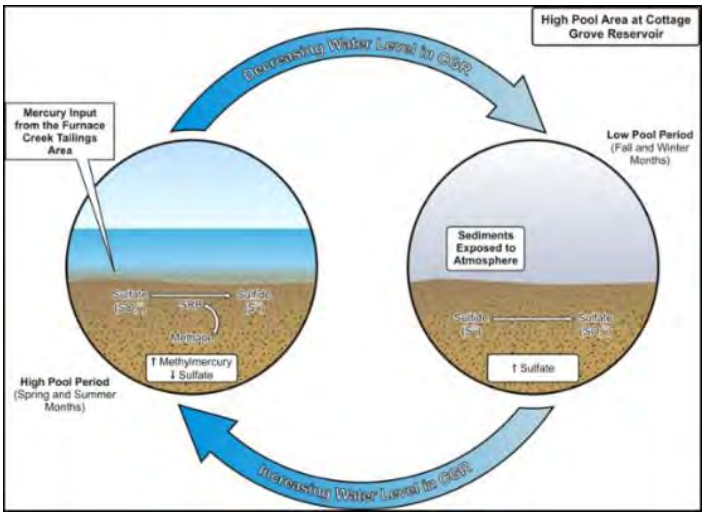

Figure 6. Mercury cycling in the Cottage Grove reservoir.

ORD scientists at the ETSC to develop a team project that would address this critical knowledge gap at the site. Field sampling in support of this project was initiated in February 2013. ORD and regional scientists carried out a field study to understand what environmental variables were responsible for mercury speciation and subsequent uptake by fish in the reservoir. The research team developed a model that shows how seasonal water level fluctuations and sulfur elemental cycling within the reservoir can influence how mercury is made bioavailable (Figure 6).

Carpenter Snow Creek Mining District (Region 8)

Figure 8. Mine influenced water entering a stream.

The Carpenter Snow Creek Mining District Superfund Site (CSCMD)[2] lies in the Little Belt Mountains of southern Cascade County, MT (Figure 7). The site encompasses approximately 9,000 acres with mine tailings, waste rock and mine-influenced waters present throughout the district, due to the many inactive and abandoned mines (Figure 8.) The State of Montana's Abandoned Mine Bureau identified, inventoried and sampled these inactive mines in the Carpenter Snow Creek area in the early 1990's. Sampling and visual inspection showed the presence of a variety of metals in the area surface water and soils that are found in concentrations known to produce risk to human health and the environment (Figure 8). The CSCMD site was listed on the Superfund National Priorities List in 2001.

Figure 7. Location of the CSCMP site in MT.

[2] http://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0801507 Accessed 7/24/2015

The ETSC serviced a technical support request from the remedial project manager for assistance in mine influenced water research. ETSC personnel performed consulting visits to the Big Seven mining area within the CSCMD to aid in the design of a biochemical reactor (BCR) system suitable for the site. ETSC researchers are currently conducting column testing to assess efficacy of a BCR system that could be constructed in the field.

ETSC Impact at Landfill Remediation Sites

Lower Darby Creek; Clearview Landfill (Region 2)

The Lower Darby Creek Superfund site[3] consists of three operational units in close vicinity to the Philadelphia International Airport and the John Heinz National Wildlife Refuge (Figure 9). Clearview Landfill operated from the 1950's to the 1970's and was closed in the mid 1970's and various businesses operated on the surface of the landfill to the present day. The landfill reportedly accepted a variety of wastes, including municipal, demolition, and hospital. The most significant contaminants detected at the Clearview site include PCBs, PAHs, heavy metals and pesticides. Moreover, potential unacceptable risks to people or ecological receptors were identified in surface and subsurface soils, ground water and consumption of fish tissue from Darby and Cobbs Creek.

