AECOM Imagine it. Delivered.

PROPOSAL

Category C
Closed Landfill Program Environmental Services

Remediation Master Contract
R3201-2000008034

PREPARED FOR

MINNESOTA POLLUTION CONTROL AGENCY (MPCA)

APRIL 11, 2018

AECOM

C COVER LETTER

AECOM
800 LaSalle Avenue, Suite 500
Minneapolis, MN 55402
USA
aecom.com

April 11, 2018

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

Re: MPCA-MDA RFP for Remediation Master Contract: Category C – Closed Landfill Program Environmental Services; AECOM Opportunity: 04191408-2099

Dear Ms. Heininger,

AECOM Technical Services, Inc. (AECOM) has sincerely enjoyed working with the Minnesota Pollution Control Agency (MPCA) and Minnesota Department of Agriculture (MDA) under our existing master contracts since 1990. Together, we have a history as a team, working to achieve the MPCA and MDA's goals of achieving a safer environment for all Minnesotans. We remain committed to this partnership as a progressive, cost effective, and efficient environmental contractor and are pleased to submit this proposal for the Minnesota Pollution Control Agency (MPCA) and Minnesota Department of Agriculture (MDA) Master Contract. This submittal is for **Category C – Closed Landfill Program Environmental Services**. Our demonstrated ability to successfully support MPCA and MDA with the identified services, our technical expertise, and ability to provide local support out of our various office locations in Minnesota provides MPCA and MDA with an experienced, qualified and proven provider. By selecting AECOM, MPCA and MDA will realize the following measureable benefits:

- **Our Knowledge and Experience with MPCA and MDA Processes and Staff Reduces Work Efforts.** We have successfully provided environmental technical support to MPCA and MDA since 1990, including recent work for both agencies. Through this robust work experience, we understand and are familiar with MPCA and MDA processes and staff that will reduces time and cost of delivering successful projects.
- **Our Minnesota Breadth and Depth of Experience is Unmatched.** We have been serving clients in Minnesota for decades and have successfully completed thousands of applicable projects across a wide variety of services, including closed landfill investigation and remediation services. We are able to and have executed successful projects across their entire life-cycle. If needed, AECOM can access industry leading experts to help solve the most complex project problems. This variety of ability provides our clients the solution to any project type or size.
- **AECOM is an Industry Leader in Landfill Life Cycle Management.** AECOM's landfill specialists have designed award-winning landfill gas management and utilization systems and have completed several hundred successful projects. Our designs range in size from small township landfills to large sites with capacities in excess of 100 million cubic yards and incorporate beneficial reuse. AECOM also designs leachate and landfill gas condensate systems including collection, pumping and storage; pre-treatment and treatment; and recirculation and bioreactors.

AECOM Overall Capabilities, History and Organizational Structure

AECOM is an approximately 87,000 person consulting engineering firm providing a full range of environmental management, engineering design and construction services to the government, commercial, and industrial markets. AECOM is listed as the No. 1 Design Firm and the No. 1 Environmental Firm by Engineering News Record (ENR Magazine 2017). AECOM has also been names named one of *Fortune* magazine's "World's Most Admired Companies" for the fourth consecutive year and ranked No. 1 for innovation, social responsibility and quality of products/services within the engineering and construction industry. In 1997, AECOM became a publicly traded company on the New York Stock Exchange (NYSE: ACM). AECOM's environmental practice now has over 8,500 employees in over 500 offices around the globe, including 5,000 staff in the United States. AECOM's environmental practice has a total of 41 staff in Minnesota located in Minneapolis, Brainerd and Duluth, Minnesota. Our Minnesota staff will work directly with our landfill design services center in Wisconsin to provide the full spectrum of professional services required by the contract under the Category C scope of work. In addition to the expertise in our Minnesota and Wisconsin offices, AECOM's national and regional staff capabilities are available as required. All offices are electronically connected for cost effective interaction between offices. AECOM was founded in 1990 and has grown by organic expansion and acquisition. Some of the predecessor firms acquired by AECOM that have provided services to MPCA and MDA

include STS Consultants, Earth Tech, ENSR, RETEC, and URS. These predecessor firms have provided environmental services to MPCA in the form of master contracts from at least 1990.

