Successful Partnerships between ORD and EPA Regions

Superfund and Technology Liaisons (STLs) and Regional Science Liaisons (RSLs) provided the following examples of successful partnerships between ORD and the Regions.

Project 3.61 - Contaminated Sites

3.61, Task 1 - ORD Technical Support to the Regions

These examples demonstrate exemplary site-specific support (one from each Region) from the ORD Technical Support Centers.

Region	Technical Support Example	ORD Tech Support Center	Contacts
1	**Ft. Devens Superfund Site** - ORD field research & technical support on the nature and extent of arsenic migration led to a remedial action that prevented contaminated groundwater discharge from the site's landfill to a local pond. Technical support to determine the effectiveness of the remediation system is ongoing. ORD field activities included: Water Quality Sampling (groundwater and surface water); Groundwater/Surface Water Interactions (temperature profiling, seepage meter survey); Hydrogeologic Characterization (physical and pneumatic slug testing). ORD also provided support by reviewing a groundwater model and determining temporal and spatial variability of groundwater velocities.	GWTSC ETSC	Dave Burden (ORD) Robert Ford (ORD) John McKernan (ORD) Jan Szaro (ORD R1 STL)
2	**Diaz Chemical Superfund Site** – ORD's Dr. Eva Davis has been assisting the region in the Remedial Design phase of the project where thermal remediation will be applied. Her expertise and experience in thermal design has been invaluable in providing direction to the project. Initially, she provided assistance with assessing the performance of the bench scale study and deciphering the lessons learned that can be carried forward in the application at the Site. More recently, Dr. Davis assisted the team in moving forward with the design of Phase I and the performance work statement that will be distributed to the thermal bidders. She reviewed the Design Analysis Report and Performance Work Statement and has provided substantive comments that will allow the agency to more effectively move forward with the design at this complex site.	GWTSC	Dave Burden (ORD) Eva Davis (ORD) Diana Cutt (ORD R2 STL)
3	**Clearview Landfill Superfund Site** - ORD is providing support on investigating groundwater/ surface water interactions/discharges at the site. SCMTSC staff is working with USGS-Storrs to provide support in locating potential/probable groundwater seeps into the river using distributed temperature sensing (DTS). This would include field data collection, data processing, interpretation and reporting. If deemed necessary and per the results, determining the ground water flux enter the stream at locations determined. Will consider instrumenting the site for a long term geophysical monitoring of remediation processes and site dynamics as it would influence contamination fate and transport and remediation effectiveness. Determining the groundwater/surface water interactions will assist in the site ecological evaluation and possibly assist in determining the effectiveness of the remedy.	SCMTSC	Bill Hagel (ORD R3 STL) Steve Rock (ORD) Dale Werkema (ORD)

Successful Partnerships between ORD and EPA Regions

4	**Wright Chemical Superfund Site** is a specialty chemical operation where previous investigations noted many tentatively identified compounds (TICs) in the analytical data. SCMTSC assisted in reviewing the TICS to help determine which chemicals should be included in the Remedial Investigation analytical program. A variety of non-standard analytes were of interest. Identifying unusual compounds that may have environmental or ecological toxicity was necessary to fully protect human health and the environment and support the adequacy of remedial decisions.	SCMTSC	Felicia Barnett (ORD)
5	**Pilsen Superfund Site -** R5 is initiating a Removal Site Evaluation in the Pilsen Neighborhood in Chicago. One objective is to determine the industrial sources of lead contamination where multiple PRP's exist. SCMTSC is doing the following to support this effort: 1) Conducting SEM/EDS soil sample analysis; 2) Working with NEIC to duplicate/confirm SEM/EDS soil analysis results previously performed by NEIC; 3) Providing scientific advice and serving as QA/QC for the lab contracted by R5 to perform SEM/EDS analysis; and, 4) Attempting to identify lead sources using novel environmental forensics.	SCMTSC	Felicia Barnett (ORD) Charles Maurice (ORD R5 STL)
6	**Camp Minden RCRA Site**- Millions of pounds of military-grade propellant have been improperly stored at the site. After part of the stock detonated in 2012, the Department of Defense proposed an open-air incineration system. The community has consistently disagreed with that solution, and pressed EPA's Region 6 for a technology with fewer air emissions. Region 6 tapped into experts across ORD to rapidly evaluate technologies that could handle the large amounts of materials, while providing safety measures for both responders and the community. ORD staff also participated in the community dialogue meetings. Subsequent to these efforts, a technology called a "Contained Burn System" (CBS) was eventually chosen for implementation. The CBS is an innovative, closed-chamber system that greatly reduces emissions while still allowing rapid throughput of the unstable material. Since activation earlier this year, the CBS has already been able to destroy over 4 million pounds of propellant and other energetic material.	ETSC	Kelly Smith (ORD) Terry Burton (ORD R6 STL)
7	**Tri-State Mining District* -** The Tri-State Mining District includes four 'mega' Superfund sites, with a total effected land area of 2,500 square miles. The watershed in this area, the Spring River Basin, drains the effected land area in three states (Kansas, Missouri, and Oklahoma) where widespread lead and zinc mining contaminated the surrounding land. ORD NRMRL through the ETSC is assisting Region 7 (with partnering from Region 6 and other federal, state, and tribal stakeholders) to develop a decision-support watershed model to assist with the effective and efficient targeting of specific stream and lake areas for multi-site cleanup.	ETSC	Brian Dyson (ORD) Souhail Al-Abed (ORD) Mohamed Hantush (ORD) John McKernan (ORD) Rob Weber (ORD R7 STL)
8	**Carpenter Snow Creek Superfund Site** (Silver Dyke) – ORD is providing support regarding mine-influenced water remediation. Drs. Souhail Al-Abed, Barbara Butler and John McKernan performed consulting visits to the Silver Dyke adit within the Carpenter Snow Creek Site (CSCS) to aid in the design of a bioreactor system installed and tested on-site. The treatability studies for the mine waters submitted from the CSC area were recently completed, and	ETSC	John McKernan (ORD) Steve Dyment (ORD R8 STL) Barbara Butler (ORD)