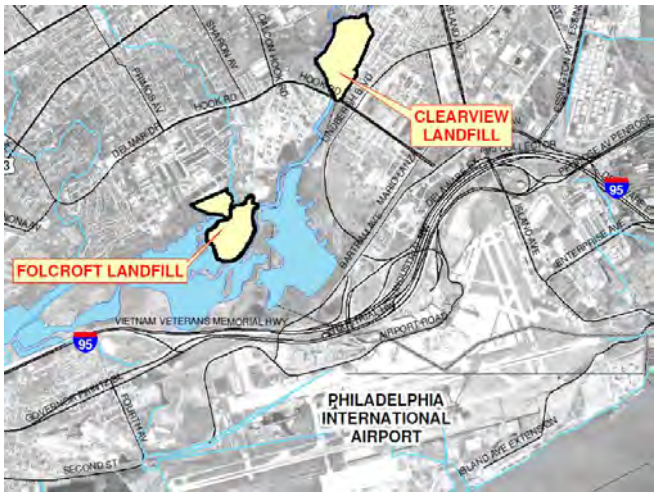

Figure 9. Location of the Clearview Landfill and other sites associated with Lower Darby Creek.

Figure 10. Tree and shrub planting for the evapotranspiration cap.

ETSC personnel are providing technical and financial support for a green remediation project at the site. An evapotranspiration cap, strategically planted with native grasses, shrubs, and trees, is being installed in an attempt to combine remedial techniques and ecological function at the site (Figure 10). ETSC scientists are also providing assistance with establishing a plant nursery on the site and providing technical input at public meetings organized by community action groups, EPA regional personnel, and ORD personnel. The cover will not only provide protective containment of the historical waste at the site, they will sequester carbon

[3] http://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0305521 Accessed 7/24/2015

(greenhouse gas implications) and create a wildlife habitat corridor that connects to the neighboring John Heinz Refuge.

ETSC Assisted Materials Management Sites

Oak Grove Village Well (Region 7)

The Oak Grove Village Well site[4] is a federal-lead Superfund site that has an unattributed and undefined trichloroethylene (TCE) ground water plume (Figure 11). TCE has been detected in the Oak Grove Village municipal drinking water well above the maximum contaminant level (MCL) since 1986. Oak Grove Village is a small rural community, with a population of about 420 people. It is adjacent to and northeast of the city of Sullivan, Missouri, which has an approximate population of 6,400. The site is underlain by dolomitic formations of the Ordovician and Cambrian Age that lend themselves to karst features including springs, sinkholes, and losing streams. Regionally, the ground water flow direction is parallel to the major surface-water drainages, which trend north to northeast, causing the ground water flow in Oak Grove Village and the city of Sullivan to vary from an easterly direction to a northeast direction. However, due to the karst terrain, ground water flow in the Oak Grove Village/Sullivan area is complicated by the possibility of fractures and subsurface conduits that run beneath the site. Through the ETSC, compound specific isotope analysis (CSIA) is being performed on samples collected from the site by the United States Geological Survey (USGS) to locate and distinguish source areas. This technique is novel, specific hydrogen isotope techniques are being developed as part of this project, and the expertise is not readily available in Region 7. If successful, this technique has the potential to identify individual contaminant sources from co-mingled source areas. Sampling was conducted in the summer of 2014 by USGS with analytical support from the ETSC. The data analysis continues into FY 2015.

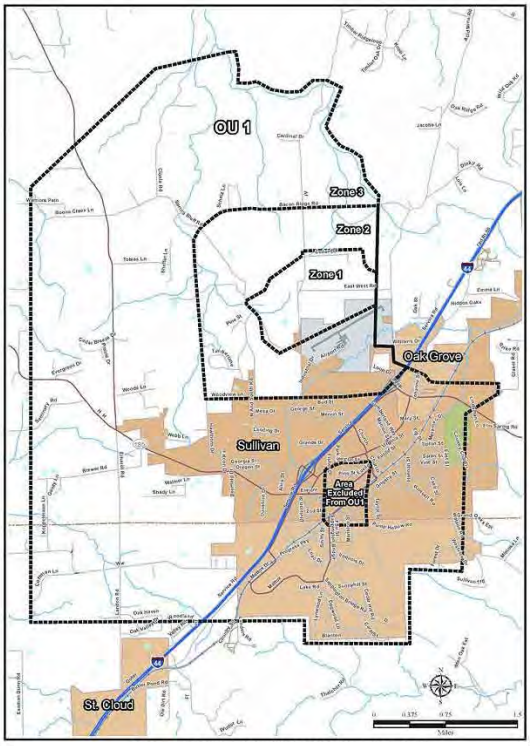

Figure 11. Location of the Oak Grove Village Well site in MO.

