

GROUND WATER TECHNICAL SUPPORT CENTER (GWTSC)

Annual Report Fiscal Year 2014 (FY14)

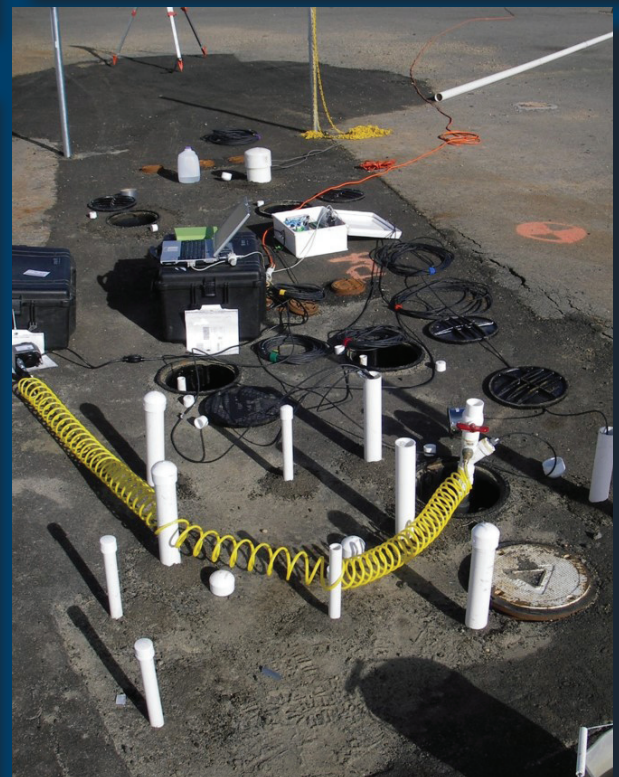
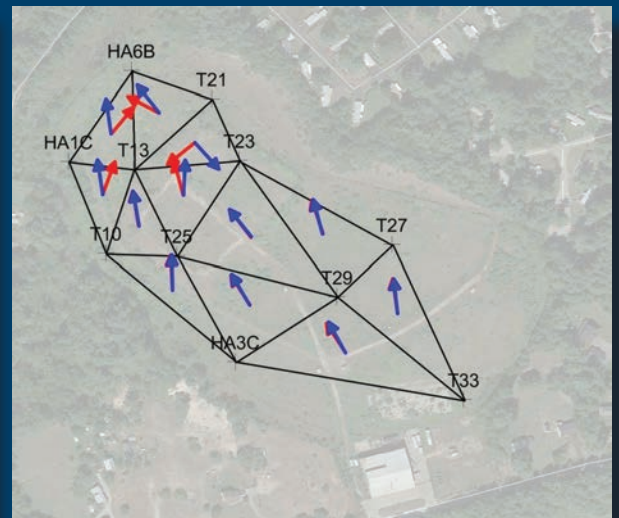
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National Risk Management Research Laboratory

Office of Research and Development

U.S Environmental Protection Agency



Acknowledgements

The Ground Water Technical Support Center (GWTSC) would like to acknowledge the contributions from ORD scientists for their efforts in support of the GWTSC's mission. The GWTSC 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 GWTSC would also like to recognize the exemplary support provided by its contractor, CSS-Dynamac, and their subcontractors and consultants. Finally the GWTSC extends special thanks to everyone that provides document reviews, responds to technical request phone calls, and provides all other manners of assistance.

Abstract

The Ground Water Technical Support Center ([GWTSC](#)) is part of the Ground Water and Ecosystems Restoration Division ([GWERD](#)), which is based in the Robert S. Kerr Environmental Research Center in Ada, Oklahoma. The GWERD is a research division of U.S. EPA's National Risk Management Research Laboratory ([NRMRL](#)). The GWTSC is one of an interlinked group of specialized Technical Support Centers that were established under the Technical Support Project ([TSP](#)). The GWTSC provides technical support on issues related to ground water. Specifically, the GWTSC provides technical support to U.S. EPA and State regulators for issues and problems related to:

1. subsurface contamination (contaminants in ground water, soils and sediments),
2. cross-media transfer (movement of contaminants from the subsurface to other media such as surface water or air), and
3. restoration of impacted ecosystems.

The GWTSC works with Remedial Project Managers (RPMs) and other decision makers to solve specific problems at Superfund, RCRA (Resource Conservation and Recovery Act), Brownfields sites, and ecosystem restoration sites.

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The GWTSC is one of the Technical Support Centers (TSC) established under the Technical Support Project (TSP) under a 1985 agreement between Office of Research and Development (ORD), Office of Solid Waste and Emergency Response (OSWER), and the EPA Regional Offices.

Ground Water Technical Support Center (Ada OK)

Engineering Technical Support Center (Cincinnati OH)

Site Characterization Technical Support Center (EPA Region IV)

The GWTSC is organized under the Ground Water and Ecosystems Restoration Division (GWERD), located in the Robert S. Kerr Laboratory building in Ada, Oklahoma. GWERD is a part of USEPA's National Risk Management Research Laboratory (NRMRL), headquartered in Cincinnati, OH; NRMRL is part of USEPA's Office of Research and Development (ORD).

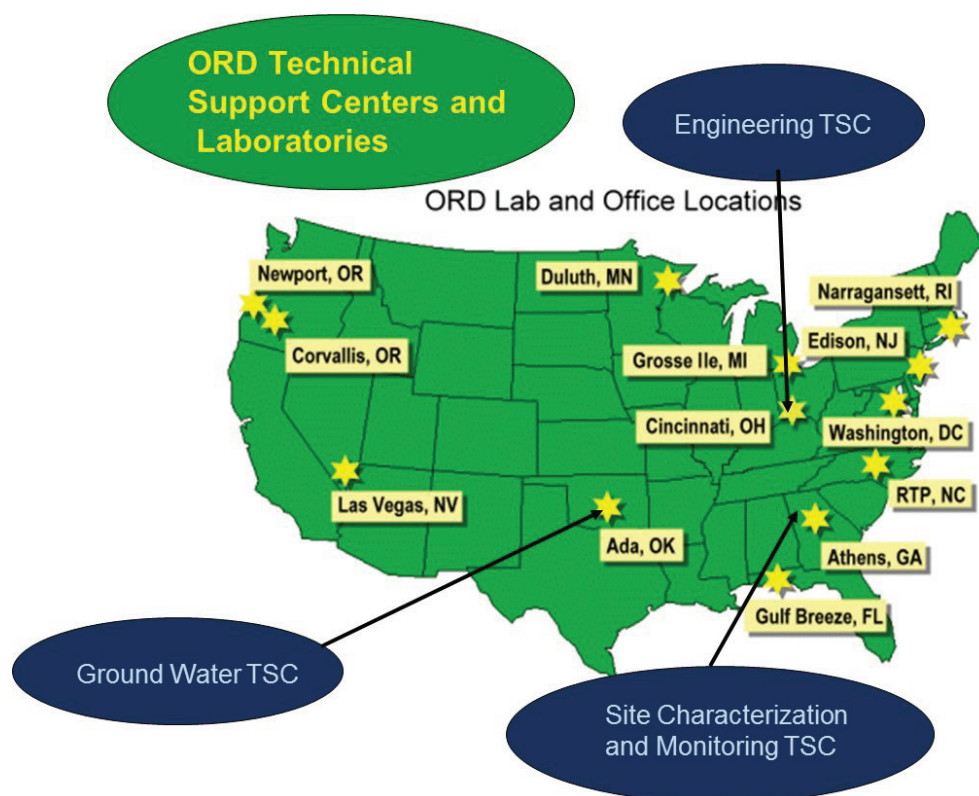
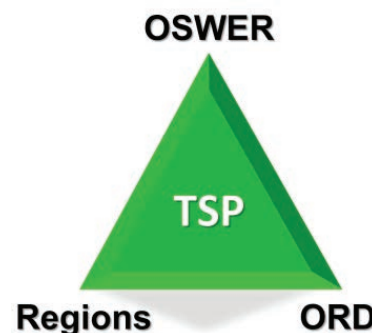


Figure 1. Map of ORD Laboratories and ORD Technical Support Centers.

GWTSC Focus Areas:
Subsurface contamination
Cross-media transfer of
contaminants
Ecosystem restoration

The GWTSC Mission: What Does the GWTSC Do?

GWTSC provides technical support to U.S. EPA and State regulators for issues and problems related to:

- subsurface contamination (contaminants in ground water, soils and sediments),
- cross-media transfer (movement of contaminants from the subsurface to other media such as surface water or air), and
- restoration of impacted ecosystems.

The GWTSC technical support cycle involves three main components:

- Linking ORD research to Agency decisions:
developing the critical links between ORD scientists and Agency decision-makers to channel technical expertise and research results to the EPA's operating programs
- Applying best practices to field applications:
facilitating application of the best scientific understanding and practices to solve real-world problems and reduce risks to human health and the environment
- Providing feedback from field application to research:
serving as a conduit to ensure GWERD and NRMRL research is addressing the most important problems the Agency is facing

Implementing the GWTSC Mission

GWTSC provides quick-response technical assistance to Program and Regional staff and other decision makers on CERCLA, RCRA, Brownfields, and ecosystem restoration issues. While GWTSC provides technical support on a wide range of site-related issues, most technical support guidance is related to these three core remediation and restoration functions:

- Guidance for Planning Site Activities:
Guidance in the planning of site characterization investigations, remedial investigations, feasibility studies, and the identification and selection of remedial alternatives
- Guidance for Choosing and Applying Models:
Support in the identification and selection of appropriate environmental modeling applications and in the review of site-specific modeling efforts
- Guidance for Use of New and Innovative Technologies:
Oversight assistance in the design, testing, implementation, and evaluation of new and innovative technologies to treat contaminated soils and ground water and to restore sensitive ecosystems

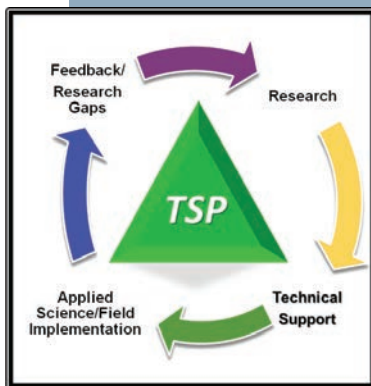


Figure 2. *The Technical Support Project knowledge cycle drives the GWTSC mission*

The GWTSC Team

Members of the EPA's Applied Research and Technical Support Branch (ARTSB) form the core of the GWTSC technical support team. Other GWERD scientists from the Subsurface Remediation Branch (SRB), the Ecosystem and Subsurface Protection Branch (ESPB) and field support staff from the Technical & Administrative Support Staff (TASS) are available to the Program and are called upon when additional expertise or support is needed.



Figure 3. Subsurface core sample



Figure 4. Subsurface sampling equipment



Contractor support, which includes CSS-Dynamac, an on-site/off-site technical support contractor, provides expertise to address technical support questions, and access to additional expertise via subcontractors and consultants.

The Center for Subsurface Modeling Support (CSMoS), an integral part of the GWTSC, also uses in-house EPA personnel and contractors to provide expertise on environmental modeling applications, and support for some publicly available ground water models.



GWTSC Technical Support Avenues

GWTSC provides technical support through site-specific technical guidance, such as site activity review memoranda, conference calls/emails, site visits and meetings; and technical transfer, such as training (workshops, demonstrations, conferences, expert panels), and publications (issue papers, fact sheets, technical guidance documents).

EPA/600/R-13/237
September 2013



Ground Water Issue

Ground Water Issue Paper: Synthesis Report on State of Understanding of Chlorinated Solvent Transformation

Bruce Pivet, Ann Keeley*, Eric Weber, Jim Weaver, John Wilson, and Cissy Ma

GWTSC Technical Support Concentration Areas

Subsurface Contamination

GWTSC/GWERD is the research and technical support leader for subsurface processes, characterization, and remediation.

GWTSC/GWERD areas of expertise for contaminants in ground water, soils and sediments include:

- Contaminant sources
- Plume behavior
- Transport and fate of contaminants
- Subsurface geology and stratigraphy
- Subsurface geochemistry
- Subsurface microorganism populations and processes
- Ground water model suitability and application
- Sampling and analysis tools
- Bench and pilot studies, and scaleup
- Performance monitoring
- Holistic/sustainable approaches



Figure 5. Vapor intrusion field sampling equipment.

GWTSC/GWERD has almost 150 publications directed to technical guidance and understanding of subsurface contamination issues, plus many more journal articles, books, etc. Some of the latest publications are listed under the Scientific and Technical Publications heading later in this Annual Report. Many more publications can be accessed from the U.S. EPA/ORD webpage.

Cross-media Transfer

Cross-media transfer includes the movement of contaminants from the subsurface to other media such as surface water or air. For example, GWTSC provides support for many sites where vapor intrusion (VI) due to movement of contaminants from ground water to soil and then to structures is a current or potential issue. GWTSC is experienced at understanding the potential VI issues that can be associated with ground water contamination and remediation.

Vapor Intrusion Issues

For a site with chlorinated solvent-contaminated ground water, GWTSC wrote that a clear discussion and detailed plans should be provided in the enhanced bioremediation work plan "... for how electron donor injection will be managed so as to limit methane and vinyl chloride production and avoid safety hazards potentially associated with production and transport into the vadose zone, buildings, etc."

Ecosystem Restoration

Ecosystem restoration involves restoration of impacted ecosystems such as riparian zones and streams, and wetlands.

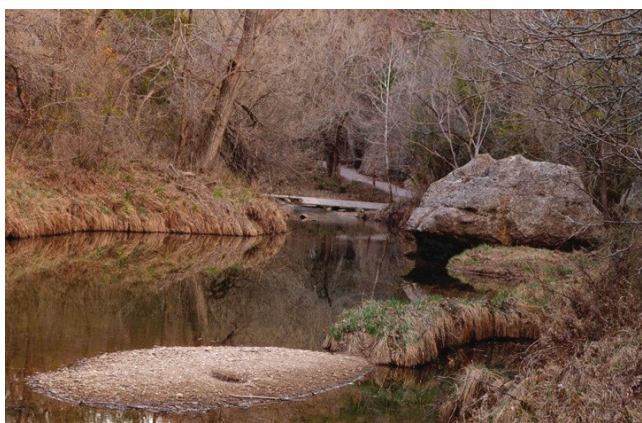


Figure 6. Natural stream with a riparian zone.