	a report was provided to the region. Future treatment testing is being planned. The QAPP for this planned work has been prepared and approved.		
9	**Green Remediation in Contaminated Site Cleanup - Updated Spreadsheets for Environmental Footprint Analysis (SEFA) Tool System* -** The updated SEFA tool includes cradle to gate life cycle inventories for the production of chemicals and materials. System boundaries include everything from the excavation of raw materials and recourse from the ground to the end of the production process or facility gate. Inventory analysis involved sorting and aggregation of relevant elementary flows into the environmental footprint categories considered in the SEFA tool. The material emission factors developed are intended for implementation in SEFA workbooks. For example, a user for a site may be using oxidants such as hydrogen peroxide or potassium permanganate as part of the site's remediation activities. The updated SEFA tool may now incorporate water use and updated emission factors for these chemicals to more accurately estimate how green a cleanup activity will be.	ETSC	Paul Randall (ORD) Karen Scheuermann (R9) Carlos Pachon (OLEM) Michele Mahoney (OLEM) Matthew Small (R9 RSL)
10	**Black Butte Mine Superfund Site -** Region 10 is evaluating options for a non-time critical removal action to control ongoing sources of mercury to surface water from the mine operation area. Studies are ongoing to evaluate the methyl mercury production in the Cottage Grove reservoir that is impacting mercury contamination of fish. The applied research on methylmercury production in the reservoir being performed by the ETSC has greatly accelerated the Regions ability to better understand options for reducing methylmercury levels in fish. This benefits Region 10 and the people of Cottage Grove who recreate at the reservoir. Because the issues being addressed at the site are focusing on understanding critical environmental processes linking reservoir management to mercury methylation, the knowledge gained from this site is also informative at other sites within R10, as well as nationally.	ETSC	John McKernan (ORD) Kira Lynch (ORD R10 STL) Todd Luxton (ORD)

3.61, Tasks 2-4 (Contaminated Groundwater, Contaminated Sediments and Vapor Intrusion)

The following are examples of ORD-funded (i.e., through RARE, RESES or STL Extramural Funding) research or technology transfer events that address regional needs through partnerships between ORD, the Regions, and in some cases, OLEM and states.

Research	Partners	Primary Contact(s)
A New Method for Borehole Scale Testing of Matrix Diffusion in a Fractured Crystalline Bedrock Aquifer- Matrix diffusion is a key limiting factor to effective remediation at thousands of hazardous waste sites where contaminants have affected non-fractured zones of bedrock and other low permeability geologic units. This project has developed a new procedure to assess the effect of matrix diffusion on contaminant transport at fractured-rock sites. The goal is for increased understanding of such contamination transport that facilitates the	R1 ORD OLEM USGS	Michael Brooks (ORD) Jan Szaro (ORD R1 STL)

