

Response to Request for Proposal

*The Minnesota Pollution Control Agency and
Minnesota Department of Agriculture*

Professional / Technical Master Contract

*Category C: Closed Landfill Program
Environmental Services*

April 11, 2018

Prepared by:

Antea®Group

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Minnesota Department of Agriculture*

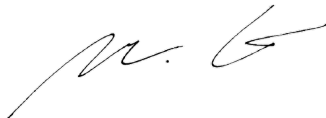
Professional / Technical Master Contract

*Category C: Closed Landfill Program
Environmental Services*

April 11, 2018



Robert M. Karls
President



John R. Estes
Consultant



Jacob Knapp
Project Manager

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1.0 COVER LETTER

April 11, 2018

Ms. Mary Henninger
Minnesota Pollution Control Agency
520 Lafayette Road North
St. Paul, Minnesota 55155-4194

**Subject: The Minnesota Pollution Control Agency
Remediation Master Contract
Category C: Closed Landfill Program Environmental Services**

Dear Ms. Henninger:

Antea®Group is pleased to provide the attached proposal in response to the Minnesota Pollution Control Agency (MPCA) February 28, 2018 Request for Proposal for Category C: Closed Landfill Program Environmental Services.

Antea Group is an international engineering and environmental consulting firm specializing in full-service solutions in the fields of environment, infrastructure, urban planning and water. By combining strategic thinking and multidisciplinary perspectives with technical expertise and pragmatic action, we do more than effectively solve client challenges; we deliver sustainable results for a better future. In the simplest terms, we help clients reduce their environmental footprints, mitigate safety risks, protect against engineering failures and minimize social impacts. With more than 3,000 employees in over 100 offices around the world, we serve multi-national clients ranging from global energy companies and manufactures to national governments and local municipalities.

In the United States, we are building on the strength and experience of our 25-year legacy brand Delta Consultants, incorporated in Minnesota in 1986. In 2008, Delta Consultants was acquired by Oranjewoud N.V., a Dutch publicly traded, engineering and environmental consulting firm. In 2011, Delta Consultants, along with the Belgian and French operations of Oranjewoud N.V., came together under one common brand and are now known in the marketplace as Antea Group. Since then, Antea Group has acquired a 110-person engineering and environmental consulting company in Colombia and a 32-person company in Brazil, expanding our reach into Latin America. In the Netherlands, engineering and environmental consulting services continue to be offered under the Oranjewoud name. Each of our home country operations (Belgium, Brazil, Colombia, France, Netherlands and USA) are managed by country CEO's and operate as separate profit and loss centers.

The added value Antea Group brings to the MPCA includes our experience in working with the MPCA as a multi-site State Contractor for 25 years. Our highly qualified and experienced staff of are equipped to promptly and effectively support the MPCA and MDA with the entire scope of services for the Category C: Closed Landfill Program Environmental Services.

Mr. John Estes is the Antea Group designated MPCA proposal coordinator. As a Consultant located in our St. Paul office, Mr. Estes is usually in the office coordinating project activities and is knowledgeable of the capabilities of the technical personnel who will be working on the Contract. Consequently, it is likely that he will be reachable by one of the following forms of communication to interact with the MPCA's Contract users.

**Response to Request for Proposal
Professional / Technical Contract
Category C: Closed Landfill Program Environmental Services**



John R. Estes
Direct Phone: 651 697 5245
E-Mail: john.estes@anteagroup.com
Website: www.us.anteagroup.com/en-us

In the event Mr. Estes is unavailable or out of the office for an extended period of time, Mr. Jacob Knapp at 651.697.5253 is an alternative contact. It is Antea Group's intent to utilize 100% Minnesota local staff on this Contract, however we have the ability and flexibility to bring in expert resources from across the country should the need arise. The number and staff classifications of local personnel to be available are included in the enclosed staff matrix and accompanying resumes. In addition, Antea Group has two employees located in our St. Paul office that have current National Radon Proficiency Program training and are both Residential Measurement and Mitigation Providers.

Antea Group has reviewed the proposed Contract issued as an attachment to the RFP along with the associated Classification Levels and Rates (Schedule 1 and 2) and the Equipment and Supplies List. The terms and conditions of the Contract are acceptable. We also accept the Classification Levels and Rates and the Equipment and Supplies List used to perform services with prices.

Antea Group is not seeking veteran owned preference and as such the included Attachment I, has been marked as not applicable.

Our US Facility Headquarters and the Minnesota local facility are both located at the following address:

5910 Rice Creek Parkway, Suite 100
Saint Paul, MN 55126
Phone: +1 651 693 9449
USA Toll-Free: + 800 477 7411
Fax: +1 651 639 9473
<http://us.anteagroup.com/>

We also have satellite offices located in Alexandria and Annandale, Minnesota.

If you have any questions or comments regarding the requested contract modifications, please contact Mr. Estes. We invite you to review the attached proposal and look forward to hearing from you regarding your Consultant selections.

Sincerely,

A handwritten signature in black ink, appearing to read "Bob Karls".

Bob Karls
President
651.639.9449
Bob.Karls@AnteaGroup.com
Antea Group

A handwritten signature in black ink, appearing to read "John R. Estes".

John R. Estes
Consultant
651-697-5245
john.estes@anteagroup.com
Antea Group

2.0 QUALIFICATIONS AND CAPABILITIES

2.1 Overall Company Capabilities

Antea Group is an international engineering and environmental consulting firm specializing in full-service solutions in the fields of environment, infrastructure, urban planning and water. By combining strategic thinking and multidisciplinary perspectives with technical expertise and pragmatic action, we do more than effectively solve client challenges; we deliver sustainable results for a better future. In the simplest terms, we help clients reduce their environmental footprints, mitigate safety risks, protect against engineering failures and minimize social impacts. With more than 3,000 employees in over 100 offices around the world, we serve multi-national clients across diverse industries including automotive, chemical, energy, food & beverage, government, manufacturing, pharmaceutical, technology and transportation.

In the United States, we are building on the strength and experience of our 25-year legacy brand Delta Consultants, incorporated in Minnesota in 1986. In 2008, Delta Consultants was acquired by Oranjewoud N.V., a Dutch publicly traded, engineering and environmental consulting firm. In 2011, Delta Consultants, along with the Belgian and French operations of Oranjewoud N.V., came together under one common brand and are now known in the marketplace as Antea Group. Since then, Antea Group has acquired a 450-person engineering and environmental consulting company in Colombia, expanding our reach into Latin America. In the Netherlands, engineering and environmental consulting services continue to be offered under the Oranjewoud name. Each of our home country operations (Belgium, Colombia, France, Netherlands and USA) are managed by country CEO's and operate as separate profit and loss centers.

Antea Group can offer the capabilities of trained and experienced environmental professionals who appreciate the particular needs and concerns of the State. Antea Group has over 700 employees in 42 offices across the United States who are available to assist the State with its program needs. Our staff includes environmental and chemical engineers, health and safety specialists, environmental management consultants, training and performance consultants, hydrogeologists, information management consultants, toxicologists, environmental scientists, and air specialists.

Antea Group's focus is to first understand the State's environmental problems and project goals, then develop and provide timely, cost-effective services that meet those goals. This will be accomplished through frequent and open communication with the MPCA and MDA on project issues.

Antea Group's project managers consider effective and continual communication with our clients to be a prime responsibility. Our professionals pride themselves in responding quickly and efficiently to our client's needs. Antea Group professionals listen to our clients; we ask questions, study the problem, and review several possible options before recommending a particular course of action. Antea Group keeps our clients involved in every step of a project, seeking their input and suggestions and incorporating their concerns along the way.

Antea Group endeavors to develop client relationships that give feedback and knowledge necessary to shape our organization and consulting capabilities to best help our client's reach their goals. We pride ourselves on not only having exceptional technical expertise to develop custom-tailored solutions for our clients, but also having the

sensitivity to make sure that Antea Group performs and presents work in a manner compatible with our client's culture and expectations.

Antea Group holds the safety of its clients and employees as a core value in the operation of our business. Our employees are OSHA trained and certified and we conduct routine refresher courses for our employees. Our employees have a "work safely" motto engrained into their daily tasks. Our employees have a full understanding of Antea Group's performance goals, project quality assurance and quality control procedures, and health and safety concerns. "Work safely" is not just a catch phrase at Antea Group – it is how we do business.

Antea Group specializes in providing innovative, yet practical, environmental remediation design, due diligence services, and operation and maintenance services. Antea Group is a solution-oriented company that provides safe, timely, cost-efficient, and risk-based solutions that provide successful remediation at hazardous substance and non-hazardous waste sites. The key to Antea Group's success is in the planning and skilled management of time, resources, and budget. Whether the situation dictates the need for a Phase I assessment, or a more intrusive Phase II assessment involving soil, groundwater, or air investigations, the primary goal is to provide solutions to the State's environmental problem sites. Antea Group identifies solutions by analyzing objectives and designing a remediation system to efficiently meet those needs. The State's needs involve: not only achieving the site cleanup objectives, managing the site safety concerns, and financial constraints, but also maintaining public awareness and involvement throughout the process. Time constraints, life cycle costs, availability of long- or short-term operation and maintenance resources, public image, and the State's specific final plans for use of the impacted property are all vital to the efficient solution to remediation needs.

Antea Group believes that the information provided in this response demonstrates the extent of our experience, the value of our resources, and our commitment to understanding and meeting the State's needs. Antea Group's qualifications and capabilities for providing services to the MPCA and MDA Programs are included in the following sections.

2.2 Staff Resumes and Matrix Table

The staff matrix illustrated in the attached Table 1 summarizes the personnel who will be assigned to this contract. The matrix includes staff classification, OSHA certification, years of service with Antea Group, summary of educational experience, work experience, licenses and certifications held by each employee assigned to the Contract, and the work location of each individual. Profiles of each staff member are included in Appendix A of this proposal package.

2.3 Total number of site investigation/remedial investigations/remedial design

Our US Facility Headquarters and the Minnesota local facility are both located at the following address:

5910 Rice Creek Parkway, Suite 100
Saint Paul, MN 55126
Phone: +1 651 693 9449
USA Toll-Free: + 800 477 7411

Fax: +1 651 639 9473
<http://us.anteagroup.com/>

We also have satellite offices located in Alexandria and Annandale, Minnesota.

2.4 Experience with Federal, State, and Local Agencies

Antea Group, and its heritage company Delta Consultants, has experience in working with the MPCA as a multi-site State Contractor for over 20 years. We have held a number of contracts with state and local government agencies and departments including state Superfund, LUST, city redevelopment and county property services contracts. A summarized listing of state contract experience follows:

State of Minnesota Superfund and Petroleum Storage Tank Investigation and Remediation Multi Site Contract

Minnesota Pollution Control Agency and Department of Agriculture

Contact: Ms. Sarah Larsen, Mr. Tom Higgins, and Mr. Eric Pederson

Contract Duration: 2003 through present

Contract Nature:

Antea Group has been providing environmental services for the MPCA under a Multi-Site State Contact since 1988. Our experienced staff utilizes comprehensive experience with the MPCA risk-based remediation program, which includes the Hazardous Substances Remediation Programs (HSRP) which comprises Superfund, Site Assessment, RCRA Cleanup, and the VIC and the Petroleum Remediation Program (PRP).

Our MPCA consulting services include but are not limited to: project management (scope development, schedule, budget and resource management, etc.), generating Work Plans/Sample Analysis Plans, subcontractor coordination and collaboration of multiple contractors and/or stakeholders, bid solicitation, field activity oversight and sampling, communication with government officials (Federal, State and Local), investigation and remedial corrective action activities and technical report preparation.

In addition, based on our close working relationships and comprehensive services, during the Fiscal Year 2013 Antea Group has also managed projects for the Closed Landfill Program, conducted Division Wide Groundwater Policy Review and Development, provided litigation support in enforcement legal proceedings, and continues to prepare 5 year reviews for Superfund projects.

State of Minnesota Superfund – Multi Site II and III Contracts

Minnesota Pollution Control Agency – Site Response Section

Contact: Mr. Dave Douglas, Ms. Jayne Stilwell Lamb

Contract Duration: 1988 through 2003.

Contract Nature:

Focus of contract is to conduct site assessments, remedial investigations and feasibility studies, interim response actions, prepare remedial action plans, remedial action oversight, and long-term operation and maintenance

activities at sites where there has been a release or threatened release of hazardous substances, pollutants, or contaminants. Work is performed for both the MPCA and the Minnesota Department of Agriculture (MDA) at sites regulated under Minnesota Environmental Response and Liability Act (MERLA).

State of Minnesota Tank Release Investigation and Cleanup – Multi Site II and III Contracts

Minnesota Pollution Control Agency – Tank and Spills Section

Contact: Ms. Jayne Stilwell Lamb

Contract Duration: 1991 through 1998.

Contract Nature:

Level of effort contract for petroleum release sites. Most sites orphaned or disputed as to responsible party. Focus on sites with imminent threat to public health or the environment. Services provided include project management; investigation; remediation design, contracting, and installation oversight; operation and maintenance; risk analysis; responsible party designation; and legal support.

State of Minnesota Department of Transportation

Office of Environmental Services

Contact: Alyssa Boock, Hydrogeologist; Michelle Waters, Hydrogeologist

Contract Duration: 2006 through present

Contract Nature:

Antea Group has participated in MnDOT's Consultant Pre-Qualification Program since early 2006 in the Work Types for Contaminated Property Investigations. We have provided Phase I ESA, Phase II Drilling Investigation, Response Action Plan (RAP) Development and Oversight of RAP Implementation during road reconstruction. Most of these projects have involved communications and reporting to either or both of the MPCA VIC or PBP programs and concerns and contaminants include petroleum, VOCs, SVOC, PAH, PCB Pesticides and Metals across a wide spectrum of property uses. Media include soil, groundwater, air and waste. Services also include development of Health and Safety Plans, work zone and work zone perimeter monitoring for protection of workers and the public.

We were more recently approved in the Pre-Qualified Program in early 2012 in MnDOT's Work Type for the highest level of Wetland Services. This work type covers wetland inventories, delineation, and wetland permits required by the Army Corp of Engineers Standard Individual Permits.

A brief outline of the Contaminated Property projects we have performed to-date is shown below:

Antea Group Phase I, Phase II, RAP and RAP Implementation Project List to Date:

Highway 22, St Peter, MN – Phase 1 ESA

Northfield, MN – Phase I ESA / Phase II

Wolverton, MN – Phase I ESA / Phase II

State of Texas

Texas Commission on Environmental Quality (TCEQ) Drinking Water Compliance Sampling program

Contact: James LaManna, TCEQ

Contract Duration: September 1, 2013 through August 31, 2018

Contract Nature:

At the beginning of fiscal year 2005 (September 2004), the TCEQ awarded a state-wide contract to Delta (Antea Group) for the coordination and collection of over 36,000 drinking water quality samples per year on a multiple-year contract. The first contract ran from September 1, 2004 through August 31, 2008. The second contract awarded to Antea Group ran from September 1, 2008 through August 31, 2013. The third contract term is listed in the heading above. We are currently going through the competitive procurement process for the next contract, which will begin on September 1, 2018. The objective of the Drinking Water Sampling Program is to collect entry point, distribution system, and source water samples from TCEQ-selected Public Water Systems (PWS) for compliance with the Safe Drinking Water Act (SDWA). In addition, Antea Group has been responsible for assisting the TCEQ with the collection of Initial Distribution System Evaluation (IDSE) samples since 2006. From January 2008 through December 2020, Antea Group, in close coordination with the Environmental Protection Agency (EPA), Great Lakes Environmental (EPA contractor), and Texas-wide PWSs, has been collecting Unregulated Contaminant Monitoring Regulation (UCMR2, 3, and 4) samples at selected small and large PWSs across the state. Antea Group works closely with the TCEQ in the execution of the drinking water compliance sampling contract.

State of Wyoming

Department of Environmental Quality (DEQ)

Contact: Ms. Karen Halvorsen, P.E.

Contract Duration: Award through work completion

Contract Nature:

The WDEQ Storage Tank Program (STP) has elected to manage all LUST sites directly. The consulting firms (Engineer) are pre-qualified for as-needed Engineering Services through a Statement of Interest which is renewed every five years. As needed, The STP selects three firms from the prequalified list to provide a Technical Proposal/Cost Estimate for the investigation and design phases of potential single or multi-site remediation projects. The WDEQ reviews the submittals and award a contract based upon a ranking that includes the firm's unique qualifications, scope of work approach, project team organization, proposed schedule and costs. The contracts cover the subsurface investigation, remedial action plan, remedial design, preparation of plans and specifications, construction oversight, ground water monitoring, operation and maintenance, and project closeout phases. Antea Group has been providing services to the WDEQ STP since 1994, and currently has projects in Fort Bridger, Rock Springs, Evanston, Kemmerer, Green River, Lander/Hudson, Powell, Sheridan, Buffalo, Cheyenne, Laramie, Platte County, Upper Platte Valley, and Shoshoni/Lysite Wyoming.

In addition, Antea Group manages one project for the WDEQ Voluntary Clean Up Program (VCUP). The Evanston Round House Project in Evanston, Wyoming was awarded through a technical proposal and interview process in

2017. The project includes subsurface investigation, remedial action plan, remedial design, preparation of plans and specifications, construction oversight, ground water monitoring, operation and maintenance, and project closeout phases.

2.5 Knowledge of the MPCA Risk Based Site Evaluation Manual, Underground Storage Tank (UST) and Aboveground Storage Tank (AST) Release Cleanup Guidance and Fact Sheets, Voluntary Investigation and Cleanup (VIC), MERLA, CERCLA, RCRA and NOHSCP and Pertinent State and Federal Regulations

PETROLEUM

Antea Group, formerly known as Delta Consultants, was incorporated in Minnesota in 1986. Since inception, we have adhered to the Minnesota Pollution Control Agency (MPCA) and State petroleum guidance requirements and submitted thousands of reports to the variously-named MPCA petroleum programs utilizing MPCA published report templates. We also understand all applicable definitions stated in Minnesota Statutes § 115C.01 – 115C.13 as well as other statutory regulations that govern the development of the Petroleum Remediation Program. Our extensive variety of clients in which petroleum investigations are performed include the MPCA fund-financed sites, responsible parties and volunteers for petroleum-impacted properties, current or prior property owners, current or past storage tank owners or operators and local or state governments.

We value the MPCA Petroleum Remediation Program (PRP) mission to investigate petroleum releases and to evaluate and remove risks to human health and the environment resulting from those releases. We recognize the PRP priorities of prompt investigation, cleanup, and closure of petroleum tank release sites. Antea Group ensures the investigations, cleanups, and closures are completed in a timely manner without compromising the MPCA mandate to protect human health and the environment.

Antea Group shares the PRP objective in all of our work conducted in the State of Minnesota to ensure clean drinking water supplies, prevention of exposure from petroleum vapors, addressing surface water petroleum impacts, and prevention of dermal contact with contaminated soil. We attempt this by eliminating pathways linking contaminant sources to receptors.

We utilize site management decisions based on existing land use. Where risks to receptors are high, we understand the program works to make the risk low. Where risks to receptors are low, or where a high-risk plume is converted to a low-risk plume (by eliminating pathways linking contaminant sources to receptors), we recognize the program relies on natural attenuation for long-term risk reduction.

The robust MPCA PRP Guidance Documents (GD) provide a structure in which we conduct all petroleum investigative and remedial work in the State. Report submittals are documented utilizing the format of scope-specific activities (example: PRP GD 4-06 Investigation Report Form). In addition, as directed by MPCA Project Managers, PRP Corrective Action GD's are utilized for other State Programs such as Superfund, Brownfields and VIC. We implement risk-based approaches to petroleum-related investigations and corrective action according to risks targeted by the PRP and in accordance with all current PRP GD's.

MERLA

Antea Group understands that the Minnesota State Superfund Program, governed by the Minnesota Environmental Response and Liability Act (MERLA) and the supplementary rules, and the federal superfund program, governed by the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and the federal regulations in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) work together to clean up various types of sites. We have worked extensively in Risk-Based Site Evaluation (RBSE) regulatory programs across the country and are very familiar with the tiered approach to evaluating risk to human health and the environment at sites impacted by hazardous substances.

Working together with the MPCA Superfund and Voluntary Investigation Cleanup (VIC) Programs, we utilize the RBSE tiered process for evaluation of risks to human health and the environment. Exposure pathways to receptors are evaluated separately in the tiered evaluation process, which allows for identification of salient risks via a certain pathway, and elimination of other pathways. Sediment, soil leaching to groundwater, ambient air, groundwater, surface water, and the food chain are exposure pathways recognized and measured in the RBSE process.

Antea Group has worked within MPCA's RBSE system since the program was initiated in the 1990s. We have steered dozens of sites, large and small, through the RBSE process. Antea Group understands the strength of the program centered in the elements of site specificity, clear identification of risk and receptors, defined cleanup goals, and the availability of institutional controls to achieve realistic closure criteria.

We have experience working with each of the two integrated MPCA Brownfield Programs: the Petroleum Brownfields Program under the Petroleum Tank Release Cleanup Act (Minn. Stat. § 115C) and the Voluntary Investigation and Cleanup (VIC) Program under Minnesota's Environmental Response and Liability Act (Minn. Stat. § 115B).

Due to our extensive experience working in the Brownfields and VIC Programs we are familiar with the Land Recycling Act of 1992 to assist with determination of future liability protection when investigation or cleanup actions are voluntarily undertaken. We understand the importance of evaluating existing environmental conditions and development of strategies for brownfields site cleanup that are protective of public health and the environment, economically viable and reflective of the community.

Site investigation and risk evaluation activities on Petroleum Brownfields projects are conducted in accordance with the PRP Guidance Document 1-01 and other applicable PRP guidance documents. The RBSE tiered process for evaluation of risks to human health and the environment and associated reporting is conducted for VIC projects.

The RBSE Manual provides a structure in which we conduct all investigative and remedial work in the State under the Superfund and VIC Programs. The RBSE Manual, and associated individual documents, is utilized to assist in the process of site characterization, community involvement, evaluating the risk to human health and the environment posed at a site, and how to address that risk. In addition, as directed by MPCA Project Managers, PRP Corrective Action Guidance Documents are utilized for certain MERLA State Programs such as Superfund, Brownfields and VIC.

In Minnesota soil and or groundwater cleanup under RCRA Corrective Action is conducted by the Site Remediation Division. Antea Group has demonstrated experience in the two types of sites that are subject to RCRA Corrective

Action (hazardous waste treatment, storage, or disposal facilities and interim status hazardous waste treatment, storage, or disposal facilities). We understand that investigation and cleanup under Minnesota’s RCRA Corrective Action Program is required to be consistent with the MPCA RBSE Process.

Minnesota Department of Agriculture’s AgVIC program is funded through MERLA and is designed to provide rapid response and specific expertise for voluntary actions, including property transfers. The program is specific to the site, and needs of the voluntary party and is the MDA counterpart to MPCA’s VIC program. Partial reimbursement of incurred costs through the Agricultural Chemical Response and Liability Act (ACRRA) is an attractive element of this program.

Agricultural chemical contamination sites not entered into the voluntary program are addressed by the MDA incident program which uses a risk-based approach to determining cleanup requirements. As with the MPCA program, potential contamination pathways and receptors are assessed on a site-specific basis. Cleanup goals are determined by the *potential* threat of contamination at a particular site and given the nature of the COCs, releases can be remediated via passive degradation, assuming there are no threats to potential receptors. MDA prioritizes ag-chem release sites both quantitatively and qualitatively, an approach to remediation that is consistent with the environment and the culture of the agricultural community. EPA’s Hazard Ranking System (HRS) Preliminary Assessment (PA) Scoresheet provides a systematic, but general risk measurement tool for assessing risk for particular exposure pathways. The qualitative approach is implemented by MDA staff which considers other factors such as quantity of products used at the site, period of operations, extent and magnitude of contamination, and the amount and quality of data.

Antea Group is familiar with the MDA published Incident Response Unit Guidance Documents GD-1 through GD-29 which provide a robust framework for the sequential approach for conducting investigations and cleanups associated with agricultural chemicals. Report submittals are documented utilizing the format of scope-specific activities (example: GD-15 Corrective Action Report).

3.0 DESCRIBE TWO REMEDIAL INVESTIGATIONS OR REMEDIAL DESIGNS SPECIFIC TO SOLID WASTE FACILITIES CONDUCTED BY THE PROPOSER

Antea Group has limited recent experience in the State of Minnesota working on Closed Landfills as we have not been working under the closed landfill group program. We have experience working on closed landfills; however, in other state and federal programs. Following are two project examples from work on projects outside Minnesota.

Project Example 1:

Project Name: PICCO Landfill
Client: Hercules (Ashland LLC) PICCO Landfill
Client Contact: Shannon Lloyd
614-790-3148

Site Description:

Project Name & Location:	PICCO Landfill Approximately ½ mile from the Monongahela River Top of Stilley Avenue, Jefferson Borough, PA
Client Contact:	Shannon Lloyd Contact: 614-790-3148
Brief Site Description:	<p>Antea Group currently provides O&M services for a closed CERCLA Landfill in West Elizabeth, Pennsylvania, which is situated along the scenic Monongahela River. The PICCO landfill was a disposal site for wastes generated during the manufacturing process of a hydrocarbon-based resin product for the adhesive and rubber industries. Wastes consisted primarily of clay poly and dechlor cake slurry, but also included organic solvents, resin cakes, filter materials, and oils from the resin manufacturing process. The constituents of concern for the PICCO site include benzene, toluene, ethylbenzene, and xylenes (BTEX) constituents, naphthalene, styrene, and trimethylbenzene constituents. USEPA-Region 3 is the lead regulatory agency for the PICCO site.</p> <p>The PICCO site consists of approximately 25.5 acres with no listed address, and consists mostly of wooded terrain. The landfill area is about 3.5 acres in size and is located at the head of a narrow valley of a former strip mine. The site is surrounded by residential property to the west and north. Drainage features are located on both the north and south edges of the landfill.</p> <p>O&M activities include groundwater sampling from a series of monitoring wells, surface water sampling, operating and maintaining a leachate collection system and onsite treatment facility, treatment system influent and effluent monitoring, cap maintenance, fence line maintenance, and cap mowing.</p>
Tasks that were subcontracted out	Subcontract tasks included; sample (ground water, surface water, system influent and effluent) laboratory analysis, landfill cap mowing and maintenance.
Outcome achieved	Antea Group has been asked to improve a challenging operation at the PICCO Landfill, and help the client avoid system upsets in the current configuration, while a new system is being designed.

Tasks accomplished personnel who performed each task	<ul style="list-style-type: none"> ▪ Project management: Chris Vandegrift ▪ Field activities: Ron Feingold, Paul Girafalco, Owen McKenna ▪ Data evaluation and report preparation: Chris Vandegrift, Shavonne Gordon, Jason Phillips, Don Reeder
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Project Example 2:

Project Name: Limestone Landfill
 Client: Good Year Tire and Rubber
 Client Contact: Mr. Stan Levenger
 330-796-1675

Site Description:

Project Name & Location:	Limestone Landfill Limestone Road Superfund Site Limestone Road off Routh 51, Cumberland, MD
Client Contact:	Stan Levenger Contact: 330-796-1675
Brief Site Description:	<p>The Limestone Landfill site in Cumberland, Allegany County, Maryland consists of two separate parcels of land. Both properties were utilized for the disposal of commercial, residential, and demolition waste throughout the 1960's and 1970's. In 1981, approximately 110 tons of waste sludge containing chromium, lead, and cadmium were illegally dumped on both properties. At the time, area residents were relying on ground water as a drinking water source. A stream which runs by the properties has been shown to contain metals associated with the site. The Limestone Landfill is part of a monitoring program with the USEPA under CERCLA.</p> <p>Antea Group is providing site O&M at the landfill. The O&M efforts consists of facility inspections, annual cap mowing, monitoring well and fence maintenance, routine brush clearing inside and outside the cap fences, and annual reporting. Groundwater and hydraulic monitoring is conducted on an annual basis in support of the Interim Monitoring Program for five monitoring wells.</p>
Tasks that were subcontracted out	Subcontract tasks included; water sample laboratory analysis.
Outcome achieved	Antea Group was recently able to negotiate a reduction in groundwater sampling from annual to bi-annual.

Tasks accomplished personnel who performed each task	<ul style="list-style-type: none"> ▪ Project management: Chris Vandegrift ▪ Field activities: Ron Feingold, Paul Girafalco, Owen McKenna ▪ Data evaluation and report preparation: Chris Vandegrift, Shavonne Gordon, Jason Phillips, Don Reeder
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4.0 SCOPE OF SERVICES

4.1 Design remediation systems and strategies for remediation of subsurface contamination.

Contaminated subsurface media includes, but is not limited to, soil, solid waste, groundwater, methane, and/or other vapor

Antea Group provides comprehensive environmental liability management solutions that utilize well-defined processes, dynamic tools and industry-leading innovation for public and private clients in Minnesota and throughout the USA. From tank system demolition, to incident response and mitigation, to multi-site remediation portfolio fixed cost liability management programs, our multi-disciplined teams apply sound engineering and science, extensive regulatory experience and proven business risk management approaches to meet project goals.

Antea Group has designed and implemented corrective actions to address impacted media that includes ground water, soil, solid wastes and related vapor impacts. Antea Group has worked with the MPCA Petroleum Remediation Program, Site Assessment, Brownfields, Voluntary Investigation and Clean up (VIC), Petroleum Brownfields Program (PVIC) and the Emergency Response group.

The evolution of site remediation techniques has recognized multiple new technologies to mitigate the risk to potential receptors. Antea Group’s approach to remediation of subsurface contamination is to evaluate the source area, contaminants of concern, pathways and receptors in a wholistic approach to design a cost effective response. The remedial action would be designed to protect human receptors and the environment through one or a combination of several of the following approaches; remove or relocate receptors, sever migration pathways between the receptor and source area and source removal. Some of the remediation technologies that Antea Group has applied include;

- Hydraulic plume control through aquifer pumping, treating impacted water and discharging clean water under permit.
- Excavation and removal of impacted soil.
- Soil vapor extraction (SVE) both as a source area treatment and method to mitigate spreading of hydrocarbon related vapors or chlorinated vapors such as TCE.
- Air sparging, bio-sparging to removed dissolve contaminants from groundwater and enhance biodegradation.
- More advanced biodegradation injection technologies including anaerobic reductive dechlorination through injection of emulsified oil products such as Newman Zone.
- In-situ chemical oxidation to adress source areas of both hydrocarbon related contaminants (BTEX),

chlorinated hydrocarbons (TCE, PCE etc) and agricultural herbicides.

- Use of injectable compounds that absorb and immobilize dissolved plumes to prevent downgradient migration.
- Sub-slab depressurization to protect indoor air from vapor intrusion from soil and/or groundwater impacts.

Some recent project examples include:

- Installation of a sub-slab depressurization system at a chemical company facility to mitigate TCE vapor migration into the building.
- Installation of a sub-slab depressurization system at a day-care center to mitigate and protect against TCE vapor migration into the facility.
- Completion of an ISCO injection to address hydrocarbon impacts at a petroleum release site.

4.2 Oversee, design, and/or conduct pilot testing, bench scale testing, field demos and treatability studies of remediation systems or technologies

Antea Group regularly oversees the planning and execution of bench-scale treatability studies and pilot tests. Emphasis is always placed on laboratory selection, practicality of the testing, and use of state-of-the-art methods. Antea Group maintains a list of approved treatability laboratories from coast to coast. Several of the laboratories are specialists in bioremediation, chemical oxidation or reduction, or heating technologies. For bench tests, we strive to develop methods that use a soil to water ratio as close to reality as possible.

Bench scale treatability and pilot tests provide vital information to the design process and optimization of a specific technology, but even more important is their ability to uncover issues that might arise on a larger scale. These issues might preclude the use of the technology all together or might require a strategic change in direction or alteration to a technology.

Typical bench and pilot tests that we oversee will begin with a plan that clearly defines the objective for the test. The number of test conditions is determined and the sample collection size and test vessel size is determined. Methods of analysis are indicated and proper controls are setup along with the various treatment conditions. The duration of testing is established. Bench tests may compare different technologies or multiple conditions within a given technology; field tests most often focus on a single approach or a combination of technologies working in concert.

At the completion of bench or field pilot tests, a report is prepared documenting sample collection, test setup, procedures used, parameters measured, and conclusions/recommendations from the test. Longer term bench tests or field pilot tests may have interim reports that document specific periods of time or sampling events and generally contain similar information as a final report.

At Antea Group >80% of our projects have bench and/or field pilot testing depending on information needed for design, site characteristics, and regulatory/client familiarity and comfort with a technology. When there is high certainty with a technology, our preference is to field pilot test so information can be gathered while a level of treatment occurs.

**Example: Former BP Service Station (Milpitas, CA)
 2011 -2012**

Antea Group contracted with a specialized in situ chemical oxidation lab (JAG/PTS Laboratories) to address a complex buffering issue in high organic content soils at an off-site property where plume migration of gasoline has remained an issue. The site has significant access issues and considerable landscaping that had to be worked around. Initially, a traditional alkaline activated persulfate approach was taken at this off-site property with multiple injections made via direct push. Maintaining a high pH proved to be impossible, even with high doses of sodium hydroxide. Antea Group oversaw the development of the test method and discussed field observations and objectives for the test. Antea Group performed QA/QC on the data generated from the testing as well as all associate analysis from an analytical lab supporting the project. Antea Group led all technical discussions on the testing program. This test evaluated the total oxidant demand (TOD) and the oxidant persistence during chemical oxidation treatment using stabilized hydrogen peroxide activated sodium persulfate, an approach that does not require high pH. Antea Group discussed results and subsequent report content with the lab that showed the stabilized hydrogen peroxide activated persulfate could not maintain an acidic pH and did not perform well on the TPH-gasoline present. A high oxidant demand was determined and additional groundwater tests showed high iron and alkalinity much greater than had been observed at the site before. This testing led to a discussion of new alternatives for the site and possibly could support a determination of technical impracticability.

4.3 Prepare corrective action design documents (e.g., CAD design reports, pilot test reports, installation notification reports, monitoring reports, plans, and as-built reports).

Antea Group prepares all reports for submittal to the MPCA in accordance with MPCA Guidance Documents, particularly the corrective action Guidance Documents 7-01 through 7-10. Antea Group has conducted over 2,500 corrective actions, including the preparation and evaluation of corrective action design documents including CAD design reports, pilot test reports, installation notification reports, monitoring reports, plans and as-built reports for more than 500 remedial systems on both Superfund and petroleum sites. Antea Group has prepared and evaluated corrective action design documents on over 150 systems in Minnesota. Antea Group's St. Paul office and Iowa office specialize in corrective action design and remediation systems and have a wealth of remediation technology experience. That experience is leveraged throughout the country and abroad and we are frequently called upon by our sister divisions and Inogen partners for support.

Antea Group also utilizes our internal Engineering Assurance Process (EAP) for every site that proceeds past a site assessment phase. The EAP requires that the project team include a registered engineer and geologist to review relevant plans and reports as well as the project objectives, schedule and projected costs. The technical reviewers are usually not part of the project team to allow for an unbiased review of the project plan. The EAP requires that the project team technical reviewers sign off on their review and approval to proceed to the next phase of the project. This Antea Group process provides assurance that the appropriate level of technical expertise is provided to each of our projects, this includes the regulatory required registered professional's participation on the project. These assurances allow us to effectively manage the risks at these sites for our clients and ourselves.

The contaminants of concern at these corrective action sites included petroleum hydrocarbons, chlorinated solvents, pesticides, herbicides, fertilizers, landfill leachate, heavy metals, wood treatment chemicals, mineral spirits, perchlorate, and sodium chlorate. These projects have ranged in size from small systems with a skimmer pump in one well to large multi-acre sites utilizing the following corrective actions:

- Air sparging (AS)
- Soil vapor extraction (SVE)
- Vacuum Enhanced Total Fluids Extraction
- Excavation
- Pump and treat
- Steam injection
- Dual phase extraction
- Enhanced fluid recovery
- Reactive barriers
- Chemical oxidation
- Bioremediation
- Chemical reduction
- Surfactant flushing
- Phytoremediation
- Monitored Natural Attenuation

Antea Group has prepared numerous corrective action designs that address remediation of soil, groundwater, and free phase product. Using the MPCA CAD approval process flow chart (MPCA PRP GD 7-01), a determination is made for the need of interim corrective action. If needed and following site investigation a final corrective action decision is presented. The project team evaluates if this action is a “simple” or “complex” action. If the corrective action is “complex”, a focused investigation might be needed, then pilot testing of the selected remedy is completed. If the pilot testing confirms the effectiveness of the remedy, then final corrective action design can begin.

Once a final remedy is selected, a detailed corrective action design report is prepared which includes the following (in accordance with Guidance Document 7-07a): site conceptual model update, detailed corrective action design overview, target zone identification and description, remediation and monitoring points, system equipment, process flow and system controls, process material chemistry (sampling locations), water generation handling and disposal, installation activities, operation strategy and performance objectives, operation monitoring plan, data evaluation and cost-effectiveness evaluation.

Antea Group staff, under the direct supervision of a licensed professional engineer, complete all corrective action design document preparation and reporting. Antea Group’s senior remediation team has extensive experience in both traditional and innovative corrective actions. A senior engineer who is experienced in the remedy being applied reviews every CAD-related report that Antea Group produces.

Antea Group’s corrective action experience includes:

**Example: HB Fuller – Sorocaba, Brazil
2011 to present**

Antea Group, is currently working in Brazil, to investigate and remediate two soil and groundwater plumes impacted with carbon tetrachloride and chloroform at a water based and hot melt adhesives manufacturing facility. The regulatory body in Brazil, CETESB, has requested an ongoing framework of reports that allows them to understand key aspects of the project at specific times. The types of reports that were prepared include:

- A Site Investigation report that includes methods, results shown in tables/figures, and a 3D model of the site impacts that can be further updated as remediation was implemented. Antea Group contracted with a specialized data management firm in the US to establish and update the model.
- A Health Risk Assessment Report documenting potential receptors and evaluating risk across the site using models and calculations required by CETESB in their regulations.
- Groundwater monitoring reports are prepared on a semi-annual basis and include methods used and tables/figures showing results. Over 100 on-site and off-site wells are gauged, field parameters measured, and samples collected and sent for analysis during each event.
- A report of a 180-day pilot test of in situ chemical reduction was prepared and included the description of the technology, the test plan, and test objectives. A pilot test design layout was prepared for the report and data collected at baseline, 30, 60, 90, and 180 days post-injection was tabulated and presented on figures. A discussion of the injection process and amendment mixing was included. Results of the monitoring were discussed and recommendations for a path forward were made.
- A Remedial Action Summary Report was prepared that included discussion on all site work involving soil removal by excavation and injection of chemical reductant spanning a one year period. The report also discussed civil works completed as part of site restoration. The report included waste inventories and figures/photos documenting locations and activities in each phase of work.

Antea Group has previously designed and installed remediation systems at two MPCA fund-financed sites, Clark Oil and Isanti-Schumacher. The Clark Oil site had an AS/SVE system. The Isanti-Schumacher site had a SVE system. The following MPCA corrective action design documents have been prepared for both remediation systems;

- PRP Guidance Document 7-05 Pilot Test Work Plan
- PRP Guidance Document 7-06 Pilot Test Report
- PRP Guidance Document 7-08 Remediation System Operation Monitoring (RSOM) Report
- PRP Guidance Document 7-02 Conceptual Corrective Action Design Report
- Additionally, the Air Emissions Screening Spreadsheet (7-09b) was utilized to evaluate the air discharge requirements.

These systems operated until remedial effectiveness reached asymptotic recovery levels and have since been decommissioned. Monitoring following system decommissioning determined that minimal rebound to groundwater concentrations in the source areas and downgradient had occurred. Based on the results of operation of these systems these sites have since been closed.

4.4 Prepare Health and Safety Plans (HASPs).

The Health and Safety Plan (HASP) is a document designed to describe the hazards that may be encountered during the course of fieldwork and specifies protective equipment, work procedures, and emergency information, including emergency phone numbers and the route to the nearest hospital. Antea Group's HASP is designed to meet hazard communication requirements and employee emergency preparedness requirements for Antea Group employees performing work at a variety of commercial, industrial, and environmental work sites. Completion and use of this plan is essential for the protection of personnel working in hazardous environments. The HASP addresses site specific hazards and tasks and is consistent with the requirements of U.S. Environmental Protection Agency (EPA) Occupational Health and Safety Manual and all applicable State and federal rules and regulations as warranted.

Antea Group prepares site specific HASPs for all Antea Group projects. Fieldwork cannot begin on an Antea Group project until the HASP is written, reviewed and approved. Antea Group's Site Health and Safety Assessments and Plans program outlines the procedures and responsibilities for completing and implementing the HASP on-site. The site project manager is responsible for ensuring that the HASP is written for the site. Project managers are accountable for the approval process of all HASPs. Health and Safety Specialists support the project managers in the development of the HASP.

Antea Group's site specific HASP include, but are not limited to, the following: identification of the site safety officer (on-site Antea Group personnel responsible for reviewing the HASP with all members of the field crew, including Antea Group employees and subcontractors and any visitor(s) on-site); planned site activities and associated hazards; local emergency telephone numbers and driving directions and map to the local hospital; emergency contacts; evacuation route and meeting location; site characterization information; general facility description; regulatory contacts; waste characterization information; remediation system information, when applicable; hazard evaluation data; personal protection and monitoring equipment guidelines and; safety standard operating procedures.

Each Antea Group team member, subcontractor employee and visitor(s) must review, sign and date the HASP before they can commence work at the project site. A signature on the HASP denotes that an individual will comply with all safety procedures outlined in the plan. The HASP is kept in the field for the duration of the project and returned to the project file upon completion of field activities. The HASP is updated whenever new hazards and control practices are identified, new project team members begin working on the project, or the scope-of-work changes. At a minimum, the HASP is reviewed annually by the project manager to verify that the plan content remains appropriate for the planned activities.

As presented in the site-specific HASP, all field crew members, including Antea Group staff and subcontractors, working in the contamination zone or who may be exposed during the course of the work are required to have completed the OSHA 40-hour HAZWOPER and annual refresher training (29 CFR 1910.120), CPR training, and First Aid training.

4.5 Oversee site investigation services for soil boring advancement, and monitoring well installation using both standard drilling methods, and direct push methods.

Antea Group has completed hundreds of remedial investigations for various clients in Minnesota utilizing conventional drilling methods and/or push probes. These investigations include Superfund, Resource Conservation and Recovery Act (RCRA), and petroleum sites. Antea Group has worked with the MPCA Petroleum Remediation Program, Site Assessment, Brownfields, Voluntary Investigation and Cleanup (VIC), Petroleum Brownfields Program (formerly VPIC), and Emergency Response during these investigations.

Site investigations typically utilize push probe, hollow stem auger, air/mud rotary, and rotosonic drilling methods, as appropriate, and depending on site conditions. Prior to conducting a subsurface investigation, Antea Group reviews geologic maps and local well logs to evaluate site hydrogeologic conditions. Conditions that influence drilling method selection include soil type, depth to bedrock, and the projected vertical extent of the soil and groundwater impacts. Based on the various site conditions and the project objectives, an appropriate drilling method is selected. In many situations, Antea Group utilizes both push probe and conventional drilling technologies in conjunction during the investigation phase. The push probe is typically utilized to delineate the horizontal and vertical extent of soil, soil vapor and groundwater impacts prior to installing permanent monitoring wells or permanent vapor sampling points. Utilizing this approach, monitoring wells and vapor sampling points can be optimally positioned to monitor plume migration, groundwater quality trends and soil vapor conditions, thus minimizing project costs associated with unnecessary monitoring wells or poorly placed wells and sampling points. Likewise, when drilling in bedrock, Antea Group often utilizes packer tests to identify preferential fracture flow pathways in an effort to position open hole wells optimally for efficient delineation of impacts. During subsurface investigations, Antea Group's geologists carefully log soil conditions and screen for the presence of contaminants using photoionization detectors equipped with appropriate ionization potential bulbs. Antea Group also utilizes the MPCA risk-based guidance for selecting the appropriate drilling methodology.

During investigations in southeastern Minnesota, Antea Group evaluates the potential that karst conditions may be present and conducts the investigation to appropriately address the situation. Multi-level sampling bedrock wells may need to be installed to evaluate multiple potential fracture pathways.

Antea Group is proficient utilizing direct sensing Geoprobe™ technologies: laser induced fluorescence (LIF), membrane interface probe (MIP), and soil conductivity results for completing site investigations. LIF directly senses free product in the soil and groundwater while MIP can directly sense volatile organic compounds in the soil and groundwater. Soil conductivity probes are used to measure soil conductivity for determination of soil lithology and potential preferential flow pathways.

Antea Group does not own drilling or push probe equipment, which promotes competitive bidding and provides the best service for our clients. Antea Group utilizes Minnesota Department of Health licensed well drillers for the installation of push probes, soil borings, and monitoring and recovery wells. Following installation, all wells are surveyed to a common datum to determine site coordinates and the elevation of the top of casing.

**Example: Former Gasoline Station
Two Harbors, Minnesota**

Antea Group utilized previously obtained data to determine appropriate locations to place monitoring wells to monitor a groundwater plume originating from two separate source areas at a former gasoline station which had been converted to a residential building. Prior to installation, each monitoring well location was investigated utilizing direct push methods for stratigraphy and sampling purposes. Monitoring wells were then installed utilizing hollow stem auger methods at each location. Following analysis of data collected during the well installation, Antea Group completed further investigation utilizing MIP technologies to define the extent of petroleum saturated soil and direct push methods to further define the extent of soil, soil vapor and groundwater impacts.

Upon completion of defining the extent and magnitude of petroleum saturated soil and dissolved phase impacts, Antea Group completed an excavation of the two separate source areas where approximately 863 tons of petroleum saturated soil was removed and transported off-site for disposal. During the excavation activities Antea Group discovered the presence of a previously unknown drain tile extending from one of the source areas to the area of a nearby wetland. The backfill of the drain tile was observed to be petroleum saturated and the drain tile and backfill was excavated to the extent feasible to the approximate edge of the wetland. Following the completion of the excavation Antea Group installed two additional monitoring wells utilizing hollow stem auger techniques to monitor the success of the excavation.

Following excavation Antea Group conducted further investigation of the drain tile within the wetland utilizing direct push methods. The results of the push probe investigation indicated that additional investigation within the wetland was not necessary and impacts were defined near the remaining drain tile. Following confirmation groundwater sampling and delineation of the drain tile area Antea Group achieved regulatory closure for this site.

This site demonstrates Antea Group's capability of utilizing push probes, traditional drilling techniques and advanced technology for investigation, remedial design and corrective action to achieve remedial goals.

**Example: Crude Oil Pipe Line Leak
Tioga, North Dakota**

Antea Group was contracted by an integrated oil company to provide emergency response oversight, remediation strategies and implementation oversight to a pipeline release of approximately 800,000 gallons of Bakken crude oil. The release occurred on a geographic high point resulting in oil spreading in multiple directions.

Antea Group provided immediate response to investigate the vertical and horizontal extent of crude oil impacts and develop an interim remedy. Antea Group provided initial delineation of the release area by advancing more than 125 direct push probes and installing groundwater monitoring wells using hollow stem auger. The interim remedy included installation of a network of oil collection trenches and vertical recovery points. The interim remedy provided a rapid transition from emergency response to remedial investigation and corrective action.

Antea Group developed a remedial investigation strategy employing multiple investigation techniques including: direct push probes and real-time laser induced fluorescence (LIF) evaluation to quickly provide the information required it aid in the development of the site remedial strategy. Real time site updates to the entire project team

during the LIF investigation reduced cost, number of probes advanced and provided the client with continuous updates.

The site remedy selected was remediation by excavation and onsite exsitu thermal desorption. During the excavation, several high permeability zones were encountered where oil had migrated away from the main body of impacted soil. To integrate this information into a more refined site conceptual model additional investigations were proposed. Additional investigation included rotosonic borings and passive soil gas sampling to identify discrete sand lenses where migration of crude had occurred.

Routine three-dimensional modeling and data visualization incorporating data collected from probes, LIF, sonic borings and excavation data provided an ongoing understanding of remedial progress and provide a budget planning tool for the ongoing remediation.

The comprehensive site investigation and remediation strategy development has provided the client with a comprehensive understanding of the site with respect to the extent, magnitude and transport mechanisms of the crude oil release.

The remedial treatment at the site is ongoing. Antea Group continues to work with the client, remediation contractors, regulatory agencies and property owners to reduce costs while working to restore the property to its original use.

Antea Group worked with the client and remedial contractors to reduce costs by continuous evaluation of remediation technologies, excavation methods and screening protocols.

Fate and transport modeling performed by Antea Group has also assisted in negotiation of a site-specific cleanup goals for the project.

Antea Groups rapid response provided project continuity through all phases of the project and provides a solid basis for the client's site management decision.

4.6 Conduct ground water, soil, surface water, sediment, and air sampling and monitoring.

Antea Group has extensive experience sampling multiple media types inclusive of groundwater, soil, surface water, sediment and air and associated ongoing monitoring as appropriate. Antea Group's field staff receives extensive training and carefully follows MPCA guidelines when collecting groundwater, soil, surface water, sediment, and air samples. Proper collection of samples is important to ensure the accuracy of the results. The following provide an overview of our various sampling qualifications.

Groundwater Sampling

Antea Group has successfully completed a wide range of groundwater sampling projects involving volatile organic compounds (VOCs), pesticides/herbicides, metals, semi-volatile organic compounds (SVOCs), inorganics, polychlorinated biphenyl's (PCBs), polynuclear aromatic hydrocarbons (PAHs), and many types of petroleum contaminants. Antea Group has experience sampling groundwater through direct-push sampling equipment, monitoring wells, domestic wells, industrial wells, and municipal wells.

Groundwater sample collection is often performed during push probe advancement or after monitoring wells have been installed, developed, and allowed to equilibrate with the ambient aquifer conditions. While groundwater sampling is performed from push probes, the results are not reproducible and consequently are used only for screening purposes. Groundwater samples are often also collected from water supply wells to assess potential impacts to human health and to further evaluate the extent of contamination extending over a regional area. Based on the suspected sources and site operational history, a list of contaminants of concern (COC) is identified and used to determine the appropriate Data Quality Objectives (DQO) and prepare a Quality Assurance Project Plan (QAPP). Once the DQO and QAPP are in place, a site sampling plan is prepared which details the sampling sequence, sample nomenclature, stabilization criteria, analytical sample requirements, QA/QC sampling requirements, and chain of custody protocol.

A typical approach to groundwater monitoring includes allowing the monitoring wells to equilibrate prior to initial groundwater sample collection. Antea Group would then mobilize to the site to perform the following activities: 1) measure water and product elevations; 2) purge each monitoring well until the groundwater is stabilized for pH, specific conductance, dissolved oxygen, oxidation-reduction potential, and temperature and; 3) collect groundwater sample(s) in appropriate laboratory grade glassware. The MPCA guidance provides specific methods for groundwater sampling and the preference for different methods. Additionally, Antea Group utilizes low flow sampling procedures following appropriate EPA guidance where project goals require low flow sampling. Low flow stabilization data is logged electronically and transferred to the project file following each sampling event. The highest quality samples are collected by purging with a bladder pump, using a flow through cell to determine when a well is stabilized and collecting a discrete sample using a clean bailer pump. Groundwater samples are collected in the appropriate sample bottles, preserved and shipped to a pre-qualified laboratory for analysis. During each monitoring event, all groundwater conditions are recorded on field sampling forms. The data collected is entered into a project database for data storage and use in evaluating data trends.

Antea Group has extensive experience collecting groundwater samples for field or laboratory analysis for inorganic parameters for evaluation of natural attenuation of dissolved phase chlorinated solvent and petroleum plumes. Antea Group has all the necessary equipment to collect groundwater samples and perform the appropriate field analysis.

Soil Sampling

Antea Group has conducted many soil sampling activities at a wide variety of sites. Our experience includes soil sampling for VOCs, SVOCs, PAHs, metals, PCP, pesticides/herbicides, nitrate/nitrite/ammonia, DDT, PCBs, and petroleum compounds. Antea Group has experience collecting samples using a wide variety of compositing techniques. For subsurface sampling, we have experience collecting samples using hand augers, direct-push drill rigs, hollow-stem auger rigs, sonic drilling methods, coring machines, and other sampling equipment. We have conducted soil sampling in excavations and designed detailed confirmation sampling plans. In addition, Antea Group has experience collecting samples and obtaining laboratory results for grain size analysis, permeability, porosity, total organic carbon, and bulk density to evaluate the physical parameters of the soil and its characteristics for contaminant transport.

Antea Group also has experience collecting soil analytical and lithology data through direct measurement technology including membrane interphase probe (MIP) for VOC detection and laser induced fluorescence (LIF) for free phase petroleum. Both MIP and LIF technologies are advanced with electric conductivity sensors which are able to provide data to determine lithology during direct sensing investigations.

Air Sampling

Antea Group has conducted numerous Vapor Intrusion Assessments (VIA) involving indoor air sampling. Indoor air samples are generally collected using Summa® canisters with 24 hour regulators concurrently with ambient (outdoor) air samples. The Summa® canisters can be analyzed for a wide variety of contaminants, but most often for VOCs utilizing United States Environmental Protection Agency (EPA) Method TO-15. Prior to collection of indoor air samples Antea Group performs a *Vapor Intrusion Interior Building Survey* following MPCA best management practice (BMP). During the air monitoring activities, Antea Group personnel will document the following:

- Building foundation type and integrity;
- Number and location of windows, outdoor air exchangers, or other air intakes;
- Building use and population, including identification of sensitive populations, disadvantaged populations, and potential exposure pathways;
- Building heating, water heating, and air venting components
- Potential sources located within buildings which may interfere with sample integrity;
- Any requests made to building occupants to limit potential sample interference;
- Any actions taken to limit potential interference (i.e. sealing doors to attached garages, removing gasoline or paint cans from buildings),
- Potential off-site sources of contaminants, including ambient outdoor and indoor emission sources.

Air quality is also monitored when remediation systems such as a soil vapor extraction (SVE) system are discharging vapors directly into the atmosphere. Emission rates for each compound detected are calculated and compared to the significant emission rate (SER) or other applicable discharge criteria, to assure that vapor discharges are not exceeding established limits. On all its sites with air emissions, Antea Group generally collects air bag samples for laboratory analysis to monitor air quality, but may use Summa® cans depending upon site analytical requirements.

Sub-Slab Air Sampling

Sub-Slab air sampling is conducted following MPCA BMP for vapor intrusion investigations and include: Installing the appropriate number of vapor sampling ports depending on the building use and size of the building footprint; performing water dam leak tests, shut in testing to ensure sample train integrity, use of individually certified Summa® canisters, and; collection of micromanometer readings to gauge pressure differential between the indoor and sub-slab air. Shut in testing is performed by affixing valves and a gauge to the sample train following protocols in the MPCA VIA BMP. After shut in test connections are made a vacuum of approximately 30 inches of mercury is applied to the sample train and is held for five minutes to ensure that leaks in the sample train are not present.

Sub-Slab samples are submitted for laboratory analysis by EPA method TO-15 for compounds on the Minnesota soil gas list and THC. Results of sub slab samples are compared to the MPCA intrusion screening values (ISV) and/or the

appropriate MPCA soil gas value based on building use (occupants) and building and/or slab condition, as appropriate.

Subsurface Air Sampling

Subsurface air sampling is conducted following MPCA Guidance Document 4-01a. The depths of the probes are determined by the proximity to buildings with basements. Soil gas probes are advanced either utilizing direct push technology or manual methods to the required depth. Each sampling point is fitted with new/unused polyethylene inert tubing and purged a minimum of three volumes via a graduated syringe. An in-line moisture trap is installed prior to obtaining each air sample. One soil vapor sample is collected from each soil vapor intrusion probe and submitted for laboratory analysis utilizing EPA method TO-15 (full scan) for compounds in the Minnesota Soil Gas List and THC. Each soil vapor sample is accompanied by a PID scan from the sampling depth.

Air samples are collected by attaching the top of inert tubing to a Summa[®] canister. The air samples are monitored via a vacuum gauge to evaluate the length of time to collect each sample and to assure that canisters retain vacuum after the sample collection. After obtaining the sample, the Summa[®] canister valve is closed. The inert tubing is then connected to a portable PID to record the relative volatile organic content of the sample. The PID measurement is recorded on the chain-of-custody form. Each form records the following information: project name and location, project number, shipped by, shipped to, sampling point and location, field identification number, sample depth, vacuum of the Summa[®] canister, date and time collected, sample type, number of containers, analysis required and the sampler's signature. Following sampling, each probe is abandoned utilizing a bentonite grout in accordance with MDH guidelines.

Where previously observed soil gas sampling laboratory analytical results indicate elevated petroleum constituents, Antea Group has installed permanent vapor sampling points either in areas surrounding the site or within the buildings in which vapor intrusion presents a risk in accordance with MPCA Guidance Document 4-01a.

Example: Former Dry Cleaning Facility Farmington, Minnesota

Previous investigations have identified the suspected source of the groundwater impacts as a former dry-cleaning facility located in a commercial area of the city. The contaminant of concern associated with the site is tetrachloroethene, or PCE. Groundwater monitoring has indicated a plume extending from the area of the former dry-cleaning facility through a residential area towards a small river.

Groundwater monitoring for this site is conducted utilizing low flow sampling techniques which involve minimal draw down of the water column in the well during purging and collecting stabilization parameters through a flow cell to determine when water from the formation is being removed from the well. Groundwater conditions at the site have improved to the point where Antea Group has been able to reduce the sampling schedule and to remove wells from the groundwater monitoring network.

Previously granular activated carbon (GAC) treatment systems were installed at two residences with impacted potable supply wells. Based on concentration detections below laboratory method detection limits the GAC system at one of the properties has been removed. Additional monitoring of multiple private groundwater wells where low

concentrations have been present historically is also conducted. Analytical data indicates that groundwater with concentrations exceeding regulatory action levels is not being used for drinking water.

Antea Group has also conducted additional source area investigations for evaluation of a potential continuous source area. Antea Group conducted a passive soil vapor survey which deployed 23 passive soil vapor samplers to identify the relative location of the highest VOC impacts near the release site property. Passive soil gas surveys provide a qualitative analysis of subsurface conditions which compare contaminant mass absorbed by the sampler over a set time period to neighboring samplers in place over the same time period. By utilizing passive soil vapor samplers Antea Group was able to determine approximate locations of two “hot spot” areas where the most contaminant mass was observed and was able to develop an investigation strategy for these areas.