[4] http://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0700020 Accessed 7/24/2015

Sustainability in the Community

San German Ground Water Contamination (Region 2)

The San German Ground Water Contamination site[5] (Figure 12) consists of a ground water plume with several potential sources of contamination. The site is located in the municipality of San German, Puerto Rico. The San German Urbano public water system consists of seven wells and two surface water intakes serving an estimated population of 25,000 people. Industrial activity in the area has contributed to contamination of these wells, one of which was ordered closed by the Puerto Rico Department of Health due to high levels of chemical solvents in the water. Other wells have shown lower levels of contamination during routine monitoring. Nearby manufacturing facilities are believed to be sources of the contamination.

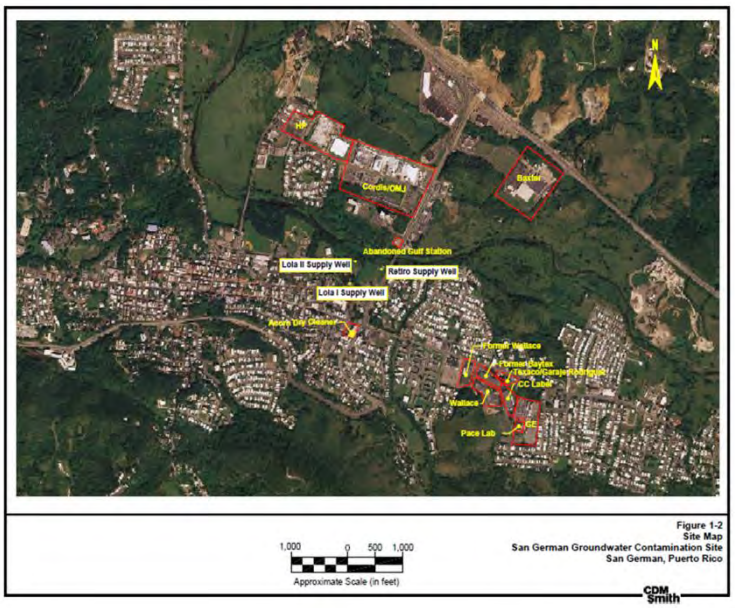

Figure 12. Location of the San German Ground Water Contamination site in Southwest Puerto Rico.

In FY 2014, ETSC, Region 2, and stakeholders have completed ground water sampling and characterization for the site and are also utilizing state of the art passive air sampling techniques to quantify chemical vapor intrusion in homes and buildings at the site. To verify the passive air samplers, active air sampling canisters are being deployed as well and will sample at the same time (Fig 13). This study is ongoing through 2014 and data generated from the project will be used in later publications and recommend remedial actions at the site.

Figure 13. Active air sampling canister (SUMA canister).

[5] http://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0205957 Accessed 7/24/2015

Omaha Lead ASARCO Site (Region 7)

Omaha Lead Site[6] in Omaha, NE is one of the largest urban Superfund sites in the United States. The site was added to the NPL in 2003. ASARCO operated a lead refinery from the 1870's until 1997 on the site. For 125 years, smokestacks from the refinery released lead containing particulates that eventually contaminated 27 square miles of downtown Omaha, NE (Figure 14). After the refinery was shutdown, soil from residential and business properties across east Omaha were sampled for lead, and routinely found to exceed 2,500 mg/kg. Clean up and removal actions on the site began in 1999 with child care facilities, and has continued with 2600+ properties being remediated to date.