improved formulation of conceptual site models and selection of appropriate remedial solutions.		
Investigation of Processes Controlling Attenuation and Cleanup of a Hexavalent Chromium Plume in Fractured Sedimentary Bedrock* – This project is studying diffusion and reaction processes affecting hexavalent chromium in fractured rock matrices. This research will allow the regions to make scientifically sound decisions at contaminated fractured rock sites throughout the U.S. Sites where contaminant mass has moved into the primary pore space of the rock are particularly difficult to remediate since the contaminants in the matrix can act as a long term source as they slowly diffuse out of the rock over time. The project team recently published some of the project's finding in the December 2015 issue of *Chemical Geology.*	R2 ORD University of Ottawa University of Guelph	Rick Wilkin (ORD) Katherine Mishkin (R2) Diana Cutt (ORD R2 STL)
Measuring Contaminant Mass Flux and Groundwater Velocity in a Fractured Rock Aquifer Using Passive Flux Meters* - At contaminated groundwater sites, groundwater specific discharge and contaminant mass flux are important parameters used to understand the significance of contaminant loading to an aquifer, evaluate contaminant fate and transport, assess risk, design a groundwater remediation system, and assess remedial performance. The primary goal of the project was to improve the measurement of groundwater flow and flux in fractured bedrock systems. This project addresses one of Region 2's science needs – to develop cost-effective techniques for identifying contamination in fractured rock aquifers. The project evaluated the use of an innovative tool - the fractured rock passive flux meter - in determining contaminant mass flux and groundwater velocity in a contaminated aquifer in New Jersey.	R2 ORD University of Florida	Michael Brooks (ORD) Katherine Mishkin (R2) Diana Cutt (R2 ORD STL)
PCB Sediment Cleanup Technology - The objective of this research is to improve the performance of the catalytic system technology consisting of the iron oxide and palladium deposited on activated carbon matrix (previously developed by NRMRL Scientists). At the same time it is intended to increase the cost efficiency of the system by minimizing the content of palladium, without decreasing the overall performance of the system.	R3 ORD OLEM	Souhail Al-Abed (ORD) Bill Hagel (ORD R3 STL)
Determining Urban Lead Background Concentrations in the SE U.S.* - Soils that have been heavily impacted by humans for decades are likely to contain elevated levels of certain metals and/or polycyclic aromatic hydrocarbons (PAHs) due to human activity, industrial operations, and to infrastructure materials. Because these increased contaminant concentrations are due to urban activity and not site releases, it benefits EPA programs to have a better understanding of the extent that anthropogenic background contributes to environmental concentrations of these contaminants. The purpose of this study is to collect data that will provide the necessary context to understand the background concentrations and distributions of urban contaminants in southeastern cities. Another goal of this project is to develop a consistent and robust data collection and analysis process that can be replicated in other states and regions. Background contaminant concentration data is especially useful for setting realistic clean-up levels for Brownfields redevelopment projects, Superfund projects, and other environmental	R4 ORD OLEM States	Barbara Alfano (R4) Glenn Adams (R4) Tim Frederick (R4) Felicia Barnett (R4 ORD STL) Brian Schumacher (ORD) Robert Ford (ORD)