The developed investigation plan included investigation through direct sensing technology utilizing a MIP/EC to identify the vertical extent of contaminant distribution in the two “hot spot” areas. Following the MIP/EC advancement a probe was advanced to collect soil and groundwater from the interval demonstrating the highest MIP response for confirmation and evaluation of the MIP data collected. Continuous soil samples were also collected from the probe to verify lithology observed by the EC sensor. Direct sensor and soil probe data collected indicated that any potential source remaining was limited in extent and potentially confined to below the foot print of the on-site building.

Vapor intrusion pathways related to the PCE release have also been evaluated at the on-site building. Sub-slab soil gas samples have been collected on multiple occasions indicating the presence of soil gas concentrations in excess of 33 times the vapor intrusion screening value (ISV). Follow up indoor air sampling and inspection of an air exchanger installed within the building indicated there were no VOC concentrations above the MPCA ISV within the building and that the air exchanger was functioning properly to continuously circulate air throughout the building. Additional investigation regarding vapor intrusion was conducted throughout the footprint of the groundwater plume. Sub surface investigation was conducted in city and county right-of-way (ROW) to define the extent and magnitude of the vapor plume associated with impacted groundwater downgradient of the site. Antea Group advanced 28 soil gas probes within public ROW to evaluate whether additional receptor specific investigation was needed. Upon evaluation of data collected from the soil gas probes it was determined that additional receptor specific sampling was necessary.

Antea Group completed observation of an EPA investigation of receptor specific sub-slab and indoor air sampling at approximately 23 individual properties in March 2015. EPA later followed up with sampling from an additional 11 properties in June 2015. Based on results of their sampling, EPA determined that a completed vapor intrusion pathway was not present at any of the homes within the groundwater plume footprint. Private supply well sampling and groundwater monitoring activities for this site are ongoing.

4.7 Conduct vapor/air monitoring for health and safety and air quality criteria.

Prior to the start of field work, Antea Group performs a health and safety risk assessment of the project site and the work to be performed to understand what hazards workers and the general public may face during the duration of

the project. Antea Group uses the information learned from the risk assessment to prepare a Site Health and Safety Plan (HASP) to outline the potential hazards and the actions to be taken to mitigate them.

Vapor/air monitoring is an important part of Antea Group's HASP as inhalation of airborne contaminants of concern (COCs) is often a primary exposure pathway for site workers. Prior to site mobilization, the project personnel evaluate the potential COC so that the proper monitoring/sampling equipment and site control measures are selected. Knowing both the potential types of contaminants and their potential concentrations are critical to understanding how to protect workers. From this, a site-specific air monitoring plan is developed within the HASP to outline the appropriate number and location of monitoring/sampling points, the types of monitoring/sampling equipment, and parameters to monitor or sample for.

Antea Group performs air quality monitoring and sampling to continuously evaluate air quality at environmental investigation and remediation sites. Air monitoring can be conducted with photoionization detectors (PIDs), organic vapor monitors, explosimeters (multi-gas meters), personal air quality monitoring devices and detector tubes, depending on the potential contaminants of concern (COCs) at the site. Air samples are collected in the field via sampling pumps or monitoring badges; samples can be collected in air bags, charcoal sampling tubes, passive badges or Summa canisters. These samples are analyzed by a laboratory to identify specific compounds and evaluate exposure criteria.

Antea Group uses the American Conference of Governmental Industrial Hygienists ACGIH Threshold Limit Values TLVs for determining safe air quality levels and protective action levels when controls must be implemented. In the absence of ACGIH values, the most stringent applicable regulatory values are used (e.g. OSHA permissible exposure levels).

Antea Group follows the hierarchy of first trying to eliminate hazardous air conditions via engineering controls (e.g. dust suppression or ventilation). If the hazard cannot be eliminated, Antea Group implements administrative controls (e.g. site control/exclusion zones, stop work criteria) and/or uses personal protective equipment (e.g. Level C or B PPE) to protect workers from potential exposures.

Air quality is also monitored when remediation systems such as a soil vapor extraction (SVE) system are discharging vapors directly into the atmosphere. Emission rates for each compound listed are calculated and compared to the Significant Emission Rates (SER) or other applicable discharge criteria, to assure that the vapor discharges are not exceeding the established limits. On all sites with air emissions, Antea Group collects samples for laboratory analysis to monitor air quality.

4.8 Conduct and/or oversee site evaluation/assessment activities (Phase I and Phase II), limited site investigations and remedial investigations.

Phase I Environmental Site Assessments

Antea Group staff performs more than 100 Phase I Environmental Site Assessments (ESA) each year. Many of these are done in conjunction with large industrial sector merger and acquisition activities occurring across North America and worldwide. At a minimum, the objective of the Phase I ESA is to identify recognized environmental conditions

associated with a property according to the (ASTM) International E 1527-13 *Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process*. A typical ATSM E 1527-13 standard scope of work would include:

▪ **Task 1 – Review Existing Subject Property Information**

This task is intended to identify past property use and activities that may be relevant in identifying potential environmental risks associated with the subject properties. The records review would at a minimum include the following searches:

- Review of available historical data which reflect property and surrounding property use which may include but are not limited to, the following items: aerial photographs, Sanborn fire insurance maps, plat maps, topographic maps and city directories.
- Review of available, pertinent state, county, and city governmental agency records which may include, but are not limited to: fire department, municipal planning/zoning office, building department, county/local environmental health departments, tax assessor.
- Review of available, site-specific geology and hydrogeology, published regional geologic and hydrogeologic information and water well records.
- Inquiry with the EPA, the MPCA, or county departments for locations of abandoned and existing solid and hazardous waste landfills.
- Inquiry with EPA, state, and appropriate local bodies for the existence of recorded past or pending enforcement actions against the subject property, compliance status of the subject property, and spill notification reports involving the subject property.
- Review of commercially available public databases concerning permit applications or issued permits and inspection reports concerning hazardous waste activities, waste water discharges; and underground storage tank registration at the subject and surrounding properties.
- Review of facility operational records to identify materials used during operations, documentation of spills and cleanup, citations, and other pertinent forms. The site contact must provide these documents or arrange for Antea Group representatives to have access to them.

▪ **Task 2 – Subject Property Reconnaissance**

Prior to conducting a subject property visit, a Health and Safety Plan would be prepared. The subject property reconnaissance would include a visual survey of the accessible areas of the subject property. Adjoining land use would be surveyed from the subject property. Antea Group employee's familiar with applicable regulations and standard environmental assessment procedures would conduct the subject property reconnaissance.

The subject property reconnaissance will include the following activities:

- Interview with the current and past site employees and owner concerning historical and current uses of the subject property.
- Review of design drawings, as-built drawings, and subject property surveys (when available) for septic systems, underground storage tanks, storm drains, and drains leading to municipal sewers.
- Visual observations of the subject property for evidence of historic and present use that may contribute to environmental risks. Observe conditions that suggest a past or potential release of hazardous substances (i.e. stressed vegetation or soil staining) and note any chemical use, storage, treatment, or disposal practices occurring on site.

- Visual identification of equipment and structures that are commonly known to contain polychlorinated biphenyls (PCBs) including electrical and hydraulic equipment.
- Observation and description of current land uses on adjoining properties to assess potential environmental impacts to the subject property. A subject property location map would be included in the final report.
- Photograph current subject property activities.
- Preparation of site diagram.
- If requested Antea Group will conduct or coordinate, visual identification of potential asbestos-containing building materials, evaluate for presence of radon, sample for lead based paint, wetland delineation, evaluate regulatory compliance, evaluate site ecological resources, evaluate the site for endangered species, evaluate site indoor air quality, evaluate the site for cultural and historical resources, evaluate site health and safety practices and industrial hygiene.

▪ **Task 3 - Prepare Phase I ESA Report**

Following review of the existing subject property information and subject property visit, Antea Group would prepare a Phase I ESA Report. The report would contain a discussion of the subject property with associated appendices. Antea Group would provide the client with requested hard copy reports along with an electronic version of the report. The report would address the following items:

- Scope-of-work for the Phase I ESA
- Discussion of the subject property reconnaissance. A summary of information gathered from the records review including past and present subject property owners/operators; interviews; and reasonably attainable Federal, State, and local records involving the subject property
- A summary of all potential environmental risks discovered during the assessment. A qualitative evaluation of the potential environmental liabilities associated with the subject property

In addition to performing Phase I ESA in accordance to ASTM 1527 E, Antea Group has conducted many ESAs in accordance with guidance for brownfield redevelopment projects (Guidance Document #8, Phase 1 Investigation). For certain Phase I's conducted in Minnesota, if required or requested, Antea Group has experience with utilizing ASTM 1527 E Phase I standards and augmenting them as applicable (i.e. review of Minnesota Department Transportation files, review of Minnesota Department of Natural Resources observation well monitoring network data, review of historic land appraisals, review of corporate reports and newspaper searches etc.). Antea Group's Phase I ESA experience includes but is not limited to: multi-site manufacturing facilities worldwide, dry cleaners, battery manufacturing facilities, gasoline stations, refineries, petroleum repackaging facilities, petrochemical manufacturing and bulk storage facilities, petroleum terminals and pipelines, scrap metal yards, residential lawn care and chemical manufacturing companies, bulk storage agricultural chemical facilities, shingle manufacturing facilities, industrial dry cleaning/laundry facilities, food processing facilities, photograph development and processing facilities, bulk storage liquid feed facilities, specialty metal plating facilities, foundries, ore processing facilities, high rise office buildings, paper and cardboard manufacturing facilities, paper industry sawmills, landfills, offset and lithographic printing facilities, commercial properties, and agricultural properties.

Phase II Environmental Site Assessments

Performing Phase I and II ESAs are primary services in Antea Group's Transaction Support Practice. The majority of our Phase I ESAs are performed in accordance with the current ASTM 1527-13 Standard. We are tracking the updates already approved by ASTM that are anticipated to be approved later this year by EPA, and formalized as ASTM 1527-13. Our staff have applied the ASTM Standard 2600-15 for *Vapor Encroachment Screening on Property Involved in Real Estate Transactions*. We use the ASTM-1527 and all appropriate inquiry (AAI) protocols in researching the often long history of developed use in areas where industrial activities take place.

Antea Group has an experienced team, specializing in due diligence, project management and meeting client expectations. The majority of Antea Group's team members are qualified as environmental professionals under the United States Environmental Protection Agency's (US EPA's) All Appropriate Inquiry (AAI) definition. Since our inception in 1986, environmental due diligence has been a core practice area of Antea Group. Antea Group staff participated on the American Society of Testing and Materials (ASTM) committee that promulgated the Phase I Environmental Site Assessment (ESA) standards in 1992, 2000 and 2005, and Antea Group staff has conducted thousands of Phase I ESAs in accordance with these standards. Antea Group has also developed alternative due diligence methods where Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) protection is not sought, and assessed properties for additional criteria such as sensitive receptors, hazardous building materials, radon, vapor intrusion and earthquake and fault zones. In order to provide more reliable estimates of environmental liabilities (costs) on contaminated properties, Antea Group has developed sophisticated probabilistic cost modeling practices following ASTM-E2137. We have worked with public and private organizations through all of the contaminated property asset lifecycles from Phase I historic use assessments through remediation and redevelopment.

Of the hundred plus Phase I ESA Antea Group conducts each year, approximately 30 percent require Phase II Environmental Site Assessments. The purpose of the Phase II ESA is typically to; a) verify the presence of soil and groundwater impacts resulting from spills or the potential of spills or releases of hazardous substances on the subject property, b) identify source areas and chemicals of concern, c) identify potential receptors and migration pathways, d) determine horizontal and vertical extent of release(s) and, e) collect sufficient data necessary to propose a corrective action if necessary.

Prior to initiating subsurface activities, and if not already previously done, Antea Group would evaluate the subject property history to determine locations of chemical handling, locations of historic spills, etc. In addition, Antea Group would prepare, if requested to do so, a Phase II Investigation work plan in accordance with applicable portions of the State's Risk Base Site Evaluation manual (i.e. Site Characterization and Sampling Document and Risk Based Site Evaluation Checklist).

Antea Group has successfully completed Phase II ESA investigations across Minnesota, the United States and the World. Like their Phase I ESA counterparts, Antea Group has completed Phase II ESA on a wide variety of properties, from retail petroleum facilities, chemical manufacturing facilities, bulk chemical agricultural facilities and industrial laundry/dry cleaning facilities, etc. Antea Group has professional staff knowledgeable in the following skill areas that are commonly called upon when conducting a Phase II ESA.

- Oversight of soil boring and test pits
- Logging of soil and rock core borings
- Soil sample collection from, hand auger, direct push soil borings, hollow stem auger and roto sonic borings
- Groundwater sample collection from groundwater monitoring wells and soil borings
- Collection of surface water and sediment samples
- Oversight and documentation of groundwater monitoring well installations and abandonments
- Monitoring well development and surveying
- Conducting vapor surveys
- Conducting groundwater and surface water surveys
- Hydrogeologic evaluations (i.e. rising and falling head slug tests, steady state and step pump tests)
- Data evaluations (comparison of data to soil leaching values, soil residual values etc.)
- Analytical data validation
- Report preparation

Limited Site Investigations

Antea Group conducts Limited Site Investigations (LSI) to evaluate the extent and magnitude of a known release and evaluate potential risk to nearby receptors. Antea Group conducts LSI in accordance with all applicable MPCA guidance documents, including:

- 4-01 Soil and Groundwater Assessments Performed during Site Investigations (c-prp4-01)
- 4-01a Vapor Intrusion Assessments Performed during Site Investigations (c-prp4-01a)
 - Vapor Intrusion Interior Building Survey Form
- 4-01c Intrusion Screening Values (c-prp4-01c)
- 4-02 Risk evaluation and site management decision at petroleum release sites (c-prp4-02)
- 4-04 Soil Sample Collection and Analysis Procedures (c-prp4-04)
- 4-05 Groundwater sample collection and analysis procedures (c-prp4-05)
- 4-06 Investigation Report (c-prp4-06)
- 4-09 Groundwater investigations in Karst areas (c-prp4-09)
- Assessment of sensitive groundwater conditions (c-prp4-18)
- Investigation Requirements for Ethanol-blended Fuel Releases

Prior to initiating subsurface activities, and if not already previously done Antea Group evaluates the subject property history, to determine locations of chemical handling, locations of historic spills, etc. In addition, Antea Group prepares, if requested to do so, an Investigation work plan in accordance with applicable client requirements or state guidance.

Antea Group has successfully completed limited site investigations across Minnesota, the United States and the World. Antea Group has completed LSI on a wide variety of properties, from retail petroleum facilities, chemical manufacturing facilities, bulk chemical agricultural facilities and industrial laundry/dry cleaning facilities, etc. Antea Group has professional staff knowledgeable in the following skill areas that are commonly called upon when conducting a LSI.

- Oversight of soil boring and test pits
- Logging of soil and rock core borings
- Soil sample collection from, hand auger, direct push soil borings, hollow stem auger and rotasonic borings
- Groundwater sample collection from groundwater monitoring wells and soil borings
- Collection of surface water and sediment samples
- Oversight and documentation of groundwater monitoring well installations and abandonments
- Monitoring well development and surveying
- Conducting vapor surveys
- Conducting groundwater and surface water surveys
- Hydrogeologic evaluations (i.e. rising and falling head slug tests, steady state and step pump tests)
- Data evaluations (comparison of data to soil leaching values, soil residual values etc.)
- Analytical data validation
- Report preparation

Antea Group's approach to site investigations is to determine if there are any immediate impacts to potential receptors and evaluate site conditions to determine if impacts at the release site could result in completed receptor pathways. If completed receptor pathways are present or if there is unacceptable risk based on site conditions Antea Group will address any immediate receptor exposure and continue to evaluate the site by performing a Remedial investigation.

Remedial Investigations

Antea Group has 30+ years of proven experience achieving site incident closures by providing sustainable strategies for soil and groundwater remediation challenges. We have designed, specified, installed, operated and decommissioned thousands of remedial solutions for automotive, chemical, energy, manufacturing, mining, pharmaceutical and transportation sector clients. We are considered a leader in petroleum, chlorinated solvents, pesticides and metals remediation due to our comprehensive understanding of industry operations, client-dedicated project teams, local regulatory knowledge and cost-effective, yet technically innovative solutions.

Our site investigation and remediation professionals utilize a project management framework that provides consistency and quality assurance to facilitate the most applicable and effective technology to meet project-specific goals.

- Appraise – Assess the extent of impact and evaluate the potential receptors and pathways to define risk

- Select – Identify the best remedial technology options based on site conditions, cost, risk, likelihood of success, and alignment with asset management objectives
- Define – Complete the design and define the scope of the remedial strategy
- Execute – Implement the remedial strategy with efficiency and safety
- Operate – Eliminate the risk and monitor technology performance

Setting us apart from our competitors, we adhere to a formal engineering assurance process that ensures a consistent level of engineering competence to each remediation project, provides audit and review structure, and reduces potential for engineering error. Antea Group strives to maintain best in class relationships with all key stakeholders in the permitting and regulatory review process allowing us to advance projects quickly and cost effectively through both formal submittals and informal meetings and site visits.

Antea Group performs remedial investigations in accordance with applicable MPCA Guidance Documents depending on the specific site conditions and site management decisions.

4.9 Prepare Conduct surface water, ground water, air and vapor receptor surveys.

Antea Group completes surface water, groundwater and vapor receptor surveys to evaluate potential receptors and risk at sites in accordance with MPCA Guidance Document 4-02 *Risk Evaluation and Site Management Decision at Petroleum Release Sites* and Guidance Document 2-07 *Petroleum Release Notification Follow Up*.

Surface Water Survey

Antea Group completes surface water receptor surveys by identifying all water bodies within ¼ mile of the release site. Surface waters are identified utilizing aerial photography, United States Geological Survey (USGS) topographical maps and a 500-foot walking survey. Other features that may be less visible on aerial photographs and maps (ditches, drain tiles, storm sewers, etc.) are also identified during the 500-foot walking survey. Results of surface water surveys are reported by developing a detailed scaled map and table which identifies the location of the surface water feature and distance and direction from the release site.

Surface water survey results are utilized to develop sampling locations, sampling plans, evaluate risk to nearby surface waters based on geologic conditions and to develop recommendations for additional investigation or corrective action.

Groundwater Receptor Survey

Antea Group performs groundwater receptor surveys to identify water wells near a release site that may be at risk due to contaminant impacts. Additional information regarding geology and groundwater use near the site is also evaluated during a groundwater receptor survey. The following tasks are completed during a groundwater receptor survey:

- a) A walking survey is conducted consisting of:
 - a. A base map illustrating property boundaries and relevant features such as buildings, roads, rivers, etc. within 500 feet of the source and a corresponding table is generated. The table generated includes:
 - Whether the property has a water supply well;

- Connection to public water supply, and confirmation with the local municipality;
 - How was the information obtained (visual observation, personal contact, returned postcard);
 - Presence of basements
 - Presence of sumps,
 - Presence of possible petroleum or contaminant sources on site;
 - And comments specific to a property.
- b. Contacting residents, property owners, tenants, business owners, and other stakeholders within 500 feet of the source to determine whether water wells basements or sumps exist on each property. Contact is first attempted in person, followed by leaving a stamped self-addressed questionnaire, brief letter or postcard or by telephone. Letters, postcards and questionnaires include questions which correspond with items listed above, a brief explanation that the purpose of the request is to evaluate risk to nearby water wells and properties, and a statement that if no reply is received in a set time period it will be assumed that there are no wells, basements or sumps at the property.
- c. Identifying and documenting the location of wells on the properties within the survey area.
- d. Identifying and documenting the location of subsurface structures, such as basements, utilities, manholes and catch basins within the survey area, manholes, catch basins and other utility access points are screened for vapor intrusion criteria during a walking survey.
- e. Identifying and documenting the location of obvious surface water features such as creeks, rivers, ponds and lakes within the survey area.
- f. Identifying and documenting the location of possible petroleum or other contaminant release sources, such as underground storage tanks, above ground storage tanks, etc. within the survey area.
- b) Public Water Supply Confirmation
- a. A list of all properties within the survey area is submitted to the city utility billing department to confirm the status of water supply to those addresses.
- c) Well Records Search and review
- a. The Minnesota Department of Health county well index is accessed to obtain well construction records.
- b. Municipalities are contacted to determine location and construction of municipal wells within ¼ mile of the release site, where applicable.
- d) Assessment of Sensitive Groundwater Conditions
- a. Sensitive groundwater assessments are completed following MPCA Guidance Document c-prp4-18 and include:
- Determining whether the site is located within a protected area of a public water supply; if so
 - Determining if the site is within a shallow bedrock area
 - Determining if a sole-source aquifer is present
 - Determining if the site is located within an area with a shallow sand and gravel aquifer.
- b. If any of the sensitive groundwater conditions are present Antea Group
- Assesses risk to the public water supply aquifer, and;
 - Reports findings of the public water supply risk assessment and follow necessary appropriate and actions.

Completion of an air and vapor receptor survey

Antea Group completes vapor receptor surveys by identifying the location and type of nearby potential vapor receptors and vapor migration pathways within 500 feet of a source. Potential vapor receptors include basements,

crawl spaces, sanitary and storm sewers, utility conduits and other subsurface structures where contaminant vapors could accumulate. Backfill of buried utility structures can provide preferential flow paths for vapors to migrate or accumulate. Following MPCA GD 4-02, utility manholes, catch basins and access points are screened with a photoionization detector and four-gas meter (hydrogen sulfide, methane [LEL], oxygen and carbon monoxide), and mapped during the 500-foot walking survey. Utility owners are also contacted for information as part of a vapor receptor survey to obtain utility construction information including:

- Utility material;
- Depth;
- Elevation;
- Liquid flow direction;
- Condition

Occupants of potentially impacted buildings are contacted during the 500-foot walking survey to determine whether they have noticed odors within their buildings. Potential vapor receptors and migration pathways within 500 feet are mapped and reported in MPCA Guidance Document 4-06 *Investigation Report Form*.

In addition to the above-mentioned screenings as part of MPCA Guidance Document 4-02, Antea Group conducts water line intrusion screening when necessary.

4.10 Arrange for transportation, storage, and proper management of wastes.

In its 30+ years in business, Antea Group has been involved in hundreds of projects involving the sampling, characterization, removal, transportation, storage, and disposal of waste. This experience is as varied as it is numerous and allows Antea Group to provide its clients with a comprehensive suite of waste handling services. These services include:

- *Waste Sampling* – Antea Group maintains staff knowledgeable in the sampling of liquid and solid waste.
- *Waste Characterization* – Antea Group can determine if a waste is non-hazardous waste, hazardous waste, special waste, or a universal waste. This may involve evaluating the origin of a waste to determine if it is a Resource Conservation and Recovery Act (RCRA) listed hazardous waste. TCLP testing may also be necessary to determine if the waste exhibits one or more of the characteristics of a hazardous waste (toxicity, ignitability, corrosivity, and/or reactivity). Antea Group prides itself in helping its clients meet their goals of waste reduction, and is continually evaluating options for reuse, recycling, or remanufacturing of waste products (i.e., thin spreading of agricultural chemical impacted soils at an appropriate application rate, thus eliminating need for land filling and preserving landfill space).
- *Waste Removal* – Antea Group has overseen the removal of wastes by properly trained, licensed, and reputable subcontractors and maintains contact with those subcontractors that are located throughout the state and country. If the situation warrants, Antea Group will prepare emergency response or contingency plans to address any spills or releases that may occur during waste removal.
- *Waste Transportation* – Antea Group can coordinate and oversee the proper transportation of waste. This may include ensuring containers are sturdy, leak-proof, and have no material defects; containers have a Hazardous Materials (HM) designation (DOT packaging specification) that is appropriate for the hazards of

the waste being stored and shipped; containers are appropriately sized; and if the contents are hazardous waste and it has not already been done, Antea Group will apply a hazardous waste label on the storage containers that identifies general information about the facility (name, address, EPA ID#, and the EPA waste number), type of waste, DOT shipping name of waste, and start date for waste accumulation. Antea Group will also assure, and properly label containers with non-hazardous waste contents that identify, name of waste, name and address of facility and start date for waste accumulation. In addition, Antea Group can ensure that shipping papers and waste manifests are accurately and consistently completed.

- *Storage and Disposal* – If a material cannot be reused, recycled, or remanufactured, the waste will be shipped to a reputable treatment, storage and disposal (TSD) facility that is previously agreed to by the client. Antea Group shall ensure that the generator obtains the generator copies of the waste manifests and assurances of proper disposal or recycling offered by the TSD or recycling facility.

**Example: Former ConocoPhillips Refinery
 Wrenshall, Minnesota**

The Wrenshall Products Terminal is located on property formerly occupied by a petroleum products refinery located in Wrenshall, Minnesota. The property is currently maintained and operated as a petroleum pipeline terminal, including several aboveground storage tanks, refined petroleum product lines and a truck loading rack. Antea Group's completed remedial efforts were part of the overall response actions being undertaken at the site.

The east-central portion of the facility contained a holding basin which consisted of a shallow, water-filled impoundment underlain by between four to six feet of petroleum-impacted sediment. The sediment was underlain by varying thicknesses of petroleum-impacted soil. The surface of the impoundment lies approximately 20-25 feet below surrounding grade and is surrounded by steep slopes.

A Technical Specification Document was prepared to provide Contractors a basis for submitting a proposal to perform the treatment, excavation, hauling, and disposal of approximately 15,000 cubic yards of sediment and soil impacted with petroleum hydrocarbons and metals. The primary focus of the work was to eliminate all visually-impacted sediment within the holding basin through stabilization/treatment followed by excavation and offsite disposal. In addition, a similar quantity of underlying petroleum-impacted soil was to be excavated, stockpiled, and either land-applied within one of two on-site land treatment areas, or processed for offsite disposal.

The scope of work consisted of the following:

- Site Preparation;
- Pond Dewatering and Stormwater Management;
- Excavate and Stockpile Clean Land Treated Backfill Material;
- Treat, Excavate, Stockpile, Load, Transport and Dispose of Impacted Sediment;
- Excavate, Stockpile, Load, Transport and Dispose of Petroleum-Impacted Soil;
- Furnish, Place and Compact Clean Backfill;
- Tilling of Land Treatment Areas;
- Site Restoration, Cleanup and Demobilization.

As proposed in the supplemental remedial action plan, the impacted sediment and soil was mixed in place during the excavation activities utilizing dried Portland cement mix as a reduction agent for the elevated lead levels in order to pass paint filter testing for approval for landfill disposal.

Due to the surface of the impoundment lying approximately 20-25 feet below surrounding grade, which was surrounded by steep slopes, a staging area for loading the excavated material was necessary for transport to the landfill. A pre-existing landfarm on-site was utilized to stage the excavated material and subsequent loading and transportation to the landfill.

**Example: Retention Pond
 Eddyville, IA**

In 2015, a chemical plant in Iowa experienced a release of hydrochloric acid into their on-site retention pond. This dropped the pH of the pond to about 2.0. Antea Group oversaw the neutralization of the pond water and its transportation off site for treatment. Approximately 3.2 million gallons of pond water was neutralized and transported for offsite disposal as non-hazardous waste. After the acid-impacted water was removed, Antea Group sampled sediment from the wet pond bottom and soil from the edges of the pond to determine the extent of impacts and for waste characterization purposes. Approximately 18 cubic yards of sediment from the pond was filter pressed and containerized and transported to an approved landfill for disposal as non-hazardous special waste.

4.11 Evaluate the need for and oversee the implementation of alternative drinking water supply, including point-of-use treatment (i.e. filtration).

Antea Group has evaluated groundwater impacts based on human exposure and use standards such as the Maximum Contaminant Level (MCL) established by the EPA and the Health Risk Limit (HRL) established by the Minnesota Department of Health (MDH) for hundreds of release sites in Minnesota. Antea Group has experience evaluating alternative drinking water options for sites where drinking water has been impacted or is imminently threatened by the release of petroleum related compounds, chlorinated volatile organic compounds and other contaminant threats to drinking water.

In an emergency situation, a bottled water service can be initiated until a more cost effective and long-term alternative can be selected. For short-term needs, an alternative temporary water supply (large tanks connected to a buildings plumbing service) or point of entry treatment is identified to provide affected residents with clean drinking water. For long-term needs, an alternative analysis is conducted to determine the best method for obtaining a clean water supply. Alternatives typically analyzed include wellhead treatment (i.e. activated carbon treatment), installation of a new residential, municipal or rural supply well or purchasing water from another source with an adequate supply.

**Example: Pipeline Release
Suburban Milwaukee, Wisconsin**

As part of an emergency response to a release of gasoline, Antea Group evaluated and provided oversight to arrange for alternative temporary drinking water supplies for approximately 70 residential properties in response to a “Flush Only” water use restriction issued near the release. Temporary water supplies included installation of approximately 10 large holding tanks for residential and agricultural purposes which were connected to the plumbing of the residential building and bottled water service for affected residences. As part of the response to the release Antea Group evaluated available data and provided oversight for installation of point-of-entry carbon treatment systems at approximately 70 residential properties, including those with temporary water supplies, in order to protect drinking water, use at properties which had been affected by or in the immediate vicinity of the contaminant release.

**Example: Former Gas Station
Bradford, Minnesota**

During quarterly monitoring a release at a former gas station was found to be impacting a downgradient residential water supply well above drinking water standards. At the time that elevated impacts were discovered Antea Group arranged for a bottled water delivery service to provide the residential property with a temporary water supply. Additional investigation at the site property and the downgradient residential property indicated that groundwater impacts were limited to the upper aquifer which is separated from a deeper, unimpacted, groundwater zone by clay till.

Based on the results of the additional investigation, Antea Group installed a new drinking water supply well at the impacted downgradient property and at the site property to provide a long-term water supply for these properties. The new drinking water wells were installed with a protective casing set into the clay till to isolate the intake of the new well in the deeper groundwater. The installation and protective construction of the new supply wells provides a long-term protective solution to the residential properties.

4.12 Coordinate and cooperate with other State-contracted services such as sampling and analytical, emergency response contactors, and hazardous waste services.

In managing and coordinating project activities on literally hundreds of projects, Antea Group’s St. Paul project team understands the importance of communicating and working with a variety of subcontractors, other vendors contracted directly by our clients and other state contractors. Antea Group staff work with the state-contracted laboratories on a daily basis and we are fully aware of the emergency response, hazardous waste and drilling firms under contract to the State of Minnesota. We will work with the MPCA/MDA project managers and other state contractors, as necessary or requested, to achieve the project objectives in a safe, timely, and cost-effective manner. It is our goal to provide seamless delivery of all services to the MPCA/MDA staff by coordinating and cooperating with the subcontractors, and vendors.

Our staff is also well experienced in working with other regulatory agencies and multiple other environmental service providers contracted by others on large complex projects. Recent examples include lead emergency response

management consultant on multiple pipeline releases in the region (e.g. Tesoro Pipeline release near Tioga North Dakota) and as a Health and Safety and Environmental Sampling oversight consultant on the Deepwater Horizon response team in the Gulf of Mexico.

4.13 Oversee subcontractors and state contractors during investigation, cleanups, and construction activities.

Antea Group has extensive experience in providing oversight of State contractors. Prior to overseeing work, we ensure that all subcontracted personnel that will be conducting work on site has completed the required and appropriate health and safety training in accordance with all OSHA requirements and any other applicable laws. Verification of certificates of completion are reviewed for accuracy and assurance that all field personnel training is in compliance.

Antea Group prepares health and safety plans (HASP) as part of pre-field work preparation. All Antea Group and subcontractor personnel are required to adhere to the Antea Group HASP. In the event Antea Group staff are working with contractors that have been hired by other entities, a robust communication plan is formulated that involves all of the project stakeholders. It is Antea Group's corporate policy that in the event any unsafe act or condition is identified during any work-related activity, all site personnel are authorized to issue stop work authority. If stop work authority is issued, the Antea Group Project Manager immediately notifies the client Project Manager.

As a current Multi-Site Contractor, we have comprehensive experience utilizing the MPCA Contractor and Subcontracting Purchasing Manual (purchasing manual) and adhering to all requirements of the manual. In accordance with the MPCA purchasing manual, Antea Group first determines if there is a State Contract available for the required subcontractor work. If a State Contract is not available, Antea Group secures a subcontractor following the requirements of the purchasing manual.

**Example: Former Bradford Garage
 Bradford, Minnesota**

Volatile organic compounds (VOC), specifically benzene and 1,2-dichloroethane (1,2-DCA), were historically detected in a private water supply well located on the east-adjointing downgradient property. This well supplied water to the residence, which was also a multi-tenant living space, and to a small office building on the property.

Due to the VOC present in the off-site private well, and the potential for impacts from the site to both the on-site commercial workshop and residential wells, all three wells were replaced with two deeper water supply wells (one on each property) and appropriate supply connections. By providing replacement wells constructed utilizing methods to case off the impacted aquifers, both residences were provided with acceptable alternative water supplies, thus eliminating the receptors and risk associated with site impacts.

Antea Group provided field oversight of the boring advancements for both supply wells that were advanced to a depth of 105 feet below grade surface (bgs) via rotosonic techniques coupled with advancement of outer protective casings to prevent vertical migration of contamination from the shallow aquifer.

Oversight activities consisted of observing installation of the replacement wells and piping for connection of the new on-site well to the residence and on-site workshop via directional drilling techniques. The piping for connecting the new off-site well to the residence was connected utilizing an extension to existing water supply piping from the former supply well via traditional trenching. Antea Group also oversaw the final electrical and all associated well connections to the new well.

4.14 Prepare and evaluate reports (e.g., investigation reports, monitoring reports, free product recovery reports).

Antea Group prepares all reports for submittal to the MPCA in accordance with MPCA Guidance Documents and the Petroleum Remediation Program General Policies. In addition, other reports (e.g. National Pollutant Discharge Elimination System (NPDES) Reports) are prepared and submitted in accordance with State and Federal requirements. The list of MPCA Guidance Documents Antea Group has prepared and submitted to the MPCA include, but are not limited to, the following:

- 1-03a Spatial Data Collection at Petroleum Remediation Sites
- 2-03 Light Non-Aqueous Phase Liquid Recovery Report
- 2-05 Release Information Worksheet
- 3-02 General Excavation Report Worksheet
- 3-02a Corrective Action Excavation Report Worksheet
- 4-06 Investigation Report Form
- 4-08 Monitoring Report
- 7-02 Conceptual Corrective Action Design Report
- 7-03 Focused Investigation Work Plan
- 7-04 Focused Investigation Report
- 7-05 Pilot Test Work Plan
- 7-06 Pilot Test Report
- 7-07a Remediation System Detailed Corrective Action Design Report
- 7-07b Excavation Detailed Corrective Action Design Report (EDCAD)
- 7-08 Remediation System Operation Monitoring Report (RSOM)

SUPERFUND:

Antea Group prepares all reports for submittal to the MPCA in accordance with MPCA Guidance and Policies of the Superfund Program. The documents are prepared and submitted in accordance with State and Federal requirements relating to releases to the environment under the Minnesota Environmental Release and Liability Act (MERLA). For certain sites in which corrective action is taking place, and as requested by the MPCA Project Manager, reports utilizing the PRP Corrective Action Guidance Documents 7-01 through 7-10 are submitted as appropriate.

When appropriate, Antea Group includes items related to vapor intrusion BMP in our reports where vapor investigation of individual properties and mitigation has occurred. Items related to VI BMP include:

- Vapor Intrusion Building Survey Form
- Vapor Intrusion Maps on the MBP Vapor Intrusion Map Templates
- Pre-Mitigation Diagnostic Checklist
- Active Mitigation System Installation Checklist
- Post-Mitigation Diagnostic Checklist
- Post-Mitigation Confirmation Sampling Checklist
- Property Summary Report

4.15 Evaluate invoices and data reports.

During every billing cycle, Antea Group's corporate accounting department provides Project Managers with prebilling analysis reports (PBR's) for every project. The PBR's provide an itemization of all costs (labor, expense, subcontractor charges, etc.) specific to each project during that billing cycle. The PBR's also contain summaries for each site-specific task including the current fee, previously billed amount, remaining budget available to bill, and budget balance. The PBR's are reviewed for accuracy and changes made as applicable prior to the issuance of a final invoice to the client. Budget spreadsheets are completed each month for each project to assure all projects are being completed in a cost-effective manner. Both the schedule and budget are updated monthly and compared with the project's projected percent completion to evaluate budget and resource capacity.

All subcontractor (example: drilling or laboratory services) and expenses (example: vehicle mileage or per diem costs) billed to a project are reviewed by the Project Manager prior to processing. Subcontractor invoices are referenced to proposals and cost itemizations provided by the subcontractors prior to completing the work.

Invoices are submitted to a client on a monthly basis for work completed during the prior month, unless no costs were incurred during that billing cycle. Documentation itemized on the submitted invoices include, but are not limited to, the following: Contractor name, work order/project/contract number, invoice number and date, invoicing period, itemized list of work performed and associated labor rates and staff classifications, supplies and equipment utilized, itemized expenses and associated backup documentation/receipts (example: hotel receipts), subcontractor invoices and associated backup documentation, budget status reports and an update of tasks completed for the submitted invoice.

We discuss evaluation of data reports in further detail in section 17 of this scope of services document.

4.16 Collect and manage field and laboratory data for electronic submittal in a format specified by the MPCA.

For more than 10 years, Antea Group has employed EarthSoft's Environmental Quality Information System (EQiS) database to store, report, and export field and laboratory analytical data for over 30 facilities in Minnesota. Antea Group's project teams populate field data collection forms, or electronic data deliverables (EDDs), using a data

collection device or manually once back in the office for importing into EQUIS. Once the project team completes the data collection, they submit the EDDs to Antea Group's Capture, Analyze, Visualize electronically (CAVe) team. The CAVe team reviews the in EQUIS Data Processor (EDP), if there are no errors the data is loaded into EQUIS. Laboratories submit analytical result EDDs to the CAVe team who then review the EDD in EDP and if there are no errors, load the data into EQUIS.

Antea Group has extensive experience managing data deliverables in formats specified by the MPCA, from Excel table formats to electronic databases. Utilizing EQUIS's EDP, the CAVe team has created both field and analytical EDDs for submission to the MPCA.

Examples:

MPCA SW Fridley Site: Antea Group received gauging and analytical data from participating facility operators in various formats. The Antea Group CAVe team compiled the data provided by the various responsible parties and loaded into Antea Group's EQUIS database. Antea Group provided EDDs to the MPCA for loading into the MPCA's instance of EQUIS.

Farmington Site: Antea Group participated in the MPCA's EDGE Pilot Program to record and submit field sampling information and generate chains of custody (COCs) in the MNCOC format. Staff populated field and analytical data into the MPCA's customized EDGE product and submitted the resultant field EDD to the MPCA. During this pilot program Antea Group provided feedback and evaluation of the MPCA EDGE users guide and evaluated processes to prevent double entry of data between the MPCA required format and Antea Groups database format.

4.17 Evaluate data quality and prepare data verification reports.

Data Quality Assurance/Quality Control (QA/QC) is assessed for all Antea Group projects in accordance with MPCA Guidance Documents 4-04 and 4-05. In addition, Antea Group reviews QA/QC issues reported by various laboratories in their reports.

Trip blanks and equipment blanks are used to evaluate potential cross contamination from sampling events. Duplicate samples are reviewed to check for sampling and analytical reproducibility.

Precision of laboratory data is assessed by comparing analytical results between matrix spike/matrix spike duplicates (MS/MSD), laboratory control sample/laboratory control sample duplicates (LCS/LCSD), and masked field duplicate samples.

Accuracy of laboratory data is assessed by reviewing the percent recoveries for surrogate samples, MS/MSD, LCS/LCSD and comparing them to the limits present within the laboratory report.

Laboratory precision and accuracy criteria are published in each laboratory report and used as the final acceptance criteria during review.

In addition, all laboratory reports are evaluated for:

- Completeness - a measure of the amount of valid data received compared to the amount expected to be received.
- Representativeness – a measure of the degree to which data accurately and precisely represents site conditions.

- Comparability – a measure of confidence with which one set of data can be compared to another.
- Sensitivity – a measure of the methodology’s and laboratory instrumentation to meet or exceed the associated screening levels.

4.18 Arrange for site access.

Antea Group staff routinely deals with the need for accessing site properties, or properties surrounding the site, for completion of various investigation activities. The properties may be privately owned, owned by the local municipality, the State, the Federal government, or on Reservation Property which exercises independent, sovereign, regulatory authority within its boundaries. Antea Group has negotiated property access at all levels of ownership and our staff has become astute at early identification of problematic issues.

A variety of access issues have been successfully dealt with by Antea Group staff, including: performance bonds, MNDOT right-of-way agreements, railroad access agreements (including associated insurance requirements, safety training, etc.), remote ownership and third-party agreements, multiple party agreements, data sharing agreements, and coordination of property purchase.

Antea Group has assisted the MPCA with obtaining access agreements through a variety of measures for State fund-financed projects. We have participated in and assisted MPCA Project Leaders through the process of utilizing the Minnesota Attorney General’s Office on multiple site projects in order to obtain access. These activities included preparation and review of affidavits, meetings with property owners, MPCA Project Leaders and the Attorney General assigned to the project. We have participated in Court Orders from the beginning through obtaining the final agreement which were conducted in order to obtain site access.

**Example: Clover Valley Store
 Two Harbors, Minnesota**

Antea Group, on behalf of the MPCA, conducted site investigation activities which included the installation of four groundwater monitoring wells on site, completion of one quarterly groundwater monitoring sampling event of the well network, sampling of the potable well located on-site and the off-site potable wells located south and west of the site, soil vapor intrusion assessment and sampling of a drainage ditch, due to observed product sheen, located immediately adjacent to the southeastern site property boundary. In addition, due to product sheen observed on the surface water in the ditch located immediately adjacent to the southeastern site property boundary and elevated dissolved phase hydrocarbons detected, Antea Group conducted additional investigation utilizing laser induced fluorescence (LIF) to evaluate the vertical and horizontal extent of free product at the site.

Based on the limited delineation of the downgradient extent of the plume it was possible that groundwater impacts discharged to surface waters in both the unnamed wetland and the surface water found within the ditch located south and east of the site. Soil, groundwater and surface water data indicated petroleum impacts adjacent to the off-site property may be present at concentrations exceeding regulatory action levels and the downgradient extent of these impacts were undefined due to the denial of access to the off-site property.

Antea Group personnel worked with the MPCA Assistant Attorney General and the MPCA Project Leader to prepare an Affidavit for the State of Minnesota District Court, County of St. Louis, Sixth Judicial District, to assist in obtaining off-site access. Antea Group participated in a judicial hearing with the Attorney General, MPCA Project Leader and the site property owners in which an Administrative Inspection Order was issued granting site access.

4.19 Coordinate utility locates by contracting the appropriate entity and, if applicable, coordinate traffic control.

The first task conducted by Antea Group at any site in Minnesota where intrusive work is to be performed is to contact Gopher One Call and a private utility locator (if necessary) to mark all public and private subsurface utilities. In the event that traffic control is necessary, traffic control plans which conform to MnDOT and/or City/County right-of-way requirements are prepared and followed. Antea Group also references the Field Manual of MnDOT Minnesota Manual on Uniform Traffic Control Devices which describes temporary traffic control (TTC) standards. The goal of a TTC zone is to provide safe and efficient movement of traffic around a location where normal function of the roadway is temporarily suspended due to assessment and or corrective action activities. Prior to commencing work on any public road right-of-way permission is obtained from the governing road authority who approves the TTC plan prior to implementation.

**Example: Utility Backfill Investigation
New Ulm, Minnesota**

As part of a site assessment Antea Group investigated potential preferential flow pathways within subsurface utility backfill utilizing hydrovacuum and air knife techniques to expose various utility lines and collect backfill and groundwater samples. Antea Group first contacted the City of New Ulm to verify that the investigation was to be conducted within City right-of-way and to verify the depths and type of utilities present. Due to the investigation being conducted on a truck route located near a residential neighborhood the city requested a more extensive detour be utilized to limit truck traffic through neighborhood streets (for safety and street weight limit purposes).

Due to the nature of the utility investigation work Antea Group requested through Gopher One Call that a utility meet be scheduled so that locators and utility owners were aware of the nature of the work and provide accurate utility mark outs. The traffic control and utility mark out procedures implemented by Antea Group resulted in investigation goals being met safely.

4.20 Coordinate Prepare and evaluate bid documents (e.g., plans and specifications), suitable for advertisement for bids, including but not limited to, landfill cover systems, remediation systems, landfill gas systems and erosion repair projects. All plans shall comply with the rules and requirements of the Minnesota Department of Administration and the MPCA.

To provide cost effective solutions for complex remedial actions, frequently prepares and evaluates bid specifications for remedial activities including remediation of soil, groundwater and free phase product. Antea Group utilizes a process which organizes and integrates data collected during site investigations, results of feasibility and treatability studies, pilot tests and risk assessments to provide an alternative analysis and/or focused feasibility study. Alternatives analysis and focused feasibility studies also evaluate Applicable and Relevant and Appropriate Requirements (ARAR) for the site against remedial options in order assure that the designed remedy will meet the regulatory standards and clean up objectives.

Once a remedy is selected, a comprehensive remedial action design is prepared detailing the technical design, installation schedule and projected costs to remediate the site. Based on the design, Antea Group prepares a detailed specification and bidding package, which is submitted to qualified bidders for solicitation of bids. The bid specifications detail applicable codes or permitting, site health and safety, schedule, change order, insurance, contract and/or performance issues the subcontractor must follow. Antea Group provides a specific scope of work in the bid package to ensure there is no uncertainty as to the subcontractor's responsibilities. After the receipt of bids, a contractor is selected to conduct the specified work based on cost, qualifications and the ability to meet the project schedule.

Where applicable, a senior engineer who is experienced with the technology utilized in the designed corrective action reviews every design and specification package developed by Antea Group. When applicable, a licensed professional engineer supervises Antea Group staff preparation of bid packages involving remedial technology design services.

As a Multi-Site Contractor with the MPCA Antea Group is proficient at completing bid specifications and procuring subcontractors for services and construction projects which are less than \$50,000 following the MPCA *Subcontractor Purchasing Manual* (Purchasing Manual) and MPCA specific bidding forms. The MPCA purchasing manual process is similar to the process utilized by Antea Group in purpose, detail and review by senior staff. Antea Group also utilizes Target Group/Economically Disadvantaged (TG/ED) when possible as a practice and following Purchasing Manual requirements. When utilizing the process described in the Purchasing Manual, Antea Group provides the MPCA with all applicable forms which detail the requested remedial design specifications or description of services and a complete package for posting on the Minnesota Department of Administration (MDA), Materials Management Division website for advertising the solicitation, as necessary. Following, posting and solicitation of bid specifications under the MPCA Purchasing Manual Process, Antea Group collects, tallies and evaluates the returned bids to recommend a contractor for the award of the work. The recommendation considers cost, qualifications and ability to meet the project schedule.

Antea Group also is proficient at completing the Minnesota Department of Administration bidding process for procuring subcontractors following MDA procurement procedures and forms for MPCA projects which cost \$50,000 or higher. This process is similar to the MPCA Purchasing Manual process; however, bids are procured through MDA processes and forms rather than the MPCA Purchasing Manual process and forms. Antea Group has utilized either the MDA process or MPCA Purchasing Manual process to procure more than a dozen contracts on behalf of and in cooperation with the State of Minnesota during the past several years.

4.21 Prepare and review Quality Assurance Project Plans (QAPP) and Sampling and Analysis Plans (SAP) in accordance with state and federal requirements.

Antea Group understands the importance of establishing clear data quality objectives and is experienced in preparing and coordinating dozens of Quality Assurance Project Plans (QAPP) and Sampling and Analysis Plans (SAP) in accordance with all State and Federal guidelines. Depending on the site complexity and the purpose of the data collection, Antea Group will consult with the MPCA to determine the appropriate level of planning required to ensure the data collection and laboratory analyses will provide an acceptable level of quality assurance / quality control (QA/QC). The primary purpose of a QAPP/SAP is to clearly define the scope of work, personnel responsibilities, lines of communication, field sampling protocols, laboratory methodology, and QA/QC procedures to reduce field sampling and laboratory error. Strict adherence to the QAPP or SAP provides a systematic approach to the sample collection and analysis process that will help ensure that the validated data meets the data quality objectives (DQO) and is usable for making project decisions.

Antea Group's experience in working with contract laboratories and the MPCA in preparing QAPPs and SAPs provide us with the appropriate level of knowledge and understanding to perform technical reviews of these plans on behalf of the MPCA.

**Example: NIROP Superfund Site
 Fridley, Minnesota**

Antea Group has worked with the MPCA to review and prepare technical comments on QAPP addendums prepared in accordance with FFA Decision Documents by the Navy for the NIROP site. The QAPP addendums focus on the sampling methodologies, emerging contaminants of concern, and sampling/analysis for monitored natural attenuation parameters.

4.22 Perform/oversee remedial action plans.

Antea Group has 25+ years of proven experience achieving site incident closures by providing sustainable strategies for soil and groundwater remediation challenges. We have designed, specified, installed, operated and decommissioned thousands of remedial solutions for automotive, chemical, energy, manufacturing, mining, pharmaceutical and transportation sector clients. We are considered a leader in petroleum, chlorinated solvents, pesticides and metals remediation due to our comprehensive understanding of industry operations, client-dedicated project teams, local regulatory knowledge and cost-effective, yet technically innovative solutions.

Our site investigation and remediation professionals utilize a project management framework that provides consistency and quality assurance to facilitate the most applicable and effective technology to meet project-specific goals.

- Appraise – Assess the extent of impact and evaluate the potential receptors and pathways in order to define risk
- Select – Identify the best remedial technology options based on site conditions, cost, risk, likelihood of success, and alignment with asset management objectives
- Define – Complete the design and define the scope of the remedial strategy
- Execute – Implement the remedial strategy with efficiency and safety
- Operate – Eliminate the risk and monitor technology performance

Setting us apart from our competitors, we adhere to a formal engineering assurance process that ensures a consistent level of engineering competence to each remediation project, provides audit and review structure, and reduces potential for engineering error. Antea Group strives to maintain best in class relationships with all key stakeholders in the permitting and regulatory review process allowing us to advance projects quickly and cost effectively through both formal submittals and informal meetings and site visits.

**Example: LNAPL Rail Yard Cleanup
Des Moines, Iowa**

Challenge

A former rail yard was sold to the City of Des Moines in 2006, though the client retained responsibility for environmental impacts at the site. Enrollment in the Voluntary Cleanup Program was sought as a means to obtain site closure, thereby fulfilling outstanding obligations as identified in the Purchase and Sale Agreement.

Investigation activities detected LNAPL on the water table in excess of the regulatory threshold. Long term monthly LNAPL monitoring and quarterly reporting or costly LNAPL remediation would be required until the LNAPL compliance threshold was attained. As a means to reduce costs and long-term liabilities, alternative closure technologies were needed.

Solution

Antea Group conducted an LNAPL mass, mobility, and recoverability evaluation to determine LNAPL characteristics and model LNAPL recoverability by various remedial technologies. Results of the LNAPL assessment were included in the Risk Evaluation and Remedial Action Plan, and indicated that the LNAPL did not exceed residual saturation, was immobile, and exhibited poor to moderate recoverability when modeled with the LNAPL Distribution and Recoverability Model software.

Through the Risk Evaluation and Remedial Action Plan, Antea Group was able to provide justification or a variance request to the IDNR LNAPL threshold and demonstrate that LNAPL remediation was not technologically or financially feasible.

Result

The IDNR responded that a variance request would be considered pending results of a pilot study of the technologies deemed most likely to be effective. A subsequent pilot test was performed with LNAPL skimming with vacuum enhancement technologies, which corroborated the modeled recovery rates.

The IDNR has indicated that the pilot test results will provide sufficient rationale to grant the variance request and no further LNAPL monitoring or remediation is required. Upon receipt of a No Further Action classification, the client will recognize a cost reduction of approximately \$600,000. Additionally, elimination of long term monitoring and reporting requirements will allow the client to fulfill their outstanding obligations to the City of Des Moines, per the Purchase and Sale Agreement.

4.23 Conduct surface water, ground water, and hydrodynamic modeling.

Antea Group is familiar with and utilizes a variety of analytical and numerical models (steady state and transient) to evaluate groundwater flow at sites across the United States. Typically, the questions to be answered, the level of site complexity, and available site data dictate the type of model that will be utilized. For example, evaluating the horizontal capture zone dimensions at a single well under uniform hydrogeologic conditions could be performed using a relatively simple analytical calculation or an analytical 2-D model such as CAPZONE. For more complex sites involving multiple geologic layers and vertical components of groundwater flow, a three-dimensional numerical model would likely be required.

For larger three-dimensional numerical modeling projects, Antea Group begins by meeting with the project stakeholders to understand the objectives of the modeling effort and to outline the modeling steps and data compilation requirements. Antea Group's modeling team utilizes GIS and database technologies for the compilation, management and interfacing with the modeling software for both model input and output. This allows for model-ready formats and streamlines output evaluation. Model development begins with a conceptual site model (CSM) which is a summary of the major components of the flow system and the processes that link them together. The CSM identifies the aquifers and their extent, the associated water bodies, the stresses of pumping and recharge, and the physical process of water moving through porous media. In designing the model domain Antea Group attempts to utilize natural groundwater flow divides or discharge areas to establish boundary conditions sufficiently beyond the focus area of the modeling project to minimize potential boundary effects during modeling. A grid is superimposed over the model domain with more detailed discretization in the areas of interest.

Aquifers and aquitards are represented by unique model layers to correlate with the CSM. Likewise, boundary conditions are designed to represent the natural boundaries incorporated into the model domain (i.e., streams, lakes, rivers, wells, and recharge). Once the model is constructed with topographic features and is running, it is evaluated to assess mass balances of flow through the various model layers and is critically compared with the CSM to ensure the model can adequately replicate the natural system. Assuming the model mass balances are acceptable, Antea Group will initiate model calibration using known head target elevations, stream base flow fluxes, and hydraulic gradients. Calibration can be performed both manually, by trial and error, and using automated inverse solutions, such as PEST. Antea Group attempts to achieve calibration manually before employing PEST which

can be used to identify modifications to the model's aquifer properties to improve model calibration statistics. Sensitivity analysis is performed to identify the key (i.e., most sensitive) model input parameters. Stochastic MODFLOW is also used to evaluate the uncertainty of the model predictions using Monte Carlo techniques which automatically adjust selected model parameters using a minimum and maximum parameter range, specified data distribution types, and associated statistical characteristics during multiple (i.e., hundreds to thousands) of model simulations.

Once the model uncertainty is evaluated, the model can be used for predictive purposes with the uncertainty of the results communicated to the stake holders. Antea Group will document the model purpose, development and findings in a comprehensive report that presents the model output in graphical and map form typically using GIS data management software.

Antea Group uses models to help answer a variety of groundwater flow questions used in decision making that can range from wellhead protection to optimization of remedial systems. Consequently, with any modeling effort, a clear understanding of the site conceptual model and the selected model's limitations and the uncertainty associated with the model input and output need to be revisited throughout the modeling process.

Antea Group has experience working with the following unsaturated and saturated flow models:

- HYDRUS – 1D
- VS2DTI – 2D
- SESOIL – 1D
- VLEACH – 1D
- ATRANS V2
- RISC 4.3b
- CAPZONE – 2D
- VISTAS 6 – 3D MODFLOW

4.24 Conduct third party review and analysis of designs, reports and technical information when requested by the MPCA for the purpose of providing conclusions and recommendations to the State.

Antea Group's collective team of engineers, hydrogeologists and scientists have the knowledge and experience to provide the MPCA with third-party reviews of various documents which include, but are not limited to HASP, site investigation reports and work plans, QAPP, SAP, field testing, response action plans, feasibility study, pilot test, remedial action, system monitoring reports, risk assessments, and Five-Year Review reports.

Depending on the technical document(s) that Antea Group is asked to review, we will assign the appropriate resources with the technical expertise and experience to adequately review and analyze the document information for purposes of rendering conclusions and recommendations that meet the current professional standard of care. Antea Group routinely provides comments, recommendations and suggestions following third party review and technical evaluation of documents as well as responses addressing comments received.

**Example: NIROP Superfund Site
Fridley, Minnesota**

Antea Group is currently serving as a third party technical reviewer on behalf of the MPCA for the NIROP Superfund Site in Fridley Minnesota. Since 2008, Antea Group technical staff has reviewed all technical documents issued by the Navy and/or its consultants/contractors. Following review of technical documents Antea Group compiles technical comments and questions for incorporation into MPCA response letters often involving multiple iterations. These technical documents have included: Annual Monitoring Reports (AMRs), Aquifer Performance Testing Plans and Reports, System Design Modification Plans, Recovery Well Installation work plans and Reports, Monthly System O&M Reports, USGS – NIROP Groundwater Flow and Transport Model Report, Source Investigation Draft Work Plans, Source Investigation QAPP/SAP, Five-Year Reviews and remedy optimization reports. In addition, the technical resources assigned to the NIROP project participate on behalf of the MPCA during Partnership Technical Team conference calls and meetings with the Navy and EPA technical teams to collaborate and provide technical input. Antea Group also provides technical support for MPCA during conference calls and meetings with local stakeholders including the City of Fridley.

4.25 Perform five year reviews and site reviews.

Antea Group has performed Five-Year Reviews at multiple Environmental Protection Agency (EPA) National Priority List (NPL) sites, also known as superfund within the past several years. Five-Year Reviews are required by EPA for NPL listed sites. Antea Group has performed Five-Year Reviews for sites within Minnesota which are in the EPA enforcement deferral pilot program in which the EPA has deferred to the MPCA as the lead regulatory agency for the site in question. Five-Year Reviews are performed following the EPA *Comprehensive Five-Year Review Guidance* (2001) and guidance or format updates as applicable to the site.

Antea Group completes all components of the comprehensive Five-Year Review process when conducting a Five-Year Review, including:

- File Review;
- Site Visit;
- Interviews with Stakeholders, Regulators, Responsible Parties (RP) as applicable;
- Draft, finalize and publish a public notice in a qualifying local newspaper;
- Review site decision documents including ROD, MEDD, ESD, Consent Orders, and RAP;
- Review historical and current site data;
- Evaluate current conditions against the selected remedy and remedial progress to date
- Evaluate institutional controls in place for the site
- Evaluate applicable or relevant and appropriate requirements (ARAR) for the site
- Identify Issues based on current site conditions, ARAR, changes to site conditions or area property use, and up to date professional or regulatory standards;
- Provide recommendations to resolve issues identified;
- Determine protectiveness based on the comprehensive review;
- Develop a Draft Five-Year Review and finalized document following comments from MPCA and EPA.