Contact Information for Requesting Technical Support

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How to Request Technical Support

First, define the specific questions you need answered. For example, "Does the Enhanced Bioremediation Work Plan call for measuring the appropriate geochemical parameters?" is a good, specific question. On the other hand, "What does GWTSC think about the Enhanced Bioremediation Work Plan?" is difficult to answer, and the answer may not zero down to the answers you really need. Provide questions that help GWTSC experts focus on those specific issues that are important to you for your site.

Second, gather the site documents needed to help GWTSC understand the hydrogeology, contaminants, plumes, and geochemistry/microbiology at the site. Site characterization data, monitoring reports, work plans, site maps and cross sections are almost always needed. Electronic copies are best except for large maps. Spreadsheets of monitoring data (i.e., in addition to tables in pdf files) are often helpful to allow GWTSC experts to slice and dice the data for analysis.

Finally, contact David Burden by phone, email, or through one of the ORD Superfund Technical Liaisons (STLs) to initiate a technical support request.

Technical Support Activity Examples

In Situ Chemical Oxidation (ISCO)

In FY14, GWTSC provided technical support to 12 sites where ISCO is used or proposed.

For example, Dr. David Burden (GWTSC Director) and Dr. Bruce Pivetz advised USEPA Project Manager Don Heller on design, implementation and interpretation of results of an ISCO study using sodium persulfate, calcium peroxide, and powdered activated carbon for a wide variety of organic contaminants including some not commonly found (e.g., p-chlorobenzotrifluoride).

Dr. Scott Huling (GWERD) reviewed the *Revised Treatment Technology Evaluation - TI Zone Technical Memorandum* (Tucson International Airport Superfund Site; RPM Martin Zeleznik) which discussed whether new technologies have been developed that can enhance remediation within the TI Waiver Zone at the site. Dr. Huling recommended that horizontal drilling technology be included in the screening process to assess whether it could be used to enhance ISCO remediation in clay layers, which present significant contaminant and oxidant mass transfer and transport limitations.

Dr. David Burden (GWTSC Director), Dr. Bruce Pivetz, and Dr. Daniel Pope (CSS-Dynamac) reviewed the *Draft In-Situ Chemical Oxidation and Enhanced Reductive Dechlorination Design Report* (Baytown Ground Water Contamination Site SR84; RPM Leah Evison). They indicated that although the general approach was reasonable and technically adequate, that there were potential problems with the assumptions, methods, and results of the various calculations used to develop specifications, so these should be checked and recomputed.

Ground Water Issue: Ground Water Sample Preservation at In-Situ Chemical Oxidation Sites - Recommended Guidelines (16 pp, 620 KB) (EPA/600/R-12/049) August 2012

In Situ Chemical Oxidation - Engineering Issue (PDF) (60 pp, 2.56 MB) (EPA/600/R-06/072) August 2006

Modeling, Screening, Plume Capture and Extraction, Soil Gas Capture and Extraction

GWTSC/GWERD "wrote the book" on evaluation of capture zones for pump and treat systems, and continues to provide extensive technical support for sites where pump and treat systems are major parts of the site remedy. Evaluating site-specific modeling of ground water capture, ground water flow, and contaminant transport are major parts of GWTSC's technical support efforts.

GWTSC Researcher Dr. Randall Ross and contractor Dr. Milovan Beljin (CSS-Dynamac) provided USEPA Project Manager Carol Stein an analysis of a modeling implementation for a ground water capture system designed to remediate an isolated hot spot where volatile organic compounds (VOCs) were greater than 1,000 micrograms per liter (ug/L) in the ground water.

Dr. Randall Ross (GWERD) and Dr. Milovan Beljin (CSS-Dynamac) evaluated the *Groundwater Flow and Solute Transport Modeling Report* (Picillo Pig Farm Superfund Site; RPM Anna Krasko). They indicated that the report did not include the details of how the modeling parameters were modified from the previously-used parameters, measured tracer dye source concentrations should be used in the model simulations, particle tracking should be used to define the simulated paths from the injection points, and the assumed

A Systematic Approach for Evaluation of Capture Zones at Pump-and-Treat Systems - Final Project Report. EPA/600/R-08/003.

The Impact of Ground Water/Surface Water Interactions on Contaminant Transport With Application to an Arsenic-Contaminated Site - Environmental Research Brief. EPA/600/S-05/002.

FOOTPRINT - A Screening Model for Estimating the Area of a Plume Produced From Gasoline Containing Ethanol, Version 1.0. EPA/600/R-08/058.

Optimal Well Locator (OWL) - A Screening Tool for Evaluating Locations of Monitoring Wells, User's Guide Version 1.2. EPA/600/C-04/017.

Development of Recommendations and Methods to Support Assessment of Soil Venting Performance and Closure (EPA/600/R-01/070) September 2001

half-life value calculated for trichloroethene (TCE) appears to be low compared to most field-derived values noted in the literature.

Thermal Treatment, DNAPL, and Source Zones

Dr. Eva Davis (GWERD) analyzed the *Draft Final Remedial Design and Remedial Action Work Plan (RAWP) for Operable Unit 2, Revised Groundwater Remedy, Site ST012* (Former Williams Air Force Base; RPM Carolyn D'Almeida), focusing on the criteria for transitioning from Steam Enhanced Extraction (SEE) to Enhanced Bioremediation (EBR) and on the monitoring to support the transition criteria.

For the Beede Waste Oil Superfund Site (RPM Cheryl Sprague), Dr. Eva Davis (GWERD) evaluated the thermal remediation plan detailed in the *90% Pre-Final Thermal Design Report – Phase 1*. Dr. Davis noted the amount of contaminant mass in the treatment area, and the rate at which it can be recovered, are critical to estimating the operational timeframe for the thermal remediation, but contaminant mass and recovery rate estimates generally have high uncertainty. She indicated that detailed performance monitoring is critical in order to get data necessary to support decisions on whether remedial goals have been met or the thermal remediation system has reached the point of diminishing returns.

Effects of Thermal Treatments on the Chemical Reactivity of Trichloroethylene. EPA/600/R-07/091.

Steam-Enhanced Remediation Research for DNAPL in Fractured Rock, Loring Air Force Base, Limestone, Maine. EPA/540/R-05/010.

Assessment and Delineation of DNAPL Source Zones at Hazardous Waste Sites – Ground Water Issue. EPA/600/R-09/119.

Impacts of DNAPL Source Treatment: Experimental and Modeling Assessment of the Benefits of Partial DNAPL Source Removal. EPA/600/R-09/096.

The DNAPL Remediation Challenge: Is There a Case for Source Depletion? EPA/600/R-03/143.

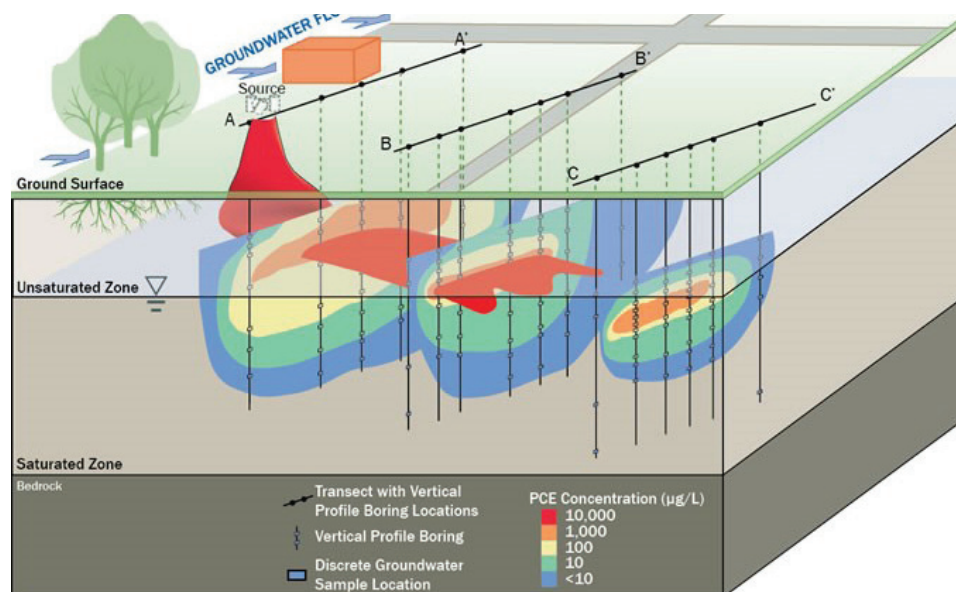


Figure 7. Example of detailed performance monitoring for PCE.

(<https://clu-in.org/characterization/technologies/hrsc/hrscintro.cfm>)

Monitored Natural Attenuation (MNA), Bioremediation, and Microorganisms

GWTSC/GWERD has not only written many technical guidance documents on MNA and bioremediation, but has helped to introduce numerous innovative techniques for characterization, assessment, and performance monitoring of MNA and bioremediation remedies for organic and metal contaminants. For example, compound specific isotope analysis (CSIA), and molecular and genomic techniques are now widely used during site assessments and remediation implementation, and GWTSC offers technical support for these useful tools.

Dr. Ralph Ludwig (GWERD) reviewed data relating to the MNA groundwater remedy option for arsenic at the Armour Road Site (RPM Hoai Tran). Dr. Ludwig indicated that reduction of arsenic concentrations in groundwater over the short term may or may not be indicative of success, so sufficient time should be allowed for re-establishment of equilibrium conditions in the subsurface to see if rebound occurs.

Dr. David Burden (GWERD) and Dr. Daniel Pope (CSS-Dynamac) reviewed the results of a two-phase pilot study of enhanced bioremediation using reductive dechlorination at the Butz Landfill Site (RPM Rashmi Mathur). They indicated that the major limiting factor in the success of enhanced bioremediation would be developing and maintaining suitable geochemical and biological conditions throughout bedrock fractures where the contaminated groundwater moves. They recommended that active measures should be taken to ensure uniform distribution of bioremediation reagents throughout the bedrock fractures.

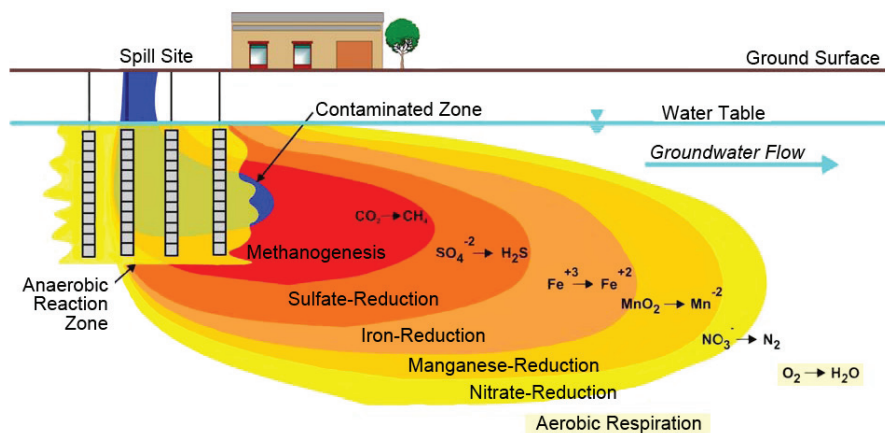


Figure 8. Example of development of geochemical and biological zones due to inputs of electron donors.

(https://clu-in.org/techfocus/default.focus/sec/Bioremediation/cat/Aerobic_Bioremediation_%28Direct%29/)

Ground Water Issue Paper: Synthesis Report on State of Understanding of Chlorinated Solvent Transformation. EPA/600/R-13/237.

The Use of Molecular and Genomic Techniques Applied to Microbial Diversity, Community Structure, and Activities at DNAPL and Metal-Contaminated Sites: Environmental Research Brief. EPA/600/R-09/103.

A Guide for Assessing Biodegradation and Source Identification of Organic Ground Water Contaminants Using Compound Specific Isotope Analysis (CSIA). EPA/600/R-08/148.

An Approach for Evaluating the Progress of Natural Attenuation in Groundwater. EPA/600/R-11/204.

Monitored Natural Attenuation of Inorganic Contaminants in Ground Water Volume 3: Assessment for Radionuclides Including Tritium, Radon, Strontium, Technetium, Uranium, Iodine, Radium, Thorium, Cesium, and Plutonium-Americium. EPA/600/R-10/093.

Identification and Characterization Methods for Reactive Minerals Responsible for Natural Attenuation of Chlorinated Organic Compounds in Ground Water. EPA/600/R-09/115.

Site Characterization to Support Use of Monitored Natural Attenuation for Remediation of Inorganic Contaminants in Ground Water. EPA/600/R-08/114.

Natural Attenuation of the Lead Scavengers 1,2-Dibromoethane (EDB) and 1,2-Dichloroethane (1,2-DCA) at Motor Fuel Release Sites and Implications for Risk Management. EPA/600/R-08/107.

Monitored Natural Attenuation of Inorganic Contaminants in Ground Water – Volume 2, Assessment for Non-Radionuclides Including Arsenic, Cadmium, Chromium, Copper, Lead, Nickel, Nitrate, Perchlorate, and Selenium. EPA/600/R-07/140.

Permeable Reactive Barriers (PRB)

Monitored Natural Attenuation of Inorganic Contaminants in Ground Water – Volume 1, Technical Basis for Assessment. EPA/600/R-07/139.

Monitored Natural Attenuation of Tertiary Butyl Alcohol (TBA) in Ground Water at Gasoline Spill Sites. EPA/600/R-07/100.

Metal Attenuation Processes at Mining Sites – Ground Water Issue. EPA/600/R-07/092.

Evaluation of the Role of Dehalococcoides Organisms in the Natural Attenuation of Chlorinated Ethylenes in Ground Water. EPA/600/R-06/029.