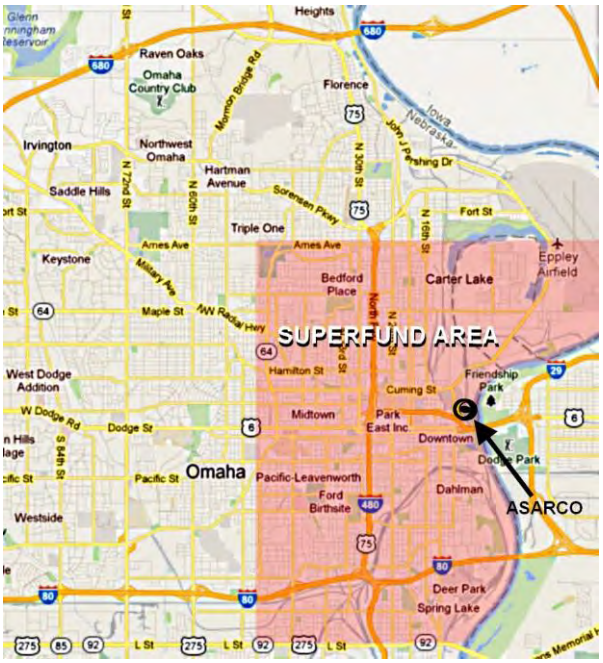

Figure 14. The extent of the Omaha Lead Superfund Site.

In FY 2014, ETSC partnered with NCEA statisticians and epidemiologists to spearhead an investigation of soil lead contamination and remediation and its effects on educational and social outcomes in urban communities. Results of this study are currently being analyzed, and EPA numbered documents and peer-reviewed journal articles will eventually be prepared. Public/community involvement in Superfund action is of central importance to the EPA, in the case of the Omaha Lead Superfund site, questions of environmental effects of lead, and human exposure were encountered often. In response to these community concerns, a Community Advisory Group (CAG) has been active at this site since 2004. The CAG has worked with EPA to ensure the public and community have easy access to site information. Two examples of this access are: 1) oversight personnel are present in the community, and 2) a local office and phone number were established for community engagement. Community awareness and EPA action has led to a steady decline in the number of children in the affected area identified with elevated blood-lead levels. In recent years, EPA has committed approximately $25 million in Recovery Act funds to significantly increase the pace of ongoing long-term soil cleanup and lead-based paint stabilization activities. While EPA continues to work at this site, the funding will help expedite implementation of the final cleanup approach for the site. ETSC anticipates long-term involvement at this site as projected completion is five to ten years.

[6] http://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0703481 Accessed 7/24/2015

Emergency Response: Elk River MCHM Spill and Clarington, OH Well Pad Fire.

ETSC supported the emergency response efforts at two large spill sites in Ohio and West Virginia. In response to the Elk/Kanawha River 4-methylcyclohexane methanol (MCHM), ETSC personnel provided mathematical equations and performed calculations that allowed the requestor (US EPA/NCEA) to determine the lower odor threshold for MCHM in air. The equations were based on existing data from West Virginia on environmental concentrations present from the uncontrolled release of MCHM.

ETSC played an advisory role in an emergency well pad fire in Clarington, OH which resulted in a large fish kill downstream from the spill. ETSC provided safety data sheets to decision makers and provided input on the development of an analytical method for (Tri-n-butyl)-n-tetradecylphosphonium chloride (TTPC) spilled from the wellpad into the surrounding waterways. Region 5 laboratory personnel developed the method eventually used to quantify TTPC in soils, water and sediment at and around the site.

National and Global Impacts of the ETSC

In FY 2014, the ETSC received 270 unique technical support requests. One-hundred sixty of those requests fulfilled Superfund related issues (62% of total sites serviced), and 76% of those Superfund sites were listed on the National Priority List. The ETSC also serviced 15 RCRA, two Brownfields and three international sites, including two sites in Vietnam and one in Canada. In 2014, the ETSC also provided support to sites located in Alaska and Puerto Rico. A map of activities is available on the following page (Figure 17).