Antea Group also performs reviews of non-NPL sites in a similar manner to Five-Year Review following similar format to the EPA *Comprehensive Five-Year Review Guidance*, however, since non-NPL sites are subject to different administrative structure some portions of the guidance such as a public notice are not performed. Site reviews to evaluate remedial progress are performed at sites that are not listed on NPL at the request of the regulatory agency. The scope of the review of non-NPL sites is developed prior to the review in cooperation with the regulatory agency. Antea Group has also provided technical evaluation of proposed remedial alternatives or proposed RAP modifications during a site review or Five-Year Review.

Antea Group has conducted Five-Year Reviews at the following sites: Oakdale Dump, General Mills/Henkel, Perham Arsenic Site, Reilly Tar and Chemical Corp., Long Prairie Groundwater Contamination Site, Koppers Coke, Kurt Manufacturing, FMC Corporation Site. Antea Group is also providing support to the MPCA in review of the Naval Industrial Reserve Ordinance Plant (NIROP) site Five-Year review being conducted by the Navy.

Example: Reilly Tar and Chemical Corp. Superfund Site
2015 Five-Year Review
St. Louis Park, Minnesota

The Reilly Tar and Chemical Corporation (Reilly) Superfund Site (Site) is located in St. Louis Park, Minnesota. The Reilly Tar Site operated as a coal tar distillation and wood preserving plant from 1917 through 1972. During the time that the Reilly facility operated, wastes containing coal tar and its distillates were disposed of into a ditch that emptied into a peat bog to the south of the Site. The discharge into the bog continued for the duration of the facility's operation. Consequently, many private wells and eventually municipal water supplies became contaminated with polynuclear aromatic hydrocarbons (PAHs).

Remedial action at the Site to address PAH-impacted groundwater is addressed through treatment and gradient control through pumping. Granular activated carbon (GAC) is utilized to treat PAH-impacted groundwater, from municipal wells, to meet drinking water standards prior to entering the City of St. Louis Park municipal water supply. There are five operable units (OU) in place at the site, all of which were evaluated in the 2015 Five-Year Review. Operable units describe a media (i.e. soil or groundwater) and/or specific portions of a site where a remedial action has been selected to address contaminants found within that portion of the site. Evaluation of the remedial progress of the site concluded that remedial actions at four of the five OU continue to be protective of human health and the environment. Protectiveness at OU2; however, was determined to be protective in the short-term due to additional data that needed to be collected and evaluated against ROD requirements. The 2015 Five-Year Review concluded that in order for the remedy to be protective in the long-term, the following actions, related to protectiveness of OU2, need to be taken: 1) Evaluate additional monitoring locations and increase gradient control in the Prairie du Chien Aquifer southwest of the Site; 2) Conduct additional groundwater modeling to evaluate plume boundaries and capture zones; 3) Develop and implement an institutional control (IC) study and IC plan; 4) Identify potentially leaky multi-aquifer wells in areas of the current Site plume not previously investigated.

4.26 Review groundwater remediation technologies and recommend alternatives and optimization options.

Complex environmental sites require optimal management of resources and information to achieve a successful result. Antea Group has the experience to manage complex sites, large or small, across a wide variety of conditions and regulatory environments. Regardless of specific contaminant type(s), varied geology/hydrogeology, or the need for one or more technologies in succession or in combination, Antea Group has experience to address the scenario.

Each site requires a detailed Conceptual Site Model (CSM) developed from site history and data collection. Antea Group considers a CSM as dynamic and we update it through the course of a project as information dictates. On a complex project, Antea Group uses its extensive database resources and translate those data into high quality visual three-dimensional graphics that can show information in various formats to target specific audiences. The CSM becomes the problem statement on a complex project and the focal point for all involved. The data that goes into the CSM requires careful planning and utilization of traditional and innovative methods for sampling groundwater, soil, sediments, air, and surface water. Antea Group has experience with everything from the tried and true approaches to newer more sophisticated methods. Quality assurance/quality control are key in the data collection process as well.

Once the CSM is established, Antea Group regularly incorporates risk based MNA strategies into our projects either as the main remedial strategy from the outset or as a polishing approach. This past year alone, MNA factored into over 100 of our sites. A good risk based MNA strategy begins with high resolution data collection to develop a clear conceptual site model. Our projects utilize MIP, HPT, LIF and CPT technologies to improve site knowledge. A thorough evaluation of exposure pathways and sensitive receptors is the next step in strategy development. Fate and transport modeling and a full understanding of field parameters (temperature, dissolved oxygen, oxidation-reduction potential, pH, and conductivity), groundwater geochemistry (electron acceptors, electron donors, key by-products), and microbial profiles (microbial groups and gene functions that code for degradation) round out the information needed for MNA strategy development. Antea Group places special emphasis on microbial profiling and we use contemporary molecular biological tools to gather those data. Because we place such value in microbial profiling, we have a national discount for microbial analysis with a major laboratory that gets passed along to our clients

Antea Group is also well versed in classic models used with MNA including BioScreen and BioChlor. We frequently use the NAS[®] software from Virginia Tech for MNA evidence evaluation and presentation. For chlorinated sites, we are using the new BioPIC software created by John Wilson and Todd Wiedemeier that also assesses natural iron minerals on a site to further support remediation. Antea Group tracks updates in ITRC and state guidance as they relate to MNA.

As a solution is crafted for a complex site, Antea Group has an established a subject matter expert (SME) matrix that spans 15 technical disciplines. Each discipline includes additional resources who support the SME. The most experienced SME's (those with 25 years or more experience) form a Remediation Engineering Evaluation Team (REET) that provides conceptual model development, remediation technology evaluation and selection, and monitoring program coordination to project managers throughout the firm. Antea Group has nationally known experts in bioremediation, in situ chemical oxidation/reduction, and in situ thermal remediation. Our expertise spans numerous technologies including less common ones like phytoremediation and electro kinetics. The variety of project work our firm is active on allows us to utilize everything from traditional technologies to more innovative approaches. The hundreds of environmental liability transfer projects we have closed to date or are currently working on have presented opportunities for use of multiple technologies, often in combination.

Antea Group maintains numerous relationships with remediation technology firms often taking the relationship to that of partner status. We regularly attend webinars presented by over a dozen technology vendors and government entities to enhance our knowledge base. Antea Group has participated in various technology development efforts, most recently with Regenesys and the PlumeStop® Liquid Activated Carbon™ suspension technology. We work with our vendor partners to prepare remedial approaches and cost estimates for projects. Remediation technologies are selected based on client business objectives, CSM understanding, risk/exposure pathways, and regulatory acceptance.

**Example: Adhesives Manufacturing Site
São Paulo, Brazil**

At a complex site in Brazil impacted by carbon tetrachloride and its daughter product, chloroform, an in situ chemical reduction (ISCR) approach implemented by Antea Group is advancing the project to closure. Prior to Antea Group's involvement on this 30-acre site near São Paulo, the project suffered from a lacking CSM, poor understanding of local regulations, inadequate delineation, and a unique cometabolic bioremediation system using butane that failed to reduce chloroform concentrations. Two source areas were identified and the groundwater plume migrated off-site to neighboring properties and under a minor highway. The regulatory body, CETESB, was frustrated with the lack of progress and level of communication on the project. They levied fines against the facility and raised the environmental site to the state legal authorities. The multi-national client needed an advocate.

deliverables. With the help of our local Inogen partner, ANGEL, we could gain an understanding of the acceptable and unacceptable risks for soil, groundwater, and air from CETESB's perspective. We discussed a wide range of remedial technologies (ISCO, ISCR, thermal, excavation, other bioremediation approaches) that were considered acceptable and not acceptable to the regulators. We also considered availability of such technologies in country at a reasonable price.

Following limited soil and groundwater delineation using the MIP and conventional sampling, Antea Group and ANGEL could create a new CSM using our CAVE resources. This became an effective means of establishing the problem and demonstrating progress to both the client and regulators. We could better define those areas of the subsurface where contaminant mass would be transported so we could design a remediation approach to contact that mass. The site was layers with silt, sand, and clay with varied permeability from one end of the site to the other.

A pilot test was undertaken using a hybrid amendment consisting of a carbon source and microscale zero valent iron was applied to low permeability silts/clays using pneumatic fracturing, trenching, direct push, and soil mixing techniques (depending on the varied lithology in the area). Significant reductions of carbon tetrachloride and chloroform were quickly observed, with changes in field parameters and geochemistry. Information on injection spacing was also developed. Finding resources that could perform the various types of application methods required local know-how and a bit of ingenuity in adapting resources from the construction industry to support the project.

Over the last four years, a full-scale application of the hybrid amendment was completed at 30 locations across three properties using a combination of techniques for different site scenarios and post-injection were data collected. Significant reductions of parent/daughter compounds (>95% mass removal) have been documented with corresponding changes in field parameters and geochemistry. Changes in mass, concentration and plume geometry were all demonstrated. Remediation is in its final stages and much of the site has met commercial treatment standards and is close to residential standards except for only a few monitoring wells.

4.27 Provide evaluation and design of energy recovery systems utilizing landfill gas.

Antea Group can provide a suite of professional services for landfill gas collection, either utilizing our own staff expertise or, when appropriate a specialty subcontractor under our oversight and review. Services include:

- Planning
 - System design including retrofits or additions
 - Permitting of air discharges and gas collection and control system design
 - Feasibility evaluation for gas recovery projects
- Construction
 - Construction drawings
 - Bid documents
 - Construction quality assurance and certification
 - Certification reports
- New Source Performance Standards for Municipal Solid Waste Landfills (NSPS) compliance
 - Well field tuning, corrective actions and re-monitoring
 - Flare Startup, Shutdown and Maintenance reporting
 - Surface emissions monitoring
 - Data reporting
 - Landfill gas sampling

- Flare testing
- Operation and Maintenance (O&M)
 - Well field inspections and maintenance
 - Blower, flare and compressor checks and maintenance
 - Sump inspections
 - Troubleshooting
 - Major repair coordination and oversight
 - Emergency response to flare shutdowns
- Beneficial Use Studies
 - Coordination with public utilities and public utility commissions
 - Beneficial use recommendation from a wide range of beneficial use options
- Air Quality and Testing
 - Testing and monitoring
 - Permitting and compliance
 - Emission inventories and characterization
 - Dispersion modeling
 - Control system evaluation

4.28 Research, evaluate and implement innovative or new technologies.

Antea Group has recently developed several new and innovative remedial technologies. Two of these technologies have been awarded patents by the United States patent office.

Zero discharge soil vapor extraction system, Enhanced Concentrated Oxygen (ECO) SVE – A non-governmental organization (NGO) filed a lawsuit against an air quality regulatory district in Southern California that eventually resulted in a moratorium being placed on new emission permits starting in January 2009. This moratorium had a direct impact on those remediation projects in Southern California where remediation by Soil Vapor Extraction (SVE) with permitted emissions of treated air streams to the atmosphere was being planned. Under the moratorium, emissions allowances were essentially reduced to zero, and any emissions above this level would require the purchase of expensive emission-offsetting credits. The cost impacts to a typical remediation project in the region were immediately clear and Antea Group soon thereafter began working on the identification of technologies that could be applied to more cost-effectively treat emissions under the new regulatory conditions. In July 2012, Antea Group was awarded Patent No. 8,210,772 B2 for the Enhanced Concentrating Oxygen (ECO) SVE system, a technology that is based on the separation of extracted air streams aboveground by pressure swing adsorber technology and the reinjection of oxygen back into the subsurface, to stimulate bioremediation. At the first site, the system was used the local air permitting regulatory agency stated that the treatment system is permit-exempt. The system is a re-circulatory system that does not have emissions to the atmosphere. Its operation costs are substantially smaller than traditional soil vapor extractions systems and the entire process is focused on bioremediation (in ground destruction) of the contaminants versus removal and treatment.

Sulfate Enhanced Bio Remediation - The opportunity to improve sulfate remediation technology was identified after working with conventional sulfate remediation technologies and gaining an understanding of the limitations of those technologies. After designing and modeling the improved technology, Antea Group secured regulatory approval to test it, and after successful deployment, secured a US Patent (No. 7,138,060), thus establishing the improved technology's unique position among remediation technologies. The technology is a simple application of Magnesium Sulfate in concentrations above 1,000 ppm to stimulate existing sulfate reduction mechanisms. The material is generally applied via gravity feed through groundwater wells or trenches. This simple application minimizes site disturbances and there are no long-term operation and maintenance requirements. The enhanced degradation processes occurs over weeks and months. Costs are minimal compared to traditional remedial techniques like pump and treat, air sparging, or dual phase extraction.

Plume Stop™ Capture and Treat - In 2012, Antea Group became the first consulting firm to evaluate a unique capture and treat technology. Plume Stop™ is comprised of water-soluble, non-toxic ingredients typically applied via direct push injection or into injection wells. This technology is protected by Regenesys patents and patents pending. It is an environmentally friendly, water-soluble composition that is injected into soil and groundwater. After the material is distributed in the subsurface, it undergoes a cross-linking process on the order of days to weeks which forms a sorbent network on the surface of soil without plugging the formation. Plume Stop™ reacts in situ to form a sorbent network throughout the contaminated zone. The intended function of the Plume-Stop™ technology is to; 1) Adsorb contaminants and reduce groundwater concentrations, 2) Inhibit transport of contaminants in groundwater, and 3) Provide a matrix for bacteria and contaminants to facilitate natural attenuation.

Recent laboratory and field studies on the Plume Stop™ technology indicate that it should have negligible impacts on groundwater oxidation-reduction potential (redox) and geochemistry. The sorbent network is intended to last in excess of a few years, and possibly 10 years or more. Laboratory studies have also shown that the biodegradation of the Plume Stop™ itself is negligible under both anaerobic and aerobic conditions for time periods of at least one year.

Carbon Footprint Calculator – In late 2008, during Antea Group's monthly technical-sharing WebEx series, Antea Group's European colleagues demonstrated an Excel-based beta-version tool for calculating the carbon footprint of remediation projects. The concept behind this tool generated considerable interest among Antea Group's US colleagues. Soon thereafter, the Europe and USA offices initiated collaboration on the development of a more comprehensive tool. During mid-2009 Antea Group won a 2009 contract from US EPA Region 9, funded by the state of California, for development of the LUST (Leaking Underground Storage Tank) Cleanup Footprint Calculator (EPA Calculator). The EPA Calculator Design Specification was prepared specifically for California inputs, but can be readily adapted to any US state or other global geography with region-specific adjustment of calculation coefficients and factors as well as for reporting the calculations units in equivalent 'Metric Tons of CO2 Emissions.' The Design Specification was completed in mid-2010, and the web-based implementation of the EPA Calculator is available on line at the State of California web site <http://www.ustcalc.com/>.

**Example 1: ECO SVE
Former Retail Service Station, Simi Valley, CA**

Antea Group began management of a typical retail service station hydrocarbon contamination site in 2009. At this time, the site had been an open leaking underground storage tank case for 20 years. Several different remedial techniques had been proposed for the site over the years but none were implemented. Antea Group proposed the installation of the ECO SVE to remediate the impacted groundwater and soil at the site. The system was installed in December of 2010. By May of 2011, the inlet concentrations of hydrocarbon extracted vapors were substantially reduced and the groundwater concentrations of benzene, MTBE and TPH particularly were lowered to or near non-detectable levels. The system was turned off for a rebound test. The rebound test indicated that the concentrations remained low, at this time several confirmatory soil borings were installed along with regular groundwater monitoring. Based upon the results of the soil samples and groundwater data the State regulatory agency granted no further action. The ECO SVE system had successfully remediated this site in under a year, with no air permit required for the remedial system.

**Example 2: Sulfate Enhanced Bioremediation
Former Retail Service Station, Porterville, MI**

Antea Group was selected to manage a leaking underground storage tank site after two documented releases. Prior to Antea Group's involvement several different remedial techniques such as total fluids recovery, biosparging, natural attenuation was attempted at this site with limited success. Groundwater at the site was shallow, one to two feet below ground surface, and was located near a sensitive receptor (wetlands). Data collected from the site indicates that natural sulfate concentrations in the plume were absent or very low as compared to other data points outside the plume. This helped Antea Group's technical team to implement a program of sulfate enhanced bioremediation. Hydrocarbon concentrations at the site remained elevated and were not acceptable to allow site closure. Antea Group created a plan to introduce four separate applications of sulfate solution into the subsurface over one year. Soon after the last application, the benzene, toluene, xylene and ethylbenzene concentrations were all substantially reduced and allowed the site to receive a no further action letter from the regulatory agency. The sulfate solution was applied through existing wells, cost less than \$7,500, created no waste and supplemental utilities were not needed.

**Example 3: Plume Stop™ Capture and Treat
Active Retail Service Station, San Jose, CA**

Antea Group oversaw the site evaluation, injection, and monitoring of a new technology to address TPH-gasoline and BTEX impacts in a source area. TPH-gasoline in two source area wells averaged 4.4 mg/L. An injection of Plume Stop™ was designed and intended to partition hydrocarbons out of groundwater in the vicinity of these wells. The application injected 8,100 gallons of Plume Stop™ solution divided equally into 7 injection points. The groundwater was monitored monthly for TPH-gasoline and BTEX for three months after application in three source area wells, then again at six months.

Following the Plume Stop™ application, groundwater in the treatment area wells exhibited approximately a 10-fold increase in petroleum hydrocarbon concentration at the 1 month monitoring event, but at the 2-month monitoring event, petroleum hydrocarbon levels had declined significantly and remained stable. As expected, geochemistry was relatively unchanged through the test. Ultimate reductions of 60% TPH-gasoline and 90% of BTEX in the source area wells were observed after six months.

4.29 Prepare presentations and present information at meetings.

Antea Group regularly makes presentations to clients, regulatory agencies, municipalities and at national conferences. Our staff is skilled in preparing presentations utilizing the most current electronic media via teleconferencing or in face to face situations.

Antea Group also provides public relations support often being a vital component of many projects. Through in-house public relations specialists, we have the expertise to establish and implement an effective public involvement program to complement a variety of project and/or client needs.

Our staff has participated in numerous public information meetings and public hearings regarding a variety of environmental issues. We have partnered with many cities, educating local residents and responding to media inquiries and other concerns over potential health risks in their community.

We are very familiar with state and federal EPA public involvement requirements and programs, and work attentively to provide our clients with the appropriate level of support. Antea Group professionals have represented clients at numerous public information sessions, public hearings and press conferences. Our comprehensive services include needs in all areas:

- Community relations plan preparation.
- Public meeting representation/presentations.
- Media relations strategies.
- Coordination with state/federal regulatory agencies.
- Public notification (public notices, news releases).
- Risk communication or consensus building.
- Training / conferences.
- Educational material preparation.

Our staff has also designed and delivered workshops on various environmental technologies at statewide regulatory staff meetings, including coursework provided instruction on concepts of remedial technology, design criteria and engineered alternatives. In addition, we have given several presentations at the EPA-sponsored and 50-states attended National UST/LUST Conference.

Antea Group has presented to MPCA hydrologists on advanced investigative tools and insitu remedial technologies during a March 2017 MPCA Hydrologist meeting.

4.30 Prepare and determine if the Stormwater Pollution Prevention Plan (SWPPP) is being followed and make recommendations if revisions are needed during the life of the construction project.

Antea Group has prepared Storm Water Pollution Prevention Plans (SWPPP) for multiple industrial facilities throughout the United States including Minnesota. Industries represented by the SWPP Plans developed by Antea Group include pulp and paper facilities, heavy manufacturing facilities, and transportation related railroad properties. Each Plan details how facilities control and monitor storm water runoff to minimize storm water impact. These plans address significant industrial materials stored on-site and industrial activities having the potential for storm water exposure. In addition, the plans describe facility best management practices, material transfer procedures, inventory control, inspection procedures and frequency, secondary containment, identification of non-storm water discharges, and spill response procedures and training.

Antea Group has extensive experience completing Erosion Control Plans, particularly as a component of storm water management projects. Storm water permits issued and managed by the MPCA require that facilities have sediment and erosion control measures in place to prevent the presence of solids in storm water runoff from facilities to waters of the state. Sediment and erosion control measures often include, but are not limited to: paved and swept surfaces, vegetation, rip rap, retention ponds, coir logs, straw wattles, silt fencing, and other filter media.

Examples of projects where Antea Group has prepared Storm Water Pollution Prevention Plans (SWPPPs) and implemented erosion control measures includes numerous railroad yards, food production facilities, and a large remedial excavation project. Implementation activities have included installation of erosion controls (e.g., coir logs, rip rap), preparation of erosion control maintenance documentation, site control after storm events, repairs of erosion controls, and decommissioning of erosion controls during shutdown of a temporary Site.

Erosion control measures are periodically reviewed and evaluated for each Site to determine if changes must be made to further prevent erosion at the Site. If construction occurs at a Site, erosion controls are evaluated and changed as needed to maintain effective erosion control throughout the Site. Additionally, as part of the MPCA industrial storm water permit, Antea Group has advised clients in evaluating sediment and erosion controls after storm water sample Total Suspended Solids (TSS) exceedances, including oversight of installation and maintenance of erosion control Best Management Practices (BMPs).

**Example: Oil Spill Site
Tioga, North Dakota**

Antea Group oversees and implements erosion control practices at the Tioga, North Dakota remediation project site. During initial remediation and excavation phases of the project, Antea Group developed an action plan to reduce storm water runoff from the project site in coordination with the State of North Dakota. This action plan utilizes sediment basins within the project site and coir logs around the perimeter of the site, preventing suspended solid migration and water runoff. Fiber coir logs are placed along parts of the property boundary of the project area to provide the same sediment-control capability as a sediment basin.

The coir log placement is chosen based on the surface drainage direction. The coir logs are inspected and maintained at least once every 14 days and within 24 hours of any rainfall event greater than 0.5 inches. The logs are cleaned out when sediment reaches 1/3 to 1/2 the height of the BMP or fabric logs. Previously, silt fencing was used for erosion control at the site; however, due to frequent destruction from strong winds, fiber coir logs have been installed as the preferred BMP.

Once inspection occurs and inadequacies are discovered, the revised SWPPP must implement these changes within 7 calendar days. Inspection reports summarize the scope of the inspections, names, and qualification of the inspector. In addition, they include inspection dates, major observations, and remedial actions taken. These records are retained as part of the SWPPP for at least 3 years after the date of inspection. Record keeping of precipitation events is also included in the project documentation logs.

4.31 Prepare Erosion Control Plans and oversee implementation.

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4.32 Provide technical assistance to the State in the evaluation and interpretation of data and information.

Antea Group provides technical assistance in the evaluation and interpretation of data for the State of Minnesota as well as other public and private clients. Data evaluation and interpretation is performed by qualified individuals in accordance with applicable guidance, regulations, and current professional standards and practices. Antea Group routinely provides technical evaluation of site data presented in reports and technical memorandums. Antea Group has demonstrated the ability to utilize advanced technologies in the collection and evaluation of data. Antea Group has utilized Geoprobe™ equipment equipped with Laser Induced Fluorescence (LIF) and Membrane Interphase Probes (MIP) to collect data for mapping free-phase petroleum (LIF) and to evaluate qualitative evaluation of chlorinated volatile organic compounds (VOC) in the subsurface (MIP). These technologies provide continuous data from the surface to the terminal depth of the probe which can be utilized to evaluate horizontal and vertical definition. Antea Group has experience pairing data collected through traditional methods and advanced data collection methods with various visualization, including three-dimensional visualization and data evaluation software to accurately interpret site geology and contaminant distribution. Antea Group selects the appropriate data evaluation and visualization software depending on site conditions, purpose of evaluation and remedial goals of the site.

Antea Group has provided technical assistance to the State of Minnesota for Federal Superfund, State Superfund, RCRA, VIC and petroleum sites as an MPCA Multi-site contractor. Technical assistance performed for the State of Minnesota includes evaluation and interpretation of data collected by Antea Group lead investigations as well as technical review of work plans, reports, proposals and investigation derived data collected by others and reported to regulatory agencies.

**Example: Southwest Fridley Area Sites Groundwater Evaluation
Fridley Minnesota**

Since 2008, Antea Group has provided technical support to the MPCA Superfund program for multiple chlorinated volatile organic compound (VOC) sites located in southwest Fridley, including NPL and PLP listed and RCRA sites. Technical support at these sites has included review of RP generated work plans, reports, memorandums, historical data, decision documents and other documents related to these sites. While performing work in support of MPCA at the various southwest Fridley sites, Antea Group recognized the need for a comprehensive evaluation of all area sites to better provide technical support to the MPCA.

Beginning in 2009 Antea Group has provided technical support to the MPCA for evaluation of groundwater quality and flow characteristics utilizing data collected at the individual Southwest Fridley Area (SWFA) sites. Antea Group routinely evaluates data collected by the individual sites and compiles the data to better understand the contaminant distribution throughout the southwest Fridley area. As part of the SWFA groundwater evaluation Antea Group developed criteria and provided technical assistance for the MPCA to arrange for all monitoring wells at the individual SWFA sites to be surveyed into a common datum for groundwater flow evaluation. Following the completion of the SWFA survey Antea Group was able to develop groundwater elevation figures utilizing ArcGIS™ to assist in the interpretation of groundwater flow and approximate contaminant distribution for different geologic horizons across the entire southwest Fridley area. The completed survey has provided the MPCA and stakeholders within this area with a better understanding of groundwater flow and contaminant distribution throughout the area of southwest Fridley. Compilation and comparison of groundwater chemistry data and multiple flow horizons across the SWFA sites had not previously been completed due to administrative constraints posed by sites under different regulatory programs. As part of the SWFA groundwater evaluation Antea Group has on multiple occasions presented the evaluation of compiled data to various regulators and stakeholders affected by groundwater conditions in the southwest Fridley area.

Antea Group has also supported the MPCA to consolidate groundwater quality data from multiple responsible parties (RPs) in the south west Fridley area. Antea Group has worked with the RPs to obtain data in electronic format and process it into our EQuIS database. Antea Group worked with the MPCA and the RPs to address significant RP data quality and format issues and provided the MPCA with a normalized data set for transfer into their version of the EQuIS database system.

4.33 Assist and provide training as requested by the MPCA. Training must be related to the scope of this Master Contract.

A key strength of the Antea Group staff located in the St. Paul office is providing a variety of training for various subject matters. Our stringent corporate health and safety internal requirements have necessitated the certification of trained staff and development of health and safety training modules that may be provided to our employees or as a service offering to our clients including but not limited to the following:

- Accident prevention;
- Contractor safety;

- Emergency response;
- Excavation;
- Hazard communication;
- HAZWOPER 8-hr refresher;
- Incident reporting;
- Personal protective equipment; and
- Site control and work zones.

Our diverse client base has also necessitated the certification of technical trained staff in our St. Paul office to provide the following to our employees or as a service offering:

- RCRA Hazardous Waste Management for LQG and SQG;
- RCRA Hazardous Waste Management for CESQG;
- Universal Waste Management;
- Spill Prevention Control and Countermeasure Plans;
- Chemical Management;
- Spill Response;
- Storm Water Management;
- Storm Water Pollution Prevention Plans;
- Wastewater Management;
- Air Emissions Management, and
- DOT HazMat Awareness Training.

Antea Group has a long history of working with clients in the development and delivery of a wide range of training topics from environmental, health and safety regulatory compliance to train the trainer and development and implementation of on-line Storage Tank Operator Training. Antea Group has multiple expert level training delivery specialists ready to assist the MPCA or MDA in the preparation of training materials which can be effectively used to present the designed materials to any target audience. Antea Group has worked with clients representing industries ranging from electronics manufacturing, to pulp and paper, to heavy manufacturing. Antea Group works with these clients to develop materials customized to their needs and specific to their application, thus helping to assure effective communication of the chosen training topic.

Our staff has also designed and delivered workshops on various environmental technologies at statewide regulatory staff meetings, including coursework provided instruction on concepts of remedial technology, design criteria and engineered alternatives. In addition, we have given several presentations at the EPA-sponsored and 50-states attended National UST/LUST Conference.

4.34 Follow MPCA green practices/procedures for remediation projects.

To reduce environmental and economic impacts of remediation projects, Antea Group utilizes green and sustainable remediation (GSR) initiatives when feasible. Opportunities for employing GSR concepts are considered in development of the overall remediation approach and corrective action goals. GSR technology alternatives that enhance natural conditions, reduce carbon footprints and provide economic value compared to conventional remediation techniques are utilized by Antea Group to provide innovative and socially responsible approaches.

Since 2009, Antea Group has been implementing and documenting use of green practices on all MPCA fund-financed site remediation projects in accordance with the *Recovery Act LUST Requirements* and have incorporated the

Recovery Act LUST Green Practices Appendix A spreadsheet into all submitted Work Plan/Cost Proposals (for PRP, Superfund, VIC and Closed Landfill Programs' sites). The Green Practices implemented subsequent to completion and final close out of an MPCA fund-financed project work order are documented in the Green Practices Metrics Table provided in a Work Order Summary Report.

Antea Group provided a design specification for a leaking UST carbon footprint calculator under contract through EPA Region 9. This calculator is now online and available to regulatory program managers and stakeholders for their use in calculating the carbon footprints of LUST remediation sites. The calculator evaluates five remedial approaches including excavation, pump-and-treat, soil vapor extraction, multi-phase extraction and MNA.

Below is a project example in which Antea Group utilized GSR practices in remediation system design and installation.

**Example: Isanti Schumacher Superfund Site
West Point, Minnesota**

The Isanti Schumacher site was once the location of an unauthorized burial pit for drums of industrial waste. These drums contained a variety of compounds including: halogenated and non-halogenated solvents, paint residues and sludges, varnish resins, metals, polychlorinated biphenyls (PCB), and volatile organic chemicals (VOC). In 1982 a contractor working for the EPA excavated, packaged and transported 843 drums to out of state disposal sites. Borings were conducted through the floor of the pit to determine the depth of contamination. The floor of the pit was then capped using a PVC liner and the excavated pit was backfilled with clean fill, however VOC impacts remained in the adjacent soils.

In the years since removal of the drums, assessment activities indicated a VOC groundwater plume migrating in the direction of the Rum River. The MPCA subsequently requested Antea Group to design a temporary SVE system to address residual VOC impacts in the former drum burial area.

GCR practices utilized in system design and installation:

- The remediation system building and several key system components were recycled from two separate existing MPCA remedial projects located in Brooklyn Center. Antea Group and MPCA personnel inspected the two systems configurations and site decisions were made in cooperation with the MPCA for those portions of the existing systems to be incorporated into the component design of the temporary SVE system.
- Soil generated during SVE well installation was thin spread in the immediate vicinity of the wells and native soil was utilized to backfill system trenching. Therefore, no waste requiring off-site disposal was generated during installation of the SVE wells or system installation.
- A wireless telemetry system was linked to the SVE system control panel. The telemetry utilizes a cellular network connection to send out fault or alarm notifications via electronic mail. This decreased the vehicle miles traveled to conduct system checks and allows for sufficient identification of alarms prior to mobilization to the site.

In addition to the benefits of utilizing the above GSR practices, the above approach saved the MPCA significant costs compared to a new system and accelerated the installation timeframe.

4.35 Oversee hydrogeologic investigations including fate & transport modeling.

Antea Group has designed, prepared and implemented hundreds of site and remedial investigation Work Plans at a variety of sites that have involved hydrogeologic investigations. These sites have included: petroleum retail, terminals and refineries; chemical processing, manufacturing; landfills; brownfield redevelopment, and Ag-Chem sites with COCs consisting of: VOCs, SVOCs, PAHs, PCBs, PFCs, heavy metals, fertilizers and pesticides. The primary objective of these investigations is to characterize the subsurface hydrogeology to the extent necessary to assess potential contaminant migration pathways and to delineate the extent of subsurface impacts in both the unsaturated and saturated horizons for purposes of evaluating remedial alternatives. Our hydrogeologists are familiar with the current MPCA risk-based site evaluation process (RBSE) guidance documents, and understand the iterative approach often required to compile sufficient regional and site specific hydrogeologic information to perform fate and transport modeling. Antea Group utilizes a variety of literature and technical resources (i.e., DNR, MDH, MGS, and USGS) in addition to conducting site specific hydrogeologic investigations, as necessary, to support our development of reasonable conceptual site models (CSM) which is a critical initial step in any model development effort.

Site-specific hydrogeologic investigations often include the collection of undisturbed unsaturated and saturated soil or core samples of unique geologic units encompassing the extent of delineated COCs to assess soil and or fracture properties that are useful in evaluating contaminant migration such as: porosity, grain size distribution, fractional organic carbon, pore saturation if NAPL is present, total organic carbon, bulk density, vertical permeability and fracture density. Depending on the fate and transport questions to be answered, the characteristics of the COCs and the site complexity, 1-D or 2-D transport models such as BIOSCREEN, BIOCHLOR-AT, or VS2DTI that incorporate dispersion, adsorption and biotransformation may be sufficient in addressing the fate and transport of dissolved phase COCs under relatively simple groundwater flow conditions. Antea Group often applies these types of models to sites where monitored natural attenuation (MNA) is being evaluated.

For more complex sites, Antea Group can utilize a variety of field tests to assess the site-specific spatial variability of the saturated units or formations hydraulic characteristics including: slug tests, tracer studies, specific capacity tests and if warranted, aquifer pumping tests. Data obtained from these tests is typically analyzed using aquifer testing analysis software (i.e., AQTESOLV) or analytical calculations to obtain estimates of the aquifer's hydraulic conductivity (K), transmissivity (T), and specific storage (S) for use in development of a more rigorous 3-D groundwater flow model using MODFLOW.

Once a MODFLOW flow model is developed and calibrated, it can be coupled with MT3D to evaluate contaminant fate and transport. Model defined source cells are setup to reproduce the source types as defined by the conceptual site model (CSM) in the appropriate model layers and the modeled layers are assigned representative transport properties including storativity, porosity, and dispersivity values. COC reaction or decay rates are also incorporated into the model to assess contaminant attenuation. Calibration to existing monitoring well concentrations is an

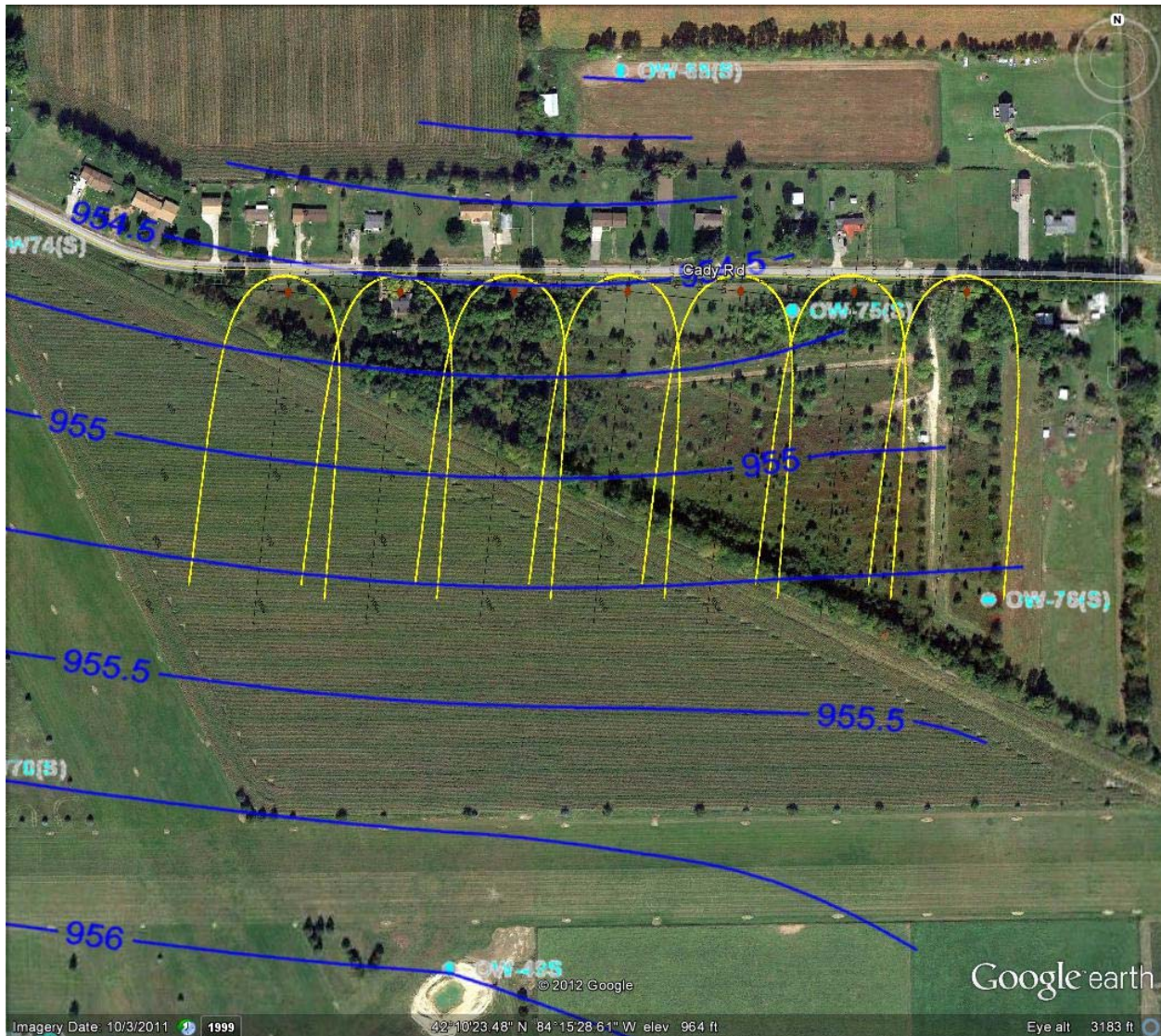
iterative approach using historical analytical trend data. In addition, sensitivity and uncertainty analyses are performed using the calibrated MODFLOW/MT3D model prior to using the model to predict future fate and transport scenarios.

**Example: Fate and Transport
 Regional Model**

Using the transient version of the MODFLOW model discussed in the groundwater flow modeling example (Conduct surface water and groundwater modeling), Antea Group incorporated the use of MT3D to evaluate the fate and transport of non-reactive COCs released from former municipal and industrial landfills within the study area. The model was developed to assess the long-term impacts to the existing and future municipal wells and the potential need for secondary treatment prior to groundwater use.

4.36 Complete capture zone analyses.

Capture zones are often used to ensure that one or more recovery wells are hydraulically containing plumes of dissolved-phase contaminants. The typical capture zones are shaped like parabolas because the basic mathematics produces that shape, which assumes a homogenous and isotropic aquifer.

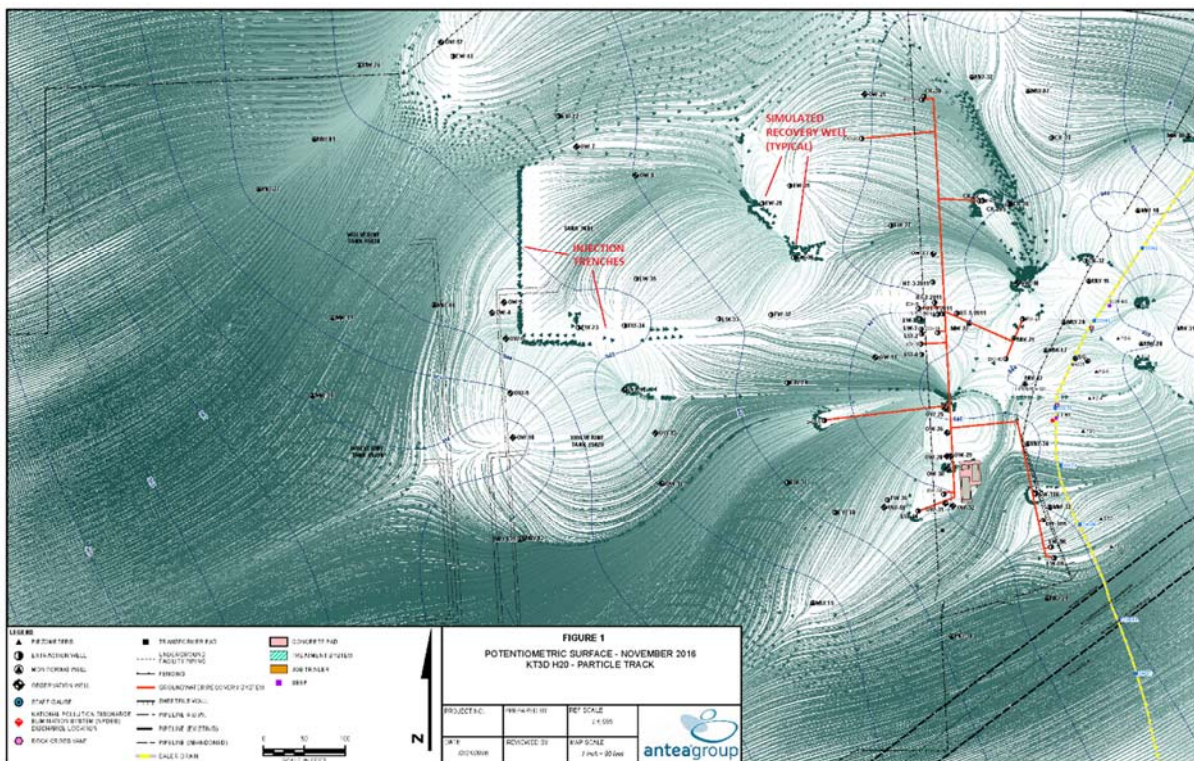


The typical approach to defining a capture zone also assumes that the aquifer is confined. Furthermore, unless the well fully penetrates the aquifer, the vertical extent of a capture zone is not defined by the standard equations. USEPA (2008) produced “A Systematic Approach for Evaluation of Capture Zones at Pump and Treat System” (EPA 600/R-08/003) which lays out a strategy and procedure for defining capture zones, including an assessment of the vertical extent through an evaluation of water levels at different depths. The publication is focused on capture zones in confined aquifers, though mention is made of a solution for a capture zone in an unconfined aquifer (Grubb, 1993).

Though aquifers are never “homogenous and isotropic” and the typical impacted aquifer is unconfined, the capture zone equations cited by the USEPA (2008) or Grubb (1993) can be applied to produce parabolic capture zones for confined and unconfined aquifers. The capture zones produced in this manner are useful for defining the extent and influence of a simple capture zones. However, an approach for defining capture zones that can simulate

both sources (injection) and sinks (recovery) while accommodating site-specific ground-water conditions can produce an area-wide representation of ground-water flow and capture zones that better reflects the actual flow paths and capture envelopes induced by injection sources and recovery wells. Programs such as KT3D_H2O, Version 3.0 Beta (S. S. Papadopoulos and Associates, 2009), are used to create the potentiometric surface through application of the kriging method. When paired with geographic information system (GIS) capability, such as the Earth Volumetric System (EVS), streamlines can be produced that are constrained by the potentiometric surface. The result is a comprehensive map that recognizes the various hydrologic stresses within the context of an existing hydrogeologic system.

As shown in the map below, the influence of injection trenches and recovery wells is portrayed using streamlines, or “particle tracking”, that produces a dense pattern of flow paths showing where water is being injected, where it is being withdrawn, and the extent of hydrologic influence (capture zones).



4.37 Perform/oversee aquifer pump tests.

Antea Group has experience with performing and providing oversight of Aquifer testing using many different methods. Aquifer testing is an essential component in understanding groundwater flow and mass transport, aquifer characterization, water-yield evaluations, and conceptual site model (CSM) development. Aquifer testing can be assigned to a variety of categories, such as single-well vs. multi-well tests, porous media vs. rock aquifer, stress tests vs. passive tests. Antea Group has experience with each of these testing techniques and some examples of their use will be described below.

For single-well tests, perhaps the most common is the in-situ hydraulic conductivity test, or “slug” test. Antea Group routinely conducts “slug” tests to provide an estimate of the hydraulic conductivity to be used in calculations of groundwater velocity. As the name implies, a “slug” is quickly removed or inserted into a single well and then the change in water level is monitored. Typically, more than one well would be tested to assess the distribution of hydraulic conductivity and note that changes in hydraulic conductivity strongly influence groundwater flow, hydraulic gradients and groundwater velocity. Standard techniques for analyzing “slug” test data include Bouwer and Rice (1976), Bouwer (1989), Horslev (1951), Cooper and others (1967), and Jacob and Lohman (1952).

Antea Group has also applied the procedures and analytical techniques for “slug” tests to estimate the transmissivity of LNAPL (Light Non-Aqueous Phase Liquid), as described by Huntley (2000). Though not an aquifer test, per se, the importance of LNAPL transmissivity or recharge rate is becoming increasingly recognized as a key parameter in assessing the recoverability of LNAPL or the endpoint in a remediation (MPCA, 2010 and 2011). These tests differ from hydraulic conductivity testing in that only LNAPL is removed from the well, but the rise in water level and product thickness are monitored as key data parameters to assess the LNAPL transmissivity. Antea Group has found that a site-wide assessment of LNAPL transmissivity and oil-specific volume (a true measure of LNAPL volume) provides an excellent “roadmap” of areas that may be favorable for LNAPL recovery, while other areas are easily recognized as lacking recoverable LNAPL. These tests are conducted as a “baildown test” involving a single removal of LNAPL from a well or as manual skimmer tests, in which LNAPL is successively removed several times until a consistent LNAPL recharge to the well is observed. It has been Antea’s experience that manual skimmer tests provide a much estimate of sustainable LNAPL recovery.

A single-well test, such as a “slug” test, is most often applied to wells completed in porous-media aquifers. Antea Group’s experience for single-well tests in bedrock aquifers include packer tests, inverted-liner transmissivity tests and borehole hydrophysics testing. Packer tests are conducted in an open borehole with inflatable packers separated along a riser pipe to define the interval to be tested. The packer string is lowered into the well to the desired depth spanned by the packer interval and then the water is removed from through the riser pipe. The recharge to the well is gauged in the same manner as for a “slug” test and the analysis of the data uses the same techniques. This method was applied at a site in southeastern Minnesota to evaluate the various hydrogeologic zones identified in the Carbonate Aquifer.

The inverted well liner technique, developed by Carl Keller (Keller, 2004) of FLUTE Technologies®, was used to further characterize the transmissive properties of the Carbonate Aquifer in southeastern Minnesota. The technique involves inserting a sealed well liner into an open borehole and encouraging it to slowly descend in the borehole by adding water to the open end of the liner. As the liner slowly progresses down the borehole, the water in the borehole is pushed back into the formation in proportion to the transmissivity of each fracture or porous zone that intersects the borehole. For the Carbonate Aquifer in southeastern Minnesota, dozens of water-bearing fractures were identified with transmissivities on the order of 0.005 cm²/sec (0.5 ft²/day), but three were identified with transmissivities of 0.01 cm²/sec (0.9 ft²/day), and one fracture at 229 feet below the ground surface recorded a transmissivity of 0.02 cm²/sec (1.8 ft²/day).

A more traditional, but serendipitous, aquifer test occurrence, the testing of a municipal well allowed for the collection of water-level data from 14 monitor wells completed in the Silurian reef-complex carbonates. Downhole transducers had been deployed in each of the 14 monitor wells and set to record water-level and temperature every 15 minutes. The test of the municipal well, located about 2 miles from the site, lasted about 1.75 days at a pumping rate of 600 gallons/minute (gpm). At the conclusion of the test, the data were downloaded and analyzed to determine aquifer properties (such as Transmissivity and Storage Coefficient) using Aqtesolv[®] 4.5 (HydroSOLVE, 2007). In addition, the immediacy or lag in reaction of the water levels in the wells and areal distribution of aquifer parameters revealed the influence of an expansive horizontal fracture and as well as the proximity to nearly vertical northwest-trending fractures or solution channels.

An example of a more sophisticated single-well aquifer test applied by Antea Group is the borehole hydrophysics. This technique has been used to identify fracture location, aperture, transmissivity and flow rate (ambient and induced) through the entire 320-foot column of interbedded carbonate and shale rocks at a site in southwestern Missouri. These types of aquifer tests are often coupled with a downhole borehole videolog that maps the orientation and aperture of every fracture that intersects the borehole. The borehole is then filled with deionized water and an electrical conductivity probe is methodically run up and down through the water column several times. The electrical conductivity probe is sensitive to changes in the total dissolved solids of the water, which is reflected in increasing electrical conductivity at discrete fractures as the native groundwater returns to the borehole. The test may be run passively to recognize where water is entering and exiting the borehole, or a pump may be used to flow into the borehole from all the water-bearing fractures and estimate the transmissivity of each fracture. Under pumping conditions, surrounding wells may be gauged or monitored to assess interconnectedness and extent of influence. The result of the investigation in southwestern Missouri was that more than 90% of the flow into the borehole came from a formational contact fracture at a depth of 248 feet below the ground surface. Previous work at the site, which did not use the borehole hydrophysics techniques, had assumed that a thin sand unit below 300 feet was the main conduit for water flow.

Antea Group has also used special application of the single-well test, called a step test, to determine the appropriate pumping rate for recovery wells and assess the well loss and formation loss as measures (Kruseman and DeRidder, 1994; Chapter 14). Step tests are conducted by incrementally increasing the pumping rate of a well as the drop in the water level is monitored within the well. As each pumping increment is started, the water level drops but then levels off as the drawdown extends farther from the well in response to the increased flow rate. A series of 6 to 10 pumping rate increases is usually sufficient to determine the optimum sustainable pumping rate and have adequate data for estimate well loss, formation loss and well efficiency.

Multiple-well tests involve one or more recovery wells, several observation wells and possibly multiple aquifers. Multiple-well tests are ambitious undertakings but the insights derived from the analysis of the drawdown data or water-quality tests are invaluable in groundwater flow or transport modeling, as well as the design of recovery well networks. Multiple-well aquifer tests may be conducted in porous media or fracture rock, though the layout, number and extent of the observation wells will most likely look quite different for the two scenarios.

Hydrogeologists with Antea Group have conducted multiple-well aquifer tests to evaluate aquifer parameters and yield at small sites of a few acres to sites of tens of acres with several production wells. In each case, the known

hydrogeologic terrane is used to develop a pattern of observation wells that facilitate the analysis of the drawdown data. In a single porous media aquifer, observation wells would be screened at the same interval as the recovery well and placed in a straight line at 1 foot, 10 feet and 100 feet away from recovery to take advantage of the logarithmic nature of the aquifer test analysis and be able to compare the time-drawdown and distance-drawdown analyses to check for recharge and boundary effects (Johnson Division, 1975).

Techniques developed by C. V. Theis, C. E. Jacob, H. H. Cooper, and others are used to analyze the drawdown data from the multiple observation wells. Many of these techniques are presented in Kruseman and DeRidder (1994). Depending on the particular hydrogeologic conditions at the site, analyses for transmissivity and storage may be sufficient, or analyses for leaky confining conditions, induced stream seepage, and delayed yield from drainage. In summary then, the design and analysis of multiple-well aquifer tests will be dictated by the site conditions (porous media, bedrock, confining units, anisotropy, streams, and hydraulic boundaries) and the desired results (well yield, well interference, capture zone delineation, aquifer homogeneity, and anisotropic trends). Development and refinement of the conceptual site model is dependent on a thorough and appropriate application aquifer tests.

4.38 Perform/oversee evaluation of soil borings, test pits, environmental boring and soil testing to determine cover integrity and availability of suitable soils.

Antea Group has worked on numerous soil characterization projects related to railroad construction. For these projects, Antea Group is asked to advance multiple soil borings within the footprint of a planned railroad construction project to log soil as well as collect multiple soil samples from each boring to submit for laboratory analysis. The horizontal extent of soil characterization is defined by carefully chosen soil boring locations (as requested by the railroad client) while the vertical extent is defined by samples collected from multiple depths during borehole advancement; borings were terminated either at or just below the expected vertical extent of the construction project.

Collection of soil samples was performed in compliance with regulatory guidance, such as MPCA guidance document c-prp4-04. Soil samples were analyzed for a full spectrum of possible contaminants such as BTEX and other VOCs, GRO, DRO, and RCRA metals.

Upon receipt of the laboratory analytical report containing the soil sample results, values were compared to regulatory values (i.e., MPCA Soil Reference Values) and models were developed to determine the extent of any soil contamination. If necessary, further soil sampling was planned and conducted to further delineate soil contamination. Finally, a report was prepared containing the project scope, sampling locations and results, and recommendations based on results. The objective of the final report was to inform the railroad client of the location and volumes of soil that could be reused/recycled as backfill or that needed to be hauled to a specific disposal facility based on the analytical results. If requested, Antea Group also assembled cost estimates and helped make arrangements for soil to be hauled to appropriate disposal facilities.

4.39 Arrange for geophysical activities.

Antea Group staff design and oversee geophysical testing utilizing qualified subcontractors to perform the actual geophysical field work. Geophysical techniques that Antea Group has utilized include seismic reflection and refraction, electrical resistivity surveys, downhole logging by natural gamma rays, resistivity, and ground penetrating radar. Antea Group also uses downhole video cameras to inspect open bore holes, well screens and casings. Antea Group also subcontract the use of direct sensing technologies such as, laser induced fluorescence (LIF), ultraviolet fluorescence (UVF) membrane interface probe (MIP), and soil conductivity techniques. LIF and UVF directly sense free product in the soil and groundwater, while MIP can directly sense volatile organic compounds in the soil and groundwater. Soil conductivity probes are used to measure soil conductivity to determine soil lithology.

PETROLEUM ENVIRONMENTAL SERVICES

Example: ConocoPhillips Former Service Station – Phillips Store #1647

St. Paul, Minnesota

To evaluate remedial technologies to remove residual product at this site, an understanding of the volume remaining was imperative. Antea Group submitted a recommendation to the MPCA to conduct a free product recoverability study to gain a better understanding of volume remaining. LIF and cone penetrometer testing (CPT) technologies were proposed to help define the horizontal and vertical extent of product. The MPCA agreed with Antea Group's recommendation and Antea Group subsequently proceeded with the work. The investigation yielded the following results: the network of probes completed during this investigation was sufficient to adequately define the horizontal and vertical extent of known free product accumulations at the site. Determining this extent and volume was the primary focus of the investigation. Readings indicative of elevated levels of gasoline-type hydrocarbon impact were identified in five of the eight probes. Fluorescence readings indicative of gasoline-type free product were identified in two of the eight probes. The remaining probe, in which elevated fluorescence readings were not observed, served to define the southeastern perimeter of the hydrocarbon-impacted area.

SUPERFUND ENVIRONMENTAL SERVICES

Example: Crude Oil Pipeline Release

Lockport, Illinois

Antea Group oversaw a geophysical survey at a crude oil pipeline release. The release had flowed beneath a railroad track and into a wetland. Depth to bedrock in the area is shallow. The purpose of the geophysical survey was to map depth to bedrock, potential fluid migration pathways using seismic refraction/earth resistivity and to locate several abandoned pipelines.

Refraction surveys were conducted along two survey lines, one in the drainage ditch between the road and the railroad tracks, and the second to the west of the tracks along the edge of the brush line and wetland. Each survey line was 750 feet long. A magnetic survey was conducted and used to identify additional pipelines in the area.

Antea Group was able to use the results of the surveys to help design a remediation system for intercepting the crude oil and dissolved phase petroleum constituents.

4.40 Conduct/oversee studies of hydrogeology, geology, and soils utilizing geophysical studies, modeling, and dye trace studies.

Geophysics

Geophysical methods, both surface and downhole, are often a key component of defining and enhancing the Conceptual Site Model (CSM). These methods include electrical, magnetic, gravimetric, acoustic, seismological, and radiometric. Many of the methods, such as magnetic, gravimetric, and seismological, are best suited for defining geology, lithology, and structural features. Electrical methods are often used to define the extent of contaminated groundwater, but have also been used to map structural features (faults and fractures), and detect groundwater flow through fractures. Radiometric methods are typically used to define stratigraphy based on shales and clays usually containing higher percentages of radioactive elements (often Potassium 40) than sandstone, limestone or sand.

Antea Group used a specialized seismological method (multi-channel analysis of surface waves) to map solution channels in carbonate rocks at a petroleum pipeline release. Using this technique, the propagation and dispersion of the surface waves (Rayleigh Waves) are monitored through an array of geophones or accelerometers. By running several lines, the northwest-trending solution channels were observed. Subsequent drilling confirmed the existence of the solution channels that allowed for interception and recovery of LNAPL and dissolved-phase hydrocarbons.

At a terminal site in a carbonate terrane, karst and cavern development were known to occur. An electrical profiling method (Wenner) was used to locate solution channels and fairly well-developed caverns prior to drilling. Several electrical profiles were run in parallel, subparallel and orthogonal orientations, which allowed for the alignment of electrical anomalies to be observed. These anomalies correlated with a set fractures or solution channels oriented SW to NE, and SE to NW.

Modeling

Antea Group is familiar with and utilizes a variety of analytical and numerical models (steady state and transient) to evaluate groundwater flow at sites across the United States. Typically, the questions to be answered include, the level of site complexity, the available site data, and the type of model that will be utilized. For example, evaluating the horizontal capture zone dimensions at a single well under uniform hydrogeologic conditions, could be performed using a relatively simple analytical calculation or an analytical 2-D model such as CAPZONE. For more complex sites involving multiple geologic layers and vertical components of groundwater flow, a three-dimensional numerical model would likely be required.

For larger three-dimensional numerical modeling projects, Antea Group begins by meeting with the project stake holders to understand the objectives of the modeling effort and to outline the modeling steps and data compilation requirements. Antea Group's modeling team utilizes GIS and database technologies for the compilation, management and interfacing with the modeling software for both model input and output. This allows for model-ready formats and streamlines output evaluation. Successful model development begins with an accurate and realistic conceptual site model (CSM) which is a summary of the major components of the flow system and the processes that link them together. The CSM characterizes the aquifers and their extent, the associated water bodies, the stresses of pumping and recharge, and the physical process of water moving through porous or fractured media.