restoration projects that aim to restore contaminated property to beneficial reuse.		
Evaluating the Use of Lead Isotopes in Soil for Potential Source Identification – Soil-lead (Pb) contamination is a global concern impacting locations from urban gardens to mega-mine sites; however, given the variety of historical uses and applications of Pb in society and subsequent release to the environment, identifying the precise source of contamination has been an elusive endeavor. The field of environmental forensics has advanced tremendously over the past decade with breakthroughs in stable Pb isotope analysis for source attribution. Since lead isotopes are created by decay of uranium and thorium, the ratios of the four common lead isotopes to one another can be very useful in tracking the source of Pb via isotopic fingerprinting with comparison to potential source materials. Our goal is to gain a better understanding of Pb isotopic forensics through a literature review and conduct Pb isotopic analysis at one site with available source materials to demonstrate isotopic ratios of Pb can differentiate the sources of Pb and identify which source is influencing contamination at the site.	R7 ORD	Kirk Scheckel (ORD) Rob Weber (ORD R7 STL)
Desktop Catchment Water Modeling Evaluation and Use - The Superfund optimization program has found significant opportunities to improve existing remediation systems, improve systems in the design phase, and even improve sites in the RI/FS stage by focusing on the conceptual site model (CSM). The purpose of this study is to evaluate the use of a new tool – the Desktop Catchment Water Model – and determine its usefulness in the Superfund process. Traditional groundwater models are typically developed after the extensive and time-consuming characterization process and rely heavily on field data and testing results. The catchment model has been designed to take advantage of publically available, high density data sets from agencies such as the USGS and NASA to create preliminary components of the hydrogeologic CSM at the catchment (basin) level in just a few days.	R8 R10 R2 ORD OLEM	Steve Dyment (ORD R8 STL) Kira Lynch (ORD R10 STL) Diana Cutt (ORD R2 STL)
State of the Science Workshop on Mercury Remediation in Aquatic Environments - As part of implementing EPA Region 9's strategic plan, ORD and the Region held a state of the science workshop to investigate the latest in remediation techniques for mercury contaminated sites in aquatic environments. The workshop was held on Thursday, September 26, 2013 at the EPA office in San Francisco, and by webinar. The objective was to understand the key mechanisms linking source loads, methylation, and bioaccumulation of mercury to guide future remediation decisions. The workshop examined the effect of current remediation practices, such as removing/capping lake sediments, isolating retort or tailings from waters, and on levels of mercury in fish tissue. The end result is to determine if removing mercury sources have a real effect on fish tissue levels and to understand the key mechanisms that actually cause fish tissue levels to drop, as well as to understand what will directly affect the methylation process at specific sites so that concrete actions can be taken to reduce fish tissue levels.	R9 R10 ORD OLEM ETSC	Matthew Small (R9 RSL) Kira Lynch (ORD R10 STL) Chris Eckley (R10) John McKernan (ORD)
Evaluating Methylmercury Contamination in Lakes and Reservoirs – This project will help understand the effects of methylmercury contamination from mines. In September, ORD researchers and staff from Regions 9 and 10 visited California's Lake Nacimiento, part of the Klau Buena Vista Mine Superfund Site, to measure mercury methylation and demethylation rates. The team, including	R10 R9 ORD OLEM	Todd Luxton (ORD) Kira Lynch (ORD R10 STL)

ORD's Todd Luxton and Jenny Goetz and Region 10's Chris Eckley, is working to identify the source of methylmercury in the lake, understand the effects of water oxygen levels on mercury methylation, and identify the relative bioavailability of inorganic mercury for methylation in the lake sediment.		
Understanding and Evaluating Ecosystem Goods and Services (EGS) at Site Remediation Projects and Applying Their Benefits to Sustainability and Livability for Surrounding Communities* - Superfund remediation projects are often large construction operations with a significant environmental footprint. Although Superfund has developed a methodology for quantifying the environmental footprint, there is no guidance on incorporation of ecosystem services. Superfund seeks to better integrate consideration of ecosystem goods and services when implementing its core mission of protecting human health and the environment at contaminated sites. This research is aimed at understanding how EGS can be incorporated into the site remediation and reuse planning. The research is also aimed at improving Best Management Practices (BMPs) to mitigate impacts on ecosystem services during contaminated site remedy construction and operations.	R10 R3 ORD OLEM	Michael Kravitz (ORD) Matt Harwell (ORD) Anne Neale (ORD) Kira Lynch (ORD R10 STL)
Deployment of Decision Analysis for a Sustainable Environment, Economy, and Society (DASEES) to Support Superfund Remedial Action Decision Process and Enhance Community Involvement* - Superfund remedy decisions are often very complex and require consideration of input from a wide audience of stakeholders. The site RPM is required to understand and communicate the decision process with limited tools to transparently document how both technical and community values based factors are considered in the selection and optimization of alternatives. Structured decision making, which is supported through DASEES analysis, can be used by the site RPM to capture all of the factors that need to be considered when developing a Superfund remedial action approach that will result in protection of human health and the environment. The objective of this research is to evaluate the use of DASEES as a tool for Superfund project managers.	R10 R2 ETSC ORD OLEM	Brian Dyson (ORD) Kira Lynch (ORD R10 STL) Diana Cutt (ORD R2 STL) John McKernan (ORD)

Project 3.62 - Environmental Releases of Oils and Fuels

The following are examples of ORD-funded (i.e., through RARE, RESES or STL Extramural Funding) research or technology transfer events that address regional needs through partnerships between ORD, the Regions, and in some cases, OLEM and states.

Research	Partners	Primary Contact(s)
TBD		

Project 3.63 - Sustainable Materials Management

Successful Partnerships between ORD and EPA Regions

The following are examples of ORD-funded (i.e., through RARE, RESES or STL Extramural Funding) research or technology transfer events that address regional needs through partnerships between ORD, the Regions, and in some cases, OLEM and states.