Monitored Natural Attenuation of MTBE as a Risk Management Option at Leaking Underground Storage Tank Sites. EPA/600/R-04/179.

Performance Monitoring of MNA Remedies for VOCs in Ground Water. EPA/600/R-04/027.

Calculation and Use of First-Order Rate Constants for Monitored Natural Attenuation Studies – Ground Water Issue. EPA/540/S-02/500.

GWERC researcher Dr. Eva Davis reviewed the *Source Area and Permeable Reactive Barrier Pre-Design Investigation Report* (South Municipal Water Supply Well Superfund Site) for RPM Kevin Heine, providing comments on whether the site data were sufficient to indicate or refute the presence of DNAPL in one area of the site.

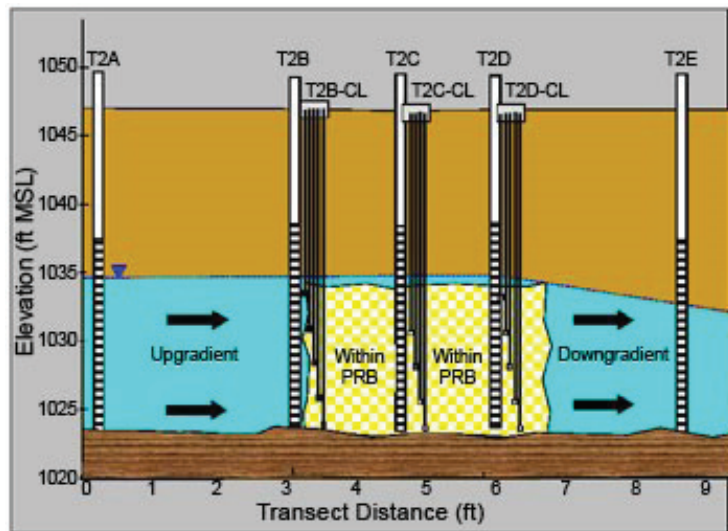


Figure 9. Example of monitoring setup for PRBs.

(https://clu-in.org/products/newsletters/tnandt/view_new.cfm?issue=0812.cfm)

Performance Assessment of a Permeable Reactive Barrier for Ground Water - Remediation Fifteen Years after Installation. Publication No. EPA/600/F-13/324.

Control of Subsurface Contaminant Migration by Vertical Engineered Barriers. EPA/600/F-10/017.

Economic Analysis of the Implementation of Permeable Reactive Barriers for Remediation of Contaminated Ground Water. EPA/600/R-02/034.

Field Application of a Permeable Reactive Barrier for Treatment of Arsenic in Ground Water. EPA/600/R-08/093.

Evaluation of Permeable Reactive Barrier Performance. EPA/542/R-04/004.

Capstone Report on the Application, Monitoring, and Performance of Permeable Reactive Barriers for Ground Water Remediation: Volume 1, Performance Evaluations at Two Sites. EPA/600/R-03/045a.

Capstone Report on the Application, Monitoring, and Performance of Permeable Reactive Barriers for Ground Water Remediation: Volume 2, Long-Term Monitoring of PRBs: Soil and Ground Water Sampling. EPA/600/R-03/045b.

GWTSC Technical Support Brief Case Studies

What Happens if the Ground Water Plume Control System is Changed?

Problem: GWTSC provided technical support to USEPA Region I RCRA Facility Manager Aaron Gilbert on the United Technologies, Hamilton Sundstrand Facility site relating to a proposal to de-activate extraction wells at the site. Groundwater at the Site is contaminated primarily by trichloroethene (TCE) and hexavalent chromium (Cr+6) which are co-located in a plume that has migrated toward seeps and surface water bodies. A groundwater extraction and treatment system has been operating since 1995 to protect Rainbow Brook (which lies along the western and southern boundaries of the Site), other downgradient water bodies such as the Rainbow Road Poned Area and the Farmington River, and a number of seeps.

Question: If groundwater extraction ceases in certain wells, could a change in groundwater flow cause the trichloroethene and Cr+6 plume to cause unacceptable effects on aquatic and semi-aquatic receptors in the waterways located hydraulically downgradient?

Solution: GWTSC determined that the evidence presented did not fully confirm the possibility of significant groundwater flow redirection. GWTSC recommended that capture zone analysis of each extraction well should be conducted prior to de-activating any extraction wells so that the likely effect of de-activating any given well could be evaluated. Then, if any wells are de-activated based on the capture zone analysis, the current extent and schedule of monitoring was recommended to continue so that the effect of de-activation on hydrologic conditions and plume behavior could be evaluated. If the monitoring data were negative or unclear regarding the effect of de-activation on ground water flow and plume behavior, the de-activated extraction wells should be reactivated.

Is the Work Plan Adequate? Approach, Data Foundation, Location for Installing a Vertical Barrier

Problem: GWTSC provided technical support to USEPA Region I Remedial Project Manager Karen Lumino on the Pine Street Canal Superfund Site, Burlington, Vermont, concerning proposed installation and testing methods for jet grout installation of a vertical barrier during a Field Demonstration Test Program. The vertical grout barrier is proposed to prevent coal-tar-related DNAPL from migrating from the site to adjacent Lake Champlain. The barrier is also intended to divert ground water containing dissolved contaminants into a peat layer where natural attenuation sorptive and biodegradative processes will help prevent the dissolved-phase contamination from reaching Lake Champlain.

Question: Given the hydrogeologic conditions and contaminant characteristics/distribution at the site, are the proposed methods, studies, and locations in the work plan appropriate for jet grout installation of a vertical barrier?

Solution: GWTSC's review determined that the work plan contained sufficient information and discussion for site activities to move forward with the Field Demonstration Test Program. The technical information in the work plan relates primarily to installation and testing methods for jet grout installation of the vertical barrier, and appeared technically adequate and valid. In general,

the proposed methods, studies, and locations appear applicable, given the site-specific conditions. Monitoring plans, including visual observations for potential grout discharge in the area surrounding the jet grouting, and monitoring piezometric impacts of the jet grouting using recording pressure transducers in nearby monitoring wells, were appropriate; however, GWTSC suggested that if possible, monitoring wells closer to the Field Demonstration Test Program location should be used to assess any piezometric impacts. The wells proposed in the work plan are located some distance to the south of the Field Demonstration Test Program location, and might not accurately indicate any potential hydrogeologic impacts at the Field Demonstration Test Program location.

Assessing and Planning a Partial Shutdown of Ground Water Extraction and Soil Vapor Extraction

Problem: GWTSC provided technical support to USEPA Region V Remedial Project Manager Lolita Hill on the Chem-Dyne Superfund Site, Hamilton, Ohio. The site, which has soil and ground water contaminated with chlorinated solvents, has used ground water extraction and soil vapor extraction to remove contaminants.

Question: Can some components of the soil vapor extraction system and the ground water extraction system be shut down without adversely affecting the site remedy?

Solution: GWTSC's analysis indicated that it is likely that pumping in a few specific wells in the ground water extraction system could be terminated, and a portion of the soil vapor extraction system could cease operation, without adversely affecting the remedy. However, improved monitoring of ground water levels with pressure transducers in key wells would provide critical data for evaluating temporal changes in the extent of the capture zone in response to changes in pumping rates and external hydraulic stressors (i.e., precipitation, changes in river or canal stage, etc.). An adequate network of appropriately instrumented wells would provide quantitative data for evaluating containment, rather than the current use of potentiometric surface maps that tend to be more subjective.

GWTSC Technical Support by the Numbers

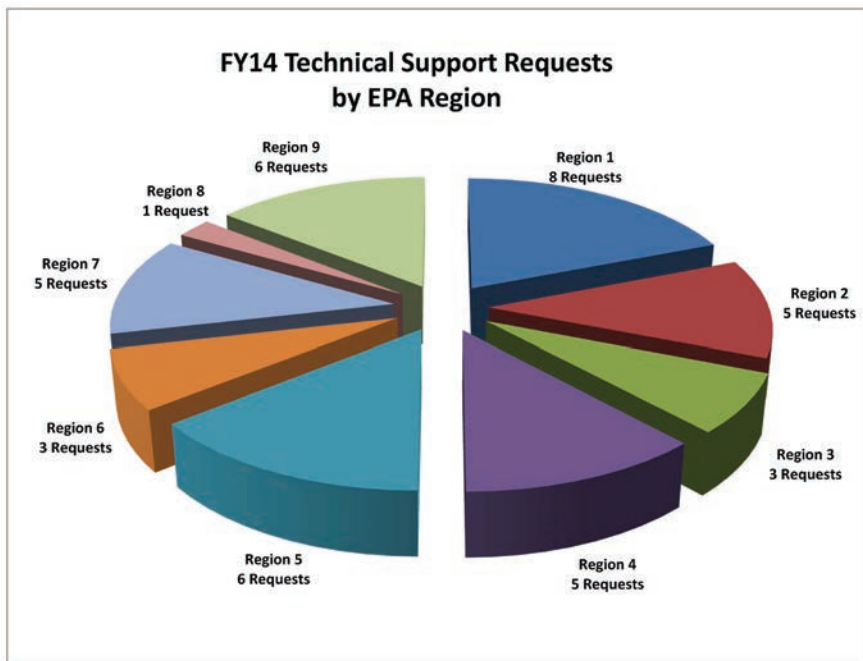


Figure 10. Technical support requests by EPA Region.

GWTSC provides technical support to every USEPA Region, and every state in the United States - and occasionally to US Territories, and even other countries. Note that GWTSC works primarily with USEPA, but in some cases support can be provided directly to states or other entities; such support efforts are requested from GWTSC through the USEPA Regional offices or USEPA Headquarters.

USEPA Regions with higher populations and a larger historical industrial base have more Superfund and RCRA sites, and so usually generate more technical support requests than other Regions.

An individual technical support request usually generates numerous GWTSC responses (i.e., emails, conference calls, review memoranda, meetings, site visits).

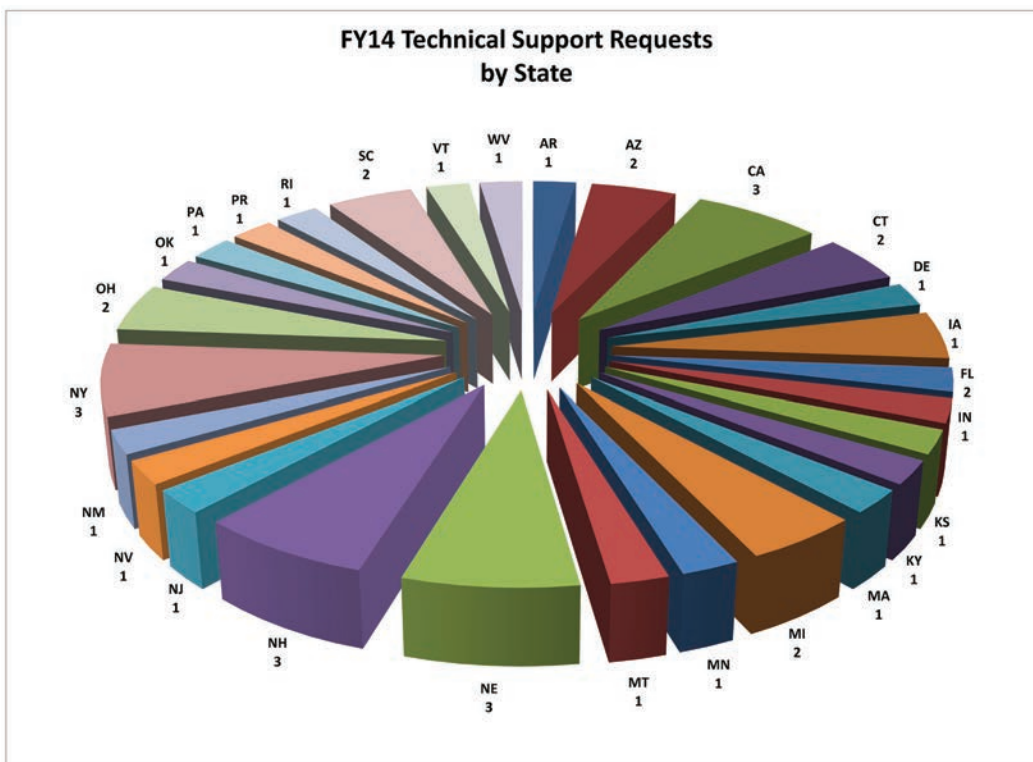


Figure 11. Technical support requests by State.

The most common contaminants at the sites for which technical support requests and GWTSC responses were made are shown in the chart below. Chlorinated solvents, hydrocarbons (e.g., BTEX and other fuel hydrocarbons are common), metals such as arsenic, wood treating wastes containing pentachlorophenol (PCP) or creosote, radioactive materials such as uranium, PCBs, and various pesticides such as DDT were found at some of these sites. The “Other” category includes contaminants such as perchlorate, 1,4-dioxane, isopropyl alcohol, acetone, hexamethylphosphoramide (HMPA), bis(2-chloroethyl)ether (BCEE), methyl tert-butyl ether (MTBE), tetrahydrofuran, ethylene dibromide (EDB), chlorobenzenes, and energetics such as Royal Demolition Explosive (RDX).