Reilly and Harbaugh (2004) note that the objective of the hydrogeologist is to include the most important aspects of the CSM into the design of the model to ensure the model will provide useful information about the system and meets the objectives compiled with the stake holders. In characterizing the model domain Antea Group seeks to utilize natural groundwater flow divides or discharge areas to establish realistic boundary conditions that lend themselves to be characterized as no-flow, constant head, or constant flux. In this way boundary effects can be minimized or eliminated. Once the model boundaries have been established, a grid is superimposed over the model domain with more detailed discretization in the areas of interest, such as pumping centers or hydraulically important surface-water bodies. Aquifers and aquitards are represented by unique model layers to align with the CSM. Likewise, boundary conditions are designed to represent the natural boundaries incorporated into the model domain. The required data for each node or element, such as hydraulic conductivity, storage coefficient, aquifer thickness(es), aquitard thickness(es), head(s) and recharge, are then organized in the model's database. Once the model is fully constructed and functional, preliminary simulations are performed to assess mass balances of flow through the various model layers and is critically compared with the CSM to ensure the model can adequately replicate the natural system. Assuming the model mass balances are acceptable, Antea Group will then initiate model calibration using known head target elevations, stream base flow fluxes, and hydraulic gradients. Calibration can be performed manually by incrementally changes key parameters in groups of nodes or elements, or by using automated inverse solutions, such as Parameter Estimation (PEST). Antea Group attempts to achieve calibration manually before employing PEST which can be used to identify modifications to the model's aquifer properties to improve model calibration statistics. Sensitivity analysis is performed by varying key model input parameters within reasonable limits to assess which have the greatest impact on the model results. Stochastic MODFLOW is also used to evaluate the uncertainty of the model predictions using Monte Carlo techniques which automatically adjust selected model parameters using a minimum and maximum parameter range, specified data distribution types, and associated statistical characteristics during multiple (hundreds to thousands) of model simulations. Once the model uncertainty is evaluated, the model can be used for predicative purposes with the uncertainty of the results communicated to the stake holders. Antea Group documents the model purpose, development and findings in a comprehensive report that presents the model output in graphical and map form typically using GIS data management software.

Antea Group uses models to help answer a variety of groundwater flow questions used in decision making that can range from wellhead protection to optimization of remedial systems. Consequently, with any modeling effort, a clear understanding of the CSM, the model's limitations, and the uncertainty associated with the model input and output need to be revisited throughout the modeling process.

Antea Group has experience working with the following unsaturated and saturated flow models:

- HYDRUS – 1D
- VS2DTI – 2D
- SESOIL – 1D
- VLEACH – 1D
- ATRANS V2
- CAPZONE – 2D
- Vistas MODFLOW – 3D

Visual MODFLOW – 3D
Visual AEM – 2D
DREAM – 2D
BIOSCREEN – 1D (including enhanced versions produced by various agencies or organizations)

Example: Litigation Project

Regional Metro Model

Vistas is the graphical interface program which incorporates the USGS MODFLOW/MODPATH models used by the Met Council in constructing the Metro Model 2.0 and pending version 3.0 for the 11 County Minneapolis/St. Paul metropolitan area. Antea Group used Vistas to evaluate groundwater flow on a regional scale in the metropolitan area using telescopic mesh refinement (TMR) to extract and further discretize the modeling domain from the original Metro 2 Model.

As with any regional modeling effort, data compilation, validation, management and input from various stake holders was a significant part of the project leading up to actually modifying model layer properties and running the model. Once the model domain and boundaries were established a systematic evaluation of the boundary conditions and flux across the model layers was performed to verify the CSM. Subsequently, calibration targets were updated to assess the model's ability to simulate actual heads, hydraulic gradients, and estimated stream base flows. Once the steady-state model was adequately calibrated, manual and automatic sensitivity analyses were performed on the input data to identify the model parameters having the most effect on model calibration and model predictions. Monte Carlo methods were also used to assess model uncertainty. A transient version of the 3D model was ultimately developed to take into account multiple municipal well field expansions and seasonally adjusted pumping variability extending out to 2050. The purpose of the model was to assess well field interferences, aquifer yield constraints and the potential impact on local stream discharge rates.

Oversee Hydrogeologic Investigations Including Fate and Transport Modeling.

Antea Group has designed, prepared and implemented hundreds of site and remedial investigation Work Plans at a variety of sites. These sites have included: petroleum retail, terminals and refineries; chemical manufacturing; landfills; brownfield redevelopment, and Ag-Chem sites with chemicals of concern (COCs) consisting of: VOCs, SVOCs, PAHs, PCBs, perfluorocarbons (PFCs), heavy metals, fertilizers and pesticides. The primary objective of these investigations is to characterize the subsurface hydrohydrogeology geology to assess potential contaminant migration pathways, delineate the extent of subsurface impacts in the unsaturated and saturated horizons, and evaluate remedial alternatives. Antea Group's hydrogeologists are familiar with the current MPCA risk-based site evaluation process (RBSE) guidance documents, and understand the iterative approach often required to compile sufficient regional and site-specific hydrogeologic information required to perform fate and transport modeling. Antea Group utilizes a variety of literature and technical resources (such as, DNR, MDH, MGS, and USGS) in addition to conducting site-specific hydrogeologic investigations, as necessary, to support development of the CSM which is a critical step in any modeling effort.

Site-specific hydrogeologic investigations often include the collection of undisturbed unsaturated and saturated soil or core samples of unique geologic units encompassing the extent of delineated COCs to assess soil and or fracture

properties that are useful in evaluating contaminant migration such as: porosity, grain size distribution, fractional organic carbon, pore saturation if NAPL is present, total organic carbon, bulk density, vertical permeability and fracture density. Depending on the fate and transport questions to be answered, the characteristics of the COCs and the site complexity, 1D or 2D transport models such as BIOSCREEN, BIOCHLOR-AT, or VS2DTI that incorporate dispersion, adsorption and biotransformation may be sufficient in addressing the fate and transport of dissolved phase COCs under relatively simple groundwater flow conditions. Antea Group often applies these types of models to sites where monitored natural attenuation (MNA) is being evaluated.

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**Example: Fate and Transport
 Regional Model**

Once a MODFLOW flow model is developed and calibrated, it can be coupled with MT3D to evaluate contaminant fate and transport. Model defined source cells are setup to reproduce the source types as defined by the CSM in the appropriate model layers and the modeled layers are assigned representative transport properties including storativity, porosity, and dispersivity values. COC reaction or decay rates are also incorporated into the model to assess contaminant attenuation. Calibration to existing monitoring well concentrations is an iterative approach using historical analytical trend data. In addition, sensitivity and uncertainty analyses are performed using the calibrated MODFLOW/MT3D model prior to using the model to predict future fate and transport scenarios.

Using the transient version of the MODFLOW model discussed in the groundwater flow modeling example, Antea Group incorporated the use of MT3D to evaluate the fate and transport of non-reactive COCs released from former municipal and industrial landfills within the study area. The model was developed to assess the long-term impacts to the existing and future municipal wells and the potential need for secondary treatment prior to groundwater use.

Tracer Studies

Antea Group conducted several tracer tests at a petroleum terminal site in southeastern Minnesota. The first tracer test was conducted to assess the connection between a sinkhole located 0.66 miles east of the terminal and two springs located 6 miles southeast of the terminal. Rhodamine WT dye was introduced into the sinkhole and was detected in water from both springs 11 days later. The results of this tracer study indicated that groundwater flow velocities in the karstic terrane are on the order of 0.5 miles per day.

A subsequent tracer test was conducted on the southwestern portion of the terminal property to evaluate groundwater flow direction at the western side of the terminal. A trench was excavated to a depth of about 2 meters where a southeast to northwest trending weathered fracture was identified. One kilogram of Eosin dye (to distinguish it from the earlier tracer test using Rhodamine WT) was poured into a trench and filled with clean water

to promote migration of the dye. Charcoal detectors were deployed in nine monitor wells, but Eosin was detected in one nested pair of monitor wells more than 5 months after the dye was introduced into the trench. Detectable concentrations of Eosin dye were subsequently detected in a multi-port Westbay well located about 675 feet north of the trench. Eosin dye was also detected in the terminal water-supply well, located about 650 feet north-northeast of the trench, in a water sample collected 6 months after the dye was emplaced in the trench. The results of the tracer test showed that the western portion of the terminal was in a different springshed than the sinkhole investigated previously.

A tracer test was conducted in 2006 in the eastern portion of the terminal to investigate groundwater and LNAPL transport from the former loading rack. For this tracer test, non-reactive sodium bromide was introduced into a monitor well near the former loading rack. Water samples had been collected and analyzed for bromide from the entire monitor well network prior to introducing the sodium bromide into the groundwater. Periodic field measurements conducted for the entire monitor well network, including the multi-port Westbay wells, suggest the bromide was transported to some monitor wells completed in the overburden and the shallow bedrock units north of the emplacement location. The lack of bromide detections in wells east of the terminal indicated that the site is not within the same springshed that includes the springs evaluated in the first tracer test.

4.41 Prepare construction cost estimates using standard engineering practices.

Antea Group has several individuals on staff with extensive experience in environmental remediation implementation cost estimating for a spectrum of varied remediation technology applications. Utilizing the resources available to us, Antea's intent is to provide the most accurate remediation system cost estimates practicable as the project advances through the different phases of the design and application process. Utilizing our in-house specialists, data from prior project experiences, current construction cost estimating software, and actual solicited contractor cost estimates, Antea Group consistently provides our clients with comprehensive cost estimates through all phases of the remediation process with a great level of accuracy.

The following is a list of technologies in which Antea Group has provided construction cost estimates for extensively from the conceptual phase through application and operation.

- Groundwater extraction
- Soil Vapor Extraction
- Multi-Phase and High-Vacuum Extraction
- Active and passive product recovery
- Bio Venting
- Air Sparging
- Ozone Sparging
- Vapor Phase Treatment
- Liquid Phase Treatment
- Biosparging
- Steam injection
- Sub-Slab Depressurization
- Insitu Chemical Oxidation
- In-situ enhanced Bioremediation

- Soil excavation
- Soil Stabilization

4.42 Assist the MPCA during the bidding process. The Contractor shall develop, advertise, distribute plans and specifications and addenda, answer bid questions, conduct pre-bid meetings, evaluate bid submittals, including bidder qualifications, and provide a recommendation for bid award.

Antea Group has frequently utilized the bidding process as outlined in the MPCA *Subcontractor Purchasing Manual* (Purchasing Manual), to provide cost effective solutions for complex remedial actions. Antea Group frequently prepares and evaluates bid specifications for remedial activities including remediation of soil, groundwater, vapor, and free phase product. Antea Group has worked on multiple projects and assisted the MPCA in awarding bids to qualifying subcontractors. Additionally, Antea Group has followed similar processes outlined in the Purchasing Manual for other clients not associated with MPCA contact work, to choose the most qualified subcontractor to complete the scope of work.

As a Multi-Site Contractor with the MPCA, Antea Group is proficient at completing bid specifications and procuring subcontractors for services and construction projects which are less than \$50,000 following the Purchasing Manual and MPCA specific bidding forms. The MPCA purchasing manual process is similar to the process utilized by Antea Group in purpose, detail and review by senior staff. Antea Group also utilizes Target Group/Economically Disadvantaged (TG/ED) when possible as a practice and following Purchasing Manual requirements. When utilizing the process described in the Purchasing Manual, Antea Group provides the MPCA with all applicable forms which detail the requested remedial design specifications or description of services and a complete package for posting on the Minnesota Department of Administration (MDA), Materials Management Division website for advertising the solicitation, as necessary. Based on the design, Antea Group prepares a detailed specification and bidding package, which is submitted to qualified bidders for solicitation of bids. The bid specifications detail applicable codes or permitting, site health and safety, schedule, change order, insurance, contract and/or performance issues the subcontractor must follow. Antea Group provides a specific scope of work in the bid package to ensure there is no uncertainty as to the subcontractor's responsibilities. Once approved for posting and posted, Antea Group is accustomed to answering bid questions as they arise from subcontractors interested in submitting bids, and understands that any changes in the scope after posting require an addendum to be posted. After the receipt of bids, a contractor is selected to conduct the specified work based on cost, qualifications and the ability to meet the project schedule.

Antea Group organizes and conducts pre-bid meetings to allow interested subcontractors to see the worksite and ask any questions they may have while developing their bid. Following posting and solicitation of bid specifications under the MPCA Purchasing Manual Process, Antea Group collects, tallies and evaluates the returned bids in order to recommend a contractor for the award of the work. The recommendation considers cost, qualifications, and ability to meet the project schedule.

Antea Group also is proficient at completing the Minnesota Department of Administration bidding process for procuring subcontractors following MDA procurement procedures and forms for MPCA projects which cost \$50,000 or higher. This process is similar to the MPCA Purchasing Manual process; however, bids are procured through MDA processes and forms rather than the MPCA Purchasing Manual process and forms. Antea Group has utilized either the MDA process or MPCA Purchasing Manual process to procure more than a dozen contracts on behalf of and in cooperation with the State of Minnesota during the past five years.

4.43 Provide project management and construction oversight. In general, this will entail:

- **Project coordination;**
 - Antea Group project managers work with the whole spectrum of stakeholders on any given project such as: clients, regulators, contractors, vendors/suppliers, property owners, media, the general public as well as our own staff and management. A project schedule is created at the beginning of the project and input from stakeholders is requested to get commitment from all parties. Scope and schedule change due to unforeseen reasons or for the benefit of the projects can occur. Antea Group managers are experienced with these dynamic project changes and can communicate the necessary information to all stakeholders to keep the project progressing. Antea Group uses a companywide resourcing tool to manage our resources and this provides visibility for our managers to staff their projects.
- **One or more qualified representatives at the project site at all times when the construction contractor is conducting significant work or when otherwise directed by the MPCA Site Team;**
 - Antea Group always has a qualified representative on project site locations no matter what the work entails. This is a best management practice (BMP) implemented by Antea Group. Contractors are provided a safety tailgate meeting, debriefing them of the project site and any potential hazards that may be present. In addition, hazards related to the contracted work being conducted are described and documented in a job safety analysis (JSA). Contracted work is always photographed, documented, and communicated to project managers daily.
- **Ensuring that all specifications are met, by reviewing tests including, but not limited to, equipment and material submittals, liner testing, soil compaction, soil gradation, materials placement, elevation grades, and concrete testing;**
 - All project data and information need to be quality assured and controlled (QA/QC). Antea Group technically reviews all project data and information and checks it against environmental standards, legal standards and project design specifications. In addition, calibration metrics need to be adhered to for final verification. When a project does not meet specification or standard, Antea Group proactively communicates this information and works with the client to develop a solution.
- **Conducting weekly progress meetings, preparing a weekly construction agenda, and distributing a summary of the weekly construction meeting minutes;**

- Antea Group field staff document, photograph, and communicate project progress through electronic avenues (email, online, and/or the cloud). Depending of the project, this progress will always be summarized weekly, but often is summarized daily. Project managers review field notes, photographs, samples taken, data collected, shipments, manifests, and safety notes to ensure that construction activities are being performed safely, meeting project objectives, within project budget, and appropriate within the project scope.
- **Reviewing and approving construction contractor invoices;**
 - Typically, when reviewing and approving contractor invoices, a bid or a quote is used as the basis to review an invoice. The agreed upon scope and cost is reviewed and compared to the work completed and invoice charges. Proper back up for materials and subcontractors is also required for all invoices. On occasion, the scope of work may change, which would require a pre-approved change order to the original contract price. Antea Group's on-site personnel provide Project Managers with the current project status and progress which can then be compared to the invoice stated work progress and pricing. Antea Group is also aware of the impact of timely payments to our contractors and we pay our contractors according to our contracted terms.
- **Erosion control measures inspections;**
 - Antea Group has prepared Storm Water Pollution Prevention Plans (SWPPPs) and implemented erosion control measures includes numerous railroad yards, food production facilities, and a large remedial excavation project. Implementation activities have included installation of erosion controls (e.g., coir logs, rip rap), preparation of erosion control maintenance documentation, site control after storm events, repairs of erosion controls, and decommissioning of erosion controls during shutdown of a temporary Site.
 - Inspections of erosion control measures are specific to each project, for example; coir logs at the Tioga, North Dakota site are inspected and maintained at least once every 14 days and within 24 hours of any rainfall event greater than 0.5 inches. This ensures soils and water runoff remain within the perimeter of the remediation and excavation activities at the project site.
- **Oversee equipment/system start-up and trouble shoot problems with the Contractor/Vendor for repair and newly installed remediation systems;**
 - Antea Group remediation projects will typically include a startup provision for newly installed systems to include startup, stress test of system functionality, testing of alarms and emergency shutoffs. When complex systems are installed, Antea Group will require the contractor to provide 3 to 7 days of onsite supervision once the system is installed to ensure proper operation after start up. Also included in the system installation scope of work is training for operations and maintenance (O&M) personnel as well as an O&M manual. The contractor is also expected to provide at least a 1 year warranty for the equipment.
- **Participation in or conduct other public and project management meetings**
 - Antea Group regularly supports our clients with presentations at public and project management meetings. We have provided technical support, general question and answer facilitation, project scope and status updates as well as media interaction. Our senior resources know of the

importance of media and public interactions and would only discuss project and client information with the strict approval of our clients.

4.44 Prepare construction documentation reports.

Antea Group understands that proper documentation is a significant factor in the success of every project. Furthermore, thorough and exact documentation of the project will be the source of information used at that site going forward, both client and non-client. It is critical that all information about the project is recorded, accurate, and verified. At Antea Group, we ensure all documents, data, interpretations, project changes, visualizations, communications, and conclusions are collected and saved after a thorough review by Antea Group staff. This material is included in a project closure documentation report. This report is stored both electronically and paper archived, then delivered to the client in the format of their choosing.

Proper documentation reporting begins on day one of the project and is adjusted as the project progresses through its lifecycle. When construction begins, countless hours have already been undertaken to develop a sound and often complex engineering design. This design is the pathway to success for the project. Documentation from the start to the end of the project provides verification that procedures and designs were followed in accordance to the specifications. Construction activities and project sites are complex, often containing multifaceted challenges. Antea Group safely navigates these complexities, providing advice and continuously updating and recording information at the project site. This information consists of:

- Daily activities and field notes
- Safety meeting minutes
- Contractors on site
- Validation against project design
- Permit approvals/requirements
- Surveying and GPS coordinates
- Project site changes
- Forecast project stages
- 3rd Party Requests
- Progress achieved vs. Invoicing
- Samples collected
- QA/QC tests conducted
- Manifests
- Upcoming activities/testing
- Photographic logs
- Track shipments/sample results
- Verification of safety standards
- Coordination of vendors and third parties
- Media Reports
- Maintain/Inventory project supply needs

In addition, communication of information between onsite personnel and laboratory testing facilities is methodically recorded and shared with the project team. In many instances, projects may be setup to automate data record keeping with the laboratory facility, ensuring complete quality assurance and control in data documentation. Finally, technology allows for real-time project monitoring using ArcGIS Online, and in field QA/QC digital data collection. This ensures information is getting managed properly, accurately, and timely.

Projects, both small and large require detailed record keeping. File structure and organization play a key role in successful documentation reporting. Antea Group has developed a procedural remedy to this process, archiving documents and information in file cabinets, electronically, online, with secure backup copies. All data and information pertaining to a project should be accessible and understandable by anyone involved in that project, both today and in the future.

In order for verification to be conclusive in documentation reporting, data and information need to be quality checked and assured (QC/QA). Antea Group technically reviews all data and information and checks it against appropriate standards and design specifications. In addition, calibration metrics need to be adhered to for final verification. When a project does not meet specification or standard, Antea Group proactively communicates this information and works with the client to develop a solution. Changes in scope, budget, and schedule are normal variables Antea Group handles comfortably and documents properly for reporting purposes.

**Example: Oil Spill Site
Tioga, North Dakota**

Antea Group has led the project remediation efforts for the largest oil spill on land in North America for the past 5 years. This project, located in Tioga, North Dakota, began as an emergency response request from large energy client. Antea Group completed daily activities during the initial project response phase that included; coordinating contractors, monitoring safety hazards, evaluating and interpreting contamination extents, photographically logging response actions, preparing permits to the state on behalf of the client, communicating observations, developing sampling procedures, and projecting the scope of the remediation to follow. As the project phase migrated from emergency response to remediation activities, Antea Group was responsible for documenting the environmental excavation and remediation efforts.

For the past 5 years, Antea Group has supplied onsite personnel to oversee daily activities 7 days a week. Field notes and daily activities, photographs, permitting metrics, safety meetings, samples taken, tests conducted, contractors on site, project site changes, projects changes, etc. are all noted and documented for reporting purposes. Data and information is verified against design and remediation plans to ensure the project remains on track, within scope and budget. Upon completion of pre-determined remediation project phases, documents, data, and information are documented in technical memorandums, quarterly reports, or semi-annual reports and stored in paper copy and electronically, then submitted to the client and/or regulatory agency. Each of these documents ultimately will be delivered within the final verified documentation report for the project.

This project demonstrates the breadth of data, information, and documentation Antea Group is capable of handling for both small and large projects. A project's overall success is reliant on the ability to communicate and convey

complex information, Antea Group takes pride in the ability to deliver verified documentation reports in a succinct, timely, and organized manner.

4.45 Prepare Operation and Maintenance (O&M) Manuals.

Antea Group has designed, installed and operated hundreds of active remediation systems in Minnesota and throughout the United States. These systems have been installed on behalf of both government and private clients. Production of an Operation and Maintenance Manual is an essential task completed prior to system start up. The purpose of the O&M manual is to provide the information necessary for proper operation, maintenance, and monitoring of the subject remediation system. The components of a typical O&M manual include:

- Detailed description of system operation and function
- Detailed piping and instrumentation drawing (P&ID)
- Listing of all major components with their manufacturer, model number and serial number noted.
- Detailed description of system controls, valves and monitoring equipment.
- Step by step start up and shut down procedures
- OEM manuals for all major components.
- System start-up, shut-down and routine monitoring checklists.
- Routine standard operating procedures (SOPs)
- Schedule of routine maintenance items
- Inspection, Evaluation, and management of change forms
- System figures and drawings
- Lock out – tag out procedures
- Applicable personnel contact information

Antea Group has developed O&M manuals for systems installed at many locations including;

- A system consisting of multiple vacuum enhanced recovery wells with pneumatic total fluids recovery pumps to recover free product and vapors from a gasoline pipeline release. The water treatment consists of an oil water separator, air stripper and carbon polish prior to discharge under a site NPDES permit. Recovered vapors are treated with an electric catalytic oxidizer to remove recovered hydrocarbon vapors prior to discharge.
- A soil vapor extraction (SVE) system installed to recover hydrocarbon vapors from a terminal gasoline release. The system consisted of multiple vapor extraction wells connected to a regenerative blower. The recovered vapors were treated with a catalytic oxidizer prior to discharge

5.0 PROJECT SCENARIOS

Scenario C: Closed Landfill Program Environmental Services

Please see Attachment A: Example Workplan

Please see Attachment B: Example Scenario Project Spreadsheet

Table 1

Staff Matrix

**Table 1
MPCA Staff Matrix - 2018**

Antea Group Team Member	Classification	OSHA Certifications	Years of Antea Group Service	Education	Total Years of Experience	Licenses/ Certifications	Location
Joy Rooney	- Field Technician - Scientist 1 - Scientist 2 - Engineer 1 - Engineer 2 - On-Site Inspector	<ul style="list-style-type: none"> ▪ 40-Hour HAZWOPER ▪ Annual 8-Hr Refresher 	6	<ul style="list-style-type: none"> ▪ BS – Biosystems and Bi-products 	12	<ul style="list-style-type: none"> ▪ Engineer In-Training: Minnesota - License #140168 	Regional
Tara Duffy	- Field Technician - Scientist 1 - Scientist 2	<ul style="list-style-type: none"> ▪ 40-Hour HAZWOPER ▪ Annual 8-Hr Refresher ▪ OSHA 30-Hr 	10	<ul style="list-style-type: none"> ▪ BS – Geology 	11	<ul style="list-style-type: none"> ▪ Accredited Office Ergonomics Evaluator (AOEE) – June 2014 ▪ Professional Member, American Society of Safety Engineers 	Local
Paul Durkee	- Project Manager	<ul style="list-style-type: none"> ▪ 40-Hour HAZWOPER ▪ Annual 8-Hr Refresher 	28	<ul style="list-style-type: none"> ▪ BA – Biology, Gustavus Adolphus College – St. Peter, Minnesota ▪ MA – Aquatic Biology, Bemidji State University – Bemidji, Minnesota 	30	<ul style="list-style-type: none"> ▪ -- 	Local
John Estes	- Scientist 1 - Scientist 2 - Project Manager - On-Site Inspector	<ul style="list-style-type: none"> ▪ 40-Hour HAZWOPER ▪ HAZWOPER Supervisor Course ▪ Annual 8-Hr Refreshers 	19	<ul style="list-style-type: none"> ▪ BS – Geology 	22	<ul style="list-style-type: none"> ▪ Certified Petroleum Release Remediator: South Dakota 	Local
Jessica Highfill	- Field Technician - GIS/CADD Specialist - Scientist 1 - Scientist 2 - On-Site Inspector	<ul style="list-style-type: none"> ▪ 40-Hour HAZWOPER ▪ Annual 8-Hr Refreshers 	14	<ul style="list-style-type: none"> ▪ BS – Environmental Biology, University of Dayton – Dayton, Ohio 	18	<ul style="list-style-type: none"> ▪ -- 	Regional

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Wayne Hutchinson	- Scientist 2 - Project Manager - On-Site Inspector	<ul style="list-style-type: none"> ▪ 40-Hour HAZWOPER ▪ Annual 8-Hr Refreshers 	13	<ul style="list-style-type: none"> ▪ MS – Geology ▪ BA – Geology 	45	<ul style="list-style-type: none"> ▪ Professional Geologist: Wisconsin – License #201-13 ▪ Professional Geologist: Illinois – License #196.000842 ▪ Professional Hydrologist: Wisconsin – License #106-111 	Regional
Bob Karls	- Project Manager - On-Site Inspector	<ul style="list-style-type: none"> ▪ 40-Hour HAZWOPER ▪ Annual 8-Hr Refresher 	31	<ul style="list-style-type: none"> ▪ MS – Hydrology ▪ BS – Earth Science/ Geology 	38	<ul style="list-style-type: none"> ▪ Professional Geologist: Minnesota – License #30067 ▪ Professional Geologist: Wisconsin – License #632 ▪ American Institute of Professional Geologists, CPG #7348 	Local
Keith Knoke	- Project Manager	<ul style="list-style-type: none"> ▪ 40-Hour HAZWOPER ▪ Annual 8-Hr Refreshers 	21	<ul style="list-style-type: none"> ▪ MS – Geology ▪ BA – Geology ▪ BA – History 	25	<ul style="list-style-type: none"> ▪ Professional Geologist: Minnesota – License #30277 ▪ Professional Geologist: Wisconsin – License #1141-013 ▪ Professional Geologist: Illinois – License #196-000386 	Local
Jacob Knapp	- Field Technician - Scientist 1 - Scientist 2 - Project Manager - On-Site Inspector	<ul style="list-style-type: none"> ▪ 40-Hour HAZWOPER ▪ Annual 8-Hr Refresher 	11	<ul style="list-style-type: none"> ▪ BA – Environmental Studies-Environmental Sciences Concentration 	14	<ul style="list-style-type: none"> ▪ Certified Radon Mitigation and Measurement Provider (ARST/NRPP) 	Local
Dean Krebs	- Scientist 1 - Scientist 2 - Engineer 1 - Engineer 2 - Engineer 3 - Engineer 4 - Project Manager	<ul style="list-style-type: none"> ▪ 40-Hour HAZWOPER ▪ HAZWOPER Supervisor Course ▪ Annual 8-Hr Refreshers 	24	<ul style="list-style-type: none"> ▪ BS – Geological Engineering 	24	<ul style="list-style-type: none"> ▪ Professional Engineer: Minnesota – License #26540 ▪ Professional Engineer: Texas – License #89822 ▪ Professional Engineer: Illinois – License #062.059808 ▪ Professional Engineer: Iowa – License #18322 	Local

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Aaron Lapine	- Scientist 2 - Project Manager	<ul style="list-style-type: none"> ▪ 40-Hour HAZWOPER ▪ Annual 8-Hr Refreshers 	19	<ul style="list-style-type: none"> ▪ MS – Environmental Science ▪ BA – Botany and Political Science 	22	<ul style="list-style-type: none"> ▪ Environmental Professional: Connecticut – License #522 	Regional
Corey Mecham	- CADD Specialist - Scientist 2 - Project Manager	<ul style="list-style-type: none"> ▪ 40-Hour HAZWOPER ▪ Annual 8-Hr Refresher 	17	<ul style="list-style-type: none"> ▪ BS – Meteorology 	17	<ul style="list-style-type: none"> ▪ Illinois GIS Association 	Regional
Cindy Meldrum	- Field Technician - Scientist 1 - Scientist 2	<ul style="list-style-type: none"> ▪ 40-Hour HAZWOPER ▪ Annual 8-Hr Refreshers 	24	<ul style="list-style-type: none"> ▪ AAS – Business, Scott Community College – Bettendorf, Iowa 	24	<ul style="list-style-type: none"> ▪ -- 	Regional
Mark Nelson	- Scientist 1 - Scientist 2 - Engineer 1 - Engineer 2 - Engineer 3 - Engineer 4 - Project Manager	<ul style="list-style-type: none"> ▪ 40-Hour HAZWOPER ▪ Annual 8-Hr Refreshers 	23	<ul style="list-style-type: none"> ▪ BS – Civil Engineering 	24	<ul style="list-style-type: none"> ▪ Professional Engineer, Minnesota – License #25828 ▪ Professional Engineer: Illinois – License #062-055081 ▪ Professional Engineer: Florida – License #65189 ▪ Professional Engineer: California – License #6359 ▪ Professional Engineer: Louisiana – License #35631 	Local
Jared Otto	- Scientist 2 - Project Manager - On-Site Inspector	<ul style="list-style-type: none"> ▪ 40-Hour HAZWOPER 	14	<ul style="list-style-type: none"> ▪ BS – Geology 	24	<ul style="list-style-type: none"> ▪ Professional Geologist: Minnesota 	Local

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Jon Pesicka	- Scientist 2 - Engineer 2 - Engineer 3 - Engineer 4 - On-Site Inspector - Project Manager	<ul style="list-style-type: none"> ▪ 40-Hour HAZWOPER ▪ Annual 8-Hr Refreshers 	27	<ul style="list-style-type: none"> ▪ BS – Civil Engineering 	31	<ul style="list-style-type: none"> ▪ Professional Engineer: California – License #46093 ▪ Professional Engineer: Wyoming – License #8380 ▪ Professional Engineer: Washington – License #35514 ▪ Professional Engineer: Arizona – License #32539 ▪ Professional Engineer: South Dakota – License #6666 ▪ Professional Engineer: Colorado – License #32708 ▪ Professional Engineer: Michigan – License #6201046313 ▪ Professional Engineer: Utah – License #4814077-2202 ▪ Professional Engineer: Idaho – License #9908 ▪ Professional Engineer: Ohio – License #64415 	Local
Brent Puck	- Scientist 2 - Project Manager	<ul style="list-style-type: none"> ▪ 40-Hour HAZWOPER ▪ Annual 8-Hr Refreshers 	14	<ul style="list-style-type: none"> ▪ MS – Physics ▪ BA – Physics 	21	<ul style="list-style-type: none"> ▪ Certified Groundwater Professional: Iowa 	Regional
Don Reeder	- CADD Specialist	<ul style="list-style-type: none"> ▪ 40-Hour HAZWOPER ▪ Annual 8-Hr Refreshers 	15	<ul style="list-style-type: none"> ▪ BS – Horticulture, University of Minnesota – Minneapolis, Minnesota 	20	<ul style="list-style-type: none"> ▪ -- 	Local

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Nancy Rodning	- Field Technician - Scientist 1 - Scientist 2 - Project Manager - On-Site Inspector	<ul style="list-style-type: none"> ▪ 40-Hour HAZWOPER ▪ Annual 8-Hr Refresher ▪ HAZWOPER Supervisor 	15	<ul style="list-style-type: none"> ▪ BS – Geology, University of Wisconsin 	20	<ul style="list-style-type: none"> ▪ -- 	Local
Tony Rossano	- Scientist 2 - QA/QC Officer	<ul style="list-style-type: none"> ▪ 40-Hour HAZWOPER ▪ Annual 8-Hr Refresher ▪ DOT Hazardous Materials Certification 	16	<ul style="list-style-type: none"> ▪ BS – Chemistry, Columbus State University – Columbus, Georgia 	35	<ul style="list-style-type: none"> ▪ DOT Hazardous Materials (HazMat Employee) Certification ▪ Lead Inspector (Target Housing and Child-Occupied Facilities) ▪ On-Scene Incident Commander (Hazardous Waste Operations and Emergency Response) ▪ Hazardous Materials Technician (Hazardous Waste Operations and Emergency Response) ▪ Asbestos Operational and Maintenance Worker ▪ Asbestos Emergency Response Act (AHERA) Building Inspector ▪ American Chemical Society Member (30+ years) ▪ Air and Waste Management Association Member 	Regional
Pete Schwalbach	- Scientist 2 - Project Manager	<ul style="list-style-type: none"> ▪ 40-Hour HAZWOPER ▪ HAZWOPER Supervisor Course ▪ Annual 8-Hr Refreshers 	24	<ul style="list-style-type: none"> ▪ BS – Civil & Environmental Engineering, University of Wisconsin – Madison, Wisconsin 	26	<ul style="list-style-type: none"> ▪ -- 	Regional

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Jack Sheldon	- Scientist 2 - Project Manager - On-Site Inspector	<ul style="list-style-type: none"> ▪ 40-Hour HAZWOPER ▪ Annual 8-Hr Refresher 	8	<ul style="list-style-type: none"> ▪ MS – Environmental Microbiology ▪ BS – Bacteriology and Public Health 	35	<ul style="list-style-type: none"> ▪ American Society for Microbiology ▪ National Groundwater Association 	Regional
Dariusz Szewczak	- Scientist 1 - Scientist 2 - Project Manager - On-Site Inspector	<ul style="list-style-type: none"> ▪ 40-Hour HAZWOPER ▪ Annual 8-Hr Refresher 	15	<ul style="list-style-type: none"> ▪ Master of Environmental Management ▪ BS – Environmental Sciences and Resource Management 	24	<ul style="list-style-type: none"> ▪ Certified Hazardous Materials Manager (CHMM) Master Level #12563 ▪ Advanced Safety Certificate; National Safety Council, 2003 	Local
Karen Thole	- Scientist 1 - Scientist 2 - Project Manager	<ul style="list-style-type: none"> ▪ 40-Hour HAZWOPER ▪ HAZWOPER Supervisor Course ▪ Annual 8-Hr Refreshers 	22	<ul style="list-style-type: none"> ▪ MS – Geology ▪ BS - Geology 	25	<ul style="list-style-type: none"> ▪ Professional Geologist: Wisconsin, License #711-013 	Local
Gary Turgeon	- Scientist 2 - Project Manager - On-Site Inspector	<ul style="list-style-type: none"> ▪ 40-Hour HAZWOPER ▪ Annual 8-Hr Refresher 	15	<ul style="list-style-type: none"> ▪ BA – Speech Communications, University of Minnesota 	30	<ul style="list-style-type: none"> ▪ Minnesota Groundwater Association Member ▪ Minnesota Petroleum Marketers Association Member ▪ League of Minnesota Cities Member ▪ Minnesota Petroleum Tank Release Compensation Fund Rule Advisory Committees 	Local
Jonathan Zimdars	- Scientist 1 - Scientist 2 - Project Manager - On-Site Inspector	<ul style="list-style-type: none"> ▪ 40-Hour HAZWOPER ▪ Annual 8-Hr Refresher 	20	<ul style="list-style-type: none"> ▪ BS – Geology 	27	<ul style="list-style-type: none"> ▪ Professional Geologist: Pennsylvania, License #2166 	Local

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MPCA Staff Matrix - 2018**

Antea Group Team Member	Classification	OSHA Certifications	Years of Antea Group Service	Education	Total Years of Experience	Licenses/ Certifications	Location
Sara Austin	- GIS/CADD Specialist - Scientist 1	<ul style="list-style-type: none"> ▪ 40-Hour HAZWOPER ▪ Annual 8-Hr Refresher 	3	<ul style="list-style-type: none"> ▪ MGIS – Geographic Information Science University of Minnesota – Minneapolis, Minnesota ▪ BLA – Landscape Architecture Ball State University – Muncie, Indiana 	5	<ul style="list-style-type: none"> ▪ -- 	Local
Dacre Busch	- Project Manager	<ul style="list-style-type: none"> ▪ 40-Hour HAZWOPER ▪ Annual 8-Hr Refresher 		<ul style="list-style-type: none"> ▪ Graduate Courses in Hydrogeology, Engineering, Geology, and theoretical Geophysics ▪ BS – Geology, California State University - Northridge, California ▪ BA – Earth Science/ Geography, California State University - Northridge, California 	25	<ul style="list-style-type: none"> ▪ -- 	Regional
Jarrold Cicha	- Field Technician - Scientist 1 - Scientist 2 - On-Site Inspector	<ul style="list-style-type: none"> ▪ 40-Hour HAZWOPER ▪ Annual 8-Hr Refresher 	2	<ul style="list-style-type: none"> ▪ MS – Earth and Climate Science (Hydrogeology focus), University of Maine - Orono, Maine ▪ BA – Geology ▪ BA – Environmental Science, University of Minnesota - Morris, Minnesota 	4	<ul style="list-style-type: none"> ▪ -- 	Local
Jacy Christenson	- Field Technician - Scientist 1 - On-Site Inspector	<ul style="list-style-type: none"> ▪ 40-Hour HAZWOPER ▪ Annual 8-Hr Refresher 	4	<ul style="list-style-type: none"> ▪ BS – Natural Resources, University of Minnesota 	4	<ul style="list-style-type: none"> ▪ -- 	Local

**Table 1
MPCA Staff Matrix - 2018**

Antea Group Team Member	Classification	OSHA Certifications	Years of Antea Group Service	Education	Total Years of Experience	Licenses/ Certifications	Location
Eric Feenstra	- Field Technician - Scientist 1 - Scientist 2 - Engineer 1 - Engineer 2	<ul style="list-style-type: none"> ▪ 40-Hour HAZWOPER ▪ Annual 8-Hr Refresher 	3	<ul style="list-style-type: none"> ▪ BS – Geological Engineering, Michigan Technological University 	5	<ul style="list-style-type: none"> ▪ Engineer In-Training – Michigan 	Regional
Stan Freedman	- GIS Technician - Field Technician - Scientist 1	<ul style="list-style-type: none"> ▪ 	4	<ul style="list-style-type: none"> ▪ BS – Geology, University of Puget Sound – Tacoma, Washington 	4	<ul style="list-style-type: none"> ▪ Post-Graduate Certificate – Geographic Information Systems, Portland Community College – Portland, Oregon ▪ Geological Society of America 	
Cathy Grams	- GIS/CADD Specialist - Scientist 1 - Scientist 2	<ul style="list-style-type: none"> ▪ 40-Hour HAZWOPER ▪ Annual 8-Hr Refresher 	10	<ul style="list-style-type: none"> ▪ BS – Geology, minor Computer Science, University of Minnesota – Duluth, Duluth, Minnesota 	15	<ul style="list-style-type: none"> ▪ -- 	Local
Craig Johnson	- Scientist 1 - Scientist 2 - On-Site Inspector - Project Manager	<ul style="list-style-type: none"> ▪ 40-Hour HAZWOPER ▪ Annual 8-Hr Refresher 	15	<ul style="list-style-type: none"> ▪ A.S. – HVAC Systems Installation, Service and Operation, Dunwoody College of Technology, Minnesota ▪ A.S. – Environmental Design Technology, Dunwoody College of Technology, Minnesota 	30	<ul style="list-style-type: none"> ▪ -- 	Local
David Koppel	- Field Technician - Scientist 1 - Scientist 2 - Project Manager - On-Site Inspector	<ul style="list-style-type: none"> ▪ 40-Hour HAZWOPER ▪ Annual 8-Hr Refresher ▪ First Aid/CRP/AED 	2	<ul style="list-style-type: none"> ▪ BA – Geology, Gustavus Adolphus College ▪ MS – Geology (Surface Processes), Ohio University 	7	<ul style="list-style-type: none"> ▪ AARST – NRPP Residential Measurement and Mitigation Provider 	Local

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Layne Kortbein	- Field Technician - Scientist 1 - Engineer 1	<ul style="list-style-type: none"> ▪ 40-Hour HAZWOPER ▪ Annual 8-Hr Refresher ▪ First Aid/CRP/AED 	1	<ul style="list-style-type: none"> ▪ BA – Bioproducts and Biosystems Engineering; Sustainability Studies University of Minnesota 	1	<ul style="list-style-type: none"> ▪ Engineer in Training (EIT): Minnesota, License #152343 	Local
Todd Kremmin	- Field Technician - GIS/CADD Specialist - Scientist 1 - Scientist 2 - On-Site Inspector	<ul style="list-style-type: none"> ▪ 40-Hour HAZWOPER ▪ Annual 8-Hr Refresher ▪ First Aid/CRP/AED 	2	<ul style="list-style-type: none"> ▪ MS – Earth and Environmental Studies, University of Minnesota – Duluth, Minnesota ▪ BA – Geology Gustavus Adolphus College 	6	<ul style="list-style-type: none"> ▪ Geologist In-Training (GIT): Minnesota, License #150242 	Local
Laura Maki	- Field Technician - Scientist 1 - Scientist 2 - On-Site Inspector	<ul style="list-style-type: none"> ▪ 40-Hour HAZWOPER ▪ Annual 8-Hr Refresher ▪ First Aid/CRP/AED 	4	<ul style="list-style-type: none"> ▪ BS – Physics and Math, Winona State University 	5	<ul style="list-style-type: none"> ▪ -- 	Local
Becky Matich	- Field Technician - GIS/CADD Specialist - Scientist 1 - Scientist 2 - On-Site Inspector	<ul style="list-style-type: none"> ▪ 40-Hour HAZWOPER ▪ Annual 8-Hr Refresher ▪ First Aid/CRP/AED 	4	<ul style="list-style-type: none"> ▪ BS – Environmental Studies, Bemidji State University 	5	<ul style="list-style-type: none"> ▪ Accredited Office Ergonomics Evaluator (AOEE) – June 2014 ▪ AIHA – Fundamentals of Industrial Hygiene 	Local
Molly Partridge	- Field Technician - GIS/CADD Specialist - Scientist 1 - Scientist 2 - On-Site Inspector	<ul style="list-style-type: none"> ▪ 40-Hour HAZWOPER ▪ Annual 8-Hr Refresher ▪ First Aid/CRP/AED 	3	<ul style="list-style-type: none"> ▪ MS – Geological Science, Central Washington University ▪ BS – Geological Science, Winona State University 	3	<ul style="list-style-type: none"> ▪ -- 	Local

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Antea Group Team Member	Classification	OSHA Certifications	Years of Antea Group Service	Education	Total Years of Experience	Licenses/ Certifications	Location
Christine Tufts	- Scientist 1 - Scientist 2 - Project Manager - On-Site Inspector	<ul style="list-style-type: none"> ▪ 40-Hour HAZWOPER ▪ Annual 8-Hr Refresher ▪ First Aid/CPR/AED 	10	<ul style="list-style-type: none"> ▪ MS – Water Resources Science, University of Minnesota ▪ BS – Geology, Michigan Technology University 	12	<ul style="list-style-type: none"> ▪ Professional Geologist: Minnesota, License #48960 ▪ Member, Minnesota Groundwater Association ▪ Member, American Institute of Professional Geologists 	Local
Paul Meier	- Field Technician - Scientist 1 - Scientist 2 - On-Site Inspector	<ul style="list-style-type: none"> ▪ 40-Hour HAZWOPER ▪ Annual 8-Hr Refresher 	13	<ul style="list-style-type: none"> ▪ BS – Geology, Winona State University – Winona, Minnesota 	30	<ul style="list-style-type: none"> ▪ Professional Geologist: Wisconsin 	Regional
Cortney Malloy	- Field Technician - Scientist 1	<ul style="list-style-type: none"> ▪ 40-Hour HAZWOPER ▪ Annual 8-Hr Refresher 	1	<ul style="list-style-type: none"> ▪ BS – Geology, Northwest Missouri State University 	1	<ul style="list-style-type: none"> ▪ -- 	Regional
Beth Firkins	- Field Technician - Scientist 1	<ul style="list-style-type: none"> ▪ 40-Hour HAZWOPER ▪ Annual 8-Hr Refresher 	4	<ul style="list-style-type: none"> ▪ BS – HTRM, University of Wisconsin-Stout – Menomonie, Wisconsin 	4	<ul style="list-style-type: none"> ▪ -- 	Local
Lawanda Olin	- GIS/CADD Specialist	<ul style="list-style-type: none"> ▪ 40-Hour HAZWOPER ▪ Annual 8-Hr Refresher 	12	<ul style="list-style-type: none"> ▪ MA – English Literature ▪ AAS – Civil Engineering Technology 	12	<ul style="list-style-type: none"> ▪ -- 	Regional
Chris Vandegrift	- Scientist 2 - Engineer 2 - Engineer 3 - Engineer 4 - On-Site Inspector - Project Manager	<ul style="list-style-type: none"> ▪ 40-Hour HAZWOPER ▪ Annual 8-Hr Refresher 		<ul style="list-style-type: none"> ▪ BS – Civil Engineering, University of Pittsburgh – Johnstown, Pennsylvania 	25	<ul style="list-style-type: none"> ▪ Professional Engineer: Pennsylvania, West Virginia, Ohio, Delaware, Maryland, and Georgia ▪ Remediation Specialist: West Virginia ▪ Member, National Society of Professional Engineers ▪ Member, National Council of Examiners for Engineering and Surveying 	

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MPCA Staff Matrix - 2018**

Antea Group Team Member	Classification	OSHA Certifications	Years of Antea Group Service	Education	Total Years of Experience	Licenses/ Certifications	Location
Ron Feingold	-	▪		<ul style="list-style-type: none"> ▪ BS – Geography, Emphasis: Human Development/Urban Planning, Pennsylvania State University – State College, Pennsylvania 		<ul style="list-style-type: none"> ▪ CSA American Greenhouse Gas Verifier Certification 	
Paul Girafalco	-	▪		<ul style="list-style-type: none"> ▪ 		<ul style="list-style-type: none"> ▪ 	
Owen McKenna	-	▪		<ul style="list-style-type: none"> ▪ MA – Environmental Management, Sustainability, Harvard University, Extension School, Cambridge, Massachusetts ▪ BA – Geology, Environmental Studies, Bowdoin College – Brunswick, Maine 		<ul style="list-style-type: none"> ▪ Certified Geologist: Maine, License #GE594 ▪ Professional Geologist: New Hampshire, License #883 	
Shavonne Gordon	-	▪		<ul style="list-style-type: none"> ▪ MS – Environmental Sciences, Ohio University – Athens, OH ▪ BS – Geology, Ohio University – Athens, Ohio 	25	<ul style="list-style-type: none"> ▪ Professional Geologist: Illinois, License #196.000122; Indiana, License #2532; Kentucky, License #2427; Pennsylvania, License #PG004519; Tennessee, License #5938 ▪ Pennsylvania Council of Professional Geologists Member ▪ CPG Member: American Institute of Professional Geologists (11411) 	
Jason Phillips	-	▪		<ul style="list-style-type: none"> ▪ BS – Industrial and Manufacturing Engineering, Western Michigan University – Kalamazoo, Michigan 	13	<ul style="list-style-type: none"> ▪ Engineer in Training (EIT) 	

Appendix A

Staff Resumes

Sara Austin

Experience Summary

Sara Austin, Project Professional, has been with Antea Group for 2 years as a part of the CAVe program. She is the Drafting Coordinator. Her background includes GIS, data management, AutoCAD, and modeling site conditions. Prior to joining Antea Group, she has approximately five years of experience working in a variety of fields managing teams of contractors for maintenance and design implementation for property management and landscape design as well as managing spatial databases.

Title

Project
Professional

Education

MGIS-
Geographic
Information
Science
University of
Minnesota,
Minneapolis, MN

BLA- Landscape
Architecture
Ball State
University,
Muncie, IN

Language

English

Related Projects

- Wrote and executed a program for watershed delineation and determination of stream locations using digital elevation models.
- Designed and implemented templates for Source Vulnerability Assessment figures for international projects.
- Created web application to interactively illustrate historical site features and potential contaminate sources.
- Managed and created maps for a variety of Antea Group projects, both static and mobile.
- Prepared and created diagrammatic and map based figures for presentations.
- Created 3 Dimensional and time lapsed models of underground chemical plumes.
- Designed and oversaw implementation of residential landscape projects as the principle designer, emphasizing native plants and ecologically friendly designs.
- Designed and created a database and analyzed data for a non profit helping alleviate food insecurity in Kossoye, Ethiopia.
- Created GIS maps to illustrate noise levels around the Memphis International Airport for use in illustrating areas of concern for noise pollution to be presented to the FAA and United States Congress.
- Undergraduate thesis- designed a comprehensive campus master plan for the University of Hyderabad in Hyderabad, India, using a variety of geological visualization techniques and emphasizing ecological conservation and preservation, water management, and intelligent growth.

Dacre Bush

Experience Summary

Dacre Bush has more than 30 years in business management and technical oversight for environmental-related projects. He has been involved with investigation and remediation of over 800 contaminated sites; has experience in CERCLA and RCRA sites involving solvents and metals; and is experienced with UST sites that were impacted with petroleum hydrocarbons. He has been involved in the design and management of thermal remediation (steam and electrical resistive heating) for the last seven years.

Dacre is currently a Project Manager and the Technical Lead of the Remediation Evaluation and Engineering Term for a “guaranteed” remediation contract for over 200 retail petroleum sites in the western United States.

Title

Senior Project Manager and Remediation Specialist

Education

Graduate Courses in Hydrogeology, Engineering, Geology, and Theoretical Geophysics

BS – Geology, California State University, Northridge, CA

BA – Earth Science/Geography, California State University, Northridge, CA

Languages

English

Experience on Superfund Sites with Chlorinated Chemicals

- **Montrose Superfund Site, Latham & Watkins, Torrance, CA:** Thermal Remediation Specialist: Assisting with the feasibility and costing of thermal remedies (steam injection and ERH) for the Montrose Superfund site in Torrance, California. Also a participant in meetings with EPA and the Montrose team, which discusses and negotiates the remedial objectives and approach for the project. The Montrose site is impacted with a DNAPL mixture that is comprised of DDT and chlorobenzene. The California DTSC is a stakeholder with this project, and reviews the remediation strategies for groundwater and soil remediation for this site.
- **Pemaco Superfund Site / Project Manager:** This was the first CERCLA site in California to utilize Electrical Resistance Heating (ERH). Note that 1-4 dioxane, as well as TCE, PCE, and other chlorinated compounds were successfully remediated in the Electrical Resistance Heating target area (18,000 SF to a depth of 95ft). Responsible for all major aspects of the project including:
 - Client communications and reporting
 - Coordination of agenda and meeting materials for Public Meetings
 - Budget, schedule and staffing
 - Writing and/or QA/QC of all submittals (Management and Operations and Maintenance Plan, Waste Management Plan, Environmental Protection Plan, Health and Safety Plan, Sampling and Analysis Plan, Hazardous Response Plan, Data Management Plan, and HazOp Analysis)

Curriculum Vitae

Dacre Bush

- Data review and oversight of heating and vapor/liquid treatment systems
- Development of project web site
- Development of post-thermal remediation strategy.

Mr. Bush was a co-author of the 5-Year Review, and has worked with the Army Corps of Engineers in the project sustainability and path to closure strategy.

Indian Bend Superfund Site, Phoenix, Arizona

Mr. Bush provided technical direction for a Superfund site in Phoenix, Arizona. EPA identified the site, an operating dry cleaner/laundry facility, as a responsible party (RP) for the South Indian Bend Superfund Area. Fluor Daniel GTI reviewed EPA's data and submitted a work plan for remedial investigation (RI) consisting of a soil gas survey, soil gas monitoring wells and monitoring wells.

Well installations were done by percussion hammer rig due to cobbles from 40 to 100 feet below grade. Groundwater sampling and aquifer tests were performed after the well installations for determining groundwater quality and hydro geologic parameters. All the above activities followed strict EPA protocol per a Consent Order. The National Contingency Plan (NCP) will require a risk assessment, although a pre-approved Record of Decision (ROD) for source reduction via vapor extraction has been negotiated.

Chevron Bulk Terminal in Superfund Area in Albuquerque, NM

Mr. Bush authored the Remediation Proposal for the Chevron Bulk Terminal in Albuquerque, which is under EPA jurisdiction by means of a Non-Interference Work Plan (NIWP). The NIWP was developed as a response to an EPA First Amended Unilateral Administrative Order. This remedial proposal provided a description of current site conditions; list of remediation standards (ARARs); justification of preferred remedial alternative; and a post- closure monitoring schedule.

Motorola 52nd Ave Superfund Site, Phoenix AZ

Mr. Bush became involved in the Motorola 52nd Street Superfund site during the Feasibility Study. The initial remediation involved a system of containment wells with the purpose of mitigating plume migration. The 52nd Street groundwater plume is primarily the results of TCE releases over a 30-year period, and is several miles long. Mr. Bush's involvement was evaluation of the logistics and locations of the treatment system and the cost projections for operation.

19th Avenue Landfill Superfund Site, Phoenix AZ

Mr. Bush assisted with the development of the final closure assessment for the 19th Avenue Landfill. The assessment consisted of a large array of ambient vapor collection from above the landfill cap, surrounding areas, and assessment of the natural attenuation of the groundwater plume. The results of the studies were there were no identifiable impacts from the landfill and closure was granted by EPA.

Curriculum Vitae

Dacre Bush

In Situ Thermal Remediation for Solvents Recovery Service of New England, Inc. Site (SRSNE) Southington, CT

Mr. Bush assisted the responsible party with review of the final design, evaluation of the contractors HazOp, participated in conference calls with the stakeholders, and reviewed of the progress of the thermal remediation.

Honeywell-Bull Superfund Site, Peoria, AZ

Mr. Bush assisted with the implementation of the first vapor extraction system for TCE at a Superfund site. The vapor extraction system was constructed in 1987 and operated for 2 years. Subsequent remediation activities (permanent pump and treat system, excavation of heavy metals, capping of metal-impacted soil, and removal of manufacturing equipment) was performed over a 6-year period. This facility was then nominated as a Brownfield site by EPA. In 1996-7 Mr. Bush aided Honeywell and Lowe's in development of risk-assessment procedures and evaluation for industrial development. The Lowe's store opened in 1998, and was the first Brownfield development in the state of Arizona.

Solvents Recovery Service of New England, Inc. Site (SRSNE) Southington, CT

Mr. Bush assisted the Responsibility Party (RP) group of 23 companies with review of the final design for DNAPL remediation, evaluation of the contractors HazOp, participating in conference calls with the stakeholders, and review the progress of the in-situ thermal remediation after it begins in late 2013.

Additional Experience

- **McMillan-McGee Corporation, Various Locations / Program Manager:** Served as Principal in charge for U.S. business development and project manager for major U.S.-based projects. Had design and project management roles for ten ElectroThermal-Dynamic Stripping Process (ET-DSP) projects noted below:
 - Emerson Electronics, St. Louis, Missouri
 - Flex-Fab, Racine, Wisconsin
 - Ato-Fina Petroleum, Greensboro, North Carolina
 - Total Petroleum, Greensboro, North Carolina
 - Cape Fear Superfund, Cape Fear, North Carolina
 - Westwater, Tampa, Florida
 - Rayloc Industries, Atlanta, Georgia
 - Site 298, Edwards AFB, California
 - Paducah Gas Diffusion Plant, Kentucky

- **Area A of the Northeast Site at the Young-Rainey STAR Center, Largo, Florida** In March of 2003, the United States Department of Energy (DOE) completed a full-scale non-aqueous-phase liquid (NAPL) remediation of Area A of the Northeast Site at the Young-Rainey STAR Center, Largo, FL. The site was remediated by SteamTech using a combination of steam-enhanced extraction and electrical resistance heating during operations lasting 4.5 months. This is the first full-scale demonstration of complete source removal at a DNAPL site. Since the post-operational sampling shows all concentrations to be below or close to groundwater MCLs, the thermal remedy may be satisfactory for site closure without a polishing phase.

- **Area B of the Northeast Site at the Young-Rainey STAR Center, Largo, Florida** DOE's prime contractor (Stoller) subcontracted a remediation team which consisted of three companies: WRS Infrastructure and Environment,

Curriculum Vitae

Dacre Bush

Inc. (WRS), McMillan-McGee Corporation (Mc2), and PPM Consultants (PPM). The approach for Area B (5x larger than Area A) was remediate the site was to heat the subsurface using Electro-Thermal Dynamic Stripping Process (ET-DSPTM) along with injection of ex situ generated steam, and then extract and treat the volatilized contaminants. Because of his experience with the Area A project, Mr. Bush was the Project Manager of the thermal elements of the project. A particularly challenging aspect of the project was to remove NAPLs from the area underneath a building, Building 1400, located adjacent to the remediation area. This building was continuously occupied by tenants during the remediation. All remediation goals and performance standards were met during the remediation. In addition, there were no accidents and no regulatory or environmental violations.

- **SteamTech Environmental Services, Bakersfield CA / Senior Project Manager:** Project Manager for Guadalupe Restoration Project Pilot Steam Injection Test and the DOE Young-Rainey STAR Center. Assisted with the design and implementation of three steam injection pilot tests at Lawry AFB, Edwards AFB, and Beale AFB.
- **URS Corporation (formerly Dames & Moore) / Engineering/Geosciences Manager:** Group Manager for the combined Geosciences and Civil/Mining practices in the Phoenix office, which had a staff of 60 engineers, geologists and environmental scientists. Mr. Bush performed design review, project management, and expert witness work for complex projects in Arizona.
- **Fluor Daniel Australia LTD, Sydney / Managing Director, Australia:** Responsible for five capital city offices and two satellite offices in Townsville and Hobart, Australia. Responsible for all environmental projects in the Pacific Rim area. Countries in which projects were performed included China, Thailand, New Zealand, Singapore, Indonesia, Korea, Japan, Malaysia, Papua New Guinea, and Vietnam. The list of services for offshore projects ranged from due diligence surveys for property acquisitions, wastewater treatment plant design and construction, contaminated site investigation and remediation, and ISO 14000 audits. Work in Japan and Korea was for the USAF, performing fueling system upgrades and construction management under an AFCEE contract.
- **Fluor Daniel GTI (formerly Groundwater Technology, Inc.) / District Manager:** Started the Phoenix office for Groundwater Technology, Inc. Later as District Manager for the Southwest, he was involved with development of the GTI Technology Review Team. The Southwest District had over 100 employees and offices in Tempe, San Diego, Albuquerque, Denver, and Salt Lake City. Oversaw large complex projects, which often involved co-mingled plumes, chlorinated solvent plumes, and multiple parties. He also was an expert witness for remediation and testified in court numerous times.