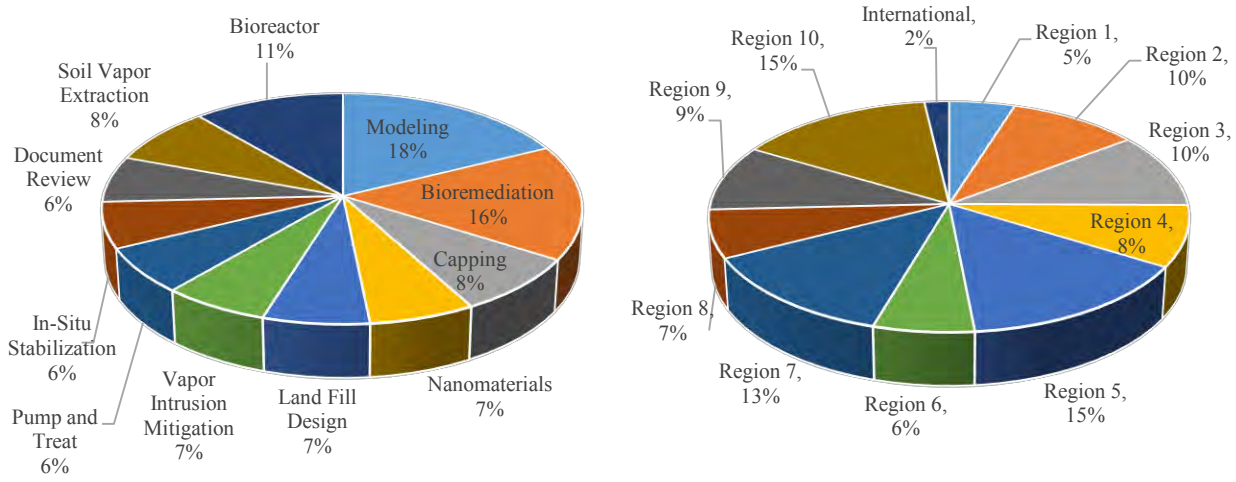

Figure 15. Pie charts illustrating technologies used at sites serviced and in which EPA regions the work took place.

Categorization of ETSC activities illustrates that U.S. EPA Regions 5, 7, and 10 account for more than half of the technical support requests to the Center, with Region 5 alone accounting for 15% of the total. Metals, PCBs and chlorinated solvents are the most common contaminants involved in technical support requests. In the past year, the most common remedial solutions applied at sites were bioremediation techniques, ground water pump and treat systems, landfilling, and fate and transport modeling.

The pie charts and word clouds in Figures 16 and 17 illustrate the breakdown of where ETSC work took place, the contaminants of concern, types of contaminated media, and remedial solutions applied at sites. Note that a single site could have multiple remedial solutions, contaminants, and contaminated media types.

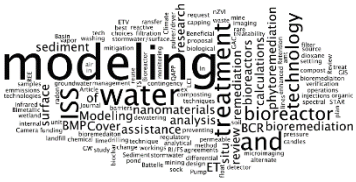

Figure 16. Word clouds depicting the most common remedial solutions and contaminants of concern.