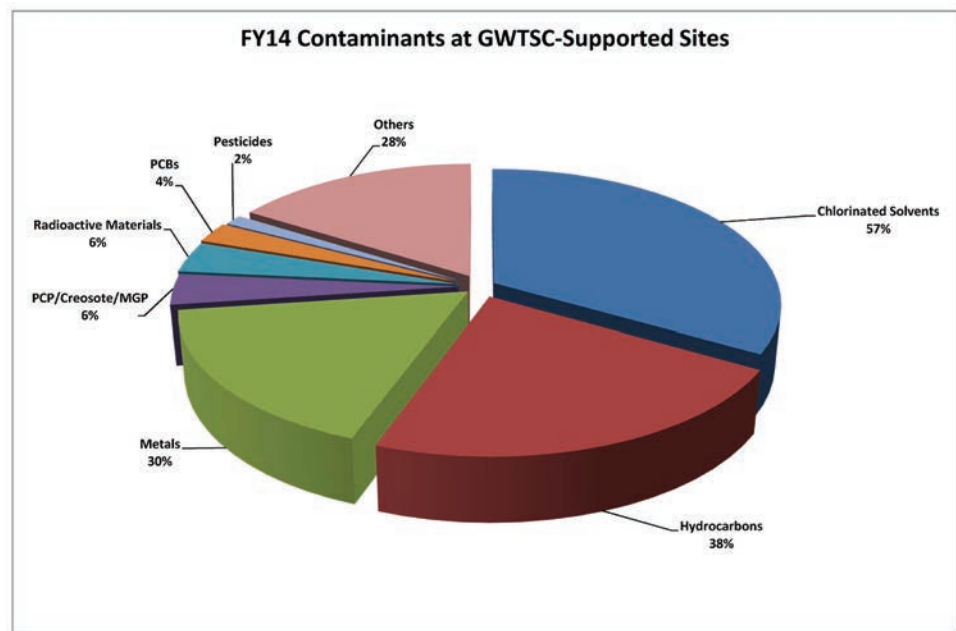


Figure 12. Contaminants at GWTSC supported sites.

The most common remedies at the sites for which technical support requests and GWTSC responses were made are shown in the chart below. Pump & Treat, Bioremediation, ISCO, Thermal, and various kinds of active and passive barrier walls make up the bulk of the remedies used at the sites. The “Other” category includes remedial approaches such as soil vacuum extraction (SVE), bioslurping, bioventing, air sparging, and zero-valent iron (ZVI). Most sites use more than one kind of remedy, and the remedies may be used concurrently or sequentially.

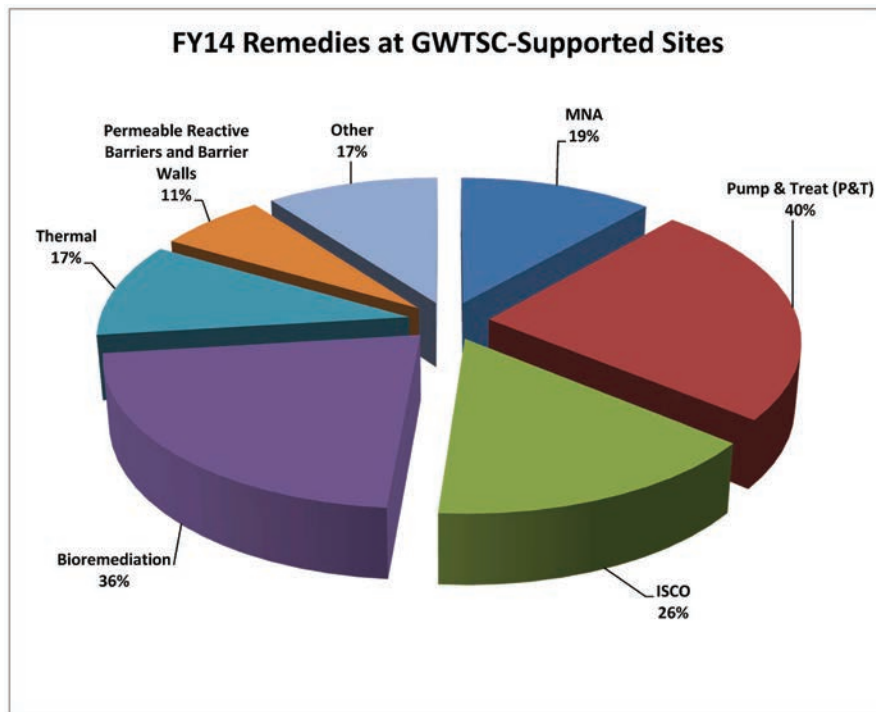


Figure 13. Remedies at GWTSC supported sites.

For a more detailed look at the technical support memorandums issued for FY14, the chart below shows memoranda and related activities by USEPA Region and fiscal year quarter. For most technical support requests, numerous conference calls and emails in addition to memorandums are provided to assist Regional personnel through evaluation and implementation of site characterization, remedy assessment, and performance monitoring approaches.

Also, several more detailed explanations of particular site-related support activities are provided throughout this Annual Report, and the Technical Support Highlights section at the end of this report provide a short description of most of the formal technical support memorandums issued for FY14.

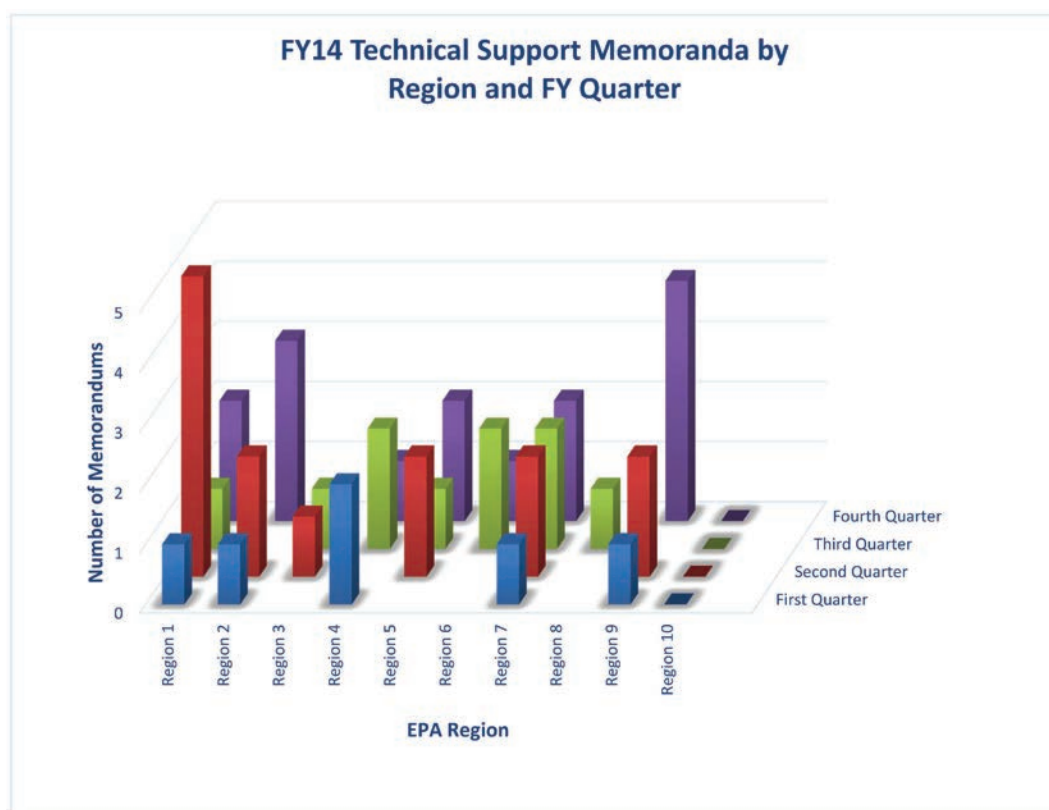


Figure 14. FY14 technical support memoranda.

Center for Subsurface Modeling Support

GWTSC, through the Center for Subsurface Modeling Support (CSMoS), distributes and supports public domain ground-water and vadose zone modeling software to government agencies and the public. Primarily, CSMoS provides direct technical support to EPA and State decision makers for subsurface model applications.

The FY14 download totals for individual models are shown in the chart below. Biochlor, Bioscreen, REMFuel, and Bioplume III are very popular downloads. These are user-friendly models that can be used to quickly examine site data and get an overview of contaminant transport and fate.

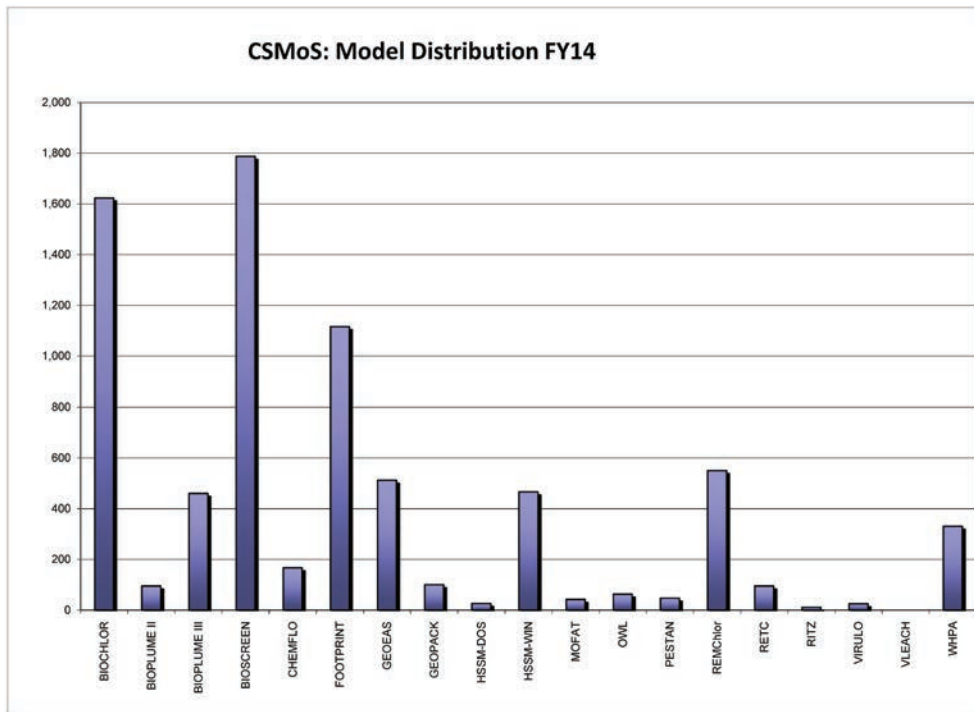


Figure 15. FY14 CSMoS model distribution statistics.

BIOCHLOR simulates degradation (first-order decay by reductive dechlorination) of dissolved solvents.

BIOPLUME III is used to model fate and transport under aerobic and anaerobic conditions of hydrocarbons; the electron acceptors oxygen, nitrate, sulfate, iron (III), and carbon dioxide; and iron (II).

BIOSCREEN simulates biodegradation of dissolved hydrocarbons by aerobic and anaerobic reactions.

REMFuel (Remediation Evaluation Model for Fuel hydrocarbons) simulates transient effects of groundwater source and plume remediation for fuel hydrocarbons.

Descriptions, and download links, for these models can be found at the [USEPA Methods, Models, Tools, and Databases for Water Research](#) webpage.

CSMoS: Description of Models Distributed by CSMoS

Model Name	Model Name and Version	Model Description
2DFATMIC	2DFATMIC 1 .0	2-D subsurface flow/transport
3DFATMIC	3DFATMIC 1 .0	3-D subsurface flow/transport
BIOCHLOR	BIOCHLOR 2 .2	1-D Domenico screening model
BIOPLUME II	BIOPLUME II 1 .1	2-D USGS MOC transport
BIOPLUME III	BIOPLUME III 1 .0	2-D USGS MOC transport with Windows GUI
BIOSCREEN	BIOSCREEN 1 .4	3-D Domenico transport
CHEMFLO	CHEMFLO 1 .3	1-D vadose zone numerical transport
FOOTPRINT	FOOTPRINT 1 .0	2-D transport of BTEX and ethanol
GEOEAS	GEOEAS 1 .2 .1	Geostatistical analysis
GEOPACK	GEOPACK 1 .0 .e	Geostatistical analysis
HSSM-DOS	HSSM-DOS 1 .1	Multiphase LNAPL flow/transport
HSSM-SPN	HSSM en Espanol 1 .2 .e	Multiphase LNAPL flow/transport (Spanish version)
HSSM-WIN	HSSM-Windows 1 .2 .e	Multiphase LNAPL flow/transport
MDFL MAN	MODFLOW Manuals	MODFLOW practice problems
MOFAT	MOFAT 2 .0 .a	2-D multiphase transport
MT3D	MT3D 1 .11	3-D numerical transport
OWL	OWL 1 .2	Monitoring well locator
PESTAN	PESTAN 4 .0	Simulate leaching of pesticides
REMChlor	REMChlor 1 .0	Simulate transient plume remediation
RETC	RETC 1 .1	Estimate soil model parameters
RITZ	RITZ 2 .12	Simulate vadose zone transport
STF	Soil Transport and Fate Database 2 .0	Database of behavior of organic and inorganic chemicals in soil
UTCHEM-PC	UTCHEM-PC 9 .0	3-D multiphase flow/transport
UTCHEM-UNIX	UTCHEM-UNIX	3-D multiphase flow/transport
VIRULO	Virulo 1 .0	Probabilistic virus leaching model
VLEACH	VLEACH 2 .2 .a	1-D vadose zone leaching model
WhaEM	WhaEM	Analytical element capture zone model
WhaEM 2000	WhaEM2000 3 .2	Analytical element capture zone model
WHPA	WHPA 2 .2	Finite-difference capture zone model

FY14 Highlights for Technical Support

Technical Assistance Region II: On November 20, 2013, Mr. Steven Acree (GWERD) provided a technical review to RPM Clifford Ng on the comments concerning the "Implementation Work Plan-Hydraulic Surcharging Pilot Study," DuPont Pompton Lakes Works, Pompton Lakes, New Jersey. In general, the changes to the work plan proposed in the responses address previous comments. The proposed changes to the monitoring of hydraulic gradients surrounding the horizontal well will greatly enhance the evaluation of flushing rates within the shallow aquifer. However, it is recommended that the three new piezometers proposed for installation south of the horizontal well be temporarily added to the ongoing semi-annual groundwater monitoring program for the duration of the pilot study. Groundwater quality data from these locations may allow relatively rapid demonstration of the effectiveness of increased flushing rates. Monitoring of groundwater quality at these three locations should be periodically re-evaluated and, ultimately, eliminated when the effects of additional flushing have been documented.