Remedial Investigation (RI) Experience

- As both Manager and Project Director, designed, supervised, and reviewed assessments for more than 1000 sites (mostly UST sites) in southern California, Arizona, New Mexico, Colorado, Utah, New Zealand, and Australia. Contaminants worked with include metals, hydrocarbons, acids, and solvents in soil and groundwater. Regulatory agencies have included EPA Region IX, EPA Region VI, New Mexico Environment Department, Arizona Department of Environmental Quality, Arizona Department of Water Resources, California Department of Health Services (presently Cal EPA), California Regional Water Quality Control Board (Region 7, 8 and 9), County Health Departments (San Diego, Orange, Los Angeles, Riverside, Imperial, Ventura, and San Luis Obispo), Utah Division of

Curriculum Vitae

Dacre Bush

Environmental Response and Remediation, Colorado Department of Health (UST and HMWM), and their Australian counterparts.

- Mr. Bush has extensive experience in the application of vapor extraction systems with thermal and/or carbon for off-gas controls). Evaluated and assisted in the implementation of pump and treatment systems utilizing air strippers and/or carbon for water treatment. Experienced with bioremediation of soil and groundwater by in-situ and ex-situ technologies. Worked on site requiring soil excavation with off-site disposal or on-site treatment. Utilized air sparging of dissolved organic compounds; implemented LNAPL fluid recovery technologies; and designed and managed in-situ enhanced oxidation for chlorinated compounds. Served as project manager for in-situ fixation of metals, thermal (steam and electrical) applications, and natural attenuation/risk assessments. Most of these remedial technology applications required permits or variances for the above agencies and/or air permits from the state or county air quality agencies.

Litigation and Negotiation Experience

- **Various Clients and Locations:** Assisted 30+ law firms and/or corporate legal staffs on a variety of issues. As an expert witness, testified in court, been deposed, written declarations, provided counsel, and attended mediation hearings. Most of the litigation and negotiation work involved determining allocation of damages, cost of remedial action, standard of care, and/or the source of impact(s).

Publications and Presentations

- "Electro-Thermal NAPL Remediation Under Building 1400 at the Northeast Site", at the Fifth International Conference Remediation of Chlorinated and Recalcitrant Compounds, Battelle Conference, Monterey, California, May 2006
- "in-Situ Electro-Thermal Remediation of Chlorinated VOCs: Full Scale Evaluation" at the Fifth International Conference Remediation of Chlorinated and Recalcitrant Compounds, Battelle Conference, Monterey, California, May 2006
- "Evaluation of Remediation Technologies and Strategies for the Tucson Basin," presented at the Pima County Association of Governments, May 2000
- "Risk-Based Closures; How Evaluating Risk Applies to Closure Standards; Technological and Economic Implications," presented at New Mexico Water Law, The Fourth Annual Conference on Water Rights and Quality, August, 1996
- Addressed and Panel Member at State of New Mexico Environment Department Underground Storage Tank Conference and Trade Show, "Sparge and Vent Technology Roundtable," 1995
- Addressed Chevron USA Products Law Seminar on Petroleum Hydrocarbon Contamination of Soil and Groundwater, Legal and Technical Overview, "Technical Support in Evaluating Claims, Determining the Cost of Cleanup V s Cost of Litigation V s Probability of Winning," April 1994
- Addressed Arizona State University center for Environmental Studies and The Arizona Department of Environmental Quality, "Site Assessments, Remedial Requirements, and Cleanup Case Histories," October 1991
"Soil Vapor Extraction: A Short Term Cost Effective or the Next Pump and Treat?" Bush, D., R. Brown, and P. Kroopnick, New England Environmental Expo, Boston, MA, May 21-23, 1991

Jacy Christenson

Experience Summary

Jacy Christenson has worked in the field of environmental consulting since graduating from the University of Minnesota, Crookston in 2014. She also served as an intern prior to that during her 2011 academic year. She has been instrumental in many internal and client-facing projects, such as data input, design work, website development, social media, and presentation design. As a Staff Professional, Jacy conducts field work at client sites, completes reports, and conducts research to fulfill project needs. Jacy has performed numerous environmental services including SPCC plans, facility response plans, pollution prevention planning, standards and regulatory assessments, benchmarking studies, and soil, groundwater, and vapor sampling. Jacy's great work ethic and timeliness brings efficiency and high quality work products to the work she performs.

Title

Staff Professional

Education

Bachelors of Science – Natural Resources, University of Minnesota

Language

English

Related Projects

- Assisted in various projects in Minnesota, North Dakota, Wisconsin, and Iowa.
- Limited Site Investigation (LSI) for a retail petroleum company in Minnesota. Conducted site assessments and soil boring field work which included soil, groundwater, and vapor intrusion sampling.
- Phase I Environmental Site Assessment (ESA) for numerous clients in Minnesota and Iowa. Conducted a full site assessment and soil boring field work which included soil and groundwater sampling.
- Involved with a large scale, pipeline-release excavation site in North Dakota beginning in May 2017. Duties include excavation oversight and guidance, soil and groundwater sampling, ensuring compliance, and communicating with the project team, client, and state officials.
- Co-lead a major Sustainable Agriculture project for 23 of the leading global beverage companies as part of the Beverage Industry Environmental Roundtable. Duties included member interviews, research, analysis of data, and final report creation.
- Spill Prevention, Control, and Countermeasure (SPCC) plans. Project team works to audit, update, and complete plans at facilities storing 1,320 gallons or more of oil to be in compliance with federal regulations. Communicated with facility managers, and completed plans to maintain compliance for clients.
- Facility Response Plans (FRP) for oil handling facilities across the western United States. Completed calculations and the final deliverable FRP to determine the worst case oil discharge scenario and how to respond to the situation.

Curriculum Vitae

Jacy Christenson

- Provided assistance to Project Managers locally and at other Antea Group offices in the delivery of various reports and plans, including Phase I Reports, Spill Prevention Control and Countermeasure Plans, and FRPs.
- Provide communications support for the Beverage Industry Environmental Roundtable. Includes press release, social media, and presentation assistance
- Designed numerous client facing presentations for senior management.

Jarrold Cicha



Title

Staff Professional

Education

MS – Earth and Climate Science
(Hydrogeology focus), University of
Maine, Orono, ME. (2013-2015)

BA – Geology

BA – Environmental Science,
University of Minnesota Morris,
Morris, MN. (2009 – 2013)

Training/Certifications

40hr HAZWOPER
First Aid/CPR/AED

Language

English

Experience Summary

Jarrold Cicha is a Staff Professional at the St. Paul office. He has worked in the field of environmental consulting since completing his MS in Earth and Climate Sciences at the University of Maine. He has thorough experience deploying and maintaining hydrologic monitoring equipment, analyzing and modeling hydrogeological data, and collection of soil, groundwater, and vapor samples. In addition to his technical abilities, Jarrold also has experience communicating scientific ideas to groups of people with varying scientific backgrounds. As a staff professional, Jarrold conducts field work at client sites, completes reports, and conducts research to fulfill project needs.

- Facility Response Plans (FRP) for oil handling facilities across the western United States. Completed calculations to determine the worst case oil discharge scenario and created reports regarding proper procedure for responding to a spill situation.
- Spill Prevention, Control, and Countermeasure (SPCC) plans. Project team works to audit, update, and complete plans at facilities storing 1,320 gallons or more of oil to be in compliance with federal regulations. Conducted site audits, communicated with facility managers, and completed plans to maintain compliance for clients.
- Multiple pre-purchase site audits. Due diligence reporting specified for client to incorporate aspects of Phase I ESAs and Phase II ESAs. Conducted contractor oversight of site assessments and soil boring field work. Completed historical and regulatory information reviews, regulatory file reviews at state agencies, and evaluating environmental conditions at subject properties for client's review before property transactions.
- Litigation support for expert witness testimony for a Manufactured Gas Plant (MGP) case. Project team worked to prepare expert witness testimony to deliver during the MPG litigation case. Prepared trial documents in an organized manner before presentation to the judges at trials.
- Construction Contingency Plan preparation. Created generic plans to have onsite during client's construction projects explaining the proper steps to take if impacted soil or groundwater is encountered during work.

Curriculum Vitae

- Worked with the Minnesota Pollution Control Agency on multiple projects. Communicated with regulators and property owners to find the best path for completion of field work such as monitoring well installation, groundwater sampling, and vapor sampling.
- Soil and Groundwater Screening Assessments (SGSA). Due diligence reporting specified for client to incorporate aspects Phase II ESAs. Conducted contractor oversight and collected soil and groundwater samples. Created reports for multiple sites.
- Completed a Master's Thesis project at the University of Maine (August 2013 – August 2015). Designed and completed experiments to assess the direction and magnitude of water flow within streambeds in northern Maine. Activities included literature reviews, writing project proposals, deploying temperature and pressure sensors, collecting large data sets, heat transport modeling with the computer language Python, manuscript preparation, and presentation of scientific findings in a group setting.
- Worked as a Research Assistant at the University of Maine from May 2014 to December 2014. Deployed and maintained hydrologic equipment in a bog setting. Collected, managed, and analyzed hydrological data.
- Worked as a Teaching Assistant at the University of Maine from August 2013 to May 2015. Led laboratory sections of Introduction to Geology and Geology of Maine.
- Worked as a Teaching Assistant at the University of Minnesota Morris from 2011 to 2013. Assisted the professor with lecture design, laboratory exercises, and grading for the following courses:
 - Mineralogy and Crystallography
 - Igneous and Metamorphic Petrology
 - GIS and Remote Sensing
- Participated in the University of Minnesota Hydrogeology field camp. Activities included conducting pumping tests, seepage meter analysis, slug tests, stream gauging, hydrogeologic modeling, and report preparation.

Tara Duffy

Experience Summary

Tara Duffy is a Project Professional with more than ten years of environmental experience and over 25 years of organizational experience. She has responsibilities for multiple steps of project lifecycles, including project management, project work plans, site health and safety plans, field work, report writing, data evaluation, database management, and cost modeling.

Related Projects

- Assists in development and management of EHS programs, written practices, training, and communications.
- Assisted in the development and maintains the internal Ergonomics program.
- Conducts monthly office audits and safety observations.
- Researches information regarding property records and other historical information required for the completion of Phase I Environmental Site Assessments (ESA).
- Assists in site walkovers, writing and completion of Phase I ESA reports.
- Provides full support for report writing including data entry support, proof reading, report assembly, uploading of reports to electronic file database, table development of laboratory analysis for inclusion in regulatory reports,
- Provides project management to client health and safety team, including responsibility for client document control database.
- Provides support to senior staff for marketing and business development projects.
- Provides assistance for completion and delivery of environmental proposals.
- Provides oversight in editing of site maps.
- Assists in writing, completion and delivery of standard operating procedures and spill prevention, control and countermeasure plans.
- Provided assistance to senior staff for BP's US Pipeline & Logistics (USPL) for nation-wide "Tank Operating Philosophy (TOP)" & "Tank Overfill Protection" programs.
- Processes Minnesota and North Dakota reimbursement applications for major petroleum companies. Tasks include gathering invoices, backup, and work orders; completing the Minnesota Department of Commerce and North Dakota Department of Insurance reimbursement application, change order forms; calculating reimbursement amount; and submitting applications to the Department of Commerce or Department of Insurance on behalf of the client.

Title

Staff Professional

Education

BS – Geology, University of Wisconsin – River Falls
River Falls, WI

Training/Certifications

Accredited Office Ergonomics Evaluator (AOEE) – June 2014
First Aid/CPR/AED
OSHA 30 Hr

Professional Associations

Professional Member, American Society of Safety Engineers

Language

English

Curriculum Vitae

Tara Duffy

- Performs fieldwork activities at a former bulk storage facility with multiple LNAPL plumes including groundwater sampling, LNAPL gauging and recovery, and treatment system monitoring and field data collection.
- Screens and logs soil/rock core samples during drilling activities; creates geologic logs and well construction diagrams for report presentation.
- Provides data analysis including chemical/hydrograph plots, groundwater impact trend evaluations and report summary text prep.
- Performs treatment system data review and processing including preparation of process flow and recovery graphs and discharge report summary tables.
- Provides cost modeling support to external and internal client needs in managing, financing and forecasting specific sites or portfolios.

Software Proficiency

- **Tr@ction** – Developed internal work flow procedures for companywide incident reporting for client’s electronic incident reporting database. Responsible for all incident reporting, follow up and documentation control of client related incident reports.
- **Cost Modeling** –Provides Crystal Ball and @RISK cost modeling and decision analysis facilitation to support external and internal client needs in managing and financing specific sites or portfolios.
- **EQulS** – Provides data entry and evaluation into petroleum company’s data management database.
- **iEHS** – Developed internal process for document control of project and contractor records. Responsible for maintenance, training and updates.
- **Log Plot** – Provides support to end user. Developed new template for creation of geologic logs.

Paul A. Durkee



Title

Senior Consultant

Education

MA – Aquatic Biology, Bemidji State University, Bemidji, MN

BA – Biology, Gustavus Adolphus College, St. Peter, MN

Languages

English

Experience Summary

Paul Durkee, a Senior Consultant, also currently serves as the Inogen Environmental Alliance President and CEO. He previously served as Managing Director for Delta-Simons Environmental Consultants Limited in Lincoln, England for four years. Paul has spent more than 30 years working with clients regarding their environmental, health and safety needs. He has a wealth of knowledge and experience in evaluating and implementing EHS organizational and management systems and has assisted clients with strategic planning. His areas of expertise include delivery of international projects for multi-national clients, implementation of environmental management systems, environmental liability management, EHS audit programs, and providing strategic planning for EHS organizations.

Related Projects

- Managed environmental, health and safety compliance audits for specialty chemical and manufacturing clients throughout the world. Protocols were agreed with the client and the audits were typically implemented using iEHS®, to conduct the audit and produce the audit reports.
- Managed a health and safety organization diagnosis for a large agricultural cooperative. This project included conducting over 35 employee (C-suite to line managers) interviews across their various business units, evaluating and trending the responses and preparation of a recommendation report to enhance their H&S organization.
- Managed and coordinated projects in the Americas, Asia, and Europe. These projects ranged from due diligence assessments for mergers and acquisitions and compliance audits to remediation of contaminated sites.
- Managed the development and continued update of environmental, health, safety and security regulatory summaries for over 70 countries. These regulatory summaries provided the information our clients require to conduct their business in the countries where they operate. The registers were produced by in-country experts and updated on a monthly basis.

Curriculum Vitae

Paul A. Durkee

- Supported numerous clients with their merger and acquisition activities throughout the world and have served as their EHS expert during negotiations with the other parties.
- Introduced our clients to the use of environmental insurance products to facilitate transactions and to extinguish reserves for environmental liabilities. Projects have included the use of cost cap, blended finite risk and pollution legal liability insurance products. The projects have ranged from one site to over 120 locations across the globe and ranged in cost from \$1.7 million to \$7.1 million.
- Managed the implementation of an environmental management system for a large agricultural cooperative. This included working with the company stakeholders to design and implement the new management system which mirrored the elements of ISO 14001.
- Conducted compliance audits at manufacturing facilities throughout the UK and Europe. The audits were undertaken as part of pre-purchase purchase due diligence. The audits were designed to review the past and current waste handling, chemical use, health and safety procedures, discharge consents, air emissions and related permits.
- Provided project management for environmental assessments and audits at numerous sites in the UK and the United States. The assessments included evaluating contaminant liability relating to property transactions and property valuations.
- Provided senior consulting on Brownfield re-development projects in the United Kingdom and the USA. The projects ranged from office, industrial, retail and residential development all located on contaminated sites. By gaining the support of the various stakeholders (government, city, community groups, seller/buyer, architects, developer, etc) involved early in the process, the projects ran smoothly to completion. Creative remedial alternatives were selected to work with the new development. This in turn typically saved time and money during the development construction.

John R. Estes



Title

Geologist, Consultant

Education

BS – Geology, California State University-Long Beach, Long Beach, CA

Professional Registrations

Board of Technical Professions:
South Dakota

Certified Petroleum Release
Remediator

Languages

English

Experience Summary

John Estes has 20 years of experience in the environmental industry. He specializes in petroleum-related remedial investigations and environmental assessments, with technical field, project management, and portfolio management services.

- Field services have included operation of environmental drill rigs for installation of monitoring wells, recovery wells, and sparge and vent wells, as well as the operation of drill rigs for geothermal heat loop installation. Additional field services include the oversight of monitoring well installations, recovery well installations, and oversight of tank removals and subsequent over excavation, ground water and soil sampling, surveying well locations and pertinent data reduction.
- Project management services have included the overall coordination (scope, schedule, budget) of several individual projects from property transaction activities, underground storage tank removal to closure, initial investigations through to closure, and associated reimbursement fund requests.
- Portfolio management services (grouping of projects) have included the overall coordination (scope, schedule, budget) from a 10-year lifecycle perspective as well as developing, implementing and managing strategies, opportunities (and threats) to minimize the portfolio's total liability in terms of environmental costs.
- Manager in the firm's Decision Analysis & Cost Modeling services. Our Cost Modeling services support external and internal client needs to assess work scopes and to forecast costs for specific sites or portfolios. A significant aspect of these practice area targets asset transactions where a single site or a portfolio of sites require appropriate scopes of work to be created and defined for end-points of regulatory acceptance and business financial goals. Our Cost Modeling Practice utilizes various industry-accepted decision analysis/cost modeling simulation software, including @RISK, Crystal Ball, ModelRisk, and RACER. Our approaches to cost modeling have applications to the following business drivers.
 - Methods to estimate total environmental liability, both known and unknown.
 - Applicable models incorporating financial structures for liability transfer.
 - Additional technical and financial considerations in contracting, and insurance evaluation (markets and adoption).

Curriculum Vitae

John R. Estes

- Achieving an understanding of the forecasted certainty for the cost of the existing and future environmental liabilities.
 - Comprehensive management and business plan alignments of environmental liabilities during periodic work plan progress and peer reviews.
- Business process services have consisted of working independently as well as participation as a team member in areas including preparation and training of safety excellence models (Achieving Safety Excellence), operational models (Achieving Operational Excellence), project information database development, resource needs evaluation, as well as policy training and material preparation.

Related Projects

- Provided project management services to Minnesota State Superfund programs sites, including scope, schedule, budget management, community relation negotiations, and client correspondence.
- Provided project management services to Minnesota Brownfield programs sites, including scope, schedule, budget management, community relation negotiations, and client correspondence.
- Operated and assisted in operation of environmental drill rigs utilizing hollow stem augers, rock coring, and mud and air rotary equipment on several investigation sites in Minnesota, Iowa, Wisconsin, South Dakota, and North Dakota
- Provided field services in Minnesota, Wisconsin, Iowa, North Carolina, South Dakota, and North Dakota for several petroleum hydrocarbon spill investigations and remediation sites. Field activities included installation of soil borings and monitoring wells; collection of soil and ground water samples; excavation of tanks and contaminated soils; Resident on-site manager-inspector on an MPCA landfill excavation removing over 50 thousand cubic yards of municipal solid waste; and performance of slug tests, pumping tests, and packer tests. Conducted several Phase I and Phase II environmental assessments for property developers and lending institutions in Minnesota.
- Provided project management services to underground storage tank projects and terminal facilities to various retail petroleum companies in Minnesota, North Dakota, South Dakota, and Wisconsin.
- Provided portfolio management services for a major oil company. The portfolio consisted of retail operations (service stations, bulk storage facilities, and terminals in Minnesota, South Dakota, and North Dakota).
- Provided business process activities internally within the firm at various levels (unit, sector, company) while working independently as well as participating as a team member and trainer of a variety of projects.

Publications

- "Aerial spray cleaning of high voltage insulators". S. C. Tsai, J. Estes, et al. Powder Technology, 74 (1993) 13-21

Eric T. Feenstra



Title

Project Engineer

Contact

Email: portgerm@gmail.com

Phone: 616-443-7020

Education

B.S. – Geological Engineering,
Michigan Technological University,
Houghton, MI

Professional Registrations

Engineer in Training (EIT)

Language

English

Experience Summary

Eric Feenstra is an Engineer working in the environmental consulting and water treatment industries since 2013. Eric's education and experience combine to create a holistic understanding about geologic settings/conditions and their effect on remediation systems design and construction, as well as operations and maintenance.

Related Projects

Project Engineer

- Development of SPCC/PIPP plans for refined products terminal, refined petroleum pipeline release, and commercial sites.
- Preparation of air and NPDES permitting along with sampling plans for multiple soil vapor extraction and pump and treat systems.
- Development of remedy progress reports, site conceptual models, Right of Way Environmental Lease Agreements, and No Further Action report documents.
- Management, planning, and site installation of soil vapor extraction system on bulk fuel terminal.
- Supported the management and operations of a both a petroleum product recovery system and an air sparge system at a refined products pipeline release site.
- Support for consultant transfer of pump and treat system including design theory, geologic subsurface and the impact to system operations; field support including NPDES sampling and compliance, air stripper cleaning and maintenance, well field optimization, electrical and PLC troubleshooting, and pump cleaning.
- Field oversight of the demolition of residential structures at a client acquired property associated with a historical refined petroleum pipeline release site, which included asbestos survey/sampling, demolition permitting, and abatement.

Curriculum Vitae

Eric Feenstra



Petroleum Treatment – Soil and Groundwater Remediation

- Installation of air sparge/soil vapor extraction remediation systems including oversight, procurement, and testing at a refined products terminal site.
- Operations and maintenance of multiple pump and treat, air sparge, soil vapor extraction, and multiphase extraction systems on multiple refined product pipeline and terminal sites, commercial, and specialty chemical sites.
- Supported the design of large pump and treat system including process and identification diagrams, equipment specification, and process flow calculations for specialty chemical company site.

Heavy Metal Water Treatment – Metal Plating Industry

- Design of heavy metal treatment systems for the metal plating industry including mass flow calculations, sludge settling rates, heavy metal hydroxide sludge removal and handling, pH control, etc.
- System build including metal work, catwalk erection, pump and pipe placement, electrical control wiring.
- Management of project goals, parts inventory, and build of water treatment systems.
- Perform extensive in house system checkout including pumps, controls and piping to ensure complete system operation.
- Field check for system completeness with attention to placement of tanks, labels, safety, and ensure system controls work once water is introduced.

Ron Feingold



Title

Project Manager, iEHS
Deployment, Antea Group

Education

BS – Geography, Emphasis: Human
Development/Urban Planning, The
Pennsylvania State University, State
College, PA

Professional Registrations

CSA America Greenhouse Gas
Verifier Certification

Languages

English, Hebrew

Experience Summary

Ron Feingold is an experienced carbon accounting and life-cycle assessment specialist. A focused and dedicated sustainability consultant, Ron provides timely, fit-for-purpose solutions for his clients. He has specific expertise in managing large sets of data, designing, managing and reporting performance metrics and measures, developing greenhouse gas inventories for a wide variety of sectors. Ron also specializes in the operational deployment of iEHS® and its seamless integration into client organizations to support environmental, compliance, and health and safety initiatives.

Ron combines a background in regulations with significant carbon expertise to deliver solutions on relevant sustainability issues, both for compliance and voluntary initiatives. His experience also includes the creation of energy efficiency action plans, greenhouse gas mitigation plans, product carbon footprinting, and creates user friendly management calculation tools in Microsoft Excel to help companies conduct business, such as greenhouse gas calculations, product carbon footprints, lighting and water management designs.

Recognizing the importance of building the business case for sustainability, Ron offers clients a thorough understanding of both climate change science and business realities. He excels at translating his technical knowledge and expertise into language clients can understand.

Related Projects

- Lead and plan greenhouse gas emission inventories for fortune 500 companies
- Supports iEHS deployments with many types of client-specific tools. Recent implementations have included Home Page design for risk assessments, global auditing results and scoring, cost estimating, financials tracking, personnel performance management, and net cost forecasting.
- Supports iEHS client implementations including transition of large datasets from heritage systems, configurations and customization, report specifications and development, and operations rollout and training
- Health and Safety Point of Contact for 13 retail stores

Curriculum Vitae

Ron Feingold

- Created a true cost of water calculator for a fortune 500 company to be used at all global facilities to determine its true cost for water and identify the cost benefit of installing a new system
- Created lighting design tool for fortune 500 company to be used at all global facilities to determine the overall impact of its current lighting system and the ROI of installing a new system
- Utilizes Sima Pro software to conduct life cycle assessments/product carbon footprints
- Created the greenerAccountant solution for organizations needing greenhouse gas inventory and energy accounting for both compliance and voluntary optimization. Developed all educational documents, marketing materials and templates for the program.
- Researched different unique greenhouse gas regulations to accommodate client's specific needs for various governing bodies (e.g., EPA).
- Optimized specialized greenhouse gas software on a Salesforce.com platform.
- Developed a standardized methodology for conducting greenhouse gas audits - a new service offering for clients.
- Created company-wide safety model and mission statement to meet ISNet World compliance; including 15 written safety plans meeting OSHA standards
- As an environmental risk analyst, implemented GIS/Equis-based analyses of environmental data, developed site plans (AutoCAD/ ESRI ArcMap), conducted statistical analysis of environmental chemistry data (Equis), and performed database programming and reporting.
- Conducted Phase I and II Environmental Site Assessments, soil and groundwater remediation projects, and brownfields site redevelopment projects. Managed daily logistics with laboratories and field technicians.
- Founder of the Centre County Community Energy Project, advising and collaborating with community leaders to create a greenhouse gas emission inventory and mitigation plan for the State College Borough
- Created Penn State energy conscious behavioral action plan implemented by the University in August 2006
- Conducted field research in Ghana, Africa, regarding the efficacy of business outsourcing as an economic development strategy. Explored the social and environmental effects on multi-scaled mining operations, and examined the sustainability of traditional agricultural practices in rural areas of Ghana.

Curriculum Vitae

Ron Feingold

Publications

- [Energy/GHG Data Collection Tool](#), Brewers Association, 2012
- [Renewable Energy Cost Calculator](#), Brewers Association, 2012
- [Full Cost of Water Calculator](#), Brewers Association, 2012
- [Pre-Treatment Water Calculation Tool](#), Brewers Association, 2012
- [Onsite Solid Waste Analysis Tool](#), Brewers Association, 2012
- [“Energizing Appalachia: Global Challenges and the Prospect of a Renewable Future,”](#) The Pennsylvania State University Department of Geography, 2007
- [“Telecommunications and ICT Development in Ghana: Lessons from Two Call Centers in Accra,”](#) Ghana Cyber Group, 2007
- [“A Greenhouse Gas Emission Inventory for the Borough of State College,”](#) Centre County Community Energy Project, 2006

Presentations

- [“Energizing Appalachia: Global Challenges and the Prospect of a Renewable Future,”](#) presented research findings to the Appalachian Regional Commission in Washington D.C. on using alternative energy sectors (wind, solar, and bio-energy) as a staple for economic transitions, 2007

Beth Firkins

Experience Summary

Beth Firkins, Project Professional, has over 4 years of experience in the environmental consulting industry and over 10 years of design, administrative, and data management experience in a variety of industries. Based in Antea Group's St. Paul office, Beth serves a variety of environment, health, safety and sustainability projects and clients. She has been instrumental in many internal and client-facing projects, such as writing press releases, creating systems for project management, conducting safety audits, facilitating employee safety trainings, reviewing reports, data review and trend analysis, staffing management, and creating online databases. Beth's diverse background and attention to details lend perspective, insight, and unique problem-solving skills to the work she performs.

Beth is also a trusted practitioner who specializes in providing services to clients in the food and beverage and technology industries. In addition to her client-facing work, Beth also serves as the Innovation Coordinator on Antea Group's Innovation and Commercialization Team.

Title

Project Professional

Education

BS – HTRM

University of Wisconsin-Stout
Menomonie, WI

Language

English

Related Experience

- Serves on the Communications Team of the Beverage Industry Environmental Roundtable (BIER), a technical coalition (facilitated by Antea Group) of leading global beverage companies that are working together to advance environmental sustainability within the beverage sector.
- Designs media campaigns for BIER's communications for work product releases and coordinates external blog series.
- Provides ongoing health and safety support and auditing for a global consumer electronics company, including support to their local retail stores, environment/health/safety (EHS) auditing, emergency response planning, and other EHS services.

Curriculum Vitae

Beth Firkins

Related Experience - Continued

- Performs daily review, validation, and follow-up on reported incidents from a global technology retailer. Analyzes trends and communicates best practices to incident reporters. Reports to the corporate HSE team.
- Assists in building, designing, reviewing, and revising internal and external presentations.
- Provided Active Threat Awareness trainings to hundreds of employees across nine stores as part of a global retailer's training initiative (Summer 2016).
- Coordinated internal innovation meetings and calls. Oversaw and facilitated the creation of a change in internal tracking systems for innovations in Antea Group's Innovation and Commercialization Program.
- Provided assistance to Project Managers locally and at other Antea Group offices in the delivery of various reports and plans, including Phase I Reports, Spill Prevention Control and Countermeasure Plans, and Facility Response Plans.
- Coordinated the organization, printing and delivery of monthly and quarterly sampling reports to home owners in support of the clean-up of a pipeline release for a major oil manufacturer.

Other Experience

- Created the strategy for a social media campaign for a local restaurant that increased Twitter followers by over sixty percent.
- Managed operations and online reservation database systems for a local restaurant, including the development of training materials, training of end users, and troubleshooting/adjustments to the system.
- Assisted in the development and facilitation of the transition to a paperless filing system for a major law firm.
- Provided administrative assistance to lawyers in a fast-paced, Wisconsin law firm. Duties included drafting, proof-reading, printing and transmittal of legal documents and formal correspondence
- Coordinated and planned large corporate sponsored events at various trade shows, including the design of booths, development of menus, and staff scheduling.

Stan Freedman

Title

Staff Professional

Education

BS– Geology, University of Puget Sound, Tacoma, WA

Post-Graduate Certificate –
Geographic Information Systems,
Portland Community College,
Portland, OR

Professional Associations

Geological Society of America

Languages

English

Experience Summary

Staff Professional with over 3 of experience as a GIS Technician and a Field Technician / Geologist working out of the Loveland, CO office. Mr. Freedman provides routine soil and groundwater sampling activities at project sites, performing planning, coordination, and data evaluation in conjunction with his field assignments. Mr. Freedman's primary GIS responsibilities include: development and application of spatial analysis solutions to meet the specific needs of projects; management of data resources for a wide range of environmental site assessments and remediation projects involving soil management, storm water management, and groundwater monitoring; technical support of GPS and field data collection units; and, development of template geodatabases and mobile GIS projects for data collection events. Prior to his current position at Antea Group, Mr. Freedman performed mudlogging activities associated with oil exploration of the Elk Hills petroleum reserve in California.

Related Projects

- Performs routine groundwater sampling events and provides maintenance and troubleshooting to remediation systems in Colorado and Wyoming.
- Performed multiple soil sampling activities, creating boring logs and overseeing drilling contractors using geoprobes, hollow stem augers, and sonic drilling methods.
- Manage GIS data resources for storm water management plans at rail yard sites. Coordinate GIS activities with project teams. Develop web maps on ArcGIS Online designed for data collection in the field. Extract and visualize data to produce high quality maps to support project teams and their site assessments. Supervise and oversee the integration of data into the organization's data management structure.
- Created an environmental sensitivity atlas for a pipeline spill response plan across Montana and North Dakota. Acquired geospatial data and utilized spatial analysis to identify environmentally sensitive areas within proximity to the pipeline. Manipulated and visualized data to produce maps meeting the client's specific needs.

Curriculum Vitae

Stan Freedman

- Perform routine groundwater monitoring at a diesel fueling site in Marshalltown, IA. Site visits include well gauging and remediation system operation and maintenance activities. Perform data compilation for technical reporting and providing spatial analysis for groundwater figures, including potentiometric and LNAPL thickness maps.
- Coordinated and conducted a series of soil and groundwater sampling events on a portfolio of railroad properties being leased to an agriculture company in Kansas. Provided oversight of utility locating and direct push (GeoProbe) contractors for soil and groundwater sampling activities. Soil and groundwater samples were collected and analyzed for VOCs, PAHs, metals, herbicides and pesticides.
- Conducted railroad tie sampling throughout northern California and Idaho to analyze ties for creosote, metals, and toxicity. Coordinated work plans and schedules with railroad personnel to effectively and safely complete scope of work in a timely manner. Responsible for sample collection, documentation, and reporting.

Shavonne Gordon, CPG



Title

Senior Project Manager
Office Lead

Education

MS – Environmental Sciences, Ohio
University, Athens, OH

BS – Geology, Ohio University,
Athens, OH

Professional Registrations

Professional Geologist:

- Illinois (196.000122)
- Indiana (2532)
- Kentucky (2427)
- Pennsylvania (PG004519)
- Tennessee (5938)

Professional Associations

Member, Pennsylvania Council of
Professional Geologists

CPG Member: American Institute of
Professional Geologists (11411)

Language

English

Experience Summary

Shavonne Gordon has more than 25 years of experience acting as a project manager, geologist, technical lead, office lead, and resource manager in consulting services for major oil companies, industrial facilities, and municipal and government-based clients. Shavonne specializes in environmental strategies, petroleum hydrocarbon investigations, remediation projects, and UST site assessments. Shavonne has also gained experience in air permitting and reporting in Ohio.

Related Projects

- Serves as a senior project manager and professional geologist for remediation investigations, site assessments, Phase I ESAs, and groundwater studies; quantifies environmental liabilities, remediation projects, and assessments to obtain No Further Action status within the state programs.
- Experience in estimating Reserves, forecasting, modeling, and managing cost to closures.
- Manage portfolio of legacy UST release sites located in IL, IN, MI, KY, WV, and PA.
- Manage oil lease gathering line mapping in Kentucky.
- Experience in coordinating teams for SPCC Plans, SWPPPs, and general permitting.
- Managed large portfolios of Phase I ESAs and Phase II site investigations for numerous clients; transaction support/stock deals.
- Served as data manager in compiling risk-based data under RCRA. Coordinated all technical presentation, tables, figures, conclusions, and recommendations.
- Provide lead technical support for multiple projects. Responsibilities included development of environmental strategies and objectives, implementation of sampling and analysis plans associated with subsurface investigations and groundwater studies, site risk prioritization, analysis of remedial alternatives, fate and transport modeling, calculation of site-specific target levels, and technical writing/review.
- Served as USEPA representative to oversee remediation and sampling of PCB contaminated soils and equipment along natural gas pipelines and stations.
- Provided technical support in the development of environmental strategies to obtain closure under federal regulations at several army and air force bases.

Curriculum Vitae

Shavonne Gordon

- Acted in oversight role for several projects, including remediation of former and current power plants and substations, former UST sites on army bases, remediation via soil excavation, and capping a landfill.
- Acted as technical support to ensure Title V compliance for industrial clients. Acted as lead geologist to perform risk assessments and evaluations under the BUSTR Tier Approach (1999, 2005 and 2017 Risk-Based Corrective Action Rule).
- Acted as technical support to ensure Title V compliance for industrial clients. Acted as lead geologist to perform risk assessments and evaluations under the BUSTR Tier Approach (1999, 2005 and 2017 Risk-Based Corrective Action Rule).
- Managed large portfolios of Phase I ESAs and Phase II site investigations for numerous clients.
- Served as data manager in compiling risk-based data under RCRA. Coordinated all technical presentation, tables, figures, conclusions, and recommendations.
- Served as laboratory coordinator for large consulting office. Performed all QA/QC on laboratory data (soil, air, and groundwater). Acted as major liaison between project managers, laboratories, and field personnel.

Cathy Grams

Experience Summary

Cathy Grams, Senior Project Manager, has over 20 years of professional experience in the computer industry working with hardware and software technical support, network administration, database management, and Geographic Information Systems.

She is well versed in environmental data management software and tools including EQuIS, Access, Excel, gINT, and Logplot. Her GIS experience includes programming, project work, and training utilizing ESRI's ArcGIS applications.

Title

Database Administrator

Education

BS – Geology, minor Computer Science,
University of Minnesota – Duluth,
Duluth, MN

Language

English

Related Projects

- Responsible for database administration, design, and customization, including stored procedures and functions, of companywide SQL database
- Administers, maintains, develops, and implements policies and procedures for ensuring the security and integrity of database
- Developed and implemented customize VB software solutions
- Implement data models and database designs, data access and table maintenance codes for database
- Tests database layout to ensure the system is meeting company needs
- Designed custom solutions for clients including database design and report creation.
- Provides technical support for end users
- Provides GIS technical support services to internal and external clients

As a Principal Consultant for a large multinational computer technology corporation, her responsibilities included:

- Implementing data model conversion process using company standard tools, documentation and defined methodology.
- Gathering customer and product requirements through customer workshops and workbook tools.
- Creating and updating technical and functional specifications from requirement gathering.
- Providing assistance during application rollout including troubleshooting and resolution of issues.
- Creating and performing test plans according to client requirements.

Curriculum Vitae

Cathy Grams

Working as a Division GIS Coordinator/UNIX System Administrator for a state government agency, Cathy:

- Formulated the Division's GIS plan
- Established a general framework and specific procedures for collection, storage and retrieval of GIS data
- Conducted analyses, pilot projects and prototype projects
- Ensured database was designed consistent with governmental GIS standards
- Provided UNIX technical support for UNIX-based GIS systems and related network infrastructures for the division

Jessica Highfill

Title

Staff Scientist

Education

BS – Environmental Biology,
University of Dayton, Dayton, OH

Languages

English

Experience Summary

Jessica Highfill is a Staff Scientist with thirteen years of environmental experience. She is knowledgeable in environmental and ecological assessments in the petroleum remediation, transportation and construction fields within multiple states regulations. She is very knowledgeable in various computer software modeling protocols including Rockworks, LogPlot, AutoCAD, MicroStation and ArcGIS. She is confident in her ability to obtain, create, and work within large databases using ArcGIS, Microsoft Access, Rockworks software or internet databases, such as iEHS.

Related Projects

- (ArcGIS and Database Management)
- Served as a graphics specialist, as well as ecologist for large scale environmental assessments in the Midwest region. Including:
 - using ArcInfo and ArcView, digitized land parcels within the project boundary. These parcels were then joined to landowner databases and used in ArcView to assess the land use and impact of highway development to property owners within the area. Using ArcInfo and ArcView, assessed economic impacts within the area by identifying and digitizing businesses within the commercial areas of the proposed development
 - using ArcView software, analyzed historic and current land use using aerial photography and digitally mapped areas within the project boundaries of approximately 80 river miles.
 - using Trimble GPS and ArcView software, identified natural areas
 - using internet based files provided by state resources, digitally portrayed the ecological receptors within the project boundaries.
 - using Trimble GPS and ArcView, performed wetland delineations
 - performing mapping, graphics and writing for the final report

Curriculum Vitae

Jessica Highfill

- (Aquatic Biology) Served as aquatic biologist for the monthly monitoring of zebra mussel populations in and around the intake/outtake piping of multiple nuclear power plants in the Midwest region. This work included both field and laboratory analysis as well as monthly and annual reporting.
- (Wetland Delineation) Served as wetland scientist, as well as graphics specialist, for multiple environmental assessments in the Midwest region. Projects varied from specific wetland delineations using Trimble GPS and ArcGIS to accurately map the wetlands and assess accuracy to state and federal databases; to simple delineations for use in permitting. In addition to these assessments, assisted in the mitigation and monitoring of numerous wetlands associated with the delineations and for use in future wetland mitigation banks.
- (AutoCAD and RBCA Reporting) - Assisted in preparing state-regulated RBCA assessments and groundwater monitoring reports for multiple states throughout the United States. Duties included data entry, the creation of tables and figures, and the creation and assistance of reports.
- (Phase 1 ESA Reporting) Served as environmental scientist for Phase 1 Environmental Site Assessments and the creation of technical reports.
- (ENFOS) - Served as a software specialist in a pilot study of an internet-based technical database. This database used Enfos to store project information from multiple contactors and clients that could be used to generate tables, figures, reports that could be state and/or client specific using a variety of software applications. In addition, it could be used to plan and organize proposed field work and deliverables.
- (Rockworks and AutoCAD) - Served as a project lead in the creation of subsurface modeling of petroleum remediation terminal and retail sites within Missouri, Illinois, Iowa and California. This modeling including cross sections and fences of both area lithology and areas of contamination.
- (LogPlot) - Assisted in preparing well construction and soil boring logs for many sites using numerous state regulations. Within select sites, used these LogPlot files in Rockworks to portray subsurface features.

Wayne Hutchinson, PG, PH

Experience Summary

Wayne Hutchinson has over 40 years of experience as a hydrogeologist, geophysicist, engineering geologist and project manager. Wayne develops and implements environmental strategies, manages hydrogeological investigations, applies models to evaluate ground-water flow and contaminant transport, and coordinates remediation projects for soil and groundwater.

Related Projects

- Designed and managed investigation and remediation of both hazardous and non-hazardous soil and installation of ground-water recovery trench/sump to treat and discharge ground water contaminated with co-mingled plumes of benzene, toluene, and chlorinated solvents.
- Assessed leakage and impact from underground propane storage cavern, redefined hydrogeological conceptual site model, and implemented expansion of water curtain to prevent further leakage.
- Designed and successfully operated a ground-water recovery and treatment system to reduce carbon tetrachloride and chloroform concentrations. Site obtained closure in Wisconsin.
- Completed enhanced bioremediation of a petroleum contaminated site using oxygen release compound (ORC). Significantly reduced concentrations of petroleum compounds and vinyl chloride at two sites using ORC.
- Conducted and supervised soil-gas investigations at release sites and under buildings including petroleum and chlorinated solvents.
- Developed Conceptual Site Models and conducted petroleum remedial investigations and remediation in porous media, fractured rock, and solution-channeled limestone at active and closed service stations, bulk terminals, industrial sites, pipelines, and government maintenance facilities in Wisconsin, Illinois, Minnesota, Missouri, New Jersey, and New York.
- Supervised or conducted Risk-Based Corrective Action (RBCA) evaluations, including use of an unsaturated-zone-transport model, to establish soil contaminant clean-up levels for petroleum compounds, pesticides and chlorinated organic compounds in Wisconsin and Illinois.
- Applied multi-phase flow modeling to estimate petroleum mobility and recoverability.

Title

Senior Professional - Hydrogeology

Education

MS – Geology, Rutgers University,
New Brunswick, NJ

BA – Geology, Southampton College
of Long Island University,
Southampton, NY

Professional Registrations

Professional Geologist: Wisconsin

Professional Geologist: Illinois

Professional Hydrologist: Wisconsin

Professional Associations

International Society for
Environmental Forensics

National Ground Water Association

Languages

English, Spanish, Arabic

Curriculum Vitae

Wayne Hutchinson, PG, PH

- Conducted soil and groundwater investigations for multi-media remediation of chlorinated solvents, lead, chromium, cadmium, mercury, and cyanide.
- Project hydrogeologist on a major inorganic and organic mercury contamination investigation involving soil, ground water, and estuary sediments.
- Applied geophysical techniques to detect buried tanks, piping, bedrock surfaces, solution channels, mine shafts, rock fractures, and contaminant plumes.
- Conducted geophysical investigations at hazardous waste landfills to confirm presence of underlying clay, hydrostratigraphy, depth to ground water and map contaminant plumes.
- Conducted an extensive field investigation, developed Wellhead Protection Area, and prepared water-supply contingency plan for a major food manufacturer located near a confirmed source of chlorinated solvents as well as other potential sources of organic chemicals.
- Used hydrogeologic mapping, geophysical techniques, and aquifer testing to evaluate glacial aquifers in northern New Jersey for supplemental water supply during a drought.
- Developed hydrogeological framework and ground-water computer model that demonstrated a carbonate/glacial aquifer in New Jersey could sustain 6,000 gallons per minute under a variety of climatic conditions to produce 200,000 pounds of trout per year.
- Expanded the ambient ground-water-monitoring network in northern New Jersey. The project received an award from the Project Management Institute.
- Used geophysical techniques to map water-filled audits in an abandoned iron mine which was subsequently used by a township in New Jersey as a new potable-water source.
- On-site Project Manager in Egypt for test borings and geophysical investigation for major dredging project to widen and deepen the Suez Canal.

Publications

- Hutchinson, W.R. Developing a Geophysical Program; in Proceedings of the Symposium on the Application of Geophysics to Engineering and Environmental Problems, Society of Engineering and Mineral Exploration Geophysicists, Golden, CO, p. 481, 13-16 March 1989.
- Canace, R. and W. R. Hutchinson. Bedrock Topography and Profiles of Valley-Fill Deposits in the Ramapo River Valley, New Jersey. Geologic Map Series 88-6, New Jersey Geological Survey, 1988.

Presentations

- Hutchinson, W. (2016) 3D Visualization for Conceptual Site Model Clarification: Wisconsin Ground Water Association Annual Meeting; Waukesha, WI; March 2016.
- Hutchinson, W. (2013) LNAPL Transmissivity and Oil-specific Volume as Key Components of the Conceptual Site Model: International Petroleum Environmental Conference (IPEC 2013); San Antonio, TX; November 2013.

Curriculum Vitae

Wayne Hutchinson, PG, PH

- Girard, M.; W. Hutchinson and M. Martinson (2011) Innovative Remediation of LNAPL: Development of a CSM Leading to a Sustainable Remedial Design: Intersol 2011
- Nelson, M.; M. Umholtz; W. Hutchinson; D. Taggart and R. Stoelting, Delineation and Recovery of Free-Phase Hydrocarbon in a Fractured/Solution-Channeled Rock; National Ground Water Association Petroleum Hydrocarbons Conference; Atlanta, GA; November 2002.
- Hutchinson, W.R. Wellhead Protection - It's Not Just for Communities; Federation of Environmental Technologists Annual Meeting, Lake Geneva, WI, 7-8 March 1995.
- Navoy, A.S.; R. A. Zampella; R. E. Good and W. R. Hutchinson. Assessment of the Potential Impact of Groundwater Supply and Related Development of the Kirkwood-Cohansey Aquifer System, Southern New Jersey: A Proposal for a Comprehensive Research Program; New Jersey Academy of Sciences, Annual Meeting, April 1990.
- Mullikin, L.; W. R. Hutchinson; S. K. Sandberg and J. S. Waldner. Hydrostratigraphy of the Kirkwood Formation in Southeastern New Jersey; Abstracts with Programs; v. 21, #2; Annual Meeting of the Geological Society of America, Northeast Section, 23-25 March 1989, New Brunswick, New Jersey.

Craig Johnson

Experience Summary

Craig Johnson is a Project Manager with 30 years of solid, varied experience in environmental consulting, construction management, and system operation and maintenance in the oil and gas, chemical and HVAC industries. During his career, Craig has worked closely with clients to meet their remediation and consulting needs.

Related Projects

- Designed, installed and operated an enhanced thermal steam injection system to remediate a 17 acre brown field site in a metropolitan setting for the Minneapolis Community Development Agency. Subsurface steam injection was utilized to heat the impacted ground water and vadose zone soils. The elevated temperatures resulted in lowering the oil viscosity to enhance mobilization to the respective recovery wells. A combination of total fluids pumping, dual phase extraction, pneumatic product skimming, and soil vapor extraction technologies were utilized for ground water and product recovery. A complex treatment process was employed for oil separation and removal and to treat the contaminated water and soil vapor to an acceptable level for discharge to the sanitary sewer and atmosphere respectively. Ultimately, the system remediated over 200,000 cubic yards of impacted soil, recovered approximately 60,000 gallons of diesel fuel, and achieved timely project closure.
- Instrumental in several soil and groundwater feasibility/alternative analysis studies for various Industrial and Energy clients. The goal of these studies was to provide screening of the best available remediation technologies as they applied to each specific site challenge. Several options were outlined and considered in each case. Some of the options were initially eliminated during these processes due to technology limitations, physical limitations, and disruptiveness, etc. The ultimate selection criteria was typically based upon effectiveness, duration, and overall cost to closure.

Title

Project Manager

Education

A.S. - HVAC Systems Installation,
Service and Operation, Dunwoody
College of Technology, MN

A.S. – Environmental Systems
Design Technology, Dunwoody
College of Technology, MN

Languages

English

Curriculum Vitae

Craig Johnson

- Designed, installed and operated several soil and groundwater remediation systems throughout the USA primarily for the industrial, oil & gas, and chemical manufacturing industries. System technologies varied due to geological conditions, physical site conditions, and targeted contaminants. Targeted contaminants were typically DNAPLs, LNAPLs, and chlorinated hydrocarbons. System technologies include enhanced groundwater pump and treat, product skimming, air sparging, ozone sparging, soil vapor extraction, thermally enhanced treatment, ART technology, In Situ Chemical oxidation and reduction (ISCO, ISCR), and several combinations of these technologies. Many combinations of product separation, and water and air process treatment elements were incorporated with these technologies to achieve required discharge criteria.
- Managed a construction management group responsible for the implementation of various soil and groundwater remediation technologies throughout the continental USA.
- Acted as liaison between engineers and construction as to provide open communication and a more consistent and effective product in the field.
- Worked on development of several design, construction management, and cost estimating tools as to simplify tasks and minimize redundancy in effort.
- Developed building, fire, electrical, mechanical and OSHA design code summaries as they applied to our industry practices.
- Designed, built and operated various portable, self-contained, soil and groundwater treatment systems. These systems were utilized for emergency response, short- term remediation, and pre system design pilot study applications.
- Developed project cost estimates and prepared project bid proposals for environmentally related construction and system operation and maintenance projects as well as, create and manage overall project budgets.
- Identified and communicated potential project improvement and value engineering practices with the internal project team, client, and subcontractors on an ongoing basis.
- Ensured on site compliance to all current clients, governmental and in-house health and safety standards and regulations. Identify, secure and assist in procurement of project mandatory governmental licenses and permits. Created, prepared, initiated, and monitored required health and safety documentation including the HASP, JSA's, JHA's etc.

Robert Karls, PG



Title

International Environment Director
Senior Consultant

Education

MS – Hydrology, University of
Arizona, Tucson, AZ

BS – Earth Science/Geology, St.
Cloud State University, St. Cloud,
MN

Professional Registrations

Registered Professional Geologist:
Wisconsin (#632), Minnesota
(#30067)

American Institute of Professional
Geologists: CPG (#7348)

Professional Associations

American Institute of Professional
Geologists

National Water Well Association –
Association of Groundwater
Scientists and Engineers

Languages

English

Experience Summary

Bob Karls, the International Environment Director and a Senior Consultant for Antea Group, has more than 34 years of environment, health and safety leadership experience. Bob specializes in the management of environmental liabilities and partners with clients to build liability reduction strategies through innovative risk transfer techniques including guaranteed fixed cost programs and cost cap insurance policies. He has a proven track record of success working with risk transfer stakeholders who often include property owners, business unit managers, environmental managers, procurement managers, attorneys, lenders and risk managers.

With extensive international experience, Bob has led projects across Europe, North America and Latin America and has provided consulting services to over 25 Fortune 500 companies including global beverage, pharmaceutical and integrated oil companies. A professional geologist with astute communication skills and an unflappable demeanor, Bob is a highly sought after expert witness. He has provided countless depositions and testimony at trial on topics including hydrogeology, remediation selection, contaminant migration and source characterization.

Related Projects

- Bob has been deposed more than 50 times and has been cross-examined at trial seven times. He is considered an expert in geology, hydrogeology, remediation selection, contaminant migration, and source characterization.
- Provided services to over 25 Fortune 1000 companies in establishing their environmental reserve estimates, updating balance sheet reserves for SEC reporting purposes, and provided consulting related to liability reduction strategies.
- Assisted more than 15 clients in eliminating or reducing balance sheet liabilities through risk transfer techniques, including finite risk and stop loss coverage. Environmental liabilities transferred or managed using these methods have exceeded \$40 million and several opportunities have involved portfolios including numerous sites in several states.

Curriculum Vitae

Robert Karls, PG

- Served as lead investigator or a team member on more than 15 manufactured gas plant (MGP) sites in the United States and the United Kingdom. He is familiar with the construction, processes, and features of MGP sites and the nature of chemicals, byproducts, and residuals related to MGP sites. He has dealt with investigation, as well as remediation, of these sites and has had a key role in negotiations related to site closures. He has provided testimony in four litigation cases related to MGP facilities regarding source, fate, and transport issues.
- Directed the implementation of an environmental management program for international telecommunications company to allow international harmonization of the client's environmental policies. Developed the client's environmental management systems.
- Provided expert testimony in an action that involved the pesticide contamination of more than 20 residential wells. The testimony was used successfully to apportion responsibility for the contamination between several responsible parties.
- Provided expert testimony and technical direction of data collection and analysis for the defense of two pipeline companies in a case involving over 20 plaintiffs alleging health impacts, property damages, and punitive damages. Testimony included multiple depositions and trial testimony. Bob's assistance helped successfully exclude 18 of the plaintiffs from the action. The case was settled during trial.
- Led a project team tasked with maintaining a construction schedule for a multi-million dollar commercial building after groundwater containing high levels of chlorinated solvents was discovered to be migrating from an adjacent manufacturing facility toward the client's site due to construction dewatering activities. Alternate dewatering methods were designed allowing reduced migration of contaminants during construction. Served as an expert witness in two separate actions to defend the clients from accusations that they had materially worsened the contamination problem and had "associated" themselves with the release. He was an expert witness in a second action on behalf of the client to recover damages incurred due to increased construction costs and delays prior to the project team's involvement. Both actions were successful with recovery of all costs and no Superfund liability for the client.
- Led a project team in determining the extent of trichlorethylene contamination in the soil and groundwater. The client needed to determine if the contamination at their site was contaminating a nearby regional groundwater aquifer. The contaminated aquifer supplied drinking water to two metropolitan communities and several private residences, and the client had been named a responsible party. Conducted a remedial investigation, including soil borings, monitoring wells, groundwater sampling, pump test analysis, and analytical contaminant transport calculations. Also reviewed files from the state regulatory agency and worked with the responsible party technical group. Prepared litigation documents, including affidavits and exhibits, and gave expert depositions on the investigation results. The investigation concluded a major off site source contributed to the regional groundwater aquifer contamination. As a result of this testimony, the court dismissed the third party claims against the client and an out of court settlement was reached.
- Served as the lead technical expert for a consortium of insurers in a coverage case involving a wood treating facility with ongoing operational releases spanning 60 years. The complex hydrogeology and multiple wood treatment processes utilized at the facility required detailed analysis, modeling, and interpretation. A key element in this case

Curriculum Vitae

Robert Karls, PG

was the ability to forensically determine causation factors leading to the contamination of soil and groundwater over the period of operation and to develop the chronological indicators of contaminant movement over the 60-year period.

- Was lead technical investigator and testifying expert in Texas on a case of alleged migration of chlorinated solvents from a client's premises to a distant property. The plaintiff alleged a diminution in value due to the discovery of chlorinated solvents on the plaintiff's site during due diligence investigations related to property transfer.
- Served as the manager of remedial investigations conducted at a city in central Minnesota to determine potential sources of contamination affecting the entire water supply of the city. The contamination resulted in the shutdown of both city supply wells. Project included establishing contacts with two drilling subcontractors, designing and implementing a soil boring program to locate potential sources and waste disposal areas, and supervising the installation and sampling of multiple shallow and deep monitoring wells. Project resulted in the location of two potentially responsible parties each with multiple potential sources.
- Served as the project manager for an alternate water supply design and contaminant pumpout program. The project included the design and supervision of the installation of a water supply for more than 20 residential locations to replace the wells contaminated by organic chemicals from a leaching pit used for the disposal of hazardous wastes. Replacement well design utilized a complex construction with multiple casings. Contaminant pumpout and treatment were completed.
- Completed extensive diagnostic evaluations of several manufacturing and service companies as a portion of the development of their strategic environmental management program. The diagnostic evaluations included: extensive survey of all portions of the companies operations and management; detailed gap analysis; work shops; strategic planning; and follow-up planning and implementation activities.
- Conducted an environmental benchmarking project for a major U.S. food manufacturing company. The benchmarking was identified as a key element of the company's environmental management system and was necessary to allow measurement of performance of the company in conjunction with their progress toward achieving ISO 14000 certification.
- Served as the project manager or technical expert on more than 200 hazardous waste contamination and petroleum investigations and remediation projects.

Jacob Knapp

Title

Project Manager

Education

BA – Environmental Studies-
Environmental Sciences
Concentration, University of
Minnesota-Duluth, Duluth, MN

Certifications

NRPP Residential Measurement and
Mitigation Provider
NRPP Multi-Family Measurement
and Mitigation Provider

Languages

English

Experience Summary

Jacob Knapp is a Project Professional with over 12 years of experience working in the environmental field. He has experience in project management and oversight of investigation and remediation at sites with a variety of environmental concerns using a variety of techniques. He has knowledge of regulations regarding, collection, transportation and disposal of various wastes including hazardous wastes. He also has experience testing and documenting construction practices and materials.

Jacob has experience developing site investigations and writing reports in accordance with applicable regulatory formats in multiple states. He has experience supporting various clients and projects including supporting expert witness reports for litigation projects. He has experience developing Five-Year review reports for superfund sites within Minnesota. He is based in our St. Paul, Minnesota office.

Related Projects

- Jacob has provided project management and investigative support for a pipeline release of 20,000 barrels of crude oil through all phases of spill cleanup. Support was provided from the emergency response phase, remediation and long term monitoring. Jacob has supported negotiations between the client, landowner and the regulator. Site investigation design has included advanced techniques supporting 3D visualization and analysis. Project management support also included maintaining data collection and management controls between multiple staff from multiple Antea Group offices.
- Jacob has provided project management of a drilling production water spill from a tank truck into a county ditch and threatening a wetland. The high chloride content of the production water required remedial excavation, dewatering and site restoration. Through continual communication with the contractor, land owners and regulators site restoration was achieved within weeks of the reported spill and regulatory closure shortly after.