Research	Partners	Primary Contact(s)
Amending Metals Contaminated Mine Soil with Biochar to Facilitate Soil Remediation and Establishment of a Soil Stabilizing Native Plant Cover – This project is to evaluate amending the tailings and spoils that create acid mine drainage at the Formosa Mine, near Riddle, OR, with well-characterized biochar that provides remediation of metals, favorable soil pH adjustment, and improvement of soil water holding properties to promote the establishment of a soil-stabilizing native plant community. Another goal of this research is to demonstrate that amending mine soils with biochar can provide a means of reducing the environmental risk due to the erosion of acid mine drainage (AMD) generating wastes, such as tailings and spoils, and leaching of hazardous heavy-metals from these wastes. This research will develop methods for selecting biochars that can be explicitly matched with impaired mine soils to facilitate the desired outcomes.	R10 OLEM ORD	Kira Lynch (ORD R10 STL) Mark Johnson (ORD)
Evaluating Impacts of Wood Waste Management on Achieving Net Zero (Focusing on Site Cleanup)* - Land clearing from contaminated site assessment and remediation operations and disaster recovery efforts can result in significant amounts of wood waste that must be managed. The Superfund program has increased its focus on the environmental footprint of cleanups through EPA's Office of Land and Emergency Management's (OLEM's) Greener Cleanups policy, Superfund's Green Remediation Strategy, and individual regional green remediation policies, such as EPA Region 2's Clean and Green Policy. Region 2's green remediation program has grappled with the issue of wood generated during cleanup activities. In addition, natural disasters can generate large amounts of vegetative and woody debris that present challenges in post-generation management. Hurricane Sandy, for example, generated more than 168,000 cubic yards of woody debris in New York City alone. Currently, there is a lack of clarity with regard to how to best manage wood from site cleanup, land clearing, and debris management projects. There is a need for research into options for managing wood and evaluating the cost and life-cycle environmental impacts/benefits of these options. The objective of this research project was to evaluate a variety of wood management options from a cost and life-cycle assessment (LCA) perspective to help decision-makers identify tradeoffs between options. The research also addressed other factors that may influence decisions about wood management, such as diversion of this waste stream from landfills and renewable energy targets.	R2 ORD OLEM	Nicole DiForte (R2) Steve Rock (ORD) Diana Cutt (ORD R2 STL) Carlos Pachon (OLEM)
Amending Jasper County, Missouri soils with biochar and other amendments following chat removal to facilitate soil restoration/revitalization and establishment of a soil-stabilizing plant cover* - Abandoned mines and the residuals from mining across the U.S. pose a considerable, pervasive risk to human health and the environment. Many soils in the Tri-State-Mining District (TSMD), located where Missouri, Kansas and Oklahoma meet, have been	R7 and ORD NHEERL	Mark Johnson (ORD) Mark Doolan (R7) Rob Weber (ORD R7 STL)

affected by the residuals of historic lead and zinc mining. Here we describe a research collaboration between ORD and Region 7 to investigate the use of customized soil amendments, which will include biochar, as a tool to provide both soil remediation and reestablishment of a soil-stabilizing native plant community at sites in the TSMD. Biochar is a charcoal-like, carbon-rich, porous by-product of thermal pyrolysis or gasification. A benefit of using biochar is the ability to engineer its properties to correspond to specific soil remediation needs. Specifically, it has properties that make it well suited for use in remediating mine soils and reestablishing vegetation, with studies indicating that biochar can complex and immobilize heavy metals. This is of critical importance for mining influenced sites. However, the optimized biochar properties for the remediation of acidic mine soils are not yet fully known. Biochar can be produced to have a range of pH values, depending upon feedstock and pyrolysis or gasification conditions, and post-production activation. Therefore, this material may be used as a liming agent to raise soil pH. Additionally, some biochars have been shown to improve soil water holding capacities and infiltration properties. Biochar can be produced with residual sorbed organics from the pyrolysis process that can provide a food source for soil microbial foodwebs, promoting healthy soil and plant growth. Collectively, biochar may serve as a useful component in the remediation of acid mine soils and mining influenced soils. While not a complete site remediation alone, amending mine soils with biochar may reduce immediate risks due to the leaching of heavy metals and off-site movement of pollutants from contaminated mine spoils. This project will initially produce a comprehensive set of biochars from a variety of local feedstocks, and through a targeted series of tests using soil from the TSMD, and more specifically Jasper County, Missouri will identify chemical and physical characteristics of biochar(s) with the most potential to remediate soils and reestablish native plant communities on the mining affected soils.		

*These projects were selected for individual posters.