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Technical Assistance Region IV: On November 22, 2013, Dr. Bruce Pivetz (Dynamac Corp.), under the direction of Dr. David Burden (GWERD), provided technical review comments to RPM Jon Bornholm on the Work Plan for a Back Valley Pre-Design Geotechnical Investigation, Chemtronics Site, Swannanoa, Buncombe County, North Carolina, (the Work Plan). It was determined that the Work Plan was technically valid and complete, based on a technical review of the Work Plan supplemented with information from previous site documents. It was further determined that the Work Plan contained sufficient information and discussion for site activities to move forward with the pre-design geotechnical investigation and laboratory study. In general, the proposed methods, studies, and investigation locations appear appropriate. No major flaws or discrepancies were found in the Work Plan. For the Work Plan, very minor clarification and the addition of some explanatory text was recommended. For the geotechnical investigation activities, recommendations include consideration of the use of grout in a few of the site borings, a very brief assessment of the potential for vertical flow to result in contaminant migration under the VBW, and that great care be taken in handling of the ground water to be used in the laboratory testing (in order to minimize loss of volatile contaminants).

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Technical Assistance Region II: On November 25, 2013, Dr. Bruce Pivetz and Dr. Daniel Pope (Dynamac Corp.), under the direction of Mr. Steven Acree (GWERD), provided technical review comments to RPM Clifford Ng on the monthly progress reports for the enhanced in-situ bioremediation (EISB) pilot study (Reports #1, #2, and #3), DuPont Pompton Lakes Works, Pompton Lakes, New Jersey. The reports briefly discuss the activities completed during the reporting period, the results to date, and the activities scheduled for the next reporting period. The available performance data indicate that the hydraulic aspects of the EISB system are, in general, performing as intended. It is recommended that the study activities continue as they are currently being conducted. An additional recommendation is that the monthly reports include some preliminary evaluation of what the bromide data mean in terms of pore volume estimations and correlation of changes in volatile organic compounds (VOC) concentrations to EISB related activities. Also, graphs over time of the parent and daughter compounds, TOC, and oxidation/reduction potential (ORP) would be useful additions to the reports.

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Technical Assistance Region I: On November 26, 2013, Mr. Steven Acree (GWERD) provided technical review comments to RPM Carol Keating on the "Long-Term Monitoring and Maintenance Plan Update, Fort Devens Site, Shepley's Hill Landfill,

Devens, Massachusetts. In general, the majority of the proposed changes to the monitoring locations and monitoring frequencies appear to be acceptable. It is noted that review of the groundwater flow model update is not yet complete and will be provided as soon as possible. Many wells are proposed only for monitoring of hydraulic head. Obtaining hydraulic head data more frequently for some of the wells would be useful for routine definition of the potentiometric surface. It is recommended that hydraulic head be monitored at the same frequency as the locations currently proposed for hydraulic monitoring only. In addition, it is recommended that hydraulic head be monitored at wells SHL-12 and SHL-17 to provide better control on the southern portion of the potentiometric surface maps and at well SHL-3 to provide control at the southern end of the slurry wall.

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Technical Assistance Region V: On December 12, 2013, Dr. Daniel Pope (Dynamac Corp.), under the direction of Dr. David Burden (GWERD), provided technical review comments to Donald Heller on the Historical Source Area Delineation and ERD Bench Scale Study Report (Report), for the Demmer Properties, LLC/ Former Motor Wheel Facility, Lansing, Michigan. The Report, developed by consultants for the potentially responsible parties (PRPs), provides the results of 1) recent source area characterization/delineation efforts, 2) a synthetic precipitation leaching procedure (SPLP) test on vadose zone materials from the source area, and 3) a bench-scale bioremediation study (Study) on contaminated ground water. The results of the bench-scale ERD Study are promising, and we recommend proceeding on design of a pilot-scale study for the saturated zone. Additionally, because positive results occurred in the SPLP test, and there is general uncertainty associated with the limited knowledge of the contaminant source distribution and possible transport at the Site, it would be prudent to consider active measures such as soil vacuum extraction to remove contaminant source material from the source area vadose zone.

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Technical Assistance Region V: On January 8, 2014, Dr. Bruce Pivetz and Dr. Daniel Pope (Dynamac Corp.), under the direction of Dr. David Burden (GWERD), provided technical review comments to RPM Donald Heller on the Memorandum: Pilot-Scale Treatability Study, Evonik Degussa Corporation, Tippecanoe Laboratories, December 4, 2013 (Eli Lilly & Company) for the Evonik Degussa Corporation Tippecanoe Laboratories Site, Tippecanoe County, Indiana. The first phase of the Study was In-Situ Chemical Oxidation (ISCO), which consisted of subsurface injection of a chemical oxidation reagent at three locations within the Site. It is recommended that the enhanced biodegradation phase of the Study be delayed until the post-ISCO ground-water samples have been analyzed for the contaminants, and the results evaluated and reviewed. It is also recommended conducting the pilot scale treatability study so that the effects and effectiveness can be differentiated for each phase of the study. Additionally, it is recommended that a discussion of the planned conditions for bioremediation be provided, along with a discussion of how these conditions will contribute to the degradation of all of the Contaminants of Concern.

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Technical Assistance Region I: On January 21, 2014, Dr. Eva Davis (GWERD) provided technical review comments to RPM Karen Lumino on the "Operation and Maintenance (O&M) Manual (Appendix D) of the In Situ Thermal Remediation Remedial Action Work Plan (RAWP) and Operations Plan," and the "Emergency Response Plan (ERP) (Appendix K) for the Solvents Recovery Services of New England, Inc. (SRSNE) Superfund Site," Southington, Connecticut. In general, the documents are well written and complete. However, the documents still contain inconsistencies, in particular in sampling types

and frequencies to be used during operation of the system to monitor the progress of the remediation. Information on all contingency monitoring should be included with the routine performance monitoring. It is understood that flexibility in the sampling program is needed to allow for unexpected conditions, but it is important to lay out a sampling plan that will be adhered to, at least until conditions of the operation justify a change to the sampling plan.

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Technical Assistance Region IX: On January 27, 2014, Mr. Steven Acree (GWERD) provided technical review comments to RPM Jere Johnson on the "Initial Bedrock Characterization Data Summary Report (DSR)," for Yerington Mine Site, Yerington, Nevada. In general, the results indicate that existing production wells appear to have significant limitations with respect to providing hydrologic and geochemical data representative of bedrock conditions. The proposed strategy of utilizing the bedrock monitoring wells that are actively monitored (pursuant to the Site-Wide Groundwater Monitoring Plan for much of the shallow bedrock characterization) appears to be a viable approach. However, the installation of additional characterization wells may be needed in a few key areas. It is recommended that a plan for completing the hydrologic and geochemical characterization of the bedrock portion of the aquifer proceed as rapidly as possible.

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Technical Assistance Region I: On January 30, 2014, Dr. Randall Ross (GWERD) and Dr. Milovan Beljin (Dynamac Corp.) provided technical review comments to RPM Carol Keating on the "Shepley's Hill Landfill Draft Groundwater Model Revision Report," Devens, Massachusetts. The current model represents a significant improvement over past modeling efforts. One of the key differences is the change in simulation mode from steady-state to transient. It appears that the current model may fail to approximate groundwater flow conditions in some areas. Although additional data would be needed to define the average condition, there are indications of a potentially significant discrepancy between observed and modeled results in these areas. The pumping rates vary significantly over time. One option to more accurately evaluate groundwater flow and plume capture would be to simulate a simplified pumping schedule of the extraction system using a sub-model.

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Technical Assistance Region I: On February 4, 2014, Mr. Steven Acree (GWERD) and Dr. Robert Ford (LRPCD) provided technical review comments to RPM Carol Keating on the "Revised Hydraulic Gradient Analysis of Pump and Treat System Performance" for the Fort Devens Site, Shepley's Hill Landfill, Devens, Massachusetts. At this site, it appears that three lines of evidence will be the most useful in the evaluation of the capture zone produced by the pump and treat system. These lines of evidence are the evaluation of hydraulic gradients surrounding the extraction wells, projections of groundwater flow derived from a well calibrated and validated flow model, and longer term assessments of chemical concentration trends in wells that are downgradient of the capture zone. The installation of additional piezometers and monitoring of groundwater elevations using pressure transducers/data loggers greatly enhanced the evaluation of hydraulic gradients and the hydraulic effects of the groundwater extraction system. It is recommended that consideration be given to the monitoring of groundwater chemistry in additional wells located northwest of the capture zone.

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Technical Assistance Region IX: On February 4, 2014, Dr. Scott Huling (GWERD) provided technical review comments to RPM Martin Zeleznik on the "2013 Revised Treatment Technology Evaluation - T1 Zone Technical Memorandum," Tucson

International Airport Superfund Site, Tucson, Arizona. This survey was prepared to determine whether new technologies have been developed that can enhance remediation within the TI Zone at the Site. One technology that was not discussed in the report is the potential use of horizontal drilling wells. It is recommended that this technology be included in the screening process to assess whether it could be used to potentially enhance remediation. The clay layer(s) found in the three subunits of Unit 4 represent significant contaminant and oxidant mass transfer and transport limitations. It is recommended that future remedial strategies be developed that specifically address the remedial contingencies presented by these layers. It was reported that a second new ISCO technology includes KMnO candles. Overall, it appears that the permanganate candles offer limited utility or advantages, and it is recommended that they not be further considered unless additional, more convincing information can be provided warranting their use.

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Technical Assistance Region II: On February 7, 2014, Dr. Bruce Pivetz and Dr. Daniel Pope (Dynamac Corp.), under the direction of Mr. Steven Acree (GWERD), provided technical review comments to RPM Clifford Ng on the "EISB Pilot Study Status Reports #4, #5, and #6" for DuPont Pompton Lakes Works, Pompton Lakes, New Jersey. In general, the data provided in the monthly reports indicate that certain aspects of the enhanced in-situ bioremediation (EISB) and recirculation system may not have been as effective as originally projected. It is recommended that the final report include a frank and critical examination of these issues, as well as any system enhancements that would be required in the design of a full-scale implementation of this or similar technology. An important outcome of the Study will be the assessment of whether or not the EISB treatment could be successfully implemented on a full scale. The final report should include a thorough examination and interpretation of all collected information including a critical evaluation of any problematic issues. In addition, the final report should provide recommendations as to how a full-scale system could be designed and operated to overcome these problematic issues.

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Technical Assistance Region I: On February 12, 2014, Dr. Eva Davis (GWERD) provided technical review comments to RPM Kevin Heine on the "Source Area and Permeable Reactive Barrier Pre-Design Investigation Report for the South Municipal Water Supply Well Superfund Site located in Peterborough, New Hampshire, dated July 2013. In addition, the review included two Technical Memorandums recently provided by New Hampshire Ball Bearing. This review focused on the characterization of the source zone areas, and did not include a substantive review of the Permeable Reactive Barrier related work. In general, the document is well written and comprehensive of the extensive characterization efforts that were undertaken from 2011 to 2013. However, there is concern with several of the conclusions drawn based on the data, and concerns about the proposed extent of treatment for the remedies chosen in the 2010 Record of Decision (ROD) Amendment. Other presentations of the data make it clear that the data does not exist to clearly determine that these areas are no longer part of the plume. Sometimes, soil analytical data can give a better indication (another line of evidence) of the presence or absence of DNAPL, however, soil sampling was not performed at MIP-12, and the results of the soil sampling at MIP-3 are not consistent with the groundwater data. Thus, there is not another line of evidence (other than the groundwater data) to indicate or refute the presence of DNAPL in this area.

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Technical Assistance Region I: On February 12, 2014, Dr. Bruce Pivetz (Dynamac Corp.), under the direction of Dr. David Burden (GWERD), provided technical review

comments to RCRA Facility Manager, Aaron Gilbert, on the Memorandum: Review of Potential Impacts to Biological Receptors Resulting from the Proposed Downsizing the Groundwater Remedial Effort at the Hamilton Sundstrand Facility, Windsor Locks, CT, October 30, 2013 (Oct. 30 Memo). The Oct. 30 Memo contains reasonable concerns about the proposal to deactivate all the EWs except for EW- 10 through EW-13. The assumption of groundwater flow redirection after deactivating the western and eastern EWs lacks adequate evidence. The Remedial SE Report does not appear to contain sufficient information to fully validate the assumption. It is recommended that evaluation or modeling of the combined capture zone of EW-10 through EW- 13 be done prior to deactivating any EWs. Further, the capture zones of the other EWs should be evaluated using the methods in USEPA (2008). If any EWs are deactivated, it is recommended maintaining the current extent and schedule of monitoring, until the impacts of deactivating any EWs are determined. If the monitoring data are negative or unclear, it is recommended that the deactivated EWs be reactivated.

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Technical Assistance Region V: On February 19, 2014, Dr. Bruce Pivetz and Dr. Daniel Pope (Dynamac Corp.), under the direction of Dr. David Burden (GWERD), provided technical review comments to CAPM Donald Heller on the Memorandum: Pilot-Scale Treatability Study, Evonik Degussa Corporation, Tippecanoe Laboratories, December 4, 2013 (Eli Lilly & Company) Lafayette, Tippecanoe County, Indiana. The Tech Memo describes some results and observations of the first phase of the pilot-scale study (the Study) the Site. The updated Tech Memo contains additional information and analytical data relating to the first phase of the Study. The updated Tech Memo makes it clear that the Study was not intended to examine the effectiveness of In-Situ Chemical Oxidation (ISCO) alone. As such, it is acknowledged that the second phase, enhanced biodegradation, could proceed. While the Study appears to be focused on the overall effect of the combined ISCO and bioremediation efforts, note that bioremediation is likely to be challenging. Therefore, it is recommended that initial or continued efforts be given to optimizing ISCO so that contaminant concentrations are reduced as much as possible before bioremediation is attempted. It is also recommended that all available hydrologic information for the Site be re-evaluated in order to clarify the probable oxidant transport pathways.