Curriculum Vitae

Jacob Knapp

- Jacob has provided litigation support for expert witness testimony for multiple cases; including manufactured gas plants and natural resource damages cases. Jacob's experience includes document review and summarization, field data collection, management and evaluation, staff management, and supporting expert report documentation and compilation.
- Jacob has managed multiple sites simultaneously within client portfolios, utilizing task appropriate staff to support specific client and project needs.
- Jacob collected, analyzed and evaluated data during emergency response and site investigation phases of a pipeline release of gasoline in suburban Milwaukee, Wisconsin. Data collection and evaluation supported response efforts, site conceptual model development, and remedial design. Data collection and evaluation included logging fractured bedrock cores during monitoring well installation and interpretation of results of LNAPL gauging, groundwater chemistry and groundwater elevation data collected from monitoring wells, residential supply wells and surface water sample locations.
- Jacob has performed site evaluation, investigation and remedial construction oversight at a former bulk terminal site located in St. Paul, Minnesota. Investigation and remedial construction at this site involved installation of air sparge and vapor extraction points into stratified layers of sandstone and shale utilizing sonic drilling techniques. During this project Jacob developed bid specifications and evaluated subcontractor bids for client specific requirements.
- Jacob has utilized multiple lines of evidence to evaluate historic groundwater chemistry data in order to gain regulatory approval for reductions to groundwater monitoring schedules at multiple sites, including petroleum terminal sites, retail petroleum sites and chlorinated solvent sites in Minnesota, Indiana, and Illinois. Jacob has evaluated historic site data utilizing concentration trend evaluation through graphical presentations, statistical analysis, spatial moment data and evaluation of groundwater elevation data. Jacob has experience utilizing the Monitoring and Remediation Optimization System (MAROS) program to perform statistical and spatial evaluation of historic site data.
- Jacob has conducted Five-Year Review Reports for ten superfund sites within Minnesota following procedures established by EPA guidance. Guidance procedures include file review, site visit, public notification, ROD/RAP review and review of remedial progress at the site. Five-Year Reviews involve review of historic and recent reports to evaluate current site conditions against remedial objectives and regulatory standards. As part of the Five-Year Review process Jacob has identified issues related to remedial progress and site protectiveness and presented recommendations to address issues identified. Jacob has provided technical support to the Minnesota Pollution Control Agency (MPCA) for multiple superfund sites.
- Jacob has evaluated technical reports and work plans submitted by site responsible parties and provided comments and recommendations to the MPCA in order to support site management decisions. Sites which Jacob has provided technical support include: Naval Industrial Ordinance Reserve Plant (NIROP), FMC Superfund Site (Fridley Plant), Kurt Manufacturing, Koppers Coke, MIBCO (State Superfund), and BAE RCRA site.
- Jacob has experience developing and implementing a regional groundwater elevation study and evaluation of regional groundwater chemistry data collected across multiple chlorinated solvent sites in southwest Fridley,

Curriculum Vitae

Jacob Knapp

Minnesota. Work plan implementation required coordination with multiple site responsible parties in order to survey more than 250 monitoring wells at five sites within the region and coordination of groundwater gauging events for each site. Groundwater elevation data was then evaluated and mapped for multiple flow horizons to provide a better understanding of regional groundwater flow. Jacob also evaluated and mapped groundwater chemistry data to understand the extent and magnitude of regional groundwater impacts. This regional study has been used by the MPCA to develop their site management strategies for sites located within the study region.

- Jacob provided technical support for environmental compliance and waste handling practices for a large vessel and equipment decontamination site in Mississippi as part of the MC-252 gulf oil spill in 2010. Daily site operations were observed in order to document and resolve environmental issues with site operations leadership.
- Jacob has experience in third party access negotiations, organizing fieldwork, conducting field work, developing subcontractor bid plans and specifications which meet client required formats, subcontractor oversight, analyzing data collected and writing reports for multiple sites within our multi-site contract with the MPCA. Jacob has utilized data collected and historic site information to develop site conceptual models for multiple sites for this client, including petroleum release sites and chlorinated solvent release sites.
- Jacob has conducted contractor oversight of site investigation and remedial activities involving test pit excavation, direct push probes, hollow stem auger, sonic drilling techniques, excavation as corrective action and remediation system installation and demolition at multiple sites throughout the Midwest for public and private clients.
- Experience includes collection and characterization for transportation and disposal of various wastes including hazardous wastes from households and businesses in many locations throughout the Midwest.
- Team leader on disaster relief efforts in Louisiana after the 2005 hurricanes; here pharmaceutical waste from damaged hospitals and clinics was identified, collected, and packaged for transportation and disposal.
- Inspected and documented liner installation and construction of landfill cells and caps in Lower Michigan.
- Test and document construction materials and practices for best practices and specification requirements. Construction materials and practices tested include concrete, asphalt, nuclear density testing and laboratory testing of soil properties for compaction strength specifications.

Keith E. Knoke, PG



Title

Senior Consultant

Education

MS – Geology, Michigan State University, East Lansing, MI

BA – Geology, University of St. Thomas, St. Paul, MN

BA – History, University of St. Thomas, St. Paul, MN

DOL/OSHA 30 Hour General Industry Training Course

Professional Registrations

Registered Professional Geologist: Illinois (#196-000386), Minnesota (#30277), Wisconsin (#1141-013)

Languages

English

Experience Summary

Keith Knoke is a Senior Consultant with more than 20 years of experience in environmental, health and safety (EHS) consulting. His technical expertise is in, EHS program development and implementation, assisting clients in identifying, quantifying and mitigating corporate EHS risk, implementing EHS information management systems, performing global EHS due diligence and remedial environmental investigations. Keith's most recent responsibilities have included, global account leadership, corporate EHS program development, EHS management system design and implementation, EHS information management system implementation, corporate EHS audit management, merger and acquisition consulting and environmental reserve estimation.

Related Projects

- Served as project manager and team member on the development and implementation of EHS management systems for a number of clients whose industries include commercial printing, US Federal Agencies, specialty chemical, private utilities, paper production, and on and offshore oil gas services.
- Served as project manager and team member on an EHS Audit program development project for a global food and beverage company
- Served as project manager and team member for the scoping and implementation of EHS information management systems (iEHS®) for a number of clients whose industries include clothing manufacturing, industrial manufacturing, US Federal agencies, specialty chemical, consumer products, food and beverage, commercial printing, and oil and gas services.
- Created and implemented a 3rd party waste and recycling audit program for a natural gas and electric utility company
- Performed compliance audits at a number of agricultural chemical storage facilities, gasoline stations, manufacturing, and transportation facilities. The projects included the preparation of applicable regulations and rules list, site visits, and report preparation.
- Served as program manager for the development of 3rd party environmental audit protocols and risk ranking procedures. Facilities being audited included metal recyclers, plastic recyclers, and waste TSD sites.

Curriculum Vitae

Keith E. Knoke, PG

- Performed environmental aspect impact analyses for heavy manufacturing and oil and gas support services companies.
- Served on several litigation support teams for the defense of cost recovery claims regarding the release of manufactured gas plant wastes to the soil and ground water.
- Served on litigation support teams for the defense of cost recovery claim regarding mitigation of aluminum dross reactions in Tennessee municipal waste landfill
- Served as project manager for a SPCC plan development and implementation program for an oil and gas production company located in Kentucky.
- Served as project manager for numerous plant closures in the printing, heavy manufacturing, light assembly and paper manufacturing industries. Tasks included, permit closure, environmental reporting, plant clean up and waste disposal management.
- Served as project manager on a merger acquisition project that involved the acquisition of seven offset and lithographic printing facilities located in the US and Puerto Rico. Conducted Phase I and Phase II environmental site assessments and compliance auditing that helped result in a successful acquisition.
- Served as project manager on a merger acquisition project that involved the acquisition of 15 manufacturing facilities located, Spain, US, China, Hungary, Finland, UK, Germany, France, Canada, Greece and Italy. Conducted Phase I Environmental assessment and liability estimations.
- Served as project manager on a merger acquisition project that involved the acquisition of 25 bulk storage facilities in the US and Canada. Conducted Phase II environmental site assessments, provided corrective action costs, assisted in reporting and compliance auditing tasks.
- Served as project manager on a merger acquisition project that involved the acquisition of eight chicken egg factories and lithographic printing facilities located in the US.
- Served as project manager on a merger acquisition of five railroad repair facilities located in the US and Canada.
- Served as project manager on a merger acquisition of six fine paper plants facilities located in the US and Germany.
- Served as project manager on a chlorinated compound release site. The site was an active battery manufacturing facility. In the late 1970s, the facility had a release of trichloroethene resulting in significant soil and ground water impacts. Project activities included assessment of the extent and magnitude of the release and an assessment of monitored natural attenuation as a remedy for the off-site portion of chlorinated compound plume. A soil vapor extraction system was installed to remediate the source area and closure was granted.
- Served as project manager on a chlorinated compound release site in Mississippi. The site was an active printing facility that had a release of trichloroethene resulting in significant soil and ground water impacts. Project activities included assessment of the extent and magnitude of the release and an assessment of remediation technologies. A combination of chemical oxidation and source area removal resulted in soil and ground water concentrations below cleanup standards and the closure request was granted.
- Served as a project manager on a two city-block Brownfield redevelopment project in St. Paul, Minnesota. The site had soil and ground water impacts from former manufacturing and agricultural activities and was enrolled in the state Superfund and agricultural voluntary cleanup programs. Remediation activities of lead and petroleum-impacted soils were successfully completed and letters of notice of No Further Action were obtained. The property was successfully currently developed for upscale condominiums and townhomes.

Curriculum Vitae

Keith E. Knoke, PG

- Served as project manager on an indoor air quality project in Mandan, North Dakota. The site was a residential apartment complex that had persistent diesel fuel vapors. Provided the client with an air quality standard and decision process from which reasonable decisions concerning the health of the residents could be made, as well as a process to be followed in the event that the standard is or was exceeded.
- Served as a project manager on a combined Phase I/Phase II Environmental Assessment of a proposed multi-unit residential development in Hinsdale, Illinois. Primary duties included preparation of a risk-based site evaluation and corrective action design. Worked closely with the developer and Illinois Environmental Protection Agency staff, which ultimately led to a successful development of the property.
- Served as project manager on a Brownfield redevelopment project in St. Paul, Minnesota. The property, a former railroad yard, was impacted with metals, petroleum products, and creosote. Assisted the developer in investigating and remediating the property for an intended future use of townhomes.
- Served as project manager on a Phase II investigation of an active tire warehouse and printing facility in St. Paul, Minnesota. Results of the investigation indicated chlorinated compounds were present in the ground water beneath the site. As a result of the impacts, the site was entered into the Minnesota Pollution Control Agency (MPCA) Voluntary Investigation and Cleanup (VIC) program. Further investigation revealed the source of the impacts was on the adjacent property and an off-site determination was issued by the MPCA resulting in a timely and successful property transfer.
- Served as a project manager for a number of Minnesota Pollution Control Agency and United States Environmental Protection Agency funded Superfund projects. The projects generally involved Phase I environmental assessments and remedial investigations. The projects included investigations of a former shingle manufacturing facility, scrap/salvage yards, a plating facility, automobile repair shop, petroleum refinery, and dry cleaning facility.
- Served as a project manager on a Minnesota site with polychlorinated biphenyl (PCB)-contaminated soils. Primary duties included budget management, preparation of risk-based site evaluation report and response action plan, managing remedial actions, and working closely with the client and MPCA staff from the VIC program to facilitate a high profile property transaction. Following limited corrective actions, VIC issued a No Further Action letter.
- Served as a project manager on a combined Phase I/Phase II Environmental Assessment of a horseshoe foundry facility in Minnesota. Primary duties included budget management, oversight of field activities, and report preparation. Due to contamination found on site, the site entered the Minnesota VIC Program. Site closure was obtained in a timely fashion and assured a successful property transfer.
- Served as a project manager on a combined Phase I/Phase II Environmental Assessment of a proposed commercial development site in Minnesota. Worked closely with staff from the Minnesota Voluntary Petroleum Investigation and Cleanup Program (VPIC) to assess ground water contamination found on site. Conducted hydrogeologic investigation and determined ground water contamination was due to an off-site source.

Publications

- "Temporal trends in nitrogen isotope values of nitrate leaching from an agricultural soil." *Chemical Geology* 146 (1998) 219-227.
- "Bull Run Discovered." *Military Images* Volume XXV, No 5 (2004) 31-33
- "Evil Effects of Dancing – The Story of James Tanner". *North and South* Vol 12 (2012) 50-65.

David Koppel

Experience Summary

David Koppel is a Project Professional with approximately five years of experience working in the environmental consulting field. He has been involved in a number of projects, and has actively participated in all stages of the project lifecycle. He has a strong knowledge and understanding of state and federal environmental regulations

Related Projects

- Perform extensive soil, groundwater, and vapor sampling, soil excavation, monitoring well installation, and sub-slab depressurization system (SSDS) installation oversight for federal, MPCA, and commercial clients.
- Manage Petrofund sites from new leak number to site closure, including soil, groundwater, and soil gas sampling, soil excavation, permanent monitoring well installation, and associated reporting.
- Manage emergency response petroleum clean-ups, including soil excavations and associate reporting.
- Develop proposals, work plans and reports for MPCA, including vapor remediation, and soil and groundwater investigations.
- Write proposals, work plans, and reports for military munitions response program (MMRP) and unexploded ordnance (UXO) sites.
- Develop work plans and reports for closure of petroleum and pesticide sites in various states around the continental United States.
- Performed Phase I environmental site assessments. Work included site reconnaissance, state file reviews, review of historical documents, and report preparation.
- Provided field support for Phase II Site Assessment investigation projects, including:
 - Contractor oversight (excavations and monitoring well installations)
 - Soil, groundwater, and soil-gas sampling,
 - Monitoring well gauging and sampling,
 - Free product recovery,
- Interpretation of field data and laboratory results, summarizing site recommendations, and investigation report development.
- Obtained certification for oversight of sub-slab depressurization system (SSDS) installation in Dec. '12 (Res. Measurement and Mitigation Provider)

Title

Project Professional

Education

BA – Geology, Gustavus Adolphus College, St. Peter, MN

MS – Geology (Surface Processes), Ohio University, Athens, OH

Training/Certification

OSHA 40-Hour HAZWOPER

First Aid/CPR/AED

AARST-NRPP Residential Measurement and Mitigation Provider

Languages

English

Layne Kortbein



Title

Staff Professional

Education

Bachelors - Bioproducts
and Biosystems
Engineering
Minor in Sustainability
Studies
University of Minnesota,
Minneapolis, MN

Certifications

Engineer in Training (EIT):
State of Minnesota,
#152343

Language

English

Experience Summary

Layne Kortbein, Staff Professional with Antea Group since August 2017, has experience collecting scientific data in the field, analyzing and interpreting data, composing technical reports, and communicating results to the scientific and non-scientific community.

Her technical experience includes maintenance and troubleshooting of active remedial systems, editing geologic maps with ArcGIS, creating boring logs under company and state standards, performing pre-purchase site assessments, and analyzing field data for site conceptual model creation.

Her analytical method experience includes gas chromatography-mass spectrometry, infrared spectroscopy, and high-performance liquid chromatography analysis. Her experience also includes laser-induced fluorescence/ultraviolet fluorescence result interpretation.

Ms. Kortbein has experience with free product removal, soil sampling, groundwater sampling, vapor sampling, vapor and groundwater well installation, well abandonments, data entry, technical report writing, Phase I and Phase II site assessment report writing, and litigation support.

Related Projects

- Assisted with various remedial system maintenance and operation management events.
- Experienced in collecting non-aqueous phase liquid, sampling groundwater, sampling soil, and collecting vapor samples to multiple state standards.
- Oversaw groundwater and vapor well installation events and well abandonments for sites in multiple states.
- Reimagined over 30 years of historical data, comprehensive geology, and hydrogeology information to complete a detailed site characterization report for a former petroleum shipping dock in Wisconsin.
- Supported a variety of field work and report writing deliverables in several Midwest states including Wisconsin, Minnesota, Iowa, Nebraska, North Dakota, and Missouri.
- Completed document reviews and prepared trial exhibits and case summaries for multiple environmental litigation cases.

Dean A. Krebs, P.E.



Title

Senior Engineer

Education

BS – Geological Engineering,
University of Minnesota,
Minneapolis, MN

Professional Registrations

[Professional Engineer: Minnesota
(#26540), Iowa (#18322), Illinois
(#062.059808)]

Languages

English

Experience Summary

Dean Krebs, a Senior Environmental Engineer/Program Director, is a Registered Professional Engineer with more than 24 years of experience in remedial investigations, environmental assessments, soil and groundwater remediation, compliance services, and project/program management. He is the program director for a multimillion dollar multidisciplinary client and the leader of Antea Group's Railroad Segment. He has implemented programmatic work across multiple business groups for various clients. His responsibilities include all aspects of client /portfolio management, including business development, resourcing, budgeting and technical review. He has extensive experience managing complex portfolios of Spill Prevention, Control and Countermeasure (SPCC) and Storm Water Pollution Prevention plans. Dean works out of our St. Paul, MN office.

Related Projects

- Designed, implemented, and managed a program to complete preparation of a portfolio of 130+ SPCC plans for complex railroad facilities across the western United States. This project consisted of customizing the plan to each site while adhering to overall client procedures and compliance with SPCC rules and regulations. The program required coalescing a team of engineers throughout multiple business units and geographies to serve a broad geographical base of facilities. The facilities ranged from moderately complex to some the largest railroad yards in the US. The program expanded to include Facility Response Plans and other compliance related inspections and documents.
- Lead Antea Group's Railroad Segment from a concept to a fully funded segment with year over year growth. In his role as Segment Leader, he has developed the marketing plan, conducted a market analysis, generated and led multiple campaigns to promote Antea Group to the railroad industry.
- Led a solution development team to bring an automated application to SPCC field evaluations creating efficiency and reducing human touch points.
- Developed and managed a program to sample treated wood (railroad ties, bridge components, signal poles, etc.) across multiple states in a logistically challenging environment.

Curriculum Vitae

Dean A. Krebs, P.E.

- Provided program management on a portfolio of SWPPP plans for a nationwide client that involved creating consistency across the facilities yet are tailored to meet the requirements of each state and locality. Managed the development and/or completed more than 160 SPCC, SWPPP or Facility Response plans.
- Provided client management on a portfolio of over 200 remediation, compliance and due diligence sites across the western U.S. that averages \$3 million dollar annual spend. Successfully negotiated two 5-year contract extensions with this client without having to go through an expensive procurement process.
- Provided senior engineering and oversight of engineering for all aspects of the firm's projects. As a senior engineer, he is focused on managing the remediation aspects of a project and tracking progress against financial and time schedule requirements. He has written external documentation and reports to meet company, client, and regulatory requirements. Additionally, he has prepared proposals and bid documents, secured new work, arranged and provided contractor oversight, and reviewed proposals, work plans, designs, and the data evaluation of staff and project level engineers.
- Has supervised many engineers-in-training and other remediation specialists. He has led a team of engineers who have worked on many large-scale remediation projects and designed complex remedial systems in many parts of the United States. He has been consulted to provide senior engineering support and review on remediation projects undertaken by other divisions within the firm. His support consists of reviewing the site and remediation technology to determine compatibility, followed by reviewing the design to determine whether it is both technically and economically feasible. During the past ten years, some of the specific project tasks completed have included the following:
 - Designed and managed multiple large-scale excavations, including; a multimillion dollar excavation that included soils contaminated with polychlorinated biphenyls (PCBs), chlorinated solvents, and petroleum hydrocarbons, a major excavation of DDT impacted soil at a former mushroom farm, a logistically complicated excavation of chlorinated solvent impacted soil at an active dry cleaning facility, and numerous excavations for petroleum impacted soils at service stations.
 - Designed, installed, and operated numerous remediation systems including, a steam injection/ extraction system to recover No. 6 fuel oil at a manufacturing facility, a combination of bioventing (BV), soil vapor extraction (SVE), and air sparging (AS) featuring more than 170 points at a major oil company terminal, a BV/SVE/AS system at a major oil company terminal located within a complicated geological region, a successful bioslurping pilot test at a site featuring more than 30,000 gallons of free phase hydrocarbons located 45 feet below ground surface, six additional bioslurping pilot study/system designs, six dual phase extraction systems across the United States to remove free phase product while minimizing groundwater recovery, 21 AS/SVE systems for service stations, chemical manufacturing facilities, and other industrial clients, five thermal and catalytic oxidizers for treatment of air emissions
 - Operated and evaluated the efficiency of a steam injection/dual phase extraction/SVE system on a 20-acre former railroad site impacted with more than 50,000 gallons of diesel fuel.
 - Designed and installed a stream aeration system to remove dissolved petroleum hydrocarbons from a major pipeline leak in rural Illinois. Designed and installed a pump-and-treat system to reduce impacts to the stream. Designed and coordinated a free-product remediation plan utilizing dual-phase extraction.

Curriculum Vitae



Todd Kremmin



Experience Summary

Todd Kremmin graduated from Gustavus Adolphus College with a Bachelor of Arts in Geology, along with minors in Geography and Environmental Studies. Todd joined the energy industry immediately following graduation and worked for 2 years in various roles at Anadarko Petroleum Corporation; Geology Intern, Senior and Staff Geosteering Technologist. Todd continued his quest to diversify his knowledge of geology, and more specifically geophysics while pursuing a Master of Science degree at the University of Minnesota Duluth. Todd gained invaluable experience during this time, assisting with seismic exploration surveys in the country of Colombia, performing geophysical surveys in and around Minnesota, mentoring teaching assistants, teaching laboratories, and further expanding his knowledge in hydrogeology, geographic information systems, geomorphology, sedimentology, stratigraphy, and environmental science. Todd is now working at Antea Group's St. Paul Office.

Title

Project Professional

Certifications

Geologist In-Training (GIT)
State of Minnesota, License 150242

Education

M.S. Earth and Environmental Sciences
University of Minnesota Duluth
Duluth, MN

B.A. Geology
Minors in Geography and
Environmental Studies
Gustavus Adolphus College
Saint Peter, MN

Languages

English
Spanish (semi-proficient)

Related Projects

- May 2016 – Current: *Project Professional, Antea Group*
Perform various statistical analyses using MAROS v. 3.0. Assist in research, reporting, and development of trial exhibits for litigation support. Provide GIS support in mapping and geospatial analysis. Write and review technical reports. Develop graphical illustrations of data, hydrographs, and groundwater contour maps. Review project specific engineering specifications and provide calculations. Support onsite field operations and maintenance at LNAPL remediation sites as well as brine spill sites. Gauge and bail LNAPL, and gauge groundwater. Assist in geoprobe drilling, monitoring well installation, vapor pin installation, and prepare boring logs from field notes. Collect soil samples, water samples, and air samples. Provide assistance with Phase I site investigations. Assist with underground storage tank removal, soil sampling, and analysis. Assist in field staff preparation and logistics.
- September 2014 – May 2016: *Lead Graduate/Graduate Teaching Assistant, University of Minnesota Duluth*
Trained and mentored 6 graduate teaching assistants. Assessed and resolved teaching assistant and student concerns. Conducted weekly meetings to prepare lab materials, communicate, and educate on future labs. Organized and coordinated graduate teaching assistant lab schedules. Taught 2-3 lab sections of Geology and Earth Systems, and Principles of Geophysics per semester. Maintained regular office hours to meet with students in study and



review sessions. Evaluated student progress and provide consistent feedback during the academic semester. Assisted professors with lecture, laboratory, and field instruction including instructing students, proctoring exams, and grading assignments.

- July 2015: *Seismic Exploration Research Assistant, Aquitania, Colombia*
Supported the Principal Investigator, Dr. Nigel Wattrus in conducting a detailed geophysical survey of Lago de Tota, a large tectonic lake in the Eastern Cordillera of the Colombian Andes. Project part of a NSF grant to map and interpret lake floor bathymetry, subsurface thicknesses of lacustrine sedimentary sequences, locations of depositional centers, transgressive-regressive lake level sequences, and long-term tropical paleoclimate records. Operated a high-resolution single-channel airgun seismic reflection system and a CHIRP sub-bottom profiler. Maintained compressors, air pressures, and data cables during surveys. Deployed and retrieved geophysical equipment from a hand built platform before and after surveys.
- January 2013- June 2014: *Senior/Staff Geosteering Technologist, Anadarko Petroleum Corporation*
Provided 24/7 geotechnical operational support for multiple active drill rigs in the unconventional Eagleford and Wolfcamp Shale plays of Southern and Western Texas. Geotechnical support included 3-4 daily operational updates and geologic interpretations of real-time wellbore placement, quality control of data acquisition, management and relationship development of vendors, and post well statistics and summarization. Supported onsite field operations for significant data acquisition jobs which included services for mudlogging, wireline, open-hole imaging, and coring. Collected, analyzed, prepared, and interpreted mudlog samples. Monitored geophysical well log and image log assembly, acquisition, and disassembly. Supervised coring logistics, assembly, recovery, and take down. Assisted onsite core processing, transportation, and storage. Verified safety and calibration quality control standards were maintained during rig site data collection operations. Consulted with geologists, geophysicists, reservoir engineers, and drilling engineers in subsurface interpretation, drilling logistics and specifications, vendor costs estimates, exploratory projects, and aided in analysis of geochemical, core, geophysical, and geospatial data.
- June 2012- January 2013: *Geology Intern, Anadarko Petroleum Corporation*
Collaborated with the Eagleford Shale asset team to understand the lateral and depositional distribution of the Upper Cretaceous Olmos Sandstone in order to determine reservoir qualities suitable for the company's interest. Interpreted vintage and new petrophysical well logs; gamma ray, resistivity, spontaneous potential, acoustic, density-neutron, sonic, and nuclear magnetic resonance. Integrated 2D and 3D geophysical data into the interpretation and generated geologic maps, cross sections, and figures. Used PETRA, Rockpilot, and Interactive Petrophysics software.

Publications

- Breckenridge, Kremmin, Dott, and Mossberger, (2016). Field Trip #9: Duluth Harbor Geologic History Boat Cruise: Quaternary to Anthropocene. Institute on Lake Superior Geology, Proceedings Volume 62 Part 2 Field Trip Guidebook, Duluth, Minnesota May 4-8, 2016, p. 160-187.

Presentations

- Near Surface Geophysics, NS41B-1944, American Geophysical Union (AGU) Poster Presentation, December 17, 2015. Title: Reconstructing the Geomorphic Evolution of a Freshwater Baymouth Bar in Response to Lake Level Change Using Three Dimensional (3D) Ground-Penetrating Radar (GPR) Data. Authors: Dr. Nigel Wattrus and Todd Kremmin.

Aaron Lapine, LEP



Title

Senior Consultant

Education

MS – Environmental Science,
University of New Haven, West
Haven, CT

BA – Botany and Political Science,
Miami University, Oxford, OH

Professional Registrations

Licensed Environmental
Professional: Connecticut (#522)

Professional Associations

Member, American Chemical
Society
Member, National Groundwater
Association

Languages

English

Experience Summary

Aaron Lapine, Senior Consultant, has more than 18 years of experience in the environmental field. His technical expertise includes: environmental site assessment; environmental exposure assessment; soil and groundwater remediation; regulatory compliance; environmental liability quantification and mitigation; environmental litigation support; and management of multiple site remediation portfolios in various states. He specializes in the quantification and management of environmental risk, whether transactional, operational, or legacy.

Related Projects

- Prepared and currently the executive sponsor for a guaranteed fixed-price to closure legacy liability mitigation option for approximately 90 active clean-up sites in Connecticut.
- Currently serving as Program Manager for a guaranteed fixed-price to closure portfolio of approximately 160 active cleanup sites across 17 states. Responsible for creating a program and building an executing team to effectively characterize, mitigate, and receive regulatory case closure for all of the active cleanup sites within a predetermined budget and timeframe.
- Provided expert testimony on behalf of an integrated energy company client in defense of a product liability class-action claim involving the additive MTBE. The testimony specifically involved the chemical fate and transport relating to the location of municipal well fields.
- Served as technical lead and the responsible manager for approximately 190 active cleanup sites in New Jersey, New York, Maryland, Delaware, District of Columbia, Mississippi, North Carolina, and South Carolina. Responsible for the formulation of contaminant characterization and innovative remedial strategies to address contamination and achieve case closure status with the appropriate regulatory agencies.
- Served as technical lead and responsible manager for approximately 185 active retail and non-retail petroleum cleanup sites in Southern California and Washington.
- Managed the remediation and provided technical expertise at a site where an active major oil storage facility terminal was located on a parcel of a former

Curriculum Vitae

Aaron Lapine, LEP

refinery. A liquid phase hydrocarbon (LPH) plume with an original estimated volume of 17 million gallons was identified under the former refinery, two million gallons of which was originally estimated under the client's active terminal. A lawsuit and counter-lawsuit were filed between two major oil companies for breach of contract related to the remediation of the contaminant plume. Multiple LPH seep areas were identified into a nearby tributary. The most significant achievements in the project included the following: characterization of the extent and estimated volume of the LPH, the management of the operation and maintenance and the later design and the implementation of a complete overhaul of a dual-phase recovery remediation system that recovered over three million gallons of LPH; the successful face-to-face negotiation as the technical lead with an NGO resulting in the preparation of a formal letter rescinding potential claims and stating that the client's containment system and remedial efforts were appropriate; the successful negotiation as the technical lead resulting in a novel settlement in which the client received services and proceeds worth an estimated value that exceeded the client's original claim; and the successful face-to-face negotiation with the state agency as the technical expert resulting in the indefinite postponement of an administrative executive order.

- Served as one of 22 experts representing private industry, academia, and local, regional, state, and federal regulatory agencies invited to participate in the National Water Research Institute (NWRI) Nominal Group Technique two-day workshop to provide answers to the workshop question: "What improvements to subsurface monitoring are needed to properly evaluate the fate and transport of petroleum and fuel oxygenate contaminants?" for the protection of potable water sources. Participants included representatives from California Regional Water Quality Control Boards of Los Angeles and Santa Clara, the California State Water Resources Control Board, Santa Clara Valley Water District, Alameda County Department of Health, and the EPA. The purpose of the workshop was to improve monitoring strategies and provide insight into planning monitoring programs that will consider new technologies providing cost-effective means of protecting drinking-water resources.
- Designed and patented (provisional Patent Application No. 60/723,508) an automated bioaugmentation/biostimulation system that delivers treatment solutions to the subsurface with limited site visits. The system can store and intermittently introduce terminal electron acceptors, macronutrients, micronutrients, and/or bacterial colonies.
- Experienced with various geophysical assessment techniques (CPT/LIF, Mise-a-la-Masse, seismic refraction, dual temperature/dual fluid resistivity, and acoustic televiwer borehole logging). Based on this knowledge, he was invited to present "3-sided Refraction Tomography Assessment Technology" at the 2003 15th Annual EPA OUST UST/LUST National Conference in support of the Site Investigation Methods Session.
- Designed, advocated, and implemented numerous novel chemical oxidation remedial applications at retail service station LUST sites. Created a safety protocol for field applications of various chemical oxidation techniques.
- Conducted numerous vapor intrusion to indoor air pathway evaluations and employed vapor intrusion mitigation technologies. Designed a thorough field sampling protocol to collect data for use in fate and transport models to evaluate human health risks associated with potential indoor air pathways.
- Developed and instituted a risk-based decision making process to prioritize portfolios and devise remedial strategies. The procedure utilizes analytical and numerical computer generated fate and transport models and field data collection to quantify potential exposure to human health and the environment.

Curriculum Vitae



Laura R. Maki

Title

Staff Professional

Education

In Progress: M.S. Civil Engineering
from University of Minnesota,
Minneapolis, MN
Expected Dec. 2014

B.S. Physics with additional major in
Mathematics from Winona State
University, Winona, MN

Awards and Recognition

Graduation with honors in physics
and mathematics from Winona
State in May, 2012

Received Eileen Fahey Memory
Scholarship granted to outstanding
woman in physics for 2011-2012
academic year

MAA Outstanding Presentation
Award for Advanced Linear Algebra
research at MAA Conference in
August, 2010

Language

English, French (some)

Experience Summary

Laura's education and research projects emphasized leadership and teamwork. She also has experience with computer modeling, using Python, Java, Mathematica, and MatLab. Her high aptitude for applied mathematics and logical problem solving lend to her abilities to do computer modeling. She successfully modeled the square cavity problem using MatLab for her Computational Fluid Dynamics course and has also used MatLab to model flow of water around stationary circular obstacles in two dimensions. In a course on remediation technologies, she helped write a Feasibility Study as part of a final group project. Most recently, her master's thesis work has required organizational and analytical skill as well as the ability to think and act quickly to solve problems using available resources.

Related Research Projects

- September 2012-Present: Master's thesis research on debris flows, specifically the erosion and entrainment of particles. She conducted laboratory experiments, collected and analyzed data, and is now in the process of writing her thesis.
- September 2010-May 2012: Honor's thesis for mathematics department at Winona State on real applications of complex analysis and advanced linear algebra. She applied principles from both branches of mathematics to two systems, an electromagnetic ball suspension system and a simple electrical circuit, to reveal information about the system variables.
- Summer 2011 – Research at the University of Michigan in Astrophysics. Laura used star location and magnitude data from a sky survey, and wrote a program using Python to calibrate it to cataloged data. This research will aid the Dark Energy Survey (DES) in trying to better understand the nature of dark energy.
- Summer 2010 – Research at the University of Minnesota in Differential Geometry, using Mathematica to write code that utilizes distance histograms to define rigid shapes and objects.

Presentations

- 'Advanced Linear Algebra applied to an Electromagnetic Ball Suspension System', MAA Mathfest in Pittsburgh, PA, in August 2010

Curriculum Vitae

Cortney E. Malloy



Title

Staff Scientist/Geologist

Education

BS – Geology, Northwest Missouri State University

Languages

English
German

Experience Summary

Cortney Malloy has one year of experience as an environmental consultant providing Environmental Site Assessments (ESAs), soil and groundwater investigation and characterization, drilling oversight, installation of groundwater monitoring wells, data evaluation and development of visual graphics, report preparation, subcontractor coordination, and characterization of subsurface soil and geology. Cortney works in Antea Group's Bettendorf, Iowa office.

Related Projects

- Provided technical and project support for multiple petroleum contaminated sites throughout the Midwest. Tasks included evaluating the nature and extent of contamination and the development of remediation costs. Activities included supervision of data collection and analysis of affected media including soil, bedrock and groundwater; estimation of remediation costs; technical evaluation of corrective actions; supervision of field staff; report preparation; and engagement with regulatory agencies.
- Supervised the installation of soil boring and groundwater monitoring well networks including classifying and logging of subsurface soil and geology, and the collecting soil and groundwater samples for chemical analyses. Provided oversight of drilling contractors using Geoprobe methods.
- Performed as the primary author of multiple Phase I ESAs for major railroad client. Project tasks included: performance of site visits, interviewing, review of EDR report and historical maps, historical investigation and reporting.
- Performs data management assignments for major railroad and high-tech clients. Tasks includes: interpretation data, formatting and development of graphical representation of data.
- Performs data management and project support for major high-tech clients. Tasks includes: subcontractor management and tracking, compiling and presenting client monthly Environmental Health and Safety (EHS) matrices, review of EHS regulatory registries, evaluate applicability of regulations and assists with the development and maintenance of client compliance calendars.

Becky Matich

Title

Project Professional

Education

BS – Environmental Studies, Bemidji State University, Bemidji, MN

Training/Certifications

Accredited Office Ergonomics Evaluator (AOEE) – June 2014

OSHA 30-Hour for General Industry

First Aid/CPR/AED

AIHA – Fundamentals of Industrial Hygiene

Languages

English

Experience Summary

Becky Matich is a Project Professional with seven years of experience working in the environmental consulting and chemical manufacturing fields. She has been involved in a number of related environmental and environmental, health and safety (EHS) projects and has actively participated in all stages of the project lifecycle. She has a very strong knowledge and understanding of EHS regulations.

Becky currently supports a wide variety of EHS projects, including incident management, industrial hygiene, emergency response plan (ERP) development, safety committees, and environmental regulatory compliance projects. She currently serves as the Health, Safety, Security, and Environmental (HSSE) Regional Advisor for Antea Group's Upper Midwest region.

Related Project Experience

- As an HSSE Regional Advisor, provides HSSE support and guidance to operations teams in the region and supports company-wide HSSE initiatives.
- Provides incident management support for a leading tech company by validating No Treatment and First Aid incidents within their Incident Management System. For certain incidents, completes follow up with store management to check on the employee's well-being, if they sought medical treatment, and/or to provide guidance on safe work practices and injury prevention.
- Conducts industrial hygiene monitoring, specifically for noise and Indoor Air Quality (IAQ) projects within the technical industry.
- Provides ongoing health and safety support for technical companies, including facilitating safety committee meetings, EHS auditing, emergency response planning, workstation ergonomic assessments, and other on-demand services.
- Prepares Spill, Prevention, Control & Countermeasure (SPCC) plans and Stormwater Pollution Prevention Plans (SWPPP) for numerous sites in various industries.
- Performs office ergonomic evaluations and provides recommendations to improve employee's comfort and prevent future discomfort or injury.

Curriculum Vitae

Becky Matich

- Provided Active Threat Awareness trainings to hundreds of employees across nine stores as part of a global retailer's training initiative (Summer 2016).
- Has performed several EHS audits in the retail, industrial and medical sectors.

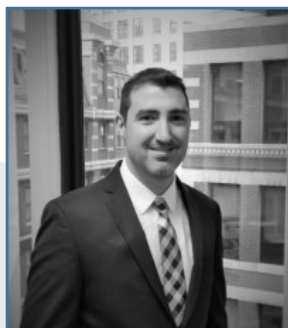
As an EHS Specialist at a leading ethanol company, Ms. Matich supported the management team in all facets of EHS regulatory compliance and safe work practices, including:

- Observed employees performing their job duties to ensure safe work practices were effective in controlling health and safety hazards.
- Completed annual reviews and updates to health and safety programs to ensure compliance, including hazard communication, blood borne pathogens, hearing conservation, lockout/tag out, and respiratory protection.
- Lead and assisted in the investigation of health and safety incidents.
- Coordinated and directed inspections for fire suppression systems, Process Safety Management (PSM) mechanical integrity requirements and pollution control equipment.
- Administered safety programs, including the instruction of hazard communication, lockout/tag out, Process Safety Management (PSM), permit-required confined space, and fall protection for approximately 42 employees at the facility.

Throughout the course of her career, Becky has also:

- Become proficient in Microsoft and iOS applications and has worked in SharePoint and Egnyte platforms for document management and storage.
- Performed Phase I environmental site assessments, where work included site reconnaissance, state file reviews, review of historical documents, and report preparation.
- Interpreted field data and laboratory analytical results, summarized site recommendations, and prepared investigation reports.
- Supported work on litigation cases by reviewing deposition transcripts, analytical data, environmental permits, and correspondence.

Owen F. McKenna



Title

Project Manager

Education

MA – Environmental Management, Sustainability, Harvard University, Extension School, Cambridge, MA

BA - Geology, Environmental Studies, Bowdoin College, Brunswick, ME

Professional Registrations

Certified Geologist: Maine, License Number GE594

Professional Geologist: New Hampshire, License Number 883

Languages

English

Experience Summary

Owen McKenna is an environmental professional with a diverse consulting background ranging from corporate sustainability reporting to environmental management consulting. He has specific expertise in the preparation of CDP reports and pollution investigation and remediation management.

Related Projects

- Sustainability reporting and disclosure preparation - Owen has provided Carbon Disclosure Project (CDP) support (e.g., CDP Climate Change, CDP Water, CDP Forests, CDP Supply Chain) to clients in the Pharmaceutical, Chemical, Forest Products, and Food & Beverage industries. He is experienced in all aspects of reporting including benchmarking evaluations, gap analysis, materiality assessments, stakeholder interviews, program story development, metrics calculations, client workshops, and report/disclosure drafting. Owen is also experienced in building business cases for corporate sustainability investments including key personnel interviews, data analysis, quantification and monetization of benefits, and case presentation.
- Management of pollution investigation and remediation activities - Owen currently manages the remediation of contaminated properties for a leading real estate investment trust and environmental liability transfer (ELT) portfolio across Connecticut, Massachusetts, and Maine. He develops and directs the implementation of site remediation activities from the initial reportable condition through closure. In addition, Owen has experience conducting environmental assessment, remediation, and regulatory reporting activities for top-tier clients across the Oil and Gas, Industrial, Automotive, and Chemical industries. He also has experience in emergency response management for the Oil & Gas industry ranging from tanker truck accidents to a large-scale pipeline releases. Owen has coordinated and overseen subcontractors for emergency response clean-up activities; managed impacted surface water, soil, and oily-debris for characterization and disposal; and interfaced with client representatives and regulators to meet remedial milestones.

Corey C. Mecham

Experience Summary

Corey Mecham, project manager with Antea Group, has 12 years of professional experience in the consulting, research, industrial and laboratory fields. His background includes project management, GIS, EMIS, LNAPL modeling and evaluation, remediation system operation and maintenance, air pollution testing, sample recovery and analysis, sampling of soil and ground water contamination and health and safety enforcement. He provides management as well as technical support for site investigation and remediation projects at a variety of active and abandoned sites in the Midwestern United States. He directs and coordinates the preparation of work plans, site health and safety plans, investigation reports, remediation reports, conceptual site models, corrective action plans and remedial designs from Antea Group's Bettendorf, Iowa, office.

Title

Project Manager

Education

BS – Meteorology, Northern Illinois University, DeKalb, Illinois

Post-Graduate Certificate in Geographic Information Analysis, Northern Illinois University, DeKalb, Illinois

Professional Associations

Illinois GIS Association

Languages

English

Related Projects

- Provides GIS and EMIS data management services for multiple North American projects, including management of large volumes of diverse spatial, geotechnical and chemical data. Utilizes ESRI Arc View 10 for creation of raster, vector and surface layers; performs spatial and three-dimensional analysis and creates visualizations for project sites. Provides data and analysis for use in decision making for investigation, risk assessment, property assessment, and environmental litigation and remediation projects.
- Guided an LNAPL assessment and remediation at a former impoundment pond in Iowa. Directed the LNAPL mass, mobility, and recoverability assessment and developed the Conceptual Site Model. Based upon the results of the LNAPL assessment, successfully proposed alternate remedial endpoints that substantially reduced remediation costs. Following successful remediation, the site obtained closure from the regulatory agency.
- Provided project management at a railroad yard in Kansas. Conducted and directed site assessment in association with an inactive fueling facility. Coordinated and directed a technical education session for the regulatory agency, on behalf of the client. Managed and coordinated field, laboratory

Curriculum Vitae

Corey C. Mecham

and engineering activities associated with a site-wide LNAPL mass, mobility and recoverability evaluation.

Performed assessment activities including determination of groundwater and soil source concentrations of VOCs, BNAs, and TPH constituents, groundwater flow direction, inferred area of soil and groundwater impact, and migration mechanisms.

- Provided field services associated with leaking underground storage tanks at a Brownfield assessment and remediation site in Iowa. Conducted soil and groundwater sampling at an abandoned railroad yard. Performed field activities that included free product measurement and removal, soil boring sampling and survey work. Completed monthly operation, maintenance and sampling of dual phase extraction system and associated monthly compliance reporting.
- Performed third-party testing at a manufacturing plant to provide information on NO_x and CO emission levels that were guaranteed objectives by the manufacturer. Simultaneously performed relative accuracy testing for calibration of plant instrumentation. Assisted in logistics and scheduling of personnel and equipment, which included shipping of hazardous materials.
- Directed field activities for testing of particulate, metals/mercury, and PCDD/PCDF, HCL, O₂/CO₂, NO_x/NO₂, SO₂ and CO emissions at various municipal waste incineration facilities in Florida. Testing was needed for state and federal EPA compliance for Title V, Municipal Waste Incinerator emission compliance, and relative accuracy testing of plant instrumentation. Activities included wet method and monitor testing, laboratory sample recovery and field analysis, packaging and shipping hazardous materials for additional laboratory analysis. Also directed personnel and equipment logistics and scheduling.

Experience Summary

Paul Meier has 30 years of experience as an environmental consultant providing services to public and private sector clients. His specialties include management of emergency response cleanups; remedial actions design and implementation; construction and excavation oversight; drilling oversight; installation of groundwater monitoring wells; soil and groundwater sample collection for analytical testing; report preparation; subcontractor coordination, and characterization of subsurface soil and geology. Paul works in Antea Group's Bettendorf, Iowa, office.

Title

Staff Scientist/Geologist

Education

BS – Geology, Winona State University, Winona, Minnesota

Professional Registrations

Professional Geologist: Wisconsin

Professional Associations

Minnesota Groundwater Association

Languages

English

Related Projects

- Participated in several Stormwater Pollution Prevention Plan (SWPPP) site surveys for an industrial client in Iowa. Project tasks included reviewing project site background information, conducting on-site inspections of the site facilities and activities and identifying stormwater flow paths and discharge points.
- Participated in a large-scale crude oil pipeline spill remediation project for a petroleum client in northwest North Dakota. Project tasks included assisting with the excavation of the impacted soils which totaled into the several hundred thousand tons, directing the drilling of direct-push soil probes to further define the crude oil plume, classification of soils and geology, and collecting soil and groundwater samples. Additional project tasks included coordinating the pumping and discharge of storm and snowmelt water from the excavation during several events and the collection of discharge samples to ensure compliance with the NDPEs permit.
- Participated in a site investigation project for an industrial client in Des Moines, Iowa. Project tasks included directing the drilling of direct-push probes to further define a petroleum TCE/PCE plume, classification of soils and geology, collection of soil and groundwater samples including the use of passive diffusion samplers, and contractor coordination and oversight.
- Participated in a large sludge pond remediation project for an industrial client in Council Bluffs, Iowa. The project included characterization of soil and

Curriculum Vitae

Paul M. Meier, PG

geology, on-site remediation via excavation and disposal of petroleum- and solvent-contaminated sludge. Project tasks included air monitoring, soil sampling, groundwater sampling, contractor coordination, and data analysis.

- Participated in a site investigation project for a commercial client in Black River Falls, Wisconsin. Project tasks included oversight of drilling groundwater monitoring wells into bedrock using a rotasonic drill rig to further define a TCE/daughter products plume, classification of soils and geology, collection of soil for laboratory analysis, collection of groundwater utilizing low-flow sampling methodology, collection of natural attenuation parameters, and contractor coordination and oversight.
- Participated in groundwater sampling projects for an industrial client at sites in Nebraska. The project included the collection of groundwater samples for chlorinated solvents using passive diffusion samplers, and recording groundwater natural attenuation parameters.
- Participated in a multi-faceted site remediation project for an industrial client in Chadron, Nebraska. Tasks includes reviewing historical information regarding site use and process; completing an on-site investigation to identify soil and groundwater impacts at the site; classification of soil and geology; and the completion of a subsurface investigation to further delineate environmental impacts at the site. The remediation phase included documenting and coordinating with contractors to remove product, sludge and contaminated water from several storage vessels; documenting the cleaning of the vessels; coordinating the disposal of the waste products; and documenting the decommissioning of the storage vessels. The storage vessel cleaning activities were conducted under permitted confined space entry. Additional work included data analysis and completion of the decommissioning report.
- Participated in a gasoline pipe line spill remediation project for a petroleum client in northwest Indiana. The project site was located in a residential neighborhood with multiple overhead and underground utilities and under high public scrutiny. Tasks included assisting with coordination and oversight of the excavation and disposal of the impacted soil, soil screening and sampling, soil segregation, soil and geology classification, and soil boring and monitoring well installation oversight.
- Participated in a crude oil pipe line spill remediation project for a petroleum client in northeast Illinois. The project site was located in a wetland adjacent to a railroad and highway corridor. Project tasks included performing sediment sampling and water quality monitoring at multiple locations within the wetland; and oversight of the installation of several groundwater monitoring wells installed into the bedrock.
- Managed many underground storage tank remedial investigations and actions. The investigations included subcontractor coordination, collection of soil and groundwater for laboratory analysis, and contractor and stakeholder coordination. Remedial action activities included the design and implementation of remediation systems including: soil venting, groundwater treatment using in-situ air sparging, carbon absorption, and liquid-phase product separation. Worked with the client and regulatory agency to provide cost-effective project solutions.
- Provided technical and project support for multiple petroleum contaminated sites throughout the Midwest. Tasks included evaluating the nature and extent of contamination and the development of remediation costs. Activities included supervision of data collection and analysis of affected media including soil, bedrock and groundwater;

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Paul M. Meier, PG

estimation of remediation costs; technical evaluation of corrective actions; supervision of field staff; report preparation; and engagement with regulatory agencies.

- Performed water use audits for the United States Post Office. The audits included conducting a walk-thru of two Post Office facilities and documenting water usage. Follow-up work included providing recommendations for water-saving fixtures and a cost benefit analysis.
- Supervised the installation of soil boring and groundwater monitoring well networks including classifying and logging of subsurface soil and geology, and the collecting soil and groundwater samples for chemical analyses. Provided oversight of drilling contractors using Geoprobe[®], hollow stem auger, rotasonic, mud rotary, air rotary, and rock coring drilling methods.

Cindy Meldrum

Experience Summary

Cindy Meldrum has an extensive background as an office manager, field technician and drafter, having provided environmental project support for more than 19 years. Her responsibilities include preparation of maps and well diagrams by utilizing AutoCAD, as well as reimbursement packets, data entry, laboratory and sample tracking, project and budget tracking, groundwater sampling, free product recovery, water level data collection, site surveys, well searches and drafting reports and Health and Safety Plans (HASP). She is currently responsible for creating over 80 HASPs for a major transportation client across the country and keeping them updated on an annual basis.

Title

Technical Scientist
Project Manager Assistant

Education

AAS – Business, Scott Community
College, Bettendorf, Iowa

Professional Registrations

Iowa Public Notary

Language

English

Related Projects

- Conducted quarterly water level data collection from 38 monitoring wells, along with low-flow groundwater sample collection from a network of 15 monitoring wells at a chemical manufacturing facility in Iowa.
- Assisted project team with performing monthly water level gauging and free product recovery, in addition to quarterly groundwater sample collection at numerous underground storage tank sites across Iowa and Illinois.
- Conducted monthly water level and free product recovery and semi-annual groundwater sampling for a national transportation client.
- Served as a project assistant responsible for performing annual water level gauging and groundwater sampling at multiple LUST sites throughout Iowa.
- Responsible for invoicing and uploading information to a major transportation corporation on a monthly basis using their systems.

Mark D. Nelson, PE



Title

Consultant

Education

BS – Civil Engineering, University of Minnesota, Minneapolis, MN

Professional Registrations

Professional Engineer: Minnesota (25828), Illinois (062-055091), Florida (65189), California (CH 6359), Louisiana (35631), Mississippi (26532)

Professional Associations

American Chemical Society

Languages

English

Experience Summary

Mark Nelson, a consultant for Antea Group, has more than 24 years of experience. He specializes in evaluating environmental risks, developing creative strategies and cost effective solution implementation. He has broad experience in the design and implementation of a creative site remedies encompassing traditional and experimental technologies including mechanical systems, bioremediation, chemical oxidation and steam injection. Mark has completed remediation projects in over 30 states and several locations abroad. In addition, Mark has substantial experience managing facility closures, safely removing site assets.

Related Projects

- **Engineering Quality Assurance.** Mark provides technical support and quality assurance for remediation system design and optimization across the company.
- **ELT Portfolio.** Mark has led several environmental liability transfer portfolios. In this role he focused on managing several project teams dedicated to extinguishing environmental liability on a portfolio of retail petroleum release sites. Antea Group entered into a contract to close all of the sites for a fixed price. Mark acted as the responsible party, managing strategies to close sites and eliminate liability at the lowest cost.
- **Account Leader.** Developed and led a multi-office team serving a National, mid-stream petroleum storage and distribution client. Services provided to this client included site remediation, emergency response, site compliance, and operations manual development. Account has consistently met revenue and profitability targets.
- **Pipeline Release, Tioga, ND.** Mark led the remedy strategy development for a large crude oil release in north western North Dakota. Mark developed the strategy for crude oil recovery as part of the emergency response and is developing the strategies for the final remedy to return the impacted area back to productive farm land.
- **Vapor Intrusion.** Mark has provided engineering design for sub-slab depressurization systems to protect building occupants from vapor intrusion. He has developed systems for residential and manufacturing facilities.

Curriculum Vitae

Mark D. Nelson, PE

- **Manufacturing Plant, Sanmina, Canada – Site Investigation/Pump & Treat Optimization** - Senior Project Scientist providing developing strategy and oversight of work scopes prepared by our local Inogen partner. Developed strategy to completed additional investigation and source area reduction to allow shut down of the current pump and treat system. Strategy was accepted by the Ontario Ministry of the Environment and will lead to earlier site closure and significant life cycle cost savings.
- **Pipeline Release, Jackson, WI.** Mark was the lead consultant developing the remedial strategy in response to a pipeline release of approximately 50,000 gallons of gasoline. Mark developed a creative remediation strategy tailored to unique site conditions to recover gasoline from a layered bedrock with gasoline impacts located a depths of 25 feet below grade and 150 feet below grade. The system consists of 53 shallow extraction wells and five deeper recovery wells.
- **Litigation Support, Green Bay, WI.** Provided Expert Witness support for a case regarding sources, transport and remediation of an LNAPL plume affecting a basement. The support required review of historical reports, forming opinions regarding the sources and transport of an LNAPL plume, writing expert reports and responding to plaintiff's expert reports. Efforts lead to a favorable settlement with the plaintiff saving the client over \$4 MM.
- **Petroleum Refinery, Petite-Caroune, France.** Mark was the lead design engineer for development of the design and implementation strategy for remediation of an LNAPL plume located under a refinery and the surrounding township that was responsible for significant vapor intrusion into a nearby residential area. Mark lead the design effort for a remedial system that will recover LNAPL and mitigate vapor intrusion from a 35 acre plume consisting of 175 multi-phase extraction points, 180 soil vapor extraction points complete with water and air treatment systems.
- **Pipeline Release, Livingston, IL.** Senior engineering oversight in response to a pipeline release of gasoline in a rural west, central Illinois. Mark designed an extensive laser induced fluorescence investigation of the release area once emergency response activities were complete. Mark interpreted the results of the investigation and is directing the remedial strategy to restore the affected properties.
- **Pipeline Release, Lockport, IL.** Mark provides senior oversight, directing the remedial response to a pipeline release of crude oil. The release affected a commuter rail line, wetlands and affected the habitat of an endangered Hines Emerald dragonfly. Mark directed remedial efforts to recover crude oil at the conclusion of the emergency response effort. These efforts included design of a system to recovery crude oil from utility corridors and design work to protect the wetlands from seeps from the remaining residual oil.
- **Closed Bulk Petroleum Storage Facility, Superior, WI.** Mark provided oversight developing the strategy for investigation and remediation of a closed bulk facility located in Superior, WI. Hydrocarbon releases over its 100 year operating history resulted in two multi-acre LNAPL plumes. Developed and implemented a source removal plan where existing underground facilities were removed. The removed facilities included over 26,457 feet of pipe recovering 16,000 gallons of product and 1300 tons of product saturated soil. Directed the design and implementation of a phased multi-phase extraction system to address one of the LNAPL plumes and directed the design and implementation of both fixed and mobile LNAPL skimming system(s) for the second plume.
- **Former Bulk Storage Facility, Peoria, IL.** Mark provided senior engineering oversight for operation of a large scale pump and treat system and strategic planning to move the site to regulatory closure. Designed and implemented sub grade facility removal removing 27,350 feet of piping. Used vacuum pigging techniques to recovery more than 9,000 gallons of product from the piping prior to removal. Discovered and removed 7 assorted process flow tanks.

Curriculum Vitae

Mark D. Nelson, PE

- **Former Bulk Storage Facility, Jefferson, Missouri.** Mark provided strategic engineering support in decommissioning a closed bulk storage facility. Removed sub grade piping between the facility and the barge dock located on the Missouri river. Removed product from piping prior to piping removal. Removed the barge dock facility utilizing barge mounted cranes and equipment to remove the dock, control room and other riverside facilities.
- **Bulk Petroleum Storage Facility, Spring Valley, MN.** Mark led the team to develop the strategy for investigation and remediation of a LNAPL plume at an operating bulk storage facility. Directed design, installation and operation of a dual phase extraction system to recovery LNAPL from karst. This system has successfully recovered LNAPL, reaching regulatory criteria for system shut down within 4 years of operation.
- **Historic Railroad Depot and Rail Yard, Minneapolis, MN:** Mark designed and performed a combination soil vapor extraction, total fluids recovery and steam injection pilot test. Used the data developed from this test to design and implement a full-scale steam injection system to treat four acres of diesel fuel impacted soils surrounding and underneath a historic railroad depot located in the downtown area of Minneapolis, MN. Operation of the steam injections system recovered over 30,000 gallons of diesel fuel and successful regulatory closure and subsequent site redevelopment.
- **Daimler-Chrysler, Huntsville, AL.** Mark designed a large-scale combination multi-phase and soil vapor extraction system for a DaimlerChrysler site located in Huntsville, Alabama. The extraction system consisted of 29 nested wells for a total of 58 separate extraction points. The system was designed to allow simultaneous SVE and MPE to operation on separate wells using the same manifold system. In this way, high volume air extraction is occurring subsequent to the well being dewatered by the multiphase extraction.

Presentations

- “Microbial Ecology as an Indicator of Effectiveness of Sequential Chemical Oxidation-Bioremediation”, 25th Annual International Conference on Soils, Sediments, Water and Energy, Amherst, MA.
- “LNAPL Recovery from Karst”, Atlantic Richfield Remediation Engineering and Technology Exchange Meeting, Houston, Texas, April, 2006
- “Underground Piping Removal: Lessons Learned From Three Terminal Sites”, The 17th Annual Conference of Remediation Management Global Soil and Groundwater Network, Calgary, Alberta, October 3, 2005.
- “Ethanol; Environmental Guidance”, BP Environmental Conference, Chicago, Illinois, January 14, 2003.
- “Ethanol Release: A Case Study”, BP California Ethanol Conference, La Palma, California, September 26, 2002.
- "Delineation and Recovery of Free-Phase Hydrocarbon in a Fractured/Solution-channeled Dolostone", 2002 National Ground Water Association, Petroleum Hydrocarbons and Organic Chemicals in Ground Water: Prevention, Detection and Remediation.
- “Milwaukee Road Depot: Application of Steam Injection”, BP Hydrocarbon Environmental Management Meeting, Chicago, Illinois, 2001.
- “In-Situ Remediation of Ethanol, Ammonia and Petroleum Hydrocarbons Via Aerobic Biodegradation”, The 6th International In Situ and On Site Bioremediation Symposium, San Diego, California, 2001.
- “Designing Piping Networks for Multi-Phase Extraction Systems”, The 5th International In Situ and On Site Biodegradation Symposium, San Diego, California, 2000.

Lawanda Olin



Title

Staff Professional/Local Contact

Education

MA - English Literature

A.A.S - Civil Engineering Technology

Languages

English

Hindi

Summary

Lawanda Olin has more than 12 years of experience in environmental consulting, providing support services including AutoCAD work, document review, quality control, and professional report writing. She specializes in working with Antea Group's Mergers & Acquisition practice area, and assists with Antea Group's due diligence work and work products. Lawanda is also a member of Antea Group's Executive Support team, supporting five senior executives within the company with day to day tasks.