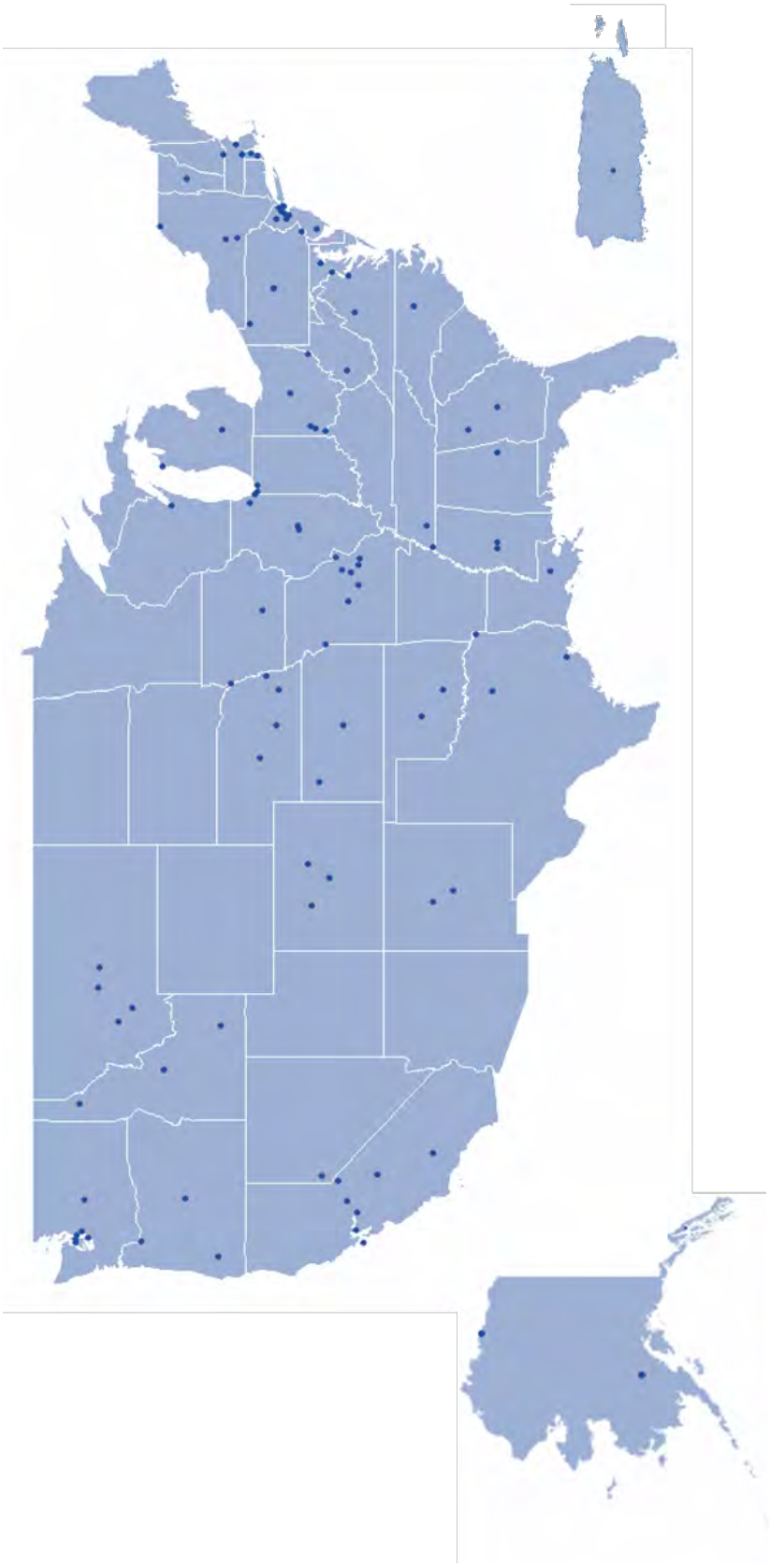

Figure 17. Map of the lower 48 of United States, Alaska and Puerto Rico. Blue markers indicate sites where ETSC has provided assistance.

Summary

The projects and investigations presented here are a selected sample of those being undertaken by the ETSC. A number of these investigations have provided substantial results, and others are working toward that end. The selected investigations provide insight into the unique role that ETSC plays as a bridge between environmental remediation (as applied research) and innovative engineering research in ORD. Firm examples of the impact and contributions the ETSC provides to clients in EPA Offices and the Regions include:

1) Development, field evaluation, and demonstration of bioremediation technologies:

- Biochemical reactors for potential treatment option at metal-rich acid mine drainage sites
- Design and implement evapotranspiration covers for landfills and Superfund sites to assist in remediating VOCs and other compounds from soil

2) Development, field evaluation, and demonstration of ground water treatment technologies:

- Design, develop and evaluate permeable reactive barrier technologies to slow or stop ground water contaminants from escaping sites
- Provide state of the art spatiotemporal fate and transport ground water modeling to evaluate existing systems or guide remedy selection
- Provide ground water pump and treat system design and optimization

3) Evaluate sediment capping efficacy, environmental impacts, and long-term sustainability.

4) Conduct analyses or studies to determine beneficial reuse of waste.

5) Provide engineering plan design reviews to ensure efficacy of selected site treatment or remedy, and cost efficiency:

- Implement proven technologies when it is a viable solution, such as applications of in-situ solidification, thermal desorption and in-situ chemical oxidation

6) Continue to provide timely and relevant technical support to contaminated sites:

- Research, evaluate or demonstrate new and innovative treatment technologies
- Provide expert assistance in a broad range of topics including life-cycle analyses (e.g., determining ‘green footprint’ and evaluating other sustainable practices and remedies)

Through its interdisciplinary background, the ETSC staff brings creative thinking to life by applying innovative engineering research in real-world scenarios. In addition to the promise they inspire, these innovations have the potential to produce long-lasting dividends and ultimately safer and healthier communities.

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