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Technical Assistance Region III: On February 27, 2014, Dr. Daniel Pope (Dynamac Corp.), under the direction of Dr. David Burden (GWERD), provided technical review comments to RPM Rashmi Mathur on numerous documents detailing results of a two-phase pilot study (Pilot Study Phase I and Phase II) of enhanced bioremediation at the Butz Landfill Site (Site) located in Jackson Township, Monroe County, Pennsylvania. A two-phase (Phase I and Phase II) pilot-scale treatability study (Study) was conducted at the Site to evaluate in-situ bioremediation (ISB) to supplement or replace the existing pump and treat (P&T) system in order to reduce the restoration time for Site groundwater. ISB via reductive dechlorination could be an effective part of the Site remedial approach, in combination with the P&T system. It is recommended that the focus be placed on enhancing reductive dechlorination, while also including use of reagents designed to increase abiotic degradation. The major limiting factor in the success of ISB at the Site will be developing and maintaining geochemical and biological conditions suitable for reductive dechlorination throughout the bedrock fractures where contaminated groundwater moves. Therefore, a strong emphasis should be placed on uniform (in space and time) distribution of reagents throughout the bedrock fractures. The P&T system can be used for plume capture as needed, and potentially modified to serve as part of a hydraulic control system to help distribute reagents.

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Technical Assistance Region IX: On March 4, 2014, Dr. Eva Davis (GWERD) provided technical review comments to RPM Carolyn D’Almeida on the “Draft Final Remedial Design and Remedial Action Work Plan (RAWP) for Operable Unit 2, Revised Groundwater Remedy, Site ST012, Former Williams Air Force Base, Mesa, Arizona.” The review focused on the criteria for transitioning from Steam Enhanced Extraction (SEE) to Enhanced Bioremediation (EBR) and on the monitoring to support the transition criteria. For this project, which will transition from SEE to EBR with the objective of reaching cleanup goals for benzene in 20 years, additional specific criteria may be appropriate to support this objective, such as the criteria included for dissolved benzene concentrations in the Target Treatment Zone (TTZ). In order to meet the overall objectives of the remediation, the benzene concentrations remaining in the TTZ should be the most important criteria for evaluating the progress of the SEE remediation and when to transition to EBR, as this is directly tied to the time frame for meeting the remedial goals. It is understood that this RAWP is also the sampling and analysis plan for performance and compliance monitoring, while process monitoring will be detailed in the SEE Operation, Maintenance, and Monitoring (OM&M) manual. In light of this fact, the RAWP must clearly state what compliance and performance monitoring will be done. The document itself must also be consistent with the Quality Assurance Project Plan; therefore, additional information should be provided.

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Technical Assistance Region III: On March 19, 2014, Dr. Scott Huling (GWERD) provided technical review comments to RPMs Laura Mohollen and Darius Ostrauskas on the “Fike/Artel Superfund Site, Limited Scale Pilot Test Workplan,” Nitro, West Virginia. Overall, this was a comprehensive pilot study that provided significant data and information to assess the feasibility of in-situ persulfate oxidation at the site. There are several technical issues raised in the review comments regarding the overall feasibility of In-Situ Chemical Oxidation (ISCO) at the site. It is recommended that additional monitoring well data be included in the report. It is also recommended that additional calculations providing insight regarding the general feasibility of ISCO at the Site, and the projected costs associated with ISCO at the Site.

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Technical Assistance Region IX: On March 19, 2014, Mr. Steven Acree (GWERD) and Dr. Robert Ford (LRPCD) provided technical review comments to RPMs Jere Johnson and David Seter on the “Supplemental Characterization Work Plan, Anaconda Evaporation Ponds, Yerington Mine Site, Yerington, Nevada.” In general, the document proposes significant additional investigations to aid in evaluations of remedy options for the evaporation ponds under both OU-1 and OU-4. However, discussions of specific data gaps to be filled, investigation procedures, and rationale behind the chosen data collection locations are vague, rendering it unclear as to whether the proposed work is likely to be successful in filling remaining data gaps. It is recommended that the document be revised to provide a stronger and more direct connection between data gaps, data collection, and how these data are expected to fill the existing gaps.

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Technical Assistance Region II: On March 21, 2014, Mr. Steven Acree (GWERD) provided technical review comments to RPM Clifford Ng on the “Groundwater Extraction and Treatment System Water Level Monitoring Network, DuPont Pompton Lakes Works, Pompton Lakes, New Jersey.” In this document, installation of three piezometers located adjacent to extraction wells where large drawdowns in water levels are routinely measured is proposed. The addition of these piezometers should strengthen the water level monitoring network, allow the practice of including hydraulic head data

from active pumping wells in potentiometric surface interpretations to be curtailed, and lead to an improved understanding of the performance of the groundwater extraction system. It is recommended that the installation of these piezometers be approved.

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Technical Assistance Region IX: On April 14, 2014, Mr. Steven Acree (GWERD) and Dr. Robert Ford (LRPCD) provided technical review comments to RPM David Seter on the "Analytical Parameter Reduction for Site-Wide Groundwater Monitor Wells, Yerington Mine Site, Yerington, Nevada." The document proposes to reduce the suite of analytes that are routinely monitored per the Site-Wide Groundwater Monitoring Plan based on the frequency of detection. Under this proposal, ten parameters would be removed from the analytical suite for existing wells in which these parameters have been infrequently detected. For new wells, monitoring of the full suite of parameters would be performed for four consecutive quarterly sampling rounds at which time the data would be analyzed to determine whether monitoring of these parameters should be continued. Given the limited detections of these parameters and the extensive record of previous analyses, it is recommended that the proposed modification to the routine analytical parameter suite detailed in Table 5 be adopted for the remainder of characterization to be performed under the remedial investigation. The monitoring program should be reevaluated at each major milestone in the process, such as during the feasibility study, remedial design, and remedy implementation, to insure that the necessary data are obtained to meet the evolving data quality objectives.

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Technical Assistance Region IV: On April 16, 2014, Dr. Bruce Pivetz (Dynamac Corp.), under the direction of Dr. Scott Huling (GWERD), provided technical review comments to RPM Lila Llamas on the Draft Work Plan, Pre-Design Investigation, Site 27/55 Motor-T Area/Equipment Parade Deck, MCRD Parris Island, Parris Island, South Carolina, Revision No. 00, for the Parris Island Marine Corps Recruit Depot. In general, the overall concept of the work described in the Draft Work Plan appears reasonable. However, there are several flaws either in how some of the proposed work will be conducted, or in how the work is discussed in the Draft Work Plan. The Draft Work Plan is very detailed regarding many aspects of the pre-design investigation (such as decontamination and investigation-derived waste), but much less so in a few aspects (e.g., the ISCO bench-scale study, or the LIF probe operation and methodology). It is recommended that this information be provided before the investigation or in a final report. It is acknowledged that there may be light non-aqueous phase liquid (LNAPL) in the saturated zone, it appears that the laser-induced fluorescence (LIF) survey and soil sampling may not include any of the unsaturated or saturated soils beneath the clay layer/smear zone. It is strongly recommended that the LIF survey and associated soil sampling include some of the zone beneath the clay layer and also include the top of the saturated zone, perhaps for one or two feet at a minimum.

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Technical Assistance Region III: On May 6, 2014, Dr. Scott Huling (GWERD) provided technical review comments to RPMs Laura Mohollen and Darius Ostruaskas on the "Fike/Artel Superfund Site, Limited Scale Pilot Test Workplan – Response to US EPA Comments," Nitro, West Virginia. The Responses by the Fike/Artel Trust do not address several of the deficiencies previously provided in EPA comments and recommendations. The main point of disagreement is that persulfate concentrations were non-detect in all nearby monitoring wells indicating a radius of influence (ROI) could not be evaluated. There are several technical issues raised in the responses to the review comments and recommendations that address topics regarding the overall feasibility of ISCO at the site. The technical concern is that site specific chemical factors

(i.e., oxidant persistence), and hydrodynamics (i.e., dispersion, diffusion, advection), including realistic estimates of the radius of influence derived from site specific data and information were not considered in this calculation and that a smaller volume of the aquifer will be targeted than projected. The basis for dispersion of oxidant into the remaining 75% of the “estimated treatment zone radius” should be explained specifically. In summary, the concentration of sodium persulfate (SP) must be determined in nearby monitoring wells to assess the oxidant ROI, which in turn can be used to help assess treatment performance. Despite these multiple pilot-scale oxidant injection events, a reliable estimate of the ROI has not been achieved.

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Technical Assistance Region VI: On May 1, 2014, Dr. Bruce Pivetz and Dr. Daniel Pope (Dynamac Corporation), under the direction of Dr. David Burden (GWERD), provided technical review comments to RPM Mike Hebert for the “Plan Development to Evaluate the Impacts of the Ground-Water/Surface Water Interactions on Contaminant Migration at the Oklahoma Refining Company Superfund Site, Cyril, Oklahoma.” Previous Site investigations have provided extensive information on contaminant concentrations in ground water, soil, surface water, and sediments. This information has indicated where contaminants are found and where they exceed the relevant standards. However, there has apparently been no estimation of the mass flux of contaminants in either ground water or surface water. It is necessary to determine the magnitude, rate, and significance of adverse impacts on Gladys Creek, and to evaluate what actions need to be taken regarding those impacts. The strategy to conduct this effort consists of identification of all major routes of ground-water discharge into Gladys Creek, quantification of ground-water discharge, measurement of surface water discharge, estimation of the contaminant mass flux in the surface water and ground water, and hydrological evaluations of the Gladys Creek watershed.

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Technical Assistance Region I: On May 5, 2014, Dr. Randall Ross (GWERD) provided technical review comments to RPM Darryl Luce for the “Hydraulic Gradient Analysis of the Sylvester (Gilson Road) Superfund Site Containment System, Nashua, New Hampshire.” The primary objective of these data collection and analysis efforts was to evaluate whether the hydrologic conditions within the physical containment system have changed over time, possibly indicating changes to the integrity of the cap and slurry wall. The data obtained do not indicate major changes in the hydrologic behavior of groundwater within the containment system. As identified during the early phases of active site remediation, it appears that groundwater is continuing to enter the containment system from the upgradient portion of the site and exit the containment system from the downgradient portion of the site. In addition to analysis of the available data and their implications regarding the effectiveness of the containment system, recommendations regarding the further uses of these data and improvements to both the overall assessment of the containment system performance and the long-term monitoring program were provided.

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Technical Assistance Region V: On May 8, 2014, Dr. Bruce Pivetz and Dr. Daniel Pope (Dynamac Corporation), under the direction of Dr. David Burden (GWERD), provided technical review comments to RPM Leah Evison on the Draft In-Situ Chemical Oxidation and Enhanced Reductive Dechlorination Design Report Baytown Ground Water Contamination Site SR84, Baytown Township, Minnesota (the Draft Design Report), dated April 10, 2014. This technical review was focused on the technical adequacy of the design of the In-Situ Chemical Oxidation (ISCO) and Enhanced Reductive Dechlorination (ERD) treatments, and on its presentation in the Draft Design Report. The Draft Design Report contains specifications for conducting ISCO at the Site.

However, there are potential problems with the assumptions, methods, and results of the various calculations used to develop specifications. The general approach is reasonable and technically adequate; however, it is recommended that all the specific assumptions, calculation methods, and results be re-checked, and recomputed if necessary prior to moving forward with the remediation. The potential problems occur in parameter values used in, or resulting from, the equations in the Draft Design Report. In general, the discussion of ERD system design in the Draft Design Report is insufficiently specific and detailed.

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Technical Assistance Region I: On May 14, 2014, Dr. Eva Davis (GWERD) provided technical review comments to RPM Cheryl Sprague on the "90% Pre-Final Thermal Design Report – Phase 1," for the Beede Waste Oil Superfund Site in Plaistow, New Hampshire. The Draft Operations & Maintenance (O&M) Plan, Draft Demonstration of Compliance (DCP), and Draft Construction Quality Assurance Project Plan (CQAPP) were also reviewed. In general, the documents are complete and well written, and incorporate the comments made on the 60% Design. However, there are concerns on how the determination will be made to shut down the thermal system, and the monitoring that will be done to support this decision. The actual amount of contaminant mass in the treatment area, and the rate at which it can be recovered, are critical to estimating the operational timeframe, but are also very difficult to estimate up front. Performance monitoring is critical in order to have the data to support the fact that the remedial goals have been met or that the system has reached the point of diminishing returns. During pressure cycling, more frequent vapor samples may be very helpful to document the rapid increases and decreases in vapor phase concentrations that are created by these changes in subsurface pressures. Also, ambient air sampling plans should be included. A critical part of the design is a thermal oxidizer for the destruction of the contaminant vapors that are generated during the thermal remediation. However, the design should include a backup for the thermal oxidizer in case of the need to shut it down for maintenance and/or repairs.

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Technical Assistance Region IX: On May 16, 2014, Dr. Milovan Beljin (Dynamac Corporation), under the direction of Dr. Randall Ross and Mr. Steven Acree (GWERD), provided technical review comments to RPM David Seter on the Groundwater Flow Model for Yerington Mine Site, Yerington, Nevada. In general, the model development reflects the procedures outlined in the work plan. The uncertainty regarding a groundwater flow model is often evaluated by sensitivity analysis, modifying model parameters and then evaluating the calibration statistics. It is recommended that the model report include a more conventional sensitivity analysis. The uncertainty analysis should identify the parameters that are the most crucial to the flow model and no data gaps were identified. Also, considering that the modeling evaluation has not been completed yet (i.e., the solute transport model), it is premature to conclude that any further investigations would yield limited additional information. For the purposes of this groundwater model, it is recommended that the conceptual model be re-evaluated and refined during the solute transport modeling. It is also recommended that the calibration of the model should be periodically refined whenever significant new data become available.

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Technical Assistance Region IX: On May 28, 2014, Mr. Steven Acree (GWERD) and Dr. Robert Ford (LRPCD) provided technical review comments to RPM David Seter on the Technical Memorandum: Site-Wide Groundwater Monitoring Optimization, for Yerington Mine Site, Yerington, Nevada. Based on the results of monitoring performed to date, the document proposes to reduce the frequency for manual water level

measurements from monthly to quarterly and the frequency of dissolved nitrate analyses from quarterly to a semiannual basis for wells installed prior to the Additional Monitor Well Work Plan. Wells installed under the Additional Monitor Well Work Plan would continue to be monitored at the current frequency to establish an adequate monitoring history. In addition, the memorandum proposes to redeploy pressure transducers to wells in areas where hydrology is less well characterized. Given the available data, these proposals appear to be appropriate and warranted.