Experience and Skills

- Produce maps for clients under specific guidelines, including regulatory electronic GIS deliverables such as NJDEP Remedial Investigation Report maps. Work includes reports for clients such as BP, Kinder Morgan, Getty, Buckeye Terminals, Alliance Energy, Ashland and state agencies.
- Create and perform calculations for client specific Environmental, Health and Safety reports, OSHA logs, Excel graphs, charts, and timelines.
- Set up Excel macro to automate processes, saving time and effort.
- Initiate and follow-up FOIA requests, online, on the phone and in person.
- Prepare summaries of EDR reports for client sites.
- Enter information and generate forms and audit protocol reports in iEHS, Antea Group's web-based platform.
- Support internal and client-facing presentations, website blogs, case studies and press releases.
- Review proposals and reports for correct grammar usage, spelling, and sense.
- Use Word and Acrobat in an advanced capacity for preparing reports, letters, and correspondence.
- Prepare invoice and backup documentation.
- Post-ghost computers and assist with minor IT issues.
- Arrange meeting venues and all details from internet access, audiovisuals, and meeting handouts to refreshments.
- Support confidential aspects of projects such as client and vendor communications.

Jared Otto



Title

Senior Project Manager

Education

BA – Geology, University of Minnesota, Morris

Professional Registrations

Professional Geologist: Minnesota

Professional Associations

Minnesota Ground Water Association (MGWA)

Languages

English

Experience Summary

Jared Otto is a Senior Project Manager with Antea Group based in Shoreview, Minnesota. He has more than 23 years of experience in environmental consulting. He specializes in project management, environmental investigations, and remedial corrective actions. His technical specialties include geology, hydrogeology, soil and water contamination source identification, contaminant fate and transport, groundwater monitoring program design, groundwater quality data analysis and evaluation, and corrective action design and implementation.

Related Projects

- Currently serves as Senior Project Manager for petroleum and railroad clients. Responsibilities include communication with clients, regulators, and contractors; preparation of work plans; budget preparation and tracking; work oversight and delegation; and project database tracking.
- Served as Project Manager / Hydrogeologist for numerous site investigations of soil and groundwater contamination in the states of Minnesota, Wisconsin, South Dakota, North Dakota, Iowa, Kansas, Montana, Missouri, Illinois, Indiana, Arizona, Michigan, Tennessee, Ohio, Nebraska, California, Wyoming, and Georgia.
- Hydrogeology field experience has included supervision of underground and above ground storage tank system removals, soil excavation, drilling supervision (push probe, hollow stem auger, air rotary, mud rotary, roto-sonic, cable tool, CPT, LIF ROST, MIP), chem-ox injections, utility receptor surveys, well receptor surveys, soil and groundwater sampling, enhanced fluid recovery technology (EFRT), slug tests, pump tests, soil gas surveys, indoor air sampling, system pilot tests, remediation system installations, and system operation and maintenance.
- Hydrogeology technical activities have included groundwater flow analysis, slug and pump test analysis, groundwater modeling, groundwater data analysis, trend analysis, soil gas evaluations, monitoring well network design, and report preparation.
- Corrective action activities have included working with soil vapor extraction, air sparge, pump and treat, product skimmers, and multi-phase recovery systems. Also performed bench scale testing, pilot testing, and full implementation of in-situ chemical oxidation.

Curriculum Vitae

Jared Otto

- Completed activities in accordance with varying and state specific regulations and guidelines. Activities included the preparation and/or review of reimbursement program applications.
- Performed technical reviews of approximately 100 leak sites to determine potential costs to closure for an environmental risk transfer project. Provided site recommendations to drive project to regulatory closure in the states of New York, New Jersey, Connecticut, Rhode Island, and Massachusetts for a large petroleum company.
- Participated in the environmental risk transfer of approximately 80 projects in Minnesota, Wisconsin, Iowa, North Dakota, and South Dakota. Activities included preparing site reviews, preparing cost to regulatory closure, and negotiating with insurance and state agencies.
- Prepared winning cost to closure bid for a liability risk transfer project in Wisconsin. The site is a former terminal with multiple LNAPL plumes and sensitive receptors nearby.
- Served as senior project manager for a terminal project involving a petroleum plume that extends over one-mile from the source area in karst topography that migrated toward sensitive receptors including a trout stream and private wells. Activities included defining and monitoring the plume, performing remediation, and communicating with neighboring stakeholders and government agencies. Site received NFA status in 2014.
- Currently serving as senior project manager for a terminal project in Wisconsin that has a LNAPL plume extending off-site onto a third party property. A multi-phase recovery system has been installed in the basement of the third party building. Indoor air monitoring and product mobility have been two areas of focus for the project.
- Serving as senior project manager for a Class 1 railroad company overseeing a program to assess environmental conditions on properties leased to non-railroad entities. Tasks include lease site file reviews, site inspections, and limited soil and groundwater site assessments on leased properties.
- Serving as senior project manager for a large railroad company overseeing a project that has nitrate, nitrite, and ammonium impacts to soil and groundwater in the state of Nebraska. A large scale excavation was completed to remove a bulk of the mass and then phytoremediation was implemented which included planting over 1,500 hybrid poplar trees. Even though the site is in a wellhead protection zone, phytoremediation was approved by the state agency as the corrective action. Long term groundwater monitoring will occur until site specific cleanup standards have been satisfied.

Molly Partridge

Experience Summary

Molly Partridge, Project Professional, started with Antea Group in March 2015. She has abundant experience collecting scientific data in the field, analyzing and interpreting data, composing technical reports, and communicating results to the scientific and non-scientific communities.

Her technical expertise includes obtaining groundwater field data; collecting GPS data; surveying site features; collecting rock samples for petrographic analysis, geochemical analysis, and geochronologic analysis; using GPS data and sample data to create geologic maps; editing geologic maps with ArcGIS and Adobe Illustrator; interpreting geologic maps and data to create corresponding cross sections.

Ms. Partridge has experience with excavation of contaminated soil, monitoring and vapor well installation, in-situ chemical oxidation (ISCO) injection, high vacuum extraction, free product removal, groundwater sampling, soil sampling, vapor sampling, ambient air monitoring, data input, hydrograph and contaminant graph creation, technical report writing, and support on litigation projects.

Related Projects

- Oversaw in-situ chemical oxidation (ISCO) events at numerous petroleum contaminated sites
- Oversaw High Vacuum Extraction (HVE) events for soil vapor extraction (SVE) and free phase product abatement
- Oversaw MIHPT drilling, a combination of a Membrane Interface Probe (MIP), Electrical Conductivity (EC) probe, and a Hydraulic Profiling Tool (HPT) to detail subsurface water table and contaminant conditions
- Assisted with various investigations including: installation and abandonment of monitoring wells, completion of soil borings, and installation of vapor monitoring points
- Conducted multiple Phase I Environmental Site Assessments and Pre-Purchase Audit Reports, including site visits, interviews, and report writing

Title

Project Professional

Education

MS – Geological Science
Central Washington University,
Washington

BS –Geological Science
Winona State University,
Minnesota

Languages

English

Curriculum Vitae



- Directed the removal of multiple types of hazardous waste from sites, including lead impacted soil and hydrochloric acid impacted water
- Experienced in collecting free phase product, sampling groundwater and soils, and collecting vapor samples
- Coordinated with subcontractors for site work for the removal of non-hazardous materials and equipment from an active petroleum terminal
- Compiled historical site data to aid in site understanding and project plan development
- Worked as field lead for various projects including contaminated soil excavation, groundwater/soil sampling, well installation/abandonment, free product recovery, and ISCO injection
- Conducted groundwater sampling and report writing for an EPA oversight project
- Communicated with regulators and clients on-site to explain site activities and plans
- Assisted with management and logistics of projects including: scheduling subcontractors, communicating project information to the project manager and staff, along with communicating with stakeholders to secure access agreements with affected third parties
- Supported a wide variety of project reports and deliverables in several Midwest states

Jon P. Pesicka, PE



Title

Senior Consultant

Education

BS – Civil Engineering, South Dakota
School of Mines and Technology,
Rapid City, SD

Professional Registrations

Professional Engineer: California,
Wyoming, South Dakota, Colorado,

Professional Associations

Member, American Society of Civil
Engineers; Association for
Environmental Health and Sciences;
National Groundwater Association;

Languages

English

Experience Summary

Through 27 years of engineering and consulting experience, Jon delivers strategic environmental liability management and business-minded remediation solutions to oil and gas industry clients. Jon provides expertise in the areas of decommissioning strategy, hydrocarbon investigation and remediation, regulatory compliance, UST system design, installation and removal, international project management and safety training. Jon also assists attorneys as an expert technical advisor during environmental case depositions and legal proceedings as well as supports counsel with strategy development and information discovery. Jon has provided portfolio management oversight for over 1,000 petroleum-impacted properties across the United States. Clients value Jon's technical focus, attention to detail and ability to seamlessly coalesce cross-functional teams to ensure compliance of common policy and procedure throughout an organization.

Related Projects

- Served as project manager for a large scale port based petroleum terminal demolition in South Africa. The recently idled terminal assets included 18 above ground storage tanks, six underground storage tanks, three two story concrete block buildings, one large warehouse and one six-story steel industrial building. The terminal was located immediately adjacent to shipping docks on one side, railroad on the other side and large volume fuel storage tanks on the remaining sides. Accountabilities included management of resources and logistics of personnel groups on site, site audits and safety assurance coordination, summary report completion and validation of site waste and transport data. The entire demolition was completed in 5 months and the site was restored to a bare lot.
- Assisted design engineer with patent application for innovative zero emissions soil vapor extraction system. Provided senior oversight of the first site operations. Assisted project team with operation and monitoring plan, schedule and implementation. The system operations resulted in groundwater concentrations decreasing to near non detectable in less than 4 months of operation. Developed marketing materials and presentations for other clients, consultants and conferences to showcase the innovative design that required no air quality permit and discharged no emissions to the atmosphere.

Curriculum Vitae

Jon P. Pesicka, PE

- Key member of company's engineering remediation practice team. The team develops key processes for operations teams to utilize when engineering or site remedies are needed. This system is available to all personnel who may need a specific technical expertise as well as maintain compliance with state registration compliance requirements. The team developed design standards, bidding specifications, construction oversight practice and an assurance process to allow project managers the opportunity to utilize expertise across the company while still managing risk for the company and documenting these actions.
- As a maintenance engineer for a global oil company responsibilities included a large scale underground storage tank replacement project in Southern California. The new UST systems included some of the first double wall tank and piping installations at retail sites. Accountabilities included complete specification packages for permitting and bidding, extensive field inspections to ensure compliance with company and vendor protocols and warranties. Various types of tanks and piping were used including Owens-Corning, Xerxes, Joor, A.O. Smith, Fiber Trench and telescoping double wall piping.
- Designed fueling systems for United States Postal service facilities. Following a site specific facility review to determine site capacities and needs, a proposed fueling system concept plan was developed for site facility managers to review. Custom fueling centers were needed due to the highly variable site constraints, volumes of fuel needed and permit requirements. Above or below ground tanks were utilized depending on site dimensions and permit requirements. Construction schedules were detailed in the bid specifications to allow for 24 hour site activity at the USPS facilities.
- Served as Senior Project Manager for Antea Group's field response to the Gulf of Mexico oil spill. Coordinated the training and logistics of over 40 personnel on the ground in the Gulf region that support client with safety oversight for cleanup operations, waste management inspections and audits and sampling. Direct resources to the region often with immediate needs and logistics of travel, field equipment, and site location support. Multiple personnel in several states were simultaneously working, with varying work locations daily, severe weather often threatening their work location and potential for unknown safety concerns.
- Served as a National Account Manager for two major oil company clients. Responsibilities included coordination of internal teams to provide seamless product delivery to national clients, assure compliance of client policies and procedures, and negotiated acceptable contract language and pricing. Created a team of resources to meet needs of clients and determine and continually calibrate team for appropriate staff mix.
- Provided technical support for litigation project at a Superfund project involving multiple parties with source determination and allocation disputes. Assisted legal counsel and expert witness with technical review of historical data, source determination, allocation of responsibility and engineering review of demolition, assessment and dredging plans.
- Provided technical assistance for a major oil company's defense against the State Attorney General's office claim. The AG was attempting to impose compliance penalties regarding underground storage tank compliance, particularly the 1998 EPA upgrade standards. Several test sites were selected and extensive reviews of site assessments, remediation plans and operations, regulatory agency records research, corrosion evaluations, permit reviews and maintenance records were conducted. A detailed evaluation of the environmental risks that may have been the result of the non-compliant components was performed as well as in-depth evaluation of alternative

Curriculum Vitae

Jon P. Pesicka, PE

methods of releases other than the non-compliant components. Several negotiation sessions were held, including in-depth review of particular sites and specific circumstances. The proposed fine was significantly reduced, without being tried in court.

- Supervised and directed teams managing over a thousand petroleum impacted site investigations at leaking underground tank sites as a major oil company representative and as an environmental consultant. Investigations incorporated work plan development, permit acquisition, subcontractor negotiations, status reporting for client, waste disposal coordination and soil boring and well placement. Investigations also included soil and water sampling, boring log preparation, assessment report preparation, data evaluation, site closure, and budget responsibility. Primary contaminants involved in the majority of the corrective actions were petroleum fuel constituents such as benzene, toluene, methylbenzene, and xylene and oxygenates such as MTBE and TBA.
- Coordinated and managed the permitting, design, construction, operation, and maintenance of several soil venting systems used for hydrocarbon site remediation. Implemented new technology remedial techniques: sparge and vent groundwater and soil remediation, in-situ bioventing. Evaluated and utilized various types of exhaust treatment systems, such as thermal oxidizers, catalytic oxidizers and granulated carbon absorption for use in conjunction with soil vapor extraction. Construction oversight was also performed for many of the designs to assure compliance with designs and permit conditions as well as providing safety oversight for all workers and stakeholders.
- Supported client with negotiations involving allocation of responsibility for sites with impacts from different operators at different times. Technical review of the sites included a detailed review of historical site owners and operators as well as what type of site operations were conducted. A historical review of regulatory compliance was performed to determine if permit compliance was maintained, potential inventory control mechanisms, and release reporting compliance. Additionally geochemistry data was analyzed to attempt to date impacts and differentiate product formulas to determine responsibility. Forecasting future cleanup costs was provided to prepare for negotiations with other responsible parties. Often the negotiations were presented to a mediator who would provide a final determination on allocation of accountability. The development of the technical arguments and the presentation of the arguments were critical to achieving a fair outcome.

Presentations

- Pesicka, Jon, Gilchrist, Phil, Poster Presentation, Zero Emissions - ECO SVE: Enhanced Concentrating Soil Vapor Extraction System, 27th Annual International Conference on Soils, Sediments, Water, and Energy. San Diego, CA, March 2012.
- Pesicka, Jon, Gilchrist, Phil, Platform Presentation, Zero Emissions - ECO SVE: Enhanced Concentrating Soil Vapor Extraction System, 28th Annual International Conference on Soils, Sediments, Water, and Energy. Amherst, MA. October 2012.

Publications

- Pesicka, Jon. Tank Decommissioning – Down But Not Out. Tank Storage Magazine, Volume No. 8, Issue No. 4, September 2012, pp. 82-83.

Jason Phillips



Title

Project Manager

Education

BS – Industrial and Manufacturing Engineering, Western Michigan University, Kalamazoo, MI

Professional Registrations

Engineer In Training (EIT)

Languages

English

Experience Summary

Jason Phillips is project manager with thirteen years of experience in the environmental industry with permitting, remedial investigations, environmental assessments, soil and groundwater remediation, and project/program management. His responsibilities include development of project specifications, design and installation, and strategic development for environmental projects ranging from small-scale retail service stations to multi-acre terminal or manufacturing facilities. He has been involved with projects ranging from the assessment through closure stages and has focused on both project and resource management.

Mr. Phillips has a great deal of experience in managing a number of contractors in varying fields, on different levels, to successfully and safely complete projects. He has also participated in many process review and safety management meetings, and has intimate knowledge of industry equipment and operation. Mr. Phillips provides project support out of Detroit, but as a remote resource living on the west side of the state of Michigan.

Related Projects

- Worked directly with project teams and client representatives on a variety of projects, from initial “define” stages to operation and optimization of remediation systems. Has worked to develop comprehensive pilot study work plans, field testing, data evaluation and has participated in completing such tasks.
- Also, worked to determine site specifics, remedial technology alternatives analysis, system specifics, specifications and equipment needs. Actively involved in the equipment selection, operation and optimization of full-scale remediation projects using a broad array of technologies including the development of project and/or system CAD drawings and figures. Developed work scope to contractors for price quotes, procurement of all equipment, award of project to contractors, and oversight for installation of subsurface and above-ground infrastructure. Supervised and directed electrical, mechanical and general contractors in the installation/construction of a multitude of remediation systems through all phases of system installation including routine maintenance tasks.

Curriculum Vitae

Jason Phillips

- Managed the development and implementation of an Integrity Management program from the initial stages through the roll-out to the supplier network for a major oil and gas client.
- Experience in design, construction and operation of mechanical remediation systems including Dual Phase Extraction, Air Sparge, Soil Vapor Extraction, Groundwater Pump and Treat and Liquid Phase Hydrocarbon Recovery Systems.
- Conducted engineering design for multiple soil vapor extraction, air sparge and multi-phase extraction systems for multiple sites throughout Michigan. Member of design team in charge of pilot study work plan development and implementation, specification development, site investigation, permitting, contracting, installation and system optimization. Evaluated data collection and reporting needs throughout the development of operation and maintenance manuals. Air sparge design processes included investigations into deep air sparging and predicting effective radii of influence. Completed investigations into system requirements for previously undocumented sparging depths. Completed extensive investigation into the use of Sulfur Hexafluoride as a tracer gas during air injection. Developed work plans, sampling protocol for use with SF6, project specifications, equipment needs, and correspondence with contractors throughout processes of AS systems. Including cost-benefit analysis, cost comparisons and estimates.
- Led the design, installation and commissioning of a large-scale horizontal-well Air Sparge and Soil Vapor Extraction remediation in south-central Michigan.
- Provided field support for operation, optimization and maintenance of large scale groundwater treatment and LNAPL recovery systems in Michigan. Included investigation of effectiveness of system configuration with worldwide technical team, and improvements necessary to improve system recovery and performance including LNAPL transmissivity evaluation to aid in system performance assessment.
- Participated in multiple safety audits for a plethora of sites, including bulk plants, distribution terminals and service stations. Have worked with clients on a large scale basis in evaluation of remedial equipment and process requirements.
- Experience in routine regulatory site-system status reporting including system data evaluation and optimization.
- Development and completion of site and equipment-specific Operations & Maintenance Manual documentation. Facilities have included petroleum remediation systems as well as chemical manufacturing emission control equipment.
- Participated in process review and safety management meetings and has intimate knowledge of industry equipment, operations and standard practices.
- Participated in safety audits and risk assessment reviews for variety of sites including bulk plants, distribution terminals and service stations.
- Participated in Emergency Response for petroleum releases including site and surrounding property assessment, personnel and contractor management and product recovery activities.
- Completion and submittal of Monthly Discharge Monitoring Reports as well as Air Emissions reporting.
- Developed DOT Hazardous Material training materials and delivered to personnel at multiple manufacturing facilities, ranging from general awareness to job-specific.

Curriculum Vitae

Jason Phillips

- Managed the preparation for a comprehensive air permit and process amendment application for a large existing chemical manufacturing facility in south-central Michigan. Assignment included regulatory correspondence, development of emission control equipment O&M manual, documentation of historical and anticipated air emissions, completion of a BACT analysis and preparation of the permit application forms.
- Completed numerous Qualified Facility and non-Qualified Facility Spill Prevention Control and Countermeasure (SPCC) Plans, Pollution Incident Prevention Plan (PIPP), Integrated Contingency Plan (ICP) and Storm Water Pollution Prevention (SWPP) Plans for manufacturing facilities across Michigan and Indiana.
- Worked with technical team for the decommissioning and decontamination of a former chemical manufacturing facility in south-central Michigan. Project work included all tasks from work scope development through the execution of the work and included substantial client interaction and support. The work included not only the decommissioning but the characterization and handling of wastes as well as all pre-job hazard evaluation. The decommissioning work included contractor-performed confined space entry, lifting and the handling of a multitude of caustic and oil products that were proactively managed.

Brent D. Puck



Title

Senior Project Manager

Education

MS – Physics, Ball State University,
Muncie, IN

BA – Physics, Taylor University,
Upland, IN

Professional Registrations

Certified Groundwater Professional,
Iowa

Languages

English

Experience Summary

Brent Puck is a senior project manager with more than 18 years of professional experience in remedial investigations, environmental site assessments (ESAs), soil and groundwater remediation and project/program management. He is the operations manager located in the Bettendorf, Iowa, office, where he is responsible for the day-to-day operations of a nine-member team. Brent focuses his efforts on providing portfolio management and oversight for all aspects of project work. As a senior project manager, he is responsible for all facets of the project's activities, including strategy development, client communications, proposal preparation, staffing assignments, data evaluation, document review, contractor oversight, and health and safety compliance. Brent monitors progress against financial and time schedule requirements, and is responsible for meeting client budgetary and project goals.

Related Projects

- Current client contact for the Midwest portfolio of a major railroad client, responsible for management of all projects within Iowa, Kansas, Missouri and Nebraska. He is responsible for assembling the 15-year environmental liability estimates for the company's entire portfolio of client sites. Also served as the senior project manager for the Midwest portfolio of a nationwide groundwater sampling program.
- Project management for the ESA and Remedial Action Plan development at a railroad yard in Iowa. Conducted and directed site assessment in association with an inactive surface impoundment pond. Performed assessment activities including determination of groundwater and soil source concentrations of volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs) and metals constituents; hydrogeology characterization; analysis of inferred area of soil and groundwater impact; and identification and evaluation of migration mechanisms. He also proposed and implemented innovative remediation of VOC-impacted soils and sludges, reducing disposal costs by judicious selection of soil amendments. Directed soil excavation and disposal permitting for VOC-, SVOC-, and metals-impacted soils and free product.

Curriculum Vitae

Brent Puck

- Primary lead in development of a Soil Management Program for a Class I railroad client. The program was developed as a means to reduce liability exposure resulting from export of surplus soils during construction projects. Worked collaboratively with the client's environmental and engineering departments to develop a uniform procedure for management of soils, including sampling frequency, sample location selection, analytical requirements, data evaluation, and deliverables.
- Senior Project Manager providing direction and oversight of emergency response actions associated with the release of petroleum to a drainage ditch. Coordinated all response actions, including oil recovery, soil excavation, surface restoration, source identification and corrective action, and incident reporting. Identified process failures with on-site water treatment facility as source of release, and directed corrective actions to prevent future failures. Facilitated communication across the client's multiple business units, and served as client liaison to regulatory agency. Cost savings were realized by identifying solutions to logistical problems related to grubbing and excavation activities.
- Primary project manager for assessment, remediation, monitoring and closure of four separate project sites within a railroad yard in Iowa. Developed individual strategies for each leaking underground storage tank (LUST) site due to heterogeneity of soils and presence of shallow bedrock. Developed and implemented supplementary investigation and remediation for non-petroleum impacts at the 30-acre site. Provided environmental support during property sale negotiations. Proposed innovative closure mechanism allowing for classification to No Further Action while exceeding regulatory free product threshold. Served as the point of contact between the new property owner and responsible party during a highway construction project through the former railroad yard.
- Lead resource for development of client-specific Ground Disturbance safety practice. Selected by client to lead practice development, which included fostering open communication and coordination with health and safety professionals from five other consulting firms providing services for the client. Accumulated input from the client's environmental, engineering, and operations departments, incorporating pertinent information to create a document that presents the ground disturbance practice in a thorough and unified manner.
- Provided management and field support for cleanup activities at an active railroad switching yard that experienced major flooding. Identified potentially hazardous materials and conditions, and coordinated cleanup efforts with emergency response personnel, railroad managers, and municipal officials. Directed removal and disposal of hazardous and non-hazardous materials, including petroleum products, solvents, propane tanks, bagged asbestos waste, paints, and general flood debris.
- Project manager directing assessment and remediation activities in association with a crop duster crash in a residential setting. The crash involved the release of fully-loaded tanks of fungicide and aviation gas. Assessment of soil, groundwater, and the residential septic system were conducted. Oversaw excavation of fungicide-impacted soils as primary remedial action, and subsequently obtained regulatory closure upon completion of assessment and remediation activities. Served as liaison between homeowner, insurance company, and regulatory agencies.

Presentations

- "Remediation of VOC Impact at a Former Surface Impoundment Pond," J. McDermott, B. Puck, K. Miller, presented at the Railroad Environmental Conference, Champaign, Illinois, October 2006.

Donald Reeder

Experience Summary

Don Reeder is a drafter with more than 15 years of experience. He specializes in AutoCAD civil and environmental drafting. Don's site maps are used in the entire lifecycle of work on a project. His drafting work is the basis for all samples, analysis and studies of groundwater and soil.

Related Projects

- Worked on several large scale projects, including civil and environmental drafting work on a large Conoco Terminal in Wrenshall, Minnesota large rail yard for Union Pacific in Clinton, Iowa.
- Served as Health and Safety Manager (Dahl and Associates) for the north central regional office.
- Assisted project management staff in Phase I Environmental Site Assessments and remedial investigation corrective action designs.
- Served as assistant in Information Services Departments (Dahl and Associates and Epoch Environmental). Created and maintained company web sites.
- Served as Field Technician. Extensive field experience included agricultural chemical site inspections; data collection; soil, water and air sampling; remediation system repair; and pilot studies in a wide range of situations. Also served as Technical Services Coordinator. Involved in scheduling and coordinating field work, field equipment maintenance and repair and supply purchases. Also experienced in directing underground storage tank removals, excavations and drilling.
- Provided civil drafting work for location of streets, roads and utilities for general analysis. The maps were used for site analysis and surveying service stations, large terminals and neighboring surroundings.
- Provided environmental drafting work related to underground storage tanks and wells used by geologists to locate groundwater flow, soil contamination and chemical analysis. Also provided Geologic Cross Sections of sites to show the underground geology of the soil and water. They are also used for drilling, Geoprobe and excavating activities at project sites.

Title

Staff Professional

Education

BS – Horticulture, University of Minnesota, Minneapolis, MN

AutoCAD 2013

Language

English

Nancy Rodning

Title

Project Geologist

Education

BS – Geology, University of Wisconsin

Languages

English

Experience Summary

Nancy Rodning is a Project Geologist with 15 years of experience in the environmental industry. She specializes in Phase I and II environmental assessments and related due diligence projects and remedial investigations. She contributes the following consulting experience and services:

- Field services at petroleum and non-petroleum sites under State Leaking Underground Storage Tank and State Voluntary Investigation and Cleanup Program direction include oversight of excavations for soil remediation; oversight of soil boring and monitoring well installations, and tank removals; soil, soil vapor, ground water, surface water, air and asbestos sampling; and, surveying.
- Technical services include interpretation and preparation of geological cross sections; writing of investigation, assessment and monitoring reports for sites with petroleum, chlorinated solvent, and metals impacts; writing of property transaction Phase Is and Phase IIs in accordance with ASTM, Minnesota VIC, Fannie Mae, and HUD guidelines; preparing Spill Prevention, Control and Countermeasure Plans; and, waste compliance oversight.
- Project management services include preparation and tracking of work scopes, budgets and job schedules; and, written and verbal correspondence with clients, contractors, off-site property owners, and local and State regulators.

Related Projects

- Multiple clients, across the US – Provides field and project management services in Minnesota, Wisconsin, Iowa, South Dakota, North Dakota, Missouri, Nebraska, Louisiana, Idaho and Texas for brownfield sites, petroleum, and non-petroleum spill investigation and remediation sites. Field activities include installation of soil borings and monitoring wells, collection of soil, soil vapor and ground water samples, excavation of contaminated soils, and Phase I and Phase II environmental assessments for property developers and lending institutions.

Curriculum Vitae

Nancy Rodning

- Westgate V/Archer-Daniels-Midland/Highway 280 Superfund Site, St. Paul, MN – Researched and prepared Phase I ESA for Superfund site; conducted soil and groundwater sampling via soil borings and monitoring wells for non-petroleum contaminants as part of redevelopment assessment; assisted with Development Response Action Plan detailing soil excavation plan for varying depth intervals; performed excavation oversight and sampling for suspect ACMs in the area of excavation.
- Union Pacific Railroad Roundhouse, Huron, SD – Conducted excavation oversight of petroleum-impacted soils in and around holding ponds and adjacent creek. Excavation oversight included field monitoring of soil samples and directing the separation of impacted soil for off-site disposal from soils acceptable for on-site re-use. A total of 47,000 cubic yards of soil was excavated over a one-year period. Prepared weekly activity reports for submittal to UPRR, South Dakota Department of Environmental Resources, and Environmental Protection Agency.
- Milwaukee Road Depot MN VIC Site, Minneapolis, MN – Researched and prepared Phase I ESA for former railroad depot; conducted soil and groundwater sampling as part of redevelopment assessment; provided excavation oversight of petroleum and non-petroleum impacted soils from former railroad depot, including soil sampling, directing the separation of impacted soil for off-site disposal.
- City of Chaska Block 5 and Klein Brick Yard Redevelopment MN VIC and VPIC Sites, Chaska, MN – Researched and conducted Phase I ESAs on two blocks slated for City redevelopment; prepared Phase II and Development Response Action Plans for redevelopment of sites for retail and multi-family residential uses; implemented DRAP at both sites, including soil and groundwater sampling for petroleum and non-petroleum impacts, excavation of impacted soil for off-site disposal, and managing waste water discharge; obtained No Further Action determination from MPCA, allowing for site redevelopment; prepared DTED grant application for project funding for the City of Chaska.
- British Petroleum(BP) MC252 Spill Site, Mississippi – Provided waste management compliance oversight at a spill response equipment decontamination facility associated with the MC252 spill site on the Gulf Coast.
- Library Square Residential Development, Mandan, ND – Researched and prepared Phase I ESA for several lots slated for residential development located over railroad petroleum plume in downtown Mandan; prepared and implemented Phase II and Development Response Action Plan for redevelopment of properties with off-site source impacts; coordinated with City and State regulatory authorities and Fannie Mae to satisfy varying environmental standards and requirements.
- Unisource MN VIC Site, St. Paul, MN – Researched and prepared Phase I ESA for commercial property located adjacent to Valentine Clark Superfund site; prepared and implemented Phase II soil and groundwater sampling for redevelopment of property with off-site source impacts.
- AlliantTech Systems, St. Paul, MN – Researched and prepared Phase I ESA for ammunicions maker and large quantity hazardous waste generator. Reviewed historical and current hazardous waste management plans and prepared and implemented Phase II soil and groundwater sampling for site-specific chemicals of concern.
- ConocoPhillips – Circle K Retail Store Site Assessments, MN, TX, LA, GA – Conducted subsurface assessments at retail gas stations as part of a large scale property transfer, including project scheduling and coordination; soil boring oversight, including soil and groundwater sampling; conductance of scope of work in accordance with State-specific regulations; release reporting to State; and, preparation of site assessment reports and release reports as required by State agencies.

Joy Rooney, EIT



Experience Summary

Joy Rooney, a project professional for Antea Group, has more than 6 years of experience exploring a host of groundwater and surface water related issues. Her experience includes operation and maintenance of soil vapor extraction, air sparge, and pump and treat remediation system. Joy also has extensive experience in surveying, hydrological modeling, instrumentation, and water, air, and soil sampling. She has written external reports to meet company, client, and regulatory requirements.

Joy pairs her field engineering experience with a deep understanding of data management. Her experience includes a vast background working with EQUS, ArcGIS, and Visual Basic. Joy uses her knowledge of field data collection to enhance the quality and integrity of data management, programming, and visualization practices.

Related Projects

- *Remediation System Operation and Maintenance:*
 - *Pipeline Spill, Jackson, WI:* Oversaw the daily engineering operation of two soil vapor extraction units and one pump and treat system. Performed all necessary scheduled and unscheduled maintenance to optimize the performance of all systems. Reconfigured enhanced fluid recovery technology on a daily basis to maximize product recovery. Completed all daily field and system readings, sampling, and reporting.
 - *Bulk Oil Storage, St. Paul, MN:* Currently the primary engineer for the operation and maintenance of a soil vapor extraction and air sparge remediation system. Performs all system readings, sampling, and reporting. Monitors system daily via telemetry.
 - *Drum Disposal Facility, Isanti, MN:* Currently the primary engineer for the operation and maintenance of a soil vapor extraction unit in Isanti, MN. Performs all system readings, sampling, and reporting.
- *EQUS Data Management and Reporting:*
 - Pioneering team member in company-wide initiative to enhance data management technology and visualization tools

Title

Staff Engineer
Data Manager

Education

BS – Biosystems and Bioproducts
Engineering, University of
Minnesota, Minneapolis, MN

Professional Registrations

Engineer in Training: Minnesota
(140168)

Languages

English

Curriculum Vitae

Joy Rooney, EIT

- Completed EarthSoft Power User training in Seattle, WA
- Currently providing EQuIS support and training to multiple Antea Group teams, including: loading data, reporting, troubleshooting loading and reporting errors, and data verification
- Communicating with laboratories to increase the integrity and consistency of data packages
- Designing tools in Visual Basic to transform historical data into formats accepted by EQuIS
- *ArcGIS – Mapping and Visualization:*
 - *Jackson, WI:* Using historical well records within a 2 mile radius of the site, calculated and mapped the hydraulic conductivity, transmissivity, and specific capacity index
 - *Nebraska:* Created visualizations in ArcGIS to delineate the extent of nitrate, nitrite, and ammonia in groundwater and varying depths in soil
 - *Kansas City, MO:* Created sensitivity maps for FRP Plan. Used LIDAR data to create cross-sections and slopes to determine flow rate and distance of a worst case scenario oil spill
 - *Superior National Forest, MN:* Implemented time saving process for identifying potential crossing locations using ArcGIS to pinpoint locations where streams cross roads and trails
- *Visual Basic Data Collection Streamlining, St. Paul, MN:* Previous data collection using a PDA system presented several problems: slowness of use, inability to check data, and limited access to data within office. Created new field forms using Visual Basic to overcome existing problems and fully integrate into the existing database at no additional cost.
- *Illicit Discharge Identification and Elimination, St. Paul, MN:* A persistent illicit discharge into the Mississippi River was both an eyesore and could potentially present a host of ecological issues. The stormwater interceptor, located 150 ft. underground, is inaccessible to traditional sampling and monitoring. Used 90,000 points of instantaneous flow data and associated laboratory data from the outfall to construct flow and load duration curves. Load duration curves are used to identify potential constituents and flow regimes associated with an illicit discharge. Identified *E. coli* and suspended solids as primary constituents associated with the illicit discharge during low to moderate flow conditions. The City of St. Paul has since relined portions of the stormwater interceptor and eliminated the illicit discharge.
- *Stormwater Monitoring and Reporting, St. Paul, MN:* Fifteen ISCO 6712 full water quality stations and 18 level loggers are located throughout the Capitol Region Watershed District. These stations are monitored to quantify the effects of stormwater improvement projects and water quality changes within the district.
 - Installed, maintained, and collected data and water samples from water quality stations and data loggers.
 - Calculated annual TP and TSS loading from each monitoring location using 10-minute instantaneous level and velocity data collected throughout monitoring year.
- *BMP Inspection and Maintenance, St. Paul, MN:* Inspected district owned BMPs for functionality and damage including; tree trenches, raingardens, infiltration trenches, catch basins, wetland systems, stormwater ponds, and an underground stormwater infiltration facility.
- *Culvert Replacement Prioritizing in the Superior National Forest, Duluth, MN:* The Superior National Forest consists of over 3 million acres in northeast Minnesota with over 1,300 miles of cold water streams and 950

Curriculum Vitae

Joy Rooney, EIT

miles of major warm water streams supporting fisheries. Many of these streams are segmented and impassible to fish and macroinvertebrates due to improper culvert sizing and alignment.

- Located and surveyed over 500 crossing locations throughout the Superior National Forest
- Ranked and prioritized crossings for replacement using quantitative and qualitative field data.
- *Background Parameter Collection of Crude Oil Spill, Bemidji, MN:* In 1979 a crude oil pipeline burst just outside of Bemidji, MN. Approximately 110,000 gallons remain in the subsurface after remediation efforts. Collected background parameter data (DO, pH, temperature, and conductivity) data using an YSI meter from over 100 sampling points throughout the affected area. This data is collected annually to monitor long-term changes outside the plume.
- *Investigating the Fate of Veterinary Pharmaceuticals in Groundwater, Bethel, MN:* Antibiotics, hormones, and other pharmaceuticals persist in the environment, present reproductive problems to fish, and often pass intact through traditional wastewater treatment facilities. A three-year field study at Cedar Creek Ecological History Reserve was conducted to investigate the fate of four antibiotics and an estrogen compound applied to different cover crops (corn, CRP, prairie, and bare ground) to groundwater.
 - Initialized project by collecting background data, determining pharmaceutical list, creating seeding plan, constructing and calibrating monitoring equipment, and installing 35 water sampling points.
 - Constructed, installed, collected and maintained data from four Campbell Scientific data loggers recording soil temperature, soil moisture, and osmotic potential at varied depths under each cover crop type.
 - Supervised five to seven interns and work studies in conducting field operations such as: USGS protocols for water and soil sampling, above and below ground biomass harvesting, ELISA kit testing, equipment calibration, and sample preparation.

Anthony (Tony) Rossano

Experience Summary

Anthony (Tony) Rossano is a senior project manager for Antea Group with more than 30 years of environmental, health and safety experience. He is extremely knowledgeable in state and federal regulations applicable to Clean Air Act permitting, reporting, and compliance, industrial hygiene, Health, Safety & Environmental program auditing, laboratory operations, due diligence auditing, environmental site assessments, OSHA compliance, chemical products evaluations, TSCA, and EPCRA compliance. He has strong project management, planning and problem resolution skills and is an effective liaison with management, employees, contractors, and regulatory agencies.

Title

Senior Project Manager

Education

BS – Chemistry, Columbus College
(Columbus State University),
Columbus, GA

Credentials

- DOT Hazardous Materials (HazMat Employee) certification
- Lead Inspector (Target Housing and Child-Occupied Facilities)
- On-Scene Incident Commander (Hazardous Waste Operations and Emergency Response)
- Hazardous Materials Technician (Hazardous Waste Operations and Emergency Response)
- Asbestos Operational and Maintenance Worker
- Asbestos Emergency Response Act (AHERA) Building Inspector
- American Chemical Society – Member (30+ yrs)
- Air and Waste Management Association - Member

Languages

English

Related Projects

- Completed Synthetic Minor Air Permit modifications for major containerboard manufacturer. Responsibilities included regulatory review, air pollutant emissions development, permitting, and interaction with State and Local permitting agencies.
- Completed environmental, due diligence, and Phase I Environmental Site Assessments (ASTM) audits for a national containerboard manufacturer. Responsibilities included reviewing environmental compliance, assessing environmental risk to property, and evaluating the current permitting / environmental reporting status (air quality, hazardous waste, storm water, wastewater, EPCRA, etc.).
- Completed numerous Qualified Facility and non-Qualified Facility Spill Prevention Control and Countermeasure (SPCC) Plans, and Storm Water Pollution Prevention (SWPP) Plans for national containerboard manufacturer and rental car company.
- Completed Title V Air Permit revisions for major automotive parts manufacturer. Responsibilities included regulatory review, air pollutant emissions development, air dispersion modeling, liaison with regulatory agency, and Title V application completion.
- Corporate Laboratory Manager for national bed and bath textile company - Supervised and managed laboratory technicians in R&D, Environmental, Analytical (Technical Services), Cotton Dust, and Water / Wastewater laboratories; Instituted and maintained quality control procedures / data and OSHA compliance for all labs.

Curriculum Vitae

Anthony (Tony) Rossano

- Completed Title V (PSD) permitting for major international glass manufacturer. Responsibilities included air dispersion modeling, emission factor development, emission reduction offsets determination, and Title V modification application.
- Completed Synthetic Minor Permit revisions for major turbine manufacturer. Responsibilities included regulatory review, air pollutant emissions development, and interaction with State and Local permitting agencies.
- Developed air emission factors for wood preservative operations for major wood preservative manufacturer. Responsibilities included protocol development for air emissions factors, development of air emissions calculations, and air permitting regulatory review for several eastern and western U.S. states.
- Completed numerous major Title V and New Source Review revisions for an international pulp, paper, and containerboard company. Responsibilities included air dispersion modeling, Title V modification application preparation, and liaison with state permitting agency.
- Completed compliance plans for import/export of chemicals under TSCA Section 12(b) and 13. Responsibilities included developing and implementing protocols for laboratory import of chemicals in major textile laboratory and development of TSCA compliance plan for a major printing company.
- Assisted major wood preservative manufacturing company with TSCA reporting and required notifications under Section 8(c).
- Developed 112(r) Chemical Risk Management Programs for numerous facilities. Programs included evaluation of chemical releases, assessment of risk, and emergency response.
- Completed major Title V and New Source Review revisions for an international packaging printing company. Responsibilities included writing draft permit and interaction with state permitting agency.
- Served as corporate environmental, health and safety coordinator for a national manufacturer of bedding and bath products. Duties included:
 - Advised facility managers and corporate management on regulatory compliance of state and federal regulations
 - Developed model General Duty Plan, Clean Air Act (CAA) amendments – Section 112 (r), for company-wide compliance
 - Prepared and submitted Conditional Major / Synthetic Minor air permit applications (Title V) and assisted facilities in implementing record keeping requirements for issued permits
 - Directed compliance with Community Right-to-Know (SARA Title III) reporting for over 50 facilities in 38 states
 - Coordinated company-wide disposal of RCRA-regulated hazardous waste, as well as universal waste
 - Implemented sampling strategy for lead paint compliance
 - Developed and implemented radiation safety program for the operation and licensing of x-ray fluorescent lead analyzer
 - Assisted corporate safety director with development of various safety programs
- Developed an asbestos management plan for a large industrial company. Plan included coordination of sampling and abatement activities, coordination of AHERA Inspector Training and researching/approving licensed asbestos abatement companies for working in company facilities.
- Developed Medical Waste disposal procedures for occupational clinics for a large industrial company for multiple state facilities including state licenses and facility medical waste management programs.
- Served as chemist and laboratory supervisor for textile manufacturer. Duties included:

Curriculum Vitae

Anthony (Tony) Rossano

- Supervised and managed laboratory technicians in R&D, Environmental, Analytical (Technical Services), Cotton Dust, and Water/Wastewater laboratories; coordinated and scheduled analyses of test samples received, developed and implemented laboratory standard operating procedures, and Quality Assurance program.
- Maintained proficiency of Environmental Measurements Lab as an American Industrial Hygiene Association accredited laboratory with participation in the NIOSH Proficiency Analytical Testing Program
- Instituted and maintained quality control procedures and OSHA compliance for all labs.
 - Assisted in evaluation of health hazards in the workplace using industrial hygiene sampling protocols.
- Developed a lead-based paint management program for a large textile manufacturer. Responsibilities included evaluating sampling strategies, potential for lead exposure, and developing cost effective removal or encapsulation strategies to minimize employee exposure to airborne lead dust.
- Prepared numerous air emission inventory reports for major Title V, Synthetic Minor, and Minor facilities. Responsibilities included overall project management, development of emission factors, emissions determinations using EPA TANKS program and vapor pressures based on Raoult's Law, report preparation and interaction with state agencies.
- Performed environmental, health & safety audits for a U. S. petroleum pipeline distributor and petroleum products manufacturer. Responsibilities included identifying non-compliance issues and providing recommendations for issue resolution. Audits included evaluation of Federal (RCRA, EPCRA, TSCA, CAA, CWA, & OSHA) as well as state compliance programs.
- Performed an environmental, health & safety audit for a U. S. API pharmaceutical company. Responsibilities included identifying non-compliance issues and providing recommendations for issue resolution. Audits included evaluation of Federal (RCRA, EPCRA, TSCA, CAA, CWA, FDA (limited) & OSHA) as well as state compliance programs.
- Completed environmental, health & safety due diligence audits for a major global medical device manufacturer. Responsibilities included reviewing environmental compliance, assessing environmental risk to property, and evaluating the current permitting / environmental reporting status (air quality, hazardous waste, storm water, wastewater, EPCRA, etc.).
- Managed multisite International EHS audit programs for numerous international and U.S. manufacturers. Responsibilities included auditor management, scheduling, protocol management/development, report preparation, and auditor training.
- Conducted numerous Phase I Environmental Site Assessments (ASTM) for several international manufacturers. Typical properties included active and closed manufacturing sites in preparation for sell by owner/operator or purchase by prospective buyer. Responsibilities included assessing recognized and de minimis environmental conditions.
- Performed environmental, health & safety audits for a major worldwide beverage manufacturer. Responsibilities included identifying non-compliance issues and providing recommendations for issue resolution. Audits included evaluation of Federal (RCRA, EPCRA, TSCA, CAA, CWA, & OSHA) as well as state compliance programs.
- Developed Integrated Contingency Plans (ICP) for several facilities to include spill control (oil), stormwater, hazardous waste (LQG), chemical storage, and bulk chemical storage tanks for a national printing and publishing company. Responsibilities included site review/observations, SOP review, site drawings, and development of comprehensive ICP.

Peter J. Schwalbach

Experience Summary

Pete Schwalbach, a Senior Project Manager, has more than 27 years of experience in the area of environmental regulatory compliance. Peter's technical specialties include compliance auditing, air emissions permitting, hazardous waste management, environmental regulatory training presentations, and stack emissions testing.

Related Projects

- The completion of environmental regulatory audits in California including the following regulatory areas: solid and hazardous waste, air emission management, emergency planning and community right to know reporting (Hazardous Materials Business Plan and Toxic Release Inventory), wastewater management, pesticide management, storm water permitting associated with industrial activity, and compliance with California Proposition 65. Types of industrial properties audited in California as part of the regulatory assessments included: pulp and paper, food and beverage, chemical, light manufacturing, and medical services.
- Conducted Process Safety Management (PSM), Risk Management Program (RMP), and Environmental regulatory compliance audits for a major food distribution company. Audits focused on the company's ammonia refrigeration systems and support activities having applicability with environmental regulatory topics (air, water, waste).
- Participated on teams conducting environmental regulatory compliance audits for the leading global brewer. Audits were conducted at the company's North American breweries, entertainment theme parks, agricultural properties, and container manufacturing locations. Audits covered all major environmental regulatory topics.
- Participated on an EHS audit team conducting environmental, health and safety regulatory compliance audit of Fortune 500 electronics manufacturing company at numerous locations throughout the United States. The audits were conducted utilizing Dakota Auditing software and addressed all major EHS regulatory topics.

Title

Senior Project Manager

Education

BS – Civil and Environmental Engineering, University of Wisconsin Madison, Madison, Wisconsin.

Languages

English

Curriculum Vitae

Peter J. Schwalbach

- Served as primary auditor for 40 multi-media environmental compliance audits at manufacturing and service facilities for an international manufacturer over a 3-year period. The facilities manufactured heavy construction equipment, auto parts, and door hardware.
- Assisted as a member of a multi-disciplinary audit team in the completion of over 70 environmental compliance audits at manufacturing and service operations across the United States.
- Served as primary auditor for multi-media environmental compliance audits at two 500,000 square-foot cereal manufacturing plants.
- Assisted in completing environmental compliance audits of eight TSDs and transporters of hazardous waste in eight different states. Operations included metal smelting, metal refining, and transportation, and disposal of hazardous waste.
- Conducted environmental regulatory compliance audits for a global consumer appliance manufacturing company at sites located in the United States. Audits covered all major environmental regulatory topics. Lead auditor for EHS audit team of a chemical manufacturing company with locations in North America. Audits covered all major environmental, health and safety topics.
- Conducted emissions testing services at electric power generation utilities following EPA Standard Test Methodology. Power plants were located throughout the United States (Connecticut, Illinois, Indiana, Iowa, Wisconsin, New Jersey, and New York).
- Project Manager and Lead Presenter for the preparation and delivery of training customized for the environmental coordinators of a major pulp and paper company. This included the development and use of practical exercises that reinforced the regulatory lessons taught during the lecture portions of the training.
- Worked closely with a client as a Project Manager and Lead Presenter in developing a long-term environmental awareness training program strategy. This program has evolved over the past 9 years to incorporate their specific business issues as they relate to environmental regulations.
- Worked with a Food and Textile Company's environmental corporate team to develop a company-wide awareness-training program. Served as the Project Manager during the development of their materials and presented at their annual training seminar.
- Completed a storm water permit application for a national based manufacturing company for one of their facilities located in North Carolina. Reviewed storm water pollution prevention plan and best management practices for an electronics manufacturing facility located in Minnesota.
- Lead Project Engineer for the completion of a Part 70 air permit at a steel fabrication facility in Wisconsin.
- Conducted air emission inventory and air quality compliance review for a manufacturing facility in Wisconsin. Assisted in preparation for writing a Major Source Operating Permit application to meet Wisconsin Clean Air Act regulations.
- Completed a chemical inventory and determination of potential to emit calculation for Title V applicability for a flexographic print shop. The printer inventoried over 150 different inks and operated four flexographic printers and four cold set presses.

Jack Sheldon



Title

Senior Professional

Education

MS – Environmental Microbiology,
Wagner College, Staten Island, New
York

BS – Bacteriology and Public Health,
Wagner College, Staten Island, New
York

Professional Associations

American Society for Microbiology

National Groundwater Association

Languages

English, German

Experience Summary

Jack Sheldon is a remediation subject matter expert located in West Des Moines, Iowa. He has over 35 years of experience as a project manager and program director. He has specialized in the field application of various types of bioremediation and chemical oxidation/reduction systems, with personal involvement in 23 first type remediation projects in their respective states/countries. He has completed remediation projects in all 50 states and several locations abroad.

Jack has provided global remediation, microbiology, and regulatory negotiation services for many government and commercial clients on concerns of soil, sediment, air, and groundwater. He has worked extensively on site investigation, prepared various environmental reports, and successfully managed numerous projects and technology programs. He works regularly with investigation tools including MIP, HPT, UVOST, ROST, FLUTe™, and SIFT™. His primary expertise has been in the identification/selection of remediation technologies for projects and the monitoring of those technologies. Jack has designed, implemented, and supervised hundreds of treatability/pilot studies comparing technologies. He is actively involved in the design, equipment selection, monitoring, supervision, and peer review of full-scale remediation projects using a broad array of technologies.

Jack has authored more than 50 technical papers/articles, two best-selling books on bioremediation, and delivered more than 100 major presentations/webinars. He has conducted seminars for many regulatory agencies and taught courses for the University of Minnesota, the University of Wisconsin, Rutgers - the State University, Drake University, and the MA/CT/NY Licensed Site Professionals program. He serves on the peer review teams for multiple clients.

Jack is the primary quality assurance resource for all in situ chemical oxidation projects implemented by the company. He is also a member of the corporate project audit team, the corporate Volunteerism group, and the Remediation Engineering Evaluation Team (REET).

Curriculum Vitae

Jack Sheldon

Selected Chlorinated Compound Remediation Projects

- **Oatland Island, Georgia, USA, Center for Disease Control, MNA/ In-situ Chemical Oxidation** - Senior Project Scientist on a Monitored Natural Attenuation evaluation for a former pesticide/herbicide disposal site impacted by DDT, pCBSA, Lindane, and Dieldrin. Designed pilot studies for potassium permanganate and Fenton's Reagent that were completed on two hot spot locations. Results showed that the latter technology was more effective at desorbing and treating the primary constituents beneath the landfill.
- **Salt Lake City ANG Base, Utah, USA, Air National Guard Bureau, In-situ Chemical Reduction/In situ Chem-Bio** - Senior Project Scientist providing FS support and evaluating specific technologies for three individual sites impacted by petroleum hydrocarbons and chlorinated solvents at an active base. Completed review of QAPP, SAP, PP, HASP, and ROD for the project. Chemical oxidation using alkaline catalyzed Klozur® persulfate (provided as a single product, Klozur® CR) for TPH and chemical reduction of TCE using the EHC™ technology were selected and injected in 2008-2009. This was a 3 year performance based contract (PBC).
- **ANGB/AC Thompson Field, Mississippi, USA, In situ Bioremediation (Anaerobic)** – Senior Project Scientist for an HRC® injection bioremediation project at an air base in Mississippi focused on TCE and daughter products. Responsible for design review and performance progress monitoring. Evaluated various carbon substrates at the start of the project.
- **Manufacturing Plant, New Jersey, USA HB Fuller, In-situ Chemical Reduction** - Senior Project Scientist for pilot test evaluation and full scale design for an in-situ chemical reduction in groundwater found in the overburden and fractured media impacted by CVOC's. Evaluated distribution of the amendment following direct placement and fracturing techniques. Reviewed progress reports and participated in client meetings. Providing full-scale design review and provide regular data interpretation using 3D visualization tools.
- **Manufacturing Plant, New York, USA, Grumman, Bioreactor** - Senior Project Scientist for pilot test evaluation of a fixed film bioreactor inoculated with a specialized culture for TCE degradation. Optimized system parameters and reviewed performance data.
- **Manufacturing Plant, Georgia, USA, Northrop Grumman, In-situ Chemical Oxidation** - Senior Project Scientist for third party review of a potassium permanganate injection approach designed by others for TCE remediation. Provided data review and a technical memorandum describing the findings of the evaluation.
- **Electronics Manufacturing Facility, North Carolina, USA, Confidential Client, MNA** - Senior technical support for data interpretation from MNA program. Provided oversight for use of the NAS model (USGS/Virginia Tech) to generate additional evidence in support of the remedy.
- **Tool Manufacturing Facility, North Carolina, USA, Confidential Client, In-situ Chemical Oxidation** - Senior technical support for two in-situ chemical oxidation pilot tests involving modified Fenton's reagent and alkaline activated persulfate on CVOC's in tight soil and fractured rock. Reviewed pilot study design and provided data interpretation.
- **Former Manufacturing Facility, Minnesota, USA, Chemart, Microbial Profiling/Remedy Selection** - Senior technical support to develop a microbial profiling program on a small CVOC site for the purpose of remedy selection. The site is administered by the MPCA. A new molecular biological tool, QuantArray Chlor™, was utilized

Curriculum Vitae

Jack Sheldon

to understand active microbial populations and processes to better focus a remedy.

- **Beverage Formulation Facility, Massachusetts, USA, Coca Cola, Additional Investigation/Feasibility Study** - Senior technical support for development of a groundwater sampling strategy to delineate CVOCs in fractured bedrock. At the client's request, prepared feasibility document showing pros/cons of conventional and innovative approaches to source treatment and plume migration.
- **Canton Drycleaners, Michigan, USA, Colony Insurance, In-situ Chemical Reduction/Bioremediation** – Senior technical support for a combination in-situ chemical reduction/bioremediation amendment delivery into an artificial saturated condition impacted by CVOC.s. Developed injection procedure and monitoring program. Assisted in regulatory interaction.
- **Former Drycleaners, New Mexico, USA, AmeriPride, In-situ Chemical Reduction/Bioremediation** – Senior technical support for implementation of a combination in-situ chemical reduction/bioremediation approach at a site impacted by CVOC's and metals. Developed monitoring plan and provide regular data interpretation.
- **Former Pump Manufacturing Facility, Illinois, USA, ITT, In-situ Soil Mixing** - Senior Consultant on an in situ soil mixing project where TCA, DCA, and DCE were treated with quicklime and Klozur® persulfate to a depth of 16 feet. Designed pilot test for soil treatment that looked at mixing regimes and amendment ratios. Evaluated data and designed scale-up. Oversaw full-scale application for treatment of 7500 cubic yards of soil.
- **North RR Superfund Site, New Mexico, USA, New Mexico DEP/EPA Region VI, In situ Bioremediation (Anaerobic)** – Senior Project Scientist for the application of bioremediation strategies at the North Railroad Superfund site in Espanola, NM. Responsible for plan review and data interpretation as part of an extensive technology pilot program involving injection of various amendments to a large chlorinated solvent plume. This project was peer reviewed by John Wilson of EPA.
- **Keyser Yard, West Virginia, USA, CSXT, In-situ Bioremediation (Anaerobic)** - Senior Project Scientist providing data interpretation for a TCE site where unique canisters of carbon source and nutrients, provided by Geovations have been placed in wells in the distal plume. Developed an exit strategy for the site.
- **Farmers Grain Coop, Utah, USA, Scouler Companies, In-situ Chemical Reduction/Chemical Oxidation** - Senior Project Scientist for the development of a bench test evaluating oxidant demand for in situ chemical oxidation using potassium permanganate and Fenton's reagent. Also, evaluated the microbial and chemical capacity of the site to degrade TCE through ethane/ethane and to determine whether emulsified oil would be a good substrate to promote degradation of the chlorinated compounds present. Ultimately developed a pilot study involving a Klozur® sodium persulfate injection in the source area and a chemical reduction barrier at the property boundary.
- **Athens Production Facility, Alabama, USA, Steelcase Manufacturing, MNA/In-situ Bioremediation (Anaerobic)** - Senior Project Scientist providing data interpretation and sampling program support for an MNA remedy on a TCE plume at an active furniture manufacturing facility. Selected emulsified vegetable oil as a substrate for source area reduction and a pilot test was conducted.
- **HRC® Technology Development Program, Wisconsin/Iowa, USA, Regenesis, In-situ Bioremediation (Anaerobic)** - Program Manager for the first field demonstrations of Hydrogen Release Compound (HRC®), an innovative in situ enhancement for bioremediation of PCE/TCE. Used direct push injection and in-well treatment techniques to apply the product at the Cedarburg Drycleaning site in Cedarburg, WI and the Mark IV Industries automotive parts

Curriculum Vitae

Jack Sheldon

manufacturing site in Eldora, IA. HRC® amendment application resulted in a >80% mass removal in 6 months in the source area of the drycleaning site. HRC® also was effective in reducing the total chlorinated VOC's by 90% at the Mark IV site over five years. This site has the longest period of HRC® application of any site in the US. The Iowa site was conducted as a demonstration project for the Iowa Department of Natural Resources.