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Technical Assistance Region VIII: On June 4, 2014, Dr. Bruce Pivetz (Dynamac Corporation), under the direction of Dr. David Burden (GWERD), provided technical review comments to RPM Joe Vranka on the Additional Site Characterization Report - DRAFT, BNSF Former Tie Treatment Plant, Somers, Montana, October 4, 2013 (the Report). The Report was very well-written and comprehensive. It contained clearly stated and concise descriptions of the characterization activities and the rationale for those activities. The report also included a detailed discussion of non-aqueous phase liquid NAPL transport relative to the Site. In general, all the necessary information for evaluating the discussions and conclusions in the Report were included within the Report and Appendices; although, some supporting information was not found. In general, the characterization methods appeared suitable for their intended purpose and appeared to be conducted properly and with careful planning. The conceptual site model (CSM) was comprehensive, well-reasoned, and technically sound, especially in regard to the discussion about NAPL fate and transport. If site conditions change significantly, or the area of interest expands beyond the current boundary, the CSM would then need to be updated again.

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Technical Assistance Region IX: On June 9, 2014, Mr. Steven Acree (GWERD) and Dr. Robert Ford (LRPCD) provided technical review comments to RPM David Seter on the "Site-Wide Groundwater Operable Unit (OU-1) Remedial Investigation Work Plan, Revision 1," Yerington Mine Site, Yerington, Nevada. In general, the revisions to the document adequately address previous comments. Although the body of this work plan is a framework document outlining the remaining data gaps in the remedial investigation and the proposed path toward completion of the investigation, it also includes several detailed work plans and reports as attachments. In response to previous comments, the document provides approximate submittal dates and time frames for the remaining products defining the remedial investigation (e.g., Background Work Plan, Bedrock Characterization Plan, and Geochemical Characterization Work Plan). It is recommended that these approximate submittal dates/time frames be reviewed and revised, as necessary, to reflect the most current estimates.

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Technical Assistance Region IX: On June 17, 2014, Dr. Eva Davis (GWERD) provided technical review comments to RPM Carolyn D'Almeida on the "Draft Addendum #1 Remedial Design and Remedial Action Work Plan (RAWP) for Operable Unit 2, Revised Groundwater Remedy, Site ST012, Former Williams Air Force Base, Mesa, Arizona." This addendum outlines the steam injection/extraction startup strategy to be used for the Steam Enhanced Extraction system based on the observed presence of light nonaqueous phase liquids (LNAPL) in borings advanced for construction of the system of steam injection and extraction wells. The purpose of this addendum is to ensure that LNAPL does not migrate away from the thermal treatment zone due to steam injection, or minimize the potential for such undesirable migration. There are some concerns with the scoring system employed to categorize the boring intervals for

potential LNAPL presence. There is also a concern about large areas with significant LNAPL contamination that, with the injection/extraction strategy outlined here, will not receive significant steam. It is strongly recommended that the use of cyclic steam injection (as described in the Final Remedial Design and Remedial Action Work Plan) be considered for particular areas in order to treat them with steam while minimizing the risk of spreading LNAPL outside of the treatment area.

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Technical Assistance Region VI: On June 20, 2014, Dr. Scott Huling (GWERD) provided technical review comments to RPM Stephen Tzhone for the "Supplemental Groundwater Tracing Study Work Plan, Arkwood Superfund Site, Omaha, AR", prepared by Ozark Underground Laboratory. The proposed tracer study report provides a good foundation to build a stronger and more comprehensive study. Based on information addressed in previous reviews, it is recommended to identify all of the wells on-site and off-site that could be used in a tracing study. The construction details of these wells should be identified to assess whether the appropriate wells are being injected with a tracer, and appropriate wells are being monitored. It is also recommended to provide a tabulated summary of screened intervals involving a common datum for all the wells. In general, it appears that there were two main areas where waste management activities occurred. It is recommended that consideration be given to expand the area over which the tracer is released, and to increase the volume of the injected dye.

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Technical Assistance Region VI: On July 1, 2014, Dr. John T. Wilson (Dynamac Corporation subcontractor) and Dr. Daniel Pope (Dynamac Corporation), under the direction of Dr. David Burden (GWERD), provided technical review comments to Tara Hubner on the "Compound-Specific Isotope Analysis (CSIA) and Biological Parameters Analysis," Kirtland Air Force Base, New Mexico. The reviewers were tasked to determine if (1) the sampling results are usable for assessing the degradation of ethylene dibromide (EDB) and benzene in ground water at the Site, and (2) based on the results is degradation of EDB and benzene occurring. It was determined that samples were collected at the appropriate existing wells within the plume. However, additional wells were available and perhaps could have provided useful data. It was also determined that the number of samples in the source, and down gradient of the source, were adequate to determine whether biodegradation of EDB and benzene was occurring. After comparing the standard operating procedure (SOP) that was used for the CSIA analysis of EDB and benzene to the recommendations in the U.S. EPA guide for analysis of stable isotopes, the reviewers found that insufficient information was available in the SOP to determine whether appropriate analytical methods were used. The reviewers suggest that the SOP for CSIA analysis of EDB and benzene should be revised as needed to provide adequate documentation of the data quality for CSIA analysis.

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Technical Assistance Region II: On July 14, 2014, Dr. Milovan Beljin (subcontractor to Dynamac Corporation) and Dr. Randall Ross (GWERD) provided technical review comments to RPM Carol Stein for the "Capture Zone Evaluation and Path Forward, GM-38Area Groundwater Treatment Plant, Naval Weapons Industrial Reserve Plant, Bethpage, New York," dated March 2014, by Tetra Tech. The review of the results of the Tetra Tech report and the USGS report agrees with the general assessment that the majority of contaminated groundwater is being intercepted by the subject wells. The drawdown and recovery patterns observed in monitoring wells during the pumping tests illustrate the complex nature of stresses impacting the aquifer and controlling the extent of capture. It is recommended that future simulations be run under transient conditions. The USGS model is a useful tool that should provide the necessary information to optimize the pumping rates of GW-38 extraction wells. The model could

also aid in identifying potential data gaps in the existing monitoring network. The use of solute transport modeling should also be considered with future simulations. This may provide insight into the nature and extents of known and unknown sources related to the NWIRP, and also provide a better understanding of the long-term impact of VOCs on downgradient receptors. Long-term monitoring of VOCs downgradient of GM-38 should continue. The model should be transferable to other areas of groundwater contamination related to NWIRP, with incorporation of differences in local hydrogeology.

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Technical Assistance Region IV: On August 4, 2014, Dr. Scott Huling (GWERD) provided technical review comments to RPM Robenson Joseph on the Laboratory Treatability Evaluation and ISCO Treatment Expectations, Final Report May 12, 2014, West Florida Natural Gas Site, Ocala, Florida. It is agreed that there are some areas of the site that will be more challenging to an in situ chemical oxidation (ISCO) remedy; however, the extent to which these results can be extended to the entire site is unclear. There are multiple factors that impact the success of ISCO at a site. Some of the factors were accurately captured in the modeling efforts, but some were not. It is unlikely that ISCO could ever achieve MCLs at a site where unconsolidated porous media is contaminated with DNAPL. However, in conjunction with natural attenuation, it may be possible that significant and long term contaminant reductions can be achieved using ISCO over portions of the site. In all likelihood, pilot scale testing of ISCO will eventually be needed to develop a more accurate assessment of the impact and potential feasibility of ISCO. At this site, it is unclear whether benzene concentrations and distribution represent unacceptable exposure pathways and risk, and therefore, significant regulatory concern. However, assuming benzene is a regulatory driver in cleanup standards at this site, ISCO, in conjunction with biodegradation would be needed to address this chemical of concern. The long term fate and transport of benzene under this remedial treatment train would require focused monitoring and assessment.

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Technical Assistance Region III: On August 14, 2014, Dr. Scott Huling (GWERD) provided technical review comments to RPM Susanne Haug on the "35% Conceptual Design for In Situ Chemical Oxidation for ISCO at Southeastern (SE) Area Operable Unit (OU) 3A, OU 11, and OU 6, Letterkenny Army Depot," Chambersburg, PA. As indicated in the report, additional details will be provided in subsequent versions of the design report. An important detail to include in revised versions of this report is the design criteria for the oxidant loading, i.e., volume and concentration of oxidant to be injected. It is recognized that given the very sensitive nature of oxidant transport and potential discharge from the site boundaries into receiving waters, the oxidant loading criteria may change with time. General comments include; 1) the ISCO design, and/or operational criteria should include detailed information regarding adequate coverage of oxidant delivery into targeted zones; and 2) if an H₂O₂-based ISCO system is selected, all reagents that will be injected should be reported, including the major and trace elemental composition. Additionally, it is recommended that the reagent mixture is sampled and analyzed for chloride content.

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Technical Assistance Region IX: On August 25, 2014, Dr. Scott Huling (GWERD) provided technical review comments to RPM Grace Ma on the "Work Plan for ISCO Pilot Study," Mountain View, California. Some wells will be shut down during the in-situ chemical oxidation pilot study, and others will continue operating. An assessment was provided in the report regarding the potential for the extraction wells on the exterior of the slurry wall to capture the injected oxidant. The effort put forth in the modeling effort is appreciated and as a first cut analysis, the results are

useful. However, the modeling effort could not take into consideration unknown preferential pathways associated with natural and manmade perturbances in the ground water flow systems. In recognition of several complexities, it is recommended that a contingency plan be developed which outlines steps to be implemented assuming permanganate is detected in the influent of the ground water treatment system. Under ambient conditions, and especially under pumping conditions, ground water may be transported from one unit to another. Assuming the ground water is contaminated, high concentrations of CVOCs may be unintentionally dispersed from high contaminated zones into lesser contaminated zones. It is recommended that a technical review be conducted which assesses the potential role of this condition at the site.

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Technical Assistance Region III: On September 3, 2014, Dr. Scott Huling (GWERD) provided technical review comments to RPM Laura Mohollen on the "Fike/Artel Superfund Site, Expert Review of In-situ Chemical Oxidation (ISCO) Technology," Nitro, West Virginia. The independent expert reviewers raised several important technical issues regarding potential scientific discovery of chemical oxidation mechanisms and ISCO deployment at the Fike/Artel Superfund site, however, there are several important ISCO limitations remain that were not addressed. Neither reviewer addressed the major limitations of ISCO regarding; (1) Poor oxidant distribution to the targeted zone, (2) Poor oxidation efficiency, (3) Cost ineffectiveness, (4) Impact of oxidant residuals, and (5) Longevity of required treatment. It was recommended that a treatability study be conducted to assess the most effective pathway of activation. While it is agreed that this would be useful to gain insight into the reaction mechanism, the overall feasibility of ISCO technology is highly suspect at this point due to major limitations. The Reviewer outlined bench scale testing that appears to have already been conducted in the XDD bench scale test. The proposed testing does not appear to contribute to information needed to address matters of treatability or ISCO design. Given the XDD bench test results, it is recommended that a critical analysis be provided between what has been performed to date, and what is proposed to rationalize additional testing. However, as described above, major limitations of the ISCO technology have been summarized, and it is recommended that future bench- and pilot-scale treatability studies are contingent upon addressing these issues.

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Technical Assistance Region IX: On September 3, 2014, Dr. Milovan Beljin (Dynamac Corporation subcontractor), under the direction of Dr. David Burden (GWERD), provided technical review comments to RPM Grace Ma on the Ground Water Model for the Middleton-Ellis-Whisman (MEW) Superfund Site, Mountain View, California. The purpose of the MEW Flow Model (an update of the 2008 version) is (1) to evaluate the current ground-water extraction system and (2) to optimize the extraction system for maximum plume capture with minimum extraction rates. Although the data gaps were identified throughout the report, they should be listed in a separate section. Model Sensitivity Analysis should be conducted not only regarding the calibration statistics but also on the impact on the capture zone analysis. Additionally, conclusions regarding the "goodness of fit" of the current Flow Model should be supported with the other lines of evidence. A solute transport model should be developed as a better management tool.

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Technical Assistance Region V: On September 22, 2014, Dr. Milovan Beljin (Dynamac Corporation subcontractor) and Dr. Randall Ross (GWERD) provided technical review comments to RPM Lolita Hill on the Chem-Dyne Superfund Site 2013 Annual Report,

Hamilton, Ohio. It appears that termination of pumping of two extraction wells can be justified; however, monitoring should continue. The contaminant removal rate of the South Plume SVE system appears to be tapering off significantly. Therefore, termination of the South Plume SVE system may be appropriate. Because the extraction wells have lower efficiency than the other wells, they should not be used to interpolate head data. It may be desirable to identify key wells used to determine whether hydraulic containment is being achieved by the extraction wells. These wells would provide quantitative data for evaluating containment, rather than the current use of potentiometric surface maps. It would be cost effective to continue operating the North Plume SVE system, which appears to be on-track to remove a mass of contaminants. The persistently elevated concentrations in several wells in the North Plume area suggest the presence of a contaminant source(s) in the subsurface. If source material is present, elevated VOC concentrations are likely to persist and may not be amenable to monitored natural attenuation.

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Technical Assistance Region IX: On September 22, 2014, Mr. Steven Acree (GWERD) and Dr. Robert Ford (LRPCD) provided technical review comments to RPM David Seter on the "Phase 1 Field Sampling and Analysis Plan, Anaconda Evaporation Ponds," Yerington Mine Site, Yerington, Nevada. It is recommended that approval of the plan include the stipulation that the procedures that are used prevent contact of the groundwater samples with the atmosphere prior to field filtration. Lysimeter installation procedures indicate that a slurry of native backfill will be placed around the porous cup. However, the procedures in SOP-28 state that a silica flour/distilled water slurry will be used for this purpose. Both methods require considerations. In general, analytical results of samples obtained from a lysimeter should be interpreted with caution. It is noted that, in some instances, the plan does not provide detailed procedures sufficient for a complete review and assessment.