- **Confidential Electronics Client, Mississippi, USA, In-situ Bioremediation (Anaerobic)** – Senior Project Scientist on one of the largest HRC® bioremediation applications at an abandoned manufacturing site. Provided conceptual design and data interpretation. Several biobarriers were installed onsite and offsite to prevent further migration of a TCE plume; some were even installed in the right of ways of residential properties. The HRC® barriers proved to be an economic alternative to an ineffective air sparging/SVE system previously installed at the site by others. The old air sparging/SVE system was relocated to another area of the site where it is being used to address a newly found source area.
- **Abandoned Zanesville Site, Ohio, USA, Lear Automotive Corp., In-situ Bioremediation (Anaerobic)** - Project Manager for an emulsified vegetable oil (SRS™) injection project for bioremediation of a chlorinated solvent groundwater plume at an abandoned automotive parts manufacturing facility. This application was more than \$100,000 less expensive than other remedial options. Provided oversight for bench testing, developed the conceptual design, selected subcontractors, supervised field application, and provided data interpretation.
- **Unison, Kansas, USA, Dow/Union Carbide, In-situ Chemical Oxidation** - Project Manager for an in situ chemical oxidation pilot study of two modified Fenton's reagent solutions at a former transformer servicing company. Both on-site and off-site TCE plumes were addressed in the pilot study. The chemical oxidants were applied directly through direct-push rods saving the cost of expensive injection well installation. Results clearly demonstrated a citric acid/ferrous iron catalyst with 8% hydrogen peroxide formulation was most effective, and helped determine the injection layout for source treatment and downgradient application. Prior to the field work, coordinated a treatability study evaluating chemical oxidant formulations for the site.
- **Maine Electronics, Maine, USA, Rockwell Collins, In-situ Chemical Oxidation** – Senior Project Scientist on an in situ chemical oxidation project where TCE and arsenic are impacting groundwater in two separate plumes that ultimately co-mingle off-site. A bench-scale treatability study was designed and completed showing that greater than 99% of both contaminants could be reacted. During a pilot study, results showed there was significant heterogeneity in the subsurface. It was possible to treat the arsenic area with chemical oxidation, but the TCE area was not treated successfully. A biological approach is currently being designed for this area of the site.
- **Manufacturing Facility, North Carolina, USA, Honeywell, Phytoremediation** – Senior Project Scientist for the development of a cap for the source area and barrier for the toe of the plume using rows of hybrid poplar and willow trees to control TCE migration. Coordinated with subcontractor, Ecolotree, to review data, collect additional information, and prepare preliminary and final design reports along with an implementation schedule and plan.
- **Manufacturing Plant, Confidential Client, Wisconsin, USA, In-situ Chemical Oxidation** – Senior Project Scientist for a multi-depth ozone sparging application for a chlorinated solvent groundwater plume in southern Wisconsin. This application was estimated at half the cost of a previously recommended ZVI barrier and was more practical in dealing with the depth to groundwater (>50 ft.) at the site.

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Jack Sheldon

- **Brownfield Property, City of Louisville, Kentucky, USA, In-situ Chemical Reduction** - Senior Project Scientist for a Brownfield site slated for development into senior citizen housing. The site was impacted by PCE/TCE from a former drycleaning operation. Evaluated site investigation data and developed list of potential cleanup technologies. In-situ chemical reduction was selected for cost estimation and a conceptual design.
- **Chemical Manufacturing Facility, Iowa, USA, Hydrite Chemical, MNA** – Senior Project Scientist on a unique MNA project involving mixed chlorinated solvents at a RCRA site. Abiotic reduction of the groundwater constituents was found to be the primary removal mechanism more so than biodegradation. Carbon isotope analysis, groundwater modeling, MNA modeling using Biochlor, mineral tests, and molecular biological assays were used to develop attenuation evidence.
- **Ralston Landfill, Iowa, USA, Rockwell Collins, MNA** – Senior Project Scientist on a unique CVOC MNA project in fractured rock at a landfill formerly operated in Cedar Rapids, IA. After extensive negotiation with EPA Region 7 and its consultants, the approach saved the client over \$1 million in treatment cost by gaining approval for this remedy over pump & treat.
- **Manufacturing Plant, Sanmina, Canada – Site Investigation/Pump & Treat Optimization/ In-situ Chemical Oxidation** - Senior Project Scientist providing oversight of work scopes prepared by Inogen partners, DCS and Franz Environmental. Project involves additional investigation of CVOC impacts through well installation and sampling program. Also, an existing Pump & Treat system was optimized to provide maximum capture prior to coupling with a source reduction approach. Currently, an ISCO program is underway using potassium permanganate injection in the source area. Providing process review and data interpretation support.
- **Asti Plant, Italy, United Technologies Corp., MNA** – Senior Project Scientist on one of the first MNA projects in the Asti region of Italy. The site was a former automotive parts manufacturing facility that used air sparging/SVE to treat chlorinated solvents in soil and groundwater. The project was transitioned into an MNA remedy for polishing.
- **Air Bag Manufacturing Plant, France, Herakles, Feasibility Study**, - Senior Project Scientist on the evaluation of biological and non-biological technologies for source area and plume control of a large perchlorate and CVOC plume. Provided expertise on conceptual model development and design study for a permeable reactive barrier and source treatment. Evaluated a unique phytoremediation amendment for source treatment.
- **Chemical Manufacturing Plant, France, Akzo Nobel/EKA Chimie, Feasibility Study**, - Senior Project Scientist on the completion of feasibility study of biological and non-biological technologies for source area and plume control of soil and groundwater impacted with sodium chlorate.
- **Manufacturing Plant, Grace, Brazil – In-situ Chemical Reduction** - Senior Project Scientist for technology selection, pilot test/full scale design and monitoring for an in-situ chemical reduction approach in a source area/distal plume impacted by CVOCs in tight media. Evaluated distribution of the amendment following direct push and hydraulic fracturing. Reviewed progress reports and also offered guidance on vapor intrusion studies performed at the site. Provide regular data interpretation. This effort was in support of Inogen partner, ANGEL.
- **Manufacturing Plant, HB Fuller, Brazil – In-situ Chemical Reduction** - Senior Project Scientist for technology selection, pilot test/full scale design and monitoring for an in-situ chemical reduction approach in both on- and off-site areas impacted by carbon tetrachloride and chloroform in tight media. Evaluated distribution of the

Curriculum Vitae

Jack Sheldon

amendment following direct push, soil mixing and hydraulic fracturing. Reviewed progress reports and participated in client meetings. Completed full-scale design review and provide regular data interpretation using 3D visualization tools. This effort is in collaboration with our Inogen partner, ANGEL.

- **Public Landfill, Confidential Client, Taiwan, - Litigation Support** – Senior technical support conducting a literature search to document fate and transport for individual CVOCs and biodegradation mechanisms.
- **Parts Degreasing Plant, Confidential Client, Brazil – In-situ Bioremediation (Anaerobic)** - Senior Project Scientist for data review and injection optimization of an emulsified vegetable oil injection for TCE in groundwater. Evaluated distribution of the amendment and ability to create anaerobic conditions and increase organic carbon. Helped local office prepare report for regulators.

Curriculum Vitae

Darius S. Szewczak, CIH, CSP, CHMM



Title

HSSE Advisor- Senior Project Manager

Education

MEM, Environmental Policy and Management, Yale University, School of Forestry and Environmental Studies, New Haven, CT

BS, Environmental Sciences and Resource Management, Lehigh University, Bethlehem, PA

Professional Registrations

CIH, Certified Industrial Hygienist

CSP, Certified Safety Professional

CHMM, Certified Hazardous Materials Manager

Professional Associations

Professional Member, American Society of Safety Engineers

Certified Member, Alliance of Hazardous Materials Professionals

Full Member, American Industrial Hygiene Association

Languages

English

Experience Summary

Darius Szewczak is an HSSE (Health, Safety, Security and Environmental) Advisor and Senior Project Manager with the firm. He has over 20 years of professional experience in the environmental, health and safety fields, with the last 12 years focused on Antea Group's internal HSSE program.

Darius has worked in both the public and private sectors. His background includes health and safety compliance and management, hazard identification and risk assessment, Superfund project management, environmental investigation and remediation of contaminated properties, and environmental site assessments.

Related Projects

Antea Group HSSE Advisor

- Oversees and manages the operation of Antea Group's internal health, safety, security and environmental (HSSE) program within the United States. Develops and implements internal policies, procedures, and training tools to ensure that employees and field sites are in compliance with regulatory, company and client health and safety requirements.
- Oversees Antea Group's Contractor Management Program- 295 contractors currently in the system.
- Performs internal HSSE audits and manages company responses to third-party HSSE audits including ISNetworld, Avetta, PEC Premier, Browz and ComplyWorks.
- Performs incident investigations and root cause analyses, incident and near miss trend analysis, and HSSE metrics tracking.
- Performs HSSE hazard analysis and risk assessments of project sites and work activities.
- Assists project teams with site-specific health and safety implementation and trains project teams on company safety programs and OSHA regulations.
- Manages HSSE staff.

Curriculum Vitae

Darius S. Szewczak, CIH, CSP, CHMM

Incident Investigation and Root Cause Analysis

- Lead investigator for over 30 formal incident investigations of employee injuries, contractor injuries, property damage events, high potential near misses and equipment failures.
- Skilled in:
 - information collection and analysis
 - interviewing
 - root cause analysis
 - corrective action plan development and implementation
 - report writing and presentations to stakeholders

In Situ Chemical Oxidation (ISCO) Hazard Assessment

- Led a team of internal experts in the H&S assessment of Antea Group's implementation of ISCO remediation projects.
- Developed an interim project review and approval process to keep existing projects on track during the assessment. The ISCO team reviewed approximately 60 sites, without delaying a single project's completion.
- Performed site audits and hazard assessments of representative ISCO field projects.
- Reviewed Antea Group contractor work procedures and established a pool of approved ISCO contractors.
- Developed new minimum safety standards to improve the execution of ISCO related field work.
- Presented a summary of the assessment process, findings and corrective actions to a nationwide audience of Antea Group operations managers and staff.

Closed Landfill HSSE Risk Assessments

- Developed a HSSE hazard risk assessment tool to meet a client's need to perform in-house hazard analyses and risk assessments of a portfolio of over 100 closed landfill sites across the state of Minnesota. The risk assessment tool identifies hazards via energy source analysis, and allows the risk ranking of the hazards through a determination of the frequency, likelihood and severity of potential incidents.
- Created a site health and safety plan (HASP) template package for the client to customize for each specific site. The template package included a HASP, the risk assessment tool, job safety analyses (JSAs), a tailgate meeting checklist and other supporting documents.

Environmental Experience

- Leaking Underground Storage Tank (LUST) Sites, Minnesota – Managed site investigations and remedial actions for multiple LUST sites throughout Minnesota. Project management tasks included developing and overseeing soil and groundwater investigations, soil and groundwater remedial actions, vapor risk assessments and groundwater receptor surveys, and underground storage tank removal activities; assisting with state-funded reimbursement applications; and managing client and regulatory agency meetings.

Curriculum Vitae

Darius S. Szewczak, CIH, CSP, CHMM

- Phase I Environmental Site Assessments, Minnesota, New Jersey, and New York– Performed Phase I Environmental Site Assessments of various industrial and commercial properties throughout Minnesota, New Jersey and New York.
- Preliminary Exposure Pathway Assessments (PEPA), South Dakota, Michigan and Georgia – Performed preliminary exposure pathway assessments (PEPA) of petroleum bulk storage facilities, oil production sites, and former retail facilities in South Dakota, Michigan and Georgia. PEPAs are regional assessments designed to identify potential preferential contaminant pathways and receptors in the event of a release from a target property.
- US EPA CERCLA Sites, Pennsylvania – Managed the State of Pennsylvania’s interests in Federal CERCLA sites within northeastern Pennsylvania. Served as liaison between EPA Remedial Project Manager and PADEP technical staff for US EPA CERCLA sites in eastern PA. Reviewed remedial action and design plans for compliance with Pennsylvania’s applicable, relevant and appropriate requirements. Coordinated PADEP responses to EPA inquiries and requests.
- Pennsylvania Department of Environmental Protection (PADEP), Hazardous Sites Cleanup Program/Site Remediation; Chemical Company, Pennsylvania - Managed the remediation of an abandoned chemical company listed in the Pennsylvania State Superfund (Hazardous Sites Cleanup) program. Coordinated the efforts of State agency technical staff and environmental consultants. Oversaw daily on-site duties and project administration. Cleanup consisted of the characterization and disposal of 500+ drums and several bulk containers of unknown chemicals and chemical mixtures.
- Site Investigation and Remedial Action Evaluation, Land Development Project, New Jersey – Managed a site investigation and remedial action evaluation for a land developer to substantiate his claim filed against his environmental insurance policy. Performed a site investigation, reviewed client’s remedial action and reviewed site investigation performed by insurance company’s environmental consultant. Formalized findings in a Remedial Action Report submitted to the NJ Department of Environmental Protection.
- Ecological Resource Risk Assessment; Golf Course; New Haven, Connecticut – Performed an ecological resource risk assessment of the effects of pesticide application to a pond within a golf course. Identified golf course pesticide use and application rates. Evaluated pesticide toxicity to aquatic organisms and determined appropriate indicator species receptors. Estimated the concentration of pesticide reaching the lentic environment using an overland flow model from the Vermont Department of Environmental Conservation. Evaluated effect of estimated pesticide concentration on indicator species population.

Karen Thole

Experience Summary

Karen Thole is a hydrogeologist with 20 years of experience. She specializes in Phase I and II environmental assessments and related due diligence projects, remedial investigations, PCB investigation and remediation, and air emissions permitting.

Related Projects

- Served as project manager and/or Environmental Professional in conducting Phase I and II Environmental Assessments at a variety of residential, commercial, industrial, and agricultural properties throughout the United States. Responsible for the coordination of staff and contractor activities and the determination and tracking of project budgets. Responsible for collection and interpretation of historical and field data and preparation of reports. Responsible for the design and implementation of subsurface contamination assessments that included the determination of contaminant source areas and evaluation of ground water chemistry.
- Served as project manager and/or hydrogeologist for numerous petroleum hydrocarbon, chlorinated VOC, and agricultural chemical spill investigations and remediations in Iowa, Michigan, Minnesota, Ohio, South Dakota, and Wisconsin. Management tasks involved communication with clients, regulators, and contractors; preparation of work plans, cost estimates, and reports; and design and implementation of investigations and remediation systems. Fieldwork included installation of soil borings and monitoring wells; collection of soil and ground water samples; excavation of tanks and contaminated soils; and performance of slug tests, pumping tests, and packer tests.
- Interpreted 10 years of hydrochemical data for the South Dakota Department of the Environment and Natural Resources. Assessed the impact of best management practices on these water quality parameters and assisted in report completion.
- Conducted PCB investigation and remediation at two industrial facilities with historical electrical transformer releases. Responsibilities included design and implementation of PCB investigations; coordination and

Title

Hydrogeologist

Education

MS – Geology, Washington State University, Pullman, WA

BS – Geology, Winona State University, Winona, MN

Professional Registrations

Professional Geologist: Wisconsin (711-013), Minnesota (30709)

Languages

English

Curriculum Vitae

Karen Thole

supervision of field staff and subcontractors; preparation of EPA notifications, applications, and certifications; and preparation of implementation reports, long-term management plans for engineered controls, and environmental covenants for residual PCBs.

- Completed annual air emission inventory reports and operating permit applications for industrial facilities in Illinois, Iowa, Minnesota, and Missouri.
- Developed a chemical inventory tracking system and completed determination of potential to emit calculations for NESHAP applicability for an industrial facility in Minnesota. The facility operated 10 paint spray booths and inventoried over 150 different paints and associated chemicals.
- Completed Form R reports for an industrial facility in Minnesota. Prepared a self-disclosure letter for violations related to late submittal of three years of Form R reports in accordance with the EPA's Audit Policy and received full penalty mitigation from the EPA.
- Completed Registration Permit and Part 70 Air Permit applications for an industrial facility in Minnesota. The facility operated two boilers, three shotblast booths, 10 paint spray booths, and a burnoff oven.

Christine R. Tufts, P.G.

Experience Summary

Ms. Tufts is a Project Manager/Geologist with over twelve years of environmental consulting experience, specializing in soil and ground water investigation and remediation. She has a broad background with the investigation and remediation of a wide variety of sites, including gas stations, dry cleaners, industrial facilities, pipeline releases, mining facilities, and manufactured gas plants. Ms. Tufts is based in Antea Group's St. Paul, Minnesota office.

Title

Project Manager

Ms. Tufts supports work on litigation and mediation cases by providing detailed analysis of case documents and recommendations to the stake holders, particularly in the areas of contaminant fate and transport and timing of contamination. Ms. Tufts also manages the day-to-day tasks of coordinating personnel and data management on large cases. Types of cases have included landfills, refineries, industrial facilities, and manufactured gas plants, among other technically challenging sites. Contaminants of concern have included petroleum hydrocarbons, chlorinated solvents, metals, explosives, and poly- and per-fluoroalkyl substances (PFAS, aka PFCs).

Education

MS – Water Resources Science,
University of Minnesota,
Minneapolis, MN

BS – Geology, Michigan
Technological University,
Houghton, MI

5-Day Basic Wetland Delineation
Course, June 6-10, 2011

Ms. Tufts provides project management services, including preparation of cost estimates, budgets, project work plans, site health and safety plans, and reports. She is the key point of contact, and communicates regularly with clients, regulators, and contractors.

Professional Registrations

Professional Geologist: Minnesota,
#48960

Ms. Tufts' work is supported by her extensive field work experience, including sample collection (soil, soil vapor, sediment, surface water, and groundwater), and supervision of drilling operations, monitoring well installations, underground storage tank (UST) removals, and remedial excavations. This experience is backed by her graduate level education and training and registration as a Professional Geologist in Minnesota.

Professional Associations

Member, Minnesota Groundwater
Association
Member, American Institute of
Professional Geologists

Languages

English
Spanish (Limited)

Curriculum Vitae

Christine R. Tufts, P.G.

Overview of Project Experience

- **Site Investigation:** Experience planning, managing, and performing delineation of the vertical and horizontal extent of contamination at multiple sites. Coordination and communication with client, regulators, and stakeholders.
- **Remediation:** Experience designing and implementing *in-situ* chemical oxidation (ISCO) for remediation of petroleum hydrocarbons in soil and groundwater. Experience designing and implementing targeted source area excavations for remediation of various COCs.
- **Litigation Support:** Provide technical expert support on litigation cases, including insurance cost-recovery projects. Review site historical and geological information to determine historical timeline of site structures and events. Establish timing of soil and groundwater contamination at the sites for use in litigation settlements. Analyze historical documents to determine placement and timing of releases. Review invoices and costs associated with environmental investigation and corrective action. Evaluate invoices for discrepancies and reasonableness of costs incurred for site remediation.
- **Feasibility Studies & Technology Assessments:** Analyzed site geological and hydrogeological data to establish the extent of free phase petroleum hydrocarbon contamination at several gas stations and railroad facilities, and chlorinated solvent contamination at several manufacturing facilities. Applied results to fully assess multiple alternatives to remediate the contamination. Evaluated each technology alternative for effectiveness, implementability, and cost to determine the most reasonable and cost-effective approach to address the contamination at the site.
- **Probabilistic Cost Modeling:** Created and updated site-specific probabilistic cost models for the purpose of predicting potential future environmental costs at sites with limited information.
- **Phase I and Phase II Environmental Site Assessments (ESAs):** Completed Phase I ESAs at multiple locations throughout the Midwest. Work included site reconnaissance, state file reviews, review of historical documents, and report preparation. Also completed Phase II ESAs at numerous properties. Responsibilities included the coordination and supervision of drilling operations and monitoring well installations, soil and groundwater sampling, and report preparation. Provided support for large-scale transaction projects, by reviewing data regarding current and historical environmental conditions at each site, and synthesis, summary, and compilation for a final report.

Example Projects

- **Active Remediation, Gasoline Service Station, Baxter, Minnesota:** Planned and managed a focused investigation utilizing laser-induced fluorescence (LIF) technology to determine the extent of non-aqueous phase liquids at the Site. Developed a corrective action design, and is leading the Site to active remediation through *in-situ* chemical oxidation (ISCO), including performance of an ISCO Pilot Test.
- **Active Remediation, Gasoline Service Station, Mounds View, Minnesota:** Developed a Remediation System Detailed Corrective Action Design Report (SDCAD) for ISCO implementation at the site to reduce the source area contaminant mass as the final remedy at the site.

Curriculum Vitae

Christine R. Tufts, P.G.

- **Active Remediation, Former Gasoline Service Station, Alexandria, Minnesota:** Developed a Conceptual Corrective Action Design (CCAD) report to determine the path forward for remediation at the Site, recommending *in-situ* chemical oxidation to reduce the source area contaminant mass. Provided future cost estimates and path forward scenarios for use in cost forecasting.
- **Site Assessment, Gasoline Service Station, Alexandria, Minnesota:** Planned and managed a remedial investigation, including the installation of a deep well using Rotosonic drilling techniques. Coordinated quarterly groundwater and soil vapor monitoring events. Prepared a remedial investigation report.
- **Due Diligence Support, Underground Mine, Michigan:** Provided Phase I ESA and Baseline Environmental Assessment support, including document review, compilation and distillation of existing site data, and report writing. The Site consisted of a 100+ acre area with former underground mine workings, surface tailings, ponds, a smelter, and a power plant.
- **Due Diligence Support, Historical Copper Smelter, Michigan:** Provided Phase I ESA and Phase II ESA support, including document review, groundwater monitoring well sampling, report writing, and due care plan activities. The Site included the remains of a smelter operation dating to the late 1800's, with numerous buildings, equipment, and debris piles.
- **Site Assessment, Niles, Michigan (Client-MDEQ):** Performed semi-annual field work, including collection of groundwater samples for chlorinated VOCs and MNA parameters, with compilation and analysis of the results in an annual report for the 10-mile long groundwater plume. Researched and wrote a detailed site history report summarizing the site's 40-year history.
- **Monitoring and Maintenance, Acid Mine Drainage Site, Michigan (Client-MDEQ):** Performed quarterly field work at a former underground mine with a passive wetland system treating acid mine drainage. This included collection of surface water quality measurements and samples, and inspection and maintenance of the treatment system.
- **Phase I and Phase II Targeted Brownfields Assessment (TBA), Chatham, Michigan (Client-USEPA):** Provided site reconnaissance, review of historical documents, and Phase I report preparation for a former gasoline station with LNAPL present in shallow bedrock groundwater monitoring wells. Performed a Phase II investigation, including the coordination and supervision of drilling operations and soil vapor probe installations, soil and soil vapor sampling, potable well sampling and abandonment, and report preparation.
- **Potentially Responsible Party (PRP) Oversight, Lake Linden, Michigan (Client-USEPA):** Provided oversight and documentation of PRP activities at a mining-era power generation site. Initial response activities that were conducted included abatement of asbestos-containing building materials, support zone construction, and hauling of asbestos-containing soil from the site for disposal.
- **Lead Sampling, Historical Lighthouse, Pictured Rocks National Lakeshore, Michigan (Client-NPS):** Investigated lead contamination in surface soil adjacent to a lighthouse with a history of lead-based paint usage in order to determine recommendations for targeted soil excavation.
- **Site Closure Activities, Skanee, Michigan (Client-MDEQ):** Performed closure activities at a school bus garage, including abandonment of existing bedrock monitoring wells. Completed documentation of closure activities.
- **Site Closure Activities, Isle Royale National Park, Michigan (Client-NPS):** Performed closure activities at several petroleum release sites on remote islands in Lake Superior, including abandonment of a bioventing system and monitoring wells. Assisted with material delivery and logistics coordination. Documented closure activities.

Curriculum Vitae

Christine R. Tufts, P.G.

- **Phase II TBA, Gladstone, Michigan (Client-USEPA):** Performed field work and reporting at a former lumber mill and tannery where arsenic was the primary contaminant of concern. Activities included collection of soil, groundwater, and sediment samples along Lake Michigan. Compiled and assessed results in a Phase II TBA Report.
- **Site Assessment and Removal Action, Manufactured Gas Plant (MGP), Ironwood, Michigan (Client-USEPA):** Performed field work at and near the former MGP, including collection of surface water, sediment, and groundwater samples, with compilation and analysis of the results in a Site Assessment Report. Provided technical assistance during excavation of impacted soils at the site under EPA oversight. Used VIPER, managed COC documentation, and assisted with preparation of POLREPs.
- **Site Assessment, Sandusky County, Ohio (Client-USEPA):** Provided technical support on a high-profile, time-sensitive assessment of 11 former dump sites. Activities included review of historical documents and aerial photographs to ascertain site histories and develop sampling locations, Field Sampling Plan preparation, collection of groundwater samples using low-flow techniques, collection of soil and vapor samples, sample management, data analysis and synthesis, and report preparation.
- **Pipeline Release, Lockport, Illinois:** Provided technical support on a crude oil pipeline release, including report preparation and data management. Releases to surface water, sediment, soil, and groundwater had occurred on the site. Work involved daily surface-water sampling in the affected wetland for the first 2.5 months following the releases. Used Equis database management software to manage multimedia sampling data for the site.
- **Remedial Excavation, Deer Creek, Minnesota (Client-MPCA):** Developed plans and specifications for a remedial excavation at a former gasoline service station in Minnesota. Provided oversight for asbestos abatement and subsequent building demolition. Oversaw and directed the remedial excavation, coordinated with various contractors, and provided daily updates to the client.
- **Chlorinated Solvent Groundwater Plume Investigation, Farmington, Minnesota (Client-MPCA):** Investigated the extent of a large chlorinated solvent plume, including low-flow groundwater sampling and installation of additional monitoring wells. Contacted and received drilling access from private property owners. Sampled potable water from GAC treatment systems located in residences.
- **Remedial Excavation, Stillwater, Minnesota:** Developed plans and specifications for a remedial excavation at a dry cleaner site in Minnesota. Oversaw and directed the removal of chlorinated solvent impacted soils, and coordinated with various contractors for sampling and disposal.
- **Raze and Rebuild Service Station Sites, Illinois:** Provided oversight and soil and groundwater sampling for numerous UST removals at gasoline service stations in Illinois. Coordinated with on-site contractors for necessary soil removal and disposal. Reported petroleum hydrocarbon releases to the State when required.
- **Wireless Sensor Network for Urban Water Quality Monitoring:** Worked with watershed districts, city personnel and consultants to plan and coordinate monitoring locations in two urban streams and a storm water pond in Brooklyn Center, Minnesota. Operated and maintained a wireless sensor network for continuous surface water quality data collection. Wrote a comprehensive user manual to guide future operation and maintenance of the wireless sensor network. Reviewed and analyzed water quality data, and calculated pollutant loadings in and out of a storm water pond.

Curriculum Vitae

Christine R. Tufts, P.G.

Publications

- Henjum, Michael B., Hozalski, Raymond M., Wennen, Christine R., Novak, Paige J. and Arnold, William A. A comparison of total maximum daily load (TMDL) calculations in urban streams using near real-time and periodic sampling data, J. Environ. Monit., 2009, DOI: 10.1039/b912990a.

Presentations

- Wennen, Christine R.; Henjum, Michael B.; Hozalski, Raymond M.; Novak, Paige J.; Arnold, William A. Application of Wireless and Sensor Technologies: Pollutant Loading in Storm Water Ponds, Minnesota Water Resources Conference, St. Paul, MN, 2008.
- Kang, James M.; Shekhar, Shashi; Wennen, Christine; Novak, Paige. Discovering Flow Anomalies: A SWEET Approach, IEEE International Conference on Data Mining, 851-856, 2008.

Gary Turgeon



Title

Consultant

Education

BA – Speech Communications,
University of Minnesota

Professional Associations

Member, Minnesota Groundwater
Association

Member, Minnesota Petroleum
Marketers Association

Member, League of Minnesota
Cities

Appointed to the Minnesota
Petroleum Tank Release
Compensation Fund (Petrofund)
Rule Advisory Committees

Languages

English

Experience Summary

Gary Turgeon has worked professionally in the field of environmental consulting and engineering for more than 29 years. He has managed projects in three of Antea Group's five Practice Areas: Transactional Support, Environmental Liability Management, and Operational Performance and Assurance. He has also worked on development teams for services in the other two practice areas – Information Knowledge Management and Sustainability Consulting. Gary has gained extensive experience in environmental due diligence, compliance, liability management, site assessment, subsurface investigation, vapor intrusion, remedial design and implementation of corrective action plans and systems. He has directed and completed corrective actions at residential, commercial, industrial and government properties and transportation corridors impacted with a range of petroleum hydrocarbons, metals, polynuclear aromatic hydrocarbons (PAHs) and volatile organic compounds (VOCs). Gary has also performed numerous other environmental services including estimates of environmental liability for financial reserves, compliance audits, training, SPCC plans, pollution prevention planning, incident response plans, litigation support, securing discharge permits, soil and waste characterization and treatment, and air emission permits.

As a Senior Project Manager, Gary manages complex projects and takes on special assignments. He has a high degree of client contact, evaluating environmental and other client issues, defining appropriate scopes of service and implementation plans, and assembling and leading teams to complete client work assignments.

Related Projects

- Phase II environmental due diligence for a 68-site portfolio of retail petroleum facilities controlled by a major integrated petroleum company in Northwest Oregon and the greater Portland area. Managed a team of approximately 50 staff members and six subcontractors on this project through all components of its implementation. This included refining site specific scopes, developing and implementing field, health and safety, data transfer and storage protocols, subcontracting, reporting and financial management.

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Gary Turgeon

Fieldwork was essentially completed within eight weeks of notice to proceed, and reports were completed four weeks afterward over a period from July to October 2007. Over 450 test borings were drilled totaling more than 9,300 vertical feet over 175 field days without a safety incident.

- Historic Chemical distribution center vapor intrusion (VI) assessment and mitigation. Although storage and distribution of chlorinated solvents was discontinued in 2000, previous historic releases of petroleum and chlorinated VOCs had impacted the soil and groundwater at the facility and resulted in a groundwater plume approximately 2000 feet long originating at the facility. Previous SVE remediation was successful in reducing contaminant mass and subsequent groundwater monitoring indicated that the groundwater plume was stable and declining; however regulatory requests to address the vapor pathway across the groundwater plume detected soil vapor concentrations at the facility and at the adjacent Daycare facility indicated concern for potential VI. Multiple soil vapor events were conducted including near building and subslab events at both facilities of concern. Indoor air sampling indicated TCE at concentrations greater than the health risk intrusion screening values (ISVs) at the facility but not at the Daycare. A Source Area Assessment was conducted in multiple phases to identify if there was a remaining contaminant mass that was amenable to remediation. First, 61 passive soil gas (PSG) samplers were used to more broadly identify potential source areas. Based on that information, direct push downhole sensing membrane interface probe (MIP) technology with PID/FID and XSD detectors and electrical conductivity (EC) sensors were employed in areas of elevated PSG response. Closely following the MIP assessment, actual soil and groundwater sampling was conducted in areas indicated by data from these previous lines of evidence. A significant contaminant mass was not identified, so subslab depressurization (SSD) of the industrial building floor slab was selected to mitigate the VI. While no exceedance of the ISVs were detected in subslab soil vapor samples at the Daycare, plans are to implement an SSD system there to pre-emptively mitigate the occurrence of VI in that building.
- Petroleum release from top of UST equipment that intersected a historic drain tile and impacted multiple receptors. Gasoline migrated through the historic drain tile and was released more significantly into the environment through a tile line failure near a wetland that flowed through a culvert into a recreational lake. Mr. Turgeon developed response actions, participated in and lead a team to address the release and break the receptor pathways. Actions included containing the release to the wetland and lake by deploying and maintaining booms and sorbent material in three locations; installation of a recovery well in the UST basin to recover LNAPL; excavation and disposal of petroleum impacted soil; vacuum truck removal of LNAPL in the UST basin and excavations in and near the wetland; replacement of the drain tile in the failed area; investigation of the extent and magnitude of the soil, groundwater and soil vapor impacts; exposing and reconfiguring the drain tile to break the connection to the source area while maintaining its drain function; conducting indoor air sampling of an adjacent residence and securing access and working with four property owners to conduct necessary work on their affected properties.
- State Highway/Main Street road reconstruction project of a 0.7 mile section of State Highway and Main Street through downtown Marshall, MN. Project team performed a Phase I and Phase II ESA for MnDOT, where findings indicated multiple areas of petroleum impact, solvent impact and commingled impacts to soil and groundwater, along with abandon steam heating piping insulated with ACM coating. Developed an overall Remedial Action Plan (RAP) under the MPCA Volunteer Investigation and Cleanup (VIC) program, a Health and Safety Plan, and training

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Gary Turgeon

and monitoring to include MnDOT inspectors and surveyors. In addition to worker and work zone monitoring, scope included developing and implementing a work zone perimeter air monitoring plan with contingencies for the excavation of solvent impacted soils from the right-of-way in the heart of downtown Marshall. The RAP was approved with minimal comments from MPCA VIC staff. Coordinated implementation oversight work with MnDOT and contractor staff, often responding on short notice to accommodate a high priority construction schedule and emergency situations (contractor fiber optic hit). He also supported MnDOT on several issues related to questionable work practices performed under the City's supervision on City utilities. Also managed multiple other transportation corridor Phase I and Phase II Drilling Investigations for Mn/DOT.

- Portfolio environmental due diligence following ASTM 1527-05 all appropriate inquiry (AAI) standards and tank compliance reviews for a new entry into the US retail petroleum/C-store market. Scoped and managed delivery of Phase I and II ESAs and review of tank system compliance incorporating both record and field inspections. Work consisted of three separate portfolios totaling 50 facilities in OH, IL and PA. Work was completed over a four-month period from May to August of 2007. Other services included clarifying State Tank Release Insurance Fund issues and follow-through with tank compliance issues on the IL portfolio.
- Provided transaction support for a client that was selling their portfolio of 76 Retail Petroleum/C-Store locations in Ohio and Pennsylvania. Support was initiated by performing Phase I ESAs at 19 of the properties in March 2012, and completed with performing Phase I ESAs at the remaining 57 in July and August 2012. Based on the Phase I findings, Phase II drilling investigation were then performed at 46 of these locations and groundwater was sampled at 10 more to help establish a baseline of current site conditions. Based on this work, 14 new LUST incidents were identified. Using this new and existing information about the open environmental incidents at 38 of these facilities, cost estimates for actions anticipated to be necessary to bring these incidents to resolution and secure "no further action" status were prepared. The purpose of these cost estimates was to allow this liability to be addressed in negotiations and to determine an appropriate escrow to fund the necessary remedial actions. Gary led a team of approximately 60 staff members from 12 offices to accomplish this work over a short time period. The 57 Final Phase I's were delivered within 7 weeks and the entire transaction support scope, including the Phase II's and remediation estimates were delivered within 10 weeks of the initial Phase I authorization.
- Litigation Support for a joint defense group representing multiple insurance companies in claims made by a rolled steel manufacturer against various environmental policies for five facilities located in four Northeastern States. Evaluated approximately \$35 million in invoices submitted for coverage, classifying costs as defense, indemnity, purpose undetermined and eligibility questionable. Lead a team of state experts in documenting project activities, critical events and timelines, project strategies and regulatory frameworks. Provided relevant technical and cost summaries and assisted in identifying areas of interest, lines of questioning and reference documents for depositions of plaintiff's representatives. Based on documents provided and in-person FOIA reviews of regulatory files, evaluated project lifecycles and projected costs to closure of remediation activities using decision trees and estimated probabilities. Project is ongoing with anticipated further need for support in preparation and during deposition of plaintiff's experts as well as expert testimony by team members.

Curriculum Vitae

Gary Turgeon

- Fractured bedrock investigation and remediation at the Minneapolis, MN main post office. Served as Project Manager for installation of a groundwater and free product recovery system to mitigate a release of petroleum in a downtown urban setting adjacent to the Mississippi River. The geology consisted of approximately 26 feet of soil overlaying 30 feet of Platteville limestone, a discontinuous thin shale layer and the St. Peter sandstone. Supervised installation of a 12" diameter recovery well and three 4" monitoring wells all installed with open-hole construction in the limestone bedrock using foam rotary drilling methods. Assisted in system sighting to house equipment in the existing structure. Also supervised and documented removal of seven 10,000-gallon capacity tanks and impacted soil during facility renovation.
- Spill Prevention, Control and Countermeasures (SPCC) Plans and Storm Water Discharge Permits and Pollution Prevention Plans (SWPPPs) for four bus facilities in the Minneapolis/St. Paul metro area. Served as Project Manager and co-author of SPCC and SWPP Plans for a regional bus company's four metro area facilities. Managed a team including a professional engineer, CAD technician and other staff. The plans were prepared as separate documents with appropriate cross references to simplify management and training where possible.
- Railyard paint shop/lead dust abatement plan for warehouse reuse in Waite Park, MN. Directed the development of a cost-effective remedial approach to address the cadmium and lead dust found within a former 100' by 300' dirt-floor railroad paint shop building used as an equipment and material warehouse. OSHA had cited the facility due to elevated contaminant levels on the dust. The facility was part of a larger Superfund site undergoing response actions. The main objective was to reduce health risks to level suitable for OSHA and end-user standards. The approach involved reasonably removing dust from the materials and equipment stored in the building and the building appurtenances. The next objective was to allow the safe removal of all building contents and appurtenances to allow the previous owners' contractors to excavate impacted soils from the building floor and to install a concrete floor. The project involved negotiations with regulators and the former facility owners' representatives and was successfully completed using the abatement plan.
- Expert opinion regarding devaluation of property due to contamination in Little Canada, MN. Provided assessment and expert opinion to a real estate appraiser and attorney regarding framing of property devaluation considerations in a property transfer to the City. The estate of a client had sold property that was a closed petroleum release site. The value of the property was to be determined considering its environmental impairment. The City's consultant had proposed that the impairment should be based on excavating all impacted soil that could reasonably be removed. Laid out a perspective based on the limit to liability assurance that the City had already secured from the State and the risk considerations under which the site had been closed. He also provided a more realistic and significantly less costly approach as to how re-development of the site could proceed through management of the residual impacts by enrolling in the State Volunteer Program. Based in part on this information, the attorney was able to negotiate a much better value and more favorable terms of the transaction.
- Soil Corrective Action Plan and Development Response Action Plan in Marshall, MN. After monitoring ground water impacts from a petroleum release for several years, it was determined that removing contaminated soil from the source was the most reasonable path to site closure. The facility was also set to undergo redevelopment, requiring that a new water main extend through the defined area of soil impacts. Prepared similar but distinct plans for Soil Corrective Actions around the source area and Development Response Actions along the water main excavation. The plans were approved within two days of submittal to the MPCA's Volunteer Petroleum

Curriculum Vitae

Gary Turgeon

Investigation and Cleanup (V-PIC) Unit. He also solicited bids for soil treatment, managed tasks to maximize State “Petrofund” reimbursement and tracked costs separately for these narrowly distinct scopes during implementation.

- Management of contingent liabilities from a corporate sale, Food ‘N Fuel to Avanti in MN and SD. The due diligence Phase II ESAs conducted when Food ‘N Fuel was purchased by Avanti Petroleum resulted in the identification of 27 petroleum release sites. Led the project team – retained by the client to mitigate the liability from these 27 petroleum release sites – in developing an approach that categorized release sites based on the most efficient path to file closure. Regulatory files were reviewed and eight site files were closed on the team’s recommendation that the impacts were indicative of levels present when the previous leak files were granted closure. Two more sites were closed after conducting baseline risk assessments, and investigative drilling was recommended for the remaining 17 sites. Eight of these sites were closed without the need for monitoring wells and extended ground water monitoring, and most of the remaining sites were closed after approximately 18 months of ground water trend analysis.
- Asbestos containing material (ACM) surveys for an office building transaction. Remotely managed a short turn survey of tile mastic beneath carpet in an office building in the spring of 2010. When laboratory analysis of samples indicated that the mastic did contain asbestos, managed short turn around sampling to determine the presence of asbestos in the air, on the carpet and in the air conditioning components as a result of the possible disturbance of remnant floor tile mastic beneath the new carpet.
- Scoped Phase II Investigation work plans and provided investigation oversight of active agricultural chemical storage and distribution facilities in the spring of 2010. Historic storage, use and past sampling indicated the potential for soil and groundwater impacts from fertilizers, pesticides, herbicides, petroleum products and solvents. Sampling protocols included shallow soil sampling using manual methods, direct push probe soil sampling and installing monitoring wells using hollow stem auger drilling.
- Estimated and tracked financial liability for a portfolio of petroleum tank release incidents. Client portfolio consisted of approximately 100 facilities with 20 petroleum release incidents. Estimates were intended to be used for corporate reserves against this liability. Strategies and estimates of the “cost to closure” were developed and progress tracked on a quarterly basis. An evaluation of state fund reimbursement programs and site specific eligibility was also made and estimates developed of anticipated reimbursement of applicable costs.
- Lead contact and primary program content developer for federally mandated, state specific UST Operator Training Programs for multiple states (MN, WI, SD, ND, IL and IA) in the North Central United States. The training program consists of 18 modules that cover required training content including tank system equipment, operation and maintenance, record keeping, regulatory requirements and financial responsibility. In this role, Gary identified state regulatory leads, developed state specific training materials including examinations, communicated and worked with state personnel to gain approval for the training program. Once approved, he supports content transfer to the Antea Group/API online training platform and manages a team that organizes and provides classroom training.

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Gary Turgeon

- Managed transactional support for international acquisitions by a large agricultural and food manufacturing company, and a large international industrial manufacturing company. Services including Phase I and II ESAs for environmental due diligence and limited environmental compliance reviews. Provided a central point of contact and managed Antea Group resources for facilities in the United States, and Inogen affiliate resources for facilities in China, Israel, and Bosnia-Herzegovina.
- Provided evaluation of costs for a long term sediment remediation project as part of a litigation support team for an Insurance company client. Developed strategy and data support for separation of costs between multiple project lifecycles and covered verses non-covered actions.
- Ongoing Project Manager for a project for international regulatory content development in the areas of Environmental Health and Safety (EHS). Managed work orders with internet platform host, engagement letters with international Inogen content providers and financials for the overall effort. Team includes internal content and quality assurance managers and more than 25 international content providers.

Presentations

- Turgeon, Watson, Schaepe, Thompson, Hannu, Panel Presentation on “Affects of Minnesota Pollution Control Agency Fact Sheet Revisions on Petroleum Release Investigations & Site Closure,” Minnesota Petroleum Marketers Convention
- Turgeon, Ryan, Thompson, “Community Concerns on Petroleum Release Investigation and Cleanup at the Cottonwood County Highway Shop,” Public Meeting, Windom, Minnesota
- Turgeon, Vieau, Bratsch, Stahman, Panel Presentation on “Working with the New MPCA and Petrofund Rules on Cleanup,” Minnesota Petroleum Marketers Convention

Christopher J. Vandegrift, PE

Experience Summary

Christopher J. Vandegrift is a licensed Professional Engineer and the Office Leader in our Pittsburgh, PA office. He has over 25 years of experience in the environmental consulting and contracting field. Chris has managed all facets of project work from initial assessment activities through site closures. He has managed annual gross operating revenues of over \$5 million and has been responsible for remedial action at a variety of facilities including retail petroleum, refining, manufacturing, mining, chemical distribution and aviation located across the eastern United States and California.

Title

Senior Project Manager

Education

BS – Civil Engineering, University of Pittsburgh, Johnstown, PA

Professional Registrations

Professional Engineer:

Pennsylvania, West Virginia, Ohio, Delaware, Maryland, and Georgia
West Virginia Licensed Remediation Specialist

Professional Associations

Member, National Society of Professional Engineers

Member, National Council of Examiners for Engineering and Surveying

Languages

English

Chris has managed large-scale remedial actions including landfill caps, secondary containment structures, excavations, impoundment closures, system installations, and facility decontamination and demolition. He has designed and implemented detailed remedial approaches with multiple remedial technologies including single and multiple well extraction, air-sparging, soil vapor extraction and bio-sparge/venting processes. He has designed various vapor treatment process including granular activated carbon, air-stripping, thermal/catalytic oxidation and internal combustion engines. Chris conducts remedial engineering design assurance, continuous improvement of remedial system performance and system optimization consistent with project closure goals and client objectives for multiple treatment facilities located in Pennsylvania, New Jersey, West Virginia, Ohio, Kentucky, North Carolina, South Carolina, Georgia, Florida, New York and Indiana. Chris has facilitated cost reductions of up to 50% with reduction of unscheduled shutdowns and increased efficiency. He is proficient in the utilization of risk-based strategies to drive remedial sites to closure, and regularly provides the expertise to identify system endpoints and modifications to accelerate site cleanup strategies.

Chris successfully managed these activities with various clients, regulatory agencies and client counsel to ensure minimal business interruptions, compliance with applicable orders and environmental regulations and with limited exposure to third party liabilities. In addition to his management experience, his additional responsibilities have included business development, strategic business planning, emergency response, AST and UST compliance, profiling and transportation of hazardous and non-hazardous wastes, and the preparation of facility plans.

Curriculum Vitae

Christopher J. Vandegrift, PE

Project Management

- Portfolio Manager for an out-source contract with a convenience store chain. Responsible for all aspects of environmental oversight on 250 sites in 13 states managed through 10 operating divisions. Accountable for national strategic planning, authoring and managing proposals, administering performance metrics, and managing the financial accrual of a four-million-dollar budget. Responsible for continuous feedback on performance, information sharing on technology and policies, management and project strategies, and operational issues.
- Project Manager and lead engineer for environmental assessment and remediation of over 120 petroleum sites and facilities including: retail service stations for major and mid-stream petroleum clients and petroleum bulk storage facilities, in southwestern Pennsylvania, West Virginia, and eastern Ohio. Managed and performed investigation, remediation, UST closure, remedial system installations and groundwater monitoring programs. Responsible for development of cost to closure estimates, remedial budgets, development of remedial options, development of work plans and corrective action plans and for negotiating with various regulatory agencies to obtain regulatory closure of petroleum spill cases.
- Office Manager responsible for a local operating division covering three states with a staff of 21 personnel. Managed and developed four major oil accounts with annual budgets exceeding one million dollars.
- Responsible for overall engineering management of approximately 15+ operating remediation systems, including pump and treat, soil vapor extraction, air sparging, multi-phase extraction, vapor-enhanced pumping, chemical injection and bioremediation. Daily tasks include scheduling of field personnel, ordering system components, managing system data, maintaining database of system performance including permits and evaluating system performance criteria.
- Remediation engineer for development of work plans for feasibility testing for aquifer characterization and construction details. Created piping and instrumentation diagrams for treatment systems. Completed air emission, mass recovery and system performance calculations and evaluation. Maintained and submitted permit information related to all systems.

Remediation System Design, Operation and Maintenance

- Senior Project Manager for an operational/optimization study for a former manufacturing facility in upstate New York, which is impacted by metals and VOCs. The facility has a Hazardous Waste Post Closure Management Permit in-place with the NYDEC. Post closure care includes operation and maintenance of a groundwater extraction system, which maintains hydraulic control of impacted groundwater as well as site wide inspections and maintenance of a soil cover system and RCRA cap area. Tasks include review of current groundwater elevation, groundwater flow, pumping flow rates and development of a strategy to optimize the remediation system and reduce long term operational costs.
- Project Engineer for a chlorinated solvent release at an industrial dry-cleaning facility in Columbus, Ohio. Prepared and implemented a work plan for a high vacuum dual phase extraction (HVDPE) pilot test to remove DNAPL. Designed HVDPE system including drawings, bid specifications, and selection of contractors. Completed discharge permitting and installed a four well extraction system. Operated and maintained system for a 9-month period with 100% run time. The HVDPE system attained closure goals and was decommissioned. A sub-slab depressurization (SSD) system was designed and installed as the final engineered remedy.

Curriculum Vitae

Christopher J. Vandegrift, PE

- Project Engineer for an engineering assessment of all remediation systems transitioned to Antea Group from an out-going supplier in the spring of 2007, and supervised the retooling efforts of inefficient systems that required control and communication upgrades.
- Project Engineer instrumental in the reuse of remediation system equipment inventory for an international chemical manufacturer, demonstrating cost savings over the need to purchase new components or systems.
- Project Manager for the installation of an air sparging/passive vent system at a former northern New Jersey vegetable oil refinery during site redevelopment activities. The system required the trenching of 2,800 linear feet and the installation of 16,000 feet of air sparge piping to 31 sparge wells, placement of 1,700 linear feet of passive vent piping and 15 passive vent risers, construction of an air injection system including a 75 Hp compressor, air dryer, wet and dry air receivers and distribution manifold.
- Prepared design specifications for a LNAPL recovery system to increase recovery volumes and decrease system operational lifecycle. Installed solar-powered LNAPL recovery pumps in remote areas of the site to eliminate fixed power capital requirements on 3rd party owned property.
- Design, installation, and operation of four dual phase extraction systems in West Virginia to remove LNAPL while minimizing groundwater recovery.
- Design and installation of an acid injection system to control the formation of iron deposits on the pump and piping ultimately reducing O&M from weekly to monthly.

Landfills

- Project manager during capping activities at a 4-acre land disposal area generated from the facility's operation. The closure consisted of erosion and sedimentation control, grading and compaction of the subgrade, placement of a geosynthetic clay liner and composite drainage net and the transportation and placement of cover material.
- System Engineer for a leachate management system at a 3.5-acre inactive hazardous waste landfill, which was associated with a former resin manufacturing facility. Work is conducted under the Superfund Program with EPA oversight. Requires the management of approximately 1,000 gallons of oil and treatment of approximately 400,000 gallons of leachate a year. Responsible for O&M of landfill cap, leachate collection and treatment system. Participate in ongoing negotiations with PADEP, USEPA Region 3, and the local treatment facility. Manage system upgrades with USEPA Region 3 and PADEP involvement. Maintain and sample large groundwater monitoring network including on-site and off-site monitoring wells. Facilitate emergency response activities during upset conditions or large rainfall events at the landfill.
- Project Engineer for the operation and maintenance of a Superfund landfill site in Cumberland, Maryland consisting of two separate parcels of land that accepted commercial, residential, and demolition waste throughout the 1960's and 1970's. The O&M efforts consist of quarterly facility inspections, biannual mowing, monitoring well and fence maintenance, routine brush clearing along the fences, annual groundwater gauging and sampling and annual reporting.

Curriculum Vitae

Christopher J. Vandegrift, PE

Soil Excavation

- Project Manager for the implementation of a comprehensive soil remediation project at a former northern New Jersey vegetable oil refinery during site redevelopment activities. Managed approximately 30,000 cubic yards of material and 600,000 gallons of groundwater/surface water impacted by VOCs. The soil was segregated on-site, sampled and based on the level of impact, either encapsulated on-site or incinerated off-site. Water was managed in a series of 20,000-gallon tanks and treated through a series of filters. The remedial action secured a NFA from the NJ DEP for soil.
- Project manager for the ex-situ remediation of 3,500 cubic yards of soil impacted with volatile organic compounds via vapor extraction and bioventing at a US international airport. Work was completed in Level C PPE and included the construction of four treatment cells. Concentrations of volatile organics were monitored daily during the 5 months of treatment with a continuous emission monitor. Once attainment samples confirmed that the soil was no longer characteristic for benzene, a petition was submitted to the US EPA Region 3 for an exemption of the Land Disposal Restrictions.
- Project Engineer responsible for the on-site treatment of chlorinated and aromatic VOCs and SVOCs from a former waste oil recycling facility in central New York. Site preparation activities included establishing temporary facilities, clearing and grubbing, solid waste removal, establishment of an exclusion zone, relocation of existing utilities, establishing sediment and erosion control measures and abandonment of existing monitoring wells. Construction of five treatment cells covering approximately 14,000 square feet to handle 2,700 tons of impacted soil. The soil was excavated, transported on-site and covered in Level B PPE. Two soil vapor systems comprised of 3 Hp regenerative blowers were utilized to remove volatile compounds from the soil. Once the soil clean-up levels were attained, the soil was returned to the excavation and the site was regraded. The site was capped with six-inches of topsoil, seeded and mulched.

Emergency Response

- Emergency Response Coordinator for a 6,000-gallon toluene tanker release in southwestern Pennsylvania. Responsibilities included release characterization, elimination of immediate threats to receptors, close interaction with client operations and regulatory agencies, waste management and recovery system design, installation and operation.

Decontamination and Demolition

- Project Engineer responsible for the removal of all surface structures associated with a former mining operation. The detailed scope of work included the development and implementation of a site specific health and safety plan, installation and maintenance of the erosion and sedimentation control including the installation of a temporary dam, the removal and disposal of PCB oil pole transformers and the demolition and removal of a coal storage silo, two railroad bridges and a mine shaft elevator. All disturbed areas were graded, seeded and mulched prior to demobilization.

Curriculum Vitae

Christopher J. Vandegrift, PE

- Completed the decommissioning and salvage work associated with the removal of inactive petroleum and wastewater pipelines, three steel support structures and two aboveground storage tanks on a former refinery site. Prior to the dismantling activities and removal of the items, the pipelines were drilled, tapped and samples were collected to profile the material at approved disposal facilities. A licensed electrician identified all the power sources in the work area and performed appropriate lock/tag-out procedure. An asbestos survey was conducted and identified transite siding and roofing material on the former transformer building. Supervised the purging, cleaning and removal of over 10,000 feet of inactive pipeline and two large above ground storage tanks. The project recycled 138 tons of steel and 2,620 gallons of motor oil. Disposed of approximately 1,500 gallons of hazardous liquid and 2,000 gallons of non-hazardous liquid off-site. The property now poses less risk to the environment, as well as having an increase in marketability.

Other Related Projects

- SPCC and SWPPP development and technical amendment reviews for refineries, bulk fuel terminal, oil & gas well pads, and other industrial and commercial facilities.
- Conducted energy assessments for metals manufacturing facilities, identifying opportunities for improving employee awareness and developing capital and non-capital cost saving initiatives.
- Document review and strategic support for expert witness testimony in an underground storage tank release case.
- Professional engineer responsible for the investigation of potential impacts associated with a discharge from an underground mine pool to a major water body. Evaluated the hydrologic balance and inorganic loading to a wetland ecosystem as well as ground water resources. Reviewed mine maps, collected water quality samples, and reviewed current site conditions to determine there was minimal impact to the ecosystem.

Jonathan Zimdars

Title

Consultant

Education

BS – Geology

University of Wisconsin-Madison
Madison, WI

Interdisciplinary Analysis of Mining
Dependent Communities, University
of Wisconsin – Madison

Containing and Controlling
Groundwater, NGWA – Orlando, FL

Soil Vapor Extraction Symposium,
Stevens Institute of Technology

Groundwater Pollution and
Hydrology, NWWA – Princeton
University

Professional Registrations

Professional Geologist:
Pennsylvania

Transportation Worker
Identification Credential (TWIC)
Holder

Global Entry Card Holder

Languages

English

Experience Summary

Jonathan Zimdars is a Consultant with 24 years of consulting experience. He has extensive experience designing and conducting aquifer and vadose zone pilot tests, remedial alternative analyses, treatment system design and permitting, treatment system performance and optimization analysis, risk-based site closure advocacy, portfolio lifecycle cost to closure modeling, and Environmental Liability Transfer (ELT) portfolio management. He has managed hydrocarbon remedial investigation projects in Alabama, Delaware, the District of Columbia, Connecticut, Illinois, Michigan, Minnesota, New York, New Jersey, Pennsylvania, Virginia, West Virginia, and Wisconsin, as well as property transaction and facility compliance projects in Azerbaijan, China, Colombia, Egypt, India, and Kenya.

Related Projects

- Managed a corrective action portfolio that consisted of 40 projects with annual budgets totaling \$1.8MM. Responsibilities included remediation strategy cost/benefit analyses, budget preparation and financial tracking, client meetings with technical performance review, field safety coordination, state reimbursement submittal support, and investigation closure strategy development and regulatory agency advocacy.
- Evaluated portfolio cost to closure models, incorporating individual site projected work scopes, project schedules, labor and subcontractor budgets, and technical/regulatory threats to achieving incident closure. Evaluations incorporated life-cycle cost threats including potential corrective action activities, regulator responses, and duration of out-year groundwater sampling.
- Managed \$10MM lifecycle cost to closure chlorinated solvent risk evaluation and remediation project at a former industrial facility in Ontario, Canada. Project elements included: cost-benefit performance evaluation of existing pump and treat groundwater remediation system, area sensitive receptor evaluation, stakeholder management, bankruptcy trust lifecycle cost settlement negotiations, and local contractor management.

Curriculum Vitae

Jonathan Zimdars

- Managed six projects in Delaware, Illinois, Maryland and West Virginia that utilized magnesium sulfate solution injection to enhance anaerobic bioremediation of dissolved-phase BTEX. Project elements included regulator technology review meetings, aquifer suitability pre-qualification, CAP preparation, field injection oversight, and post-injection monitoring and closure suitability evaluation.
- Provided daily engineering oversight during the eight-month closure and capping of an 18-acre landfill in Milwaukee County, Wisconsin. Project elements included the installation of 18 methane extraction wells, 1.25 miles of HDPE header pipe, and five condensate tanks; relocation of the existing blower/flare system; installation and compaction of a 2-foot clay cap; blower/flare system startup, system operation maintenance and monitoring; contractor technical performance evaluation; and surface drainage grading with prairie grass re-vegetation.
- Provided work team coordination and field oversight during the emergency response following the release of 55,000 gallons of gasoline from a refined product distribution pipeline; responsibilities included: field safety monitoring, impacted soil excavation oversight and sidewall soil sample collection, domestic well sampling program development and staff schedule coordination, core logging and impact screening during roto-sonic rig delineation and recovery well installation, and field data evaluation and staff/contractor coordination during the initial LNAPL recovery from the bedrock well network.
- Managed emergency response remedial evaluation and contractor oversight at multiple incidents involving fuel oil distribution tanker truck accidents at commercial, residential and public space properties in Wisconsin and Illinois. Oversight activities included initial spill abatement, spill reporting and regulatory compliance, disposal coordination, site restoration contractor supervision, and regulatory closure reporting.
- Provided delineation design and historical records review for a retail hydrocarbon investigation impacted with chlorinated solvents. The results of the soil and groundwater delineation and historical records review documented an off-site source for site area solvent impact.
- Managed the permitting, contractor coordination, and demolition oversight of a residential structure with hydrocarbon impact to the foundation and basement enclosure.
- Coordinated state air permits for the controlled burn of two abandoned residential structures. The client-owned structures were donated for local fire department training.
- Managed the client field liability evaluation during the emergency response phase of an incident involving the surface discharge of 18,000 gallons of fuel oil.
- Provided corrective action pilot testing and RAP development for an active industrial laundry facility impacted with chlorinated solvents; project elements included regulatory advocacy, permitting, venting system pilot testing and design. The system operated with 100% run time achieving soil gas target concentrations.
- Provided project management of a corrective action site with LPH in multiple wells 20 feet below grade at an active third-party operated facility. After three years of AS/SVE system operation, over 2,500 equivalent gallons of hydrocarbons were recovered and LPH was no longer observed; termination of system operation and compliance sampling was completed achieving incident closure.
- Provided project management of a corrective action site in Illinois with LPH in multiple wells. After 20 months of SVE system operation, over 2,700 equivalent gallons of LPH were recovered and the regulatory incident was closed after demonstrating no LPH rebound during monthly gauging and quarterly sampling.