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Technical Assistance Region IX: On September 22, 2014, Mr. Steven Acree (GWERD) and Dr. Robert Ford (LRPCD) provided technical review comments to RPM David Seter on the "Draft Preliminary Responses to the June 9, 2014, EPA Comments on the Site-Wide Groundwater Operable Unit (OU-1) Remedial Investigation Work Plan, Revision 1," Yerington Mine Site, Yerington, Nevada. The responses appear to be acceptable and adequately address the comments. In addition, the reviewers concur with the decision to eliminate the borehole flowmeter survey of well WDW019 due to the limited value of this activity, the condition of the well, and the additional work that has been performed since this test was originally proposed.

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Technical Assistance Region III: On October 7, 2014, Dr. Bruce Pivetz (Dynamac Corporation), under the direction of Dr. David Burden (GWERD), provided technical review comments to RPM Debra Rossi for documents from the Supplemental Site Characterization - Revision 1 (the SSCR), March 2014, for the Delaware Sand and Gravel (DS&G) Site, New Castle, Delaware. A review of the available data and information from Figures from the SSCR indicates that it is likely that dissolved manganese is being contributed to the plume from both the DS&G Site and the Army Creek Landfill Site. There are locations of detected manganese immediately downgradient of each Site. The contoured manganese concentrations use relatively sparse location data; and not all monitoring wells are "included in current monitoring." It is recommended that a synoptic round of ground-water analyses be conducted if it is desired to have a better definition of the manganese plume(s). There do not appear to be many (or any) data points in the Upper Potomac Confining Unit Transition Zone farther downgradient

away from the DS&G Site. This unit may act as a contaminant migration pathway. It is recommended that additional scrutiny of this unit is warranted. It is likely that As and Co in the plume are present as anthropogenic contaminants from the DS&G landfill. If further examination of As and Co is desired, it is recommended that dissolved As and Co concentrations be provided and plotted on cross-section and in map view.

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Technical Assistance Region V: On October 7, 2014, Dr. Daniel Pope (Dynamac Corporation), under the direction of Dr. David Burden (GWERD), provided technical review comments to RPM Donald Heller for the Enhanced Reductive Dechlorination (ERD) Pilot Scale Study Workplan, August 28, 2014, for the Demmer Properties LCC/ Former Motor Wheel Facility (Site) located in Lansing, Michigan. In general, a pilot study of ERD for the Site is appropriate, given that the Site conditions appear to be appropriate for successful use of ERD as part of the Site remedial activities for groundwater. As is usually the case for studies of groundwater remediation, there are uncertainties involved in interpreting the data likely to be derived from the study. These problems (uncertainty about groundwater flow direction and the orientation of the treatment zone, incomplete transect coverage across the treatment zone, incomplete depth monitoring, long-screened monitoring wells, etc.) can cause difficulties with interpretation of treatment effectiveness, contamination attenuation rates, treatment timeframes, etc. Therefore, it is recommended that the monitoring well transects be extended to reach all the way across the anticipated treatment zones to define the boundaries of the treatment zone, and three wells within each treatment zone to monitor the "core" of the zone and the fringes, for each transect. Also, we recommend that each treatment zone be monitored with at least one transect that includes vertical monitoring to define the variations (contaminant, geochemistry, reagents) by depth for the zone.

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Technical Assistance Region VIII: On October 30, 2014, Mr. Frank Beodray and Dr. Daniel Pope (Dynamac Corporation), under the direction of Dr. David Burden (GWERD), provided technical review comments to RPM Sam Garcia on groundwater monitoring data reports and documents for the Bountiful/Woods Cross 5th South PCE Plume Superfund Site (the Site), Bountiful and Woods Cross, Utah. The review comments addressed questions posed by EPA Region VIII. The PCE plume originated from a former dry cleaner facility founded in the early 1940s that released wastewater from their operation to the subsurface through an underground sump and possibly a former septic system. As indicated in the Site documentation, section, a SVE system was initially proposed and then removed from the Treatment Pilot Study Record of Decision (ROD) objectives. In summary, five years ago SVE was considered and found not to be an effective remedial option based on low concentrations of VOCs. Despite not identifying remaining source material at Bountiful Cleaners Incorporated (BCI), soil gas contaminant concentrations were elevated and groundwater contamination appears to still originate from the BCI property, suggesting that tetrachloroethene (PCE) contamination remains at the BCI property. It is assumed that the PCE concentrations have decreased in the vadose zone since 2008 but re-evaluation of potential PCE sources may be warranted in lieu of waiting for remaining PCE to enter groundwater for treatment by the GWTS. Investing in a pilot program to evaluate an SVE system does not seem appropriate until such time that the source of groundwater contamination is better identified and defined. Two wells appear to be out of the radius of influence of the extraction well, and the concentration of PCE in one well has actually increased slightly based on the 2013 data. Since well one well has been destroyed, a minimum of two additional wells are recommended for this area to better understand the horizontal and vertical plume migration to the south. Again it is recommended that soil

samples be collected from each permeable unit in the unsaturated vadose zone during installation to gain a better understanding of what concentration of PCE remains in each unit.

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Technical Assistance Region VII: On November 5, 2014, Dr. Ralph Ludwig (GWERD) provided technical review comments to RPM Hoai Tran on the "Armour Road Site MNA option for groundwater, North Kansas City, Missouri." Clearly, very extensive and exhaustive site characterization work has already been conducted at the site. The only possible weakness with the work done is the apparent limited information on groundwater redox conditions at the site. In order to defend monitored natural attenuation (MNA) as a viable option for addressing groundwater impacts at the site, a solid conceptual model is needed to demonstrate a good understanding of the geochemical and hydrogeological processes in play at the site and how these processes will act to support the MNA option. Most of this work has certainly been done. Redox characterization would be important in understanding the fate and transport of redox-sensitive constituents such as arsenic. Reduction of arsenic concentrations in groundwater over the short term may or may not be indicative of success. Sufficient time should be allowed for re-establishment of equilibrium conditions in the subsurface. As conditions eventually revert back to the original more reducing conditions (if these were the original conditions). This may explain why a rebound is currently being observed.

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Technical Assistance Region I: On November 25, 2014, Dr. Randall Ross (GWERD) and Dr. Milovan Beljin (Dynamac Corp.) provided technical review comments to RPM Anna Krasko on the "Groundwater Flow and Solute Transport Modeling Report, Picillo Pig Farm Superfund Site, Coventry, Rhode Island." The report focuses on the refinement of the existing model using the shutdown test results and the tracer study results. The flow and solute transport has been and will continue to be a useful management tool at the Site. However, some of the latest model modifications should be re-examined. Most modifications to the current model are based on data collected during the tracer study and the shut-down test. While some model input data were clearly described as the results of the latest investigation, it is not always obvious whether the model parameters were modified, and if so, what the previous model parameter values were. Future modeling efforts should clearly identify which input parameters were modified and provide a list the new input values along the list of the values being replaced.

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Technical Assistance Region V: On November 26, 2014, Dr. Bruce Pivetz and Dr. Daniel Pope (Dynamac Corporation), under the direction of Dr. David Burden (GWERD), provided technical review comments to Corrective Action Project Manager Donald Heller on the "Treatability Study Report and Remedial Design for the Eli Lilly & Co. - Evonik Corporation Tippecanoe Laboratories, Lafayette, Tippecanoe County, Indiana." The purpose of the review was to identify any design or scientific problems or issues associated with the pilot-scale treatability study or the full-scale remedial design. Overall, the Report appears satisfactory in that it provides sufficient discussion regarding the results of the pilot-scale study. Its discussions and conclusions appear reasonable. The Remedial Design (RD) recommendations for full-scale remediation and monitoring within each source area appear reasonable and conservative and are supported by adequate and satisfactory discussion. It is recommended that the issues discussed in this technical review be addressed as the RD process continues. An explanation and justification of the use of a presumably average contaminant concentration in calculating the required sodium persulfate mass for all the injection

locations within each source area is recommended. It is also recommended additional investigation and discussion of the issue of contaminant sorption, and the possible influence of the injected activated carbon on the sorbed- and dissolved-phase contaminants be provided. Overall, it appears that the enhanced bioremediation component of the pilot study had relatively little effect on subsurface geochemistry and contaminant concentrations. It is recommended that a strong emphasis be placed on use of in-situ chemical oxidation (ISCO) to meet remedial goals, and that the ISCO component be considered the more effective and primary remedial component. The enhanced bioremediation component (if any) could possibly be delayed and ISCO be continued until the remedial goals are met.

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Technical Assistance Region I: On December 1, 2014, Dr. Eva Davis (GWERD) provided technical review comments to RPM Cheryl Sprague on the "100% Pre-Final Thermal Design Report – Phase 1, Beede Waste Oil Superfund Site, Plaistow, New Hampshire." In general, the report presents a complete remedial design for the Phase 1 Steam Enhanced Extraction (SEE) for the former Lagoon area of the site, and adequately responds to previous comments. It may be advisable to obtain both PID and FID measurements on the vapor streams, and compare them to the summa canister results to determine which measurement more accurately reflects the contaminant concentration in the vapor phase. Additional information should be provided to explain the contingencies for treating effluent vapors if the thermal oxidizer is down for an extended period of time. Also, clarification should be provided concerning where effluent water from Weir Tank T-109 will be discharged.

Scientific and Technical Publications

Ford, R., M. Brooks, C. Enfield, M. Kravitz. 2014. Evaluating Potential Exposures to Ecological Receptors Due To Transport of Hydrophobic Organic Contaminants in Subsurface Systems. U.S. Environmental Protection Agency, Ecological Risk Assessment Support Center, Cincinnati, OH. EPA/600/R-10/015. (M. Brooks (GWERD) 580-436-8982)

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Hockenbury, Laura A. (Region X), Barton R. Faulkner and Kenneth J. Forshay (GWERD), and J. Renee Brooks (NHEERL). 2014. "Green Island and the Hyporheic Zone: Why Restoration Matters." EPA/600/F-13/340. (B. Faulkner (GWERD) 580-436-8530)

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Huang, Junqi (GWERD), Mark Neil Goltz (Air Force Institute of Technology, Wright-Patterson AFB, OH). 2014. Spatial Moment Equations for a Groundwater Plume with Degradation and Rate-Limited Sorption. Journal of Hydrologic Engineering, Vol. 19, No. 5, pgs 1053-1058, May 1, 2014. © ASCE, ISSN 1084-0699/2914/5-1053-1058. DOI: 10.1061/(ASCE)HE.1943-5584.0000885. © 2014 American Society of Civil Engineers. (J. Huang (GWERD) 580-436-8915)

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Hu, Shangchun (NRC, GWERD), Ann Keeley (GWERD). 2014. Aesthetic Considerations for Stream Restoration. Technical Fact Sheet - Science in Action, Innovative Research for a Sustainable Future. EPA/600/F-14 /300. (Ann Keeley (GWERD) 580-436-8890)

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Liao, Xiaoyong, Dan Zhao, Xiulan Yan (Chinese Academy of Science, Beijing, China), Scott Huling (GWERD). 2014. "Identification of persulfate oxidation products of polycyclic aromatic hydrocarbon during remediation of contaminated soil." Journal of Hazardous Materials, 276 (2014)26-34.

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Wilson, John T., Cherri Adair, Cindy Paul (GWERD), Linzi Thompson (East Central University, Ada, OK). 2013. Corrosion in STP Sumps. What Causes It and What Can Be Done About It? Petroleum Equipment Institute Journal (aka The PEI Journal), Third Quarter 2013, pages 26-33.

Meetings, Conferences & Training

Drs. Scott Huling, Randall Ross, and David Burden gave presentations at the 2014 EPA National Association of Remedial Project Managers (NARPM) Training Program held on June 16th – June 20th in Atlanta, GA. NARPM is EPA's major conference for RPMs to receive training and to hear presentations and case studies of remediation taking place at Superfund sites, RCRA sites, and Federal Facilities. In conjunction with the 23rd Annual NARPM Training Program, EPA's Technical Support Project Forums (TSP) conducted their business meetings. The TSP consists of a network of Regional Forums and specialized Technical Support Centers located in ORD and OSWER's Environmental Response Team (ERT). The objectives of the TSP are to network with other EPA programs and other Federal agencies. On Tuesday June 17th, Dr. Huling gave a presentation titled "In Situ Chemical Oxidation: Site Complexities, Guidelines, and Lessons Learned." Also on Tuesday Dr. Randall Ross, was a presenter in the "Site Evaluation Tools and Emerging Technologies" session. During this session Dr. Ross gave a presentation titled "An Automated Tool for the Estimation of Groundwater Flow Vectors." On Wednesday, June 18th Dr. David Burden co-chaired a session with Mr. Robert Weber (STL, Region VII) titled "Using Models to Assist with Clean-up Decisions at Contaminated Sites." Dr. Burden opened the session with a presentation describing the services and capabilities available to RPMs from the Ground Water Technical Support Center (GWTSC) and the Center for Subsurface Modeling Support (CSMoS).

About the Robert S. Kerr Environmental Research Center

The Ground Water and Ecosystems Restoration Division (GWERD), under the leadership of Division Director Dr. Richard Lowrance, pursues areas of investigation that are part of the Office of Research and Development's (ORD) Strategic Plan and the mission of the National Risk Management Research Laboratory. GWERD is EPA's center of expertise for investigation of the soil and subsurface environment and ecosystem restoration. To carry out its mission, the division is divided into four branches: Subsurface Remediation Branch, Ecosystem and Subsurface Protection Branch, Applied Research and Technical Support Branch, and Technical and Administrative Support Staff.

The Division's research programs include basic studies to enhance understanding of the physical, chemical, and biological processes that control the transport of mass and energy in surface and subsurface ecosystems through the movement of water; the impact of these processes on surface and subsurface ecosystems; and, the application of this process understanding to protect and restore water quality throughout a watershed. A broad range of expertise and scientific disciplines are represented at GWERD, with professionals who are microbiologists, chemists, hydrologists, ecologists, environmental scientists, geochemists, soil scientists, chemical and environmental engineers, and modelers.



Figure 16: Photograph of the R.S. Kerr Environmental Research Center, Ada, OK.

Photograph by: David S. Burden

Drone Operator: Ken Jewell