Firm Headquarters

AECOM headquarters is located in Los Angeles, California. We operate presently from two main offices in Minnesota including Minneapolis and Duluth, in addition to a project office in Brainerd. The address for the Minneapolis and Duluth offices are as follows:

- Minneapolis: 800 LaSalle Ave., Suite 500, Minneapolis, MN 55402 612-376-2000
- Duluth: Duluth Technology Village, 11 East Superior Street, Suite 150, Duluth MN 55802 218-625-8768
- Brainerd: Project Office serving Northern Minnesota

These offices will be the base from which all services will be provided. AECOM has offices throughout the Midwest and United States. Specialty services may be utilized from any of the AECOM offices as needed to meet specific project needs and MPCA/MDA requirements. These specialty services include:

- Landfill design and engineering services including gas recovery, remediation system and cover design
- Emerging contaminant research, assessment, and remediation including PFAS
- Landfill assessment, construction services and operations and maintenance

Proposal Contact and Personnel Availability

Mr. Daryl Beck, has served as the Contract Manager and will the MPCA and MDA primary contact.

800 LaSalle, Avenue, Suite 500
Minneapolis, MN 55402
Telephone: 612-376-2424
Email: daryl.beck@aecom.com
Website: www.aecom.com

Mr. Beck is available on a day-to-day basis to organize services, provide invoicing and technical information on projects, and to discuss, inform and interact with MPCA and MDA users of the contract. Mr. Beck will assign a project manager and local team that have the knowledge and experience to undertake a specific project. Mr. Beck also has access to a wide network of experts across the company that are available to advise and conduct work on complex projects. Communication necessary to execute projects, complete progress reports and discuss billing issues will occur directly between MPCA/MDA staff and the assigned AECOM project manager.

The Minnesota offices of AECOM have initially assigned local staff and staff located outside of Minnesota to support this contract. The staff includes a full range of experienced technicians, scientists, engineers, CAD specialists, project managers, QA/QC specialists and human and ecological risk assessors, many who have been working on MPCA and MDA projects for years. Project management and field work will be performed by staff located in the Minnesota offices.

Contract Conditions

AECOM accepts all the Contract Conditions, including: Classification and Rates – Schedules 1 and 2 and Equipment and Supplies List.

Closure

We look forward to continuing our relationship with the State of Minnesota on this contract. If you have any questions about this proposal, please contact Mr. Daryl Beck at 612-376-2424.

Yours sincerely,

Daryl R. Beck, P.E.
Senior Engineer
daryl.beck@aecom.com

Christina Boehm Carlson, P.G.
Vice President
chris.boehm@aecom.com

AECOM

C QUALIFICATIONS & CAPABILITIES

Section 2 – Qualifications and Capabilities

Overall Company Capabilities

AECOM and its predecessor companies have provided services defined in the Category A scope of work for over 30 years. With a total staff of approximately 87,000 employees, AECOM has a vast resource of engineering and consulting capabilities. AECOM provides services in the following broad categories: Architecture, Building Engineering, Construction Services, Design & Planning, Economics, Energy, Government, Mining, Oil & Gas, Program Cost Consultancy, Transportation, and Water.

Environment practice staff will primarily service this contract and environment staff in the United States total approximately 5,000. Over the past five years, technical staff in our Water practice has provided engineering services for a number of drinking water treatment related projects managed by MPCA. Our staff provides a full range of services including investigation, design and construction services, contaminant assessment, engineering, corrective action and operation and maintenance (O&M) services. The following subsections present an overview of AECOM's overall company capabilities based on the general categories of petroleum, Superfund, agricultural chemicals and landfill services.

Our staff experience and capabilities are demonstrated in Tables 1 through 4 included in this proposal. As you can see we are a major provider of environmental services to both the public and private sectors. AECOM's Minnesota staff has successfully worked on 1,000s of environmental projects in Minnesota and across the Upper Midwest. Our recent roster of MPCA and MDA projects place us throughout the State – Grand Marias, Winona, Warren, and across the Twin City Metro area. Our staff roster provides the MPCA and MDA a variety of experience at the specified Labor Classifications to cost effectively and completely deliver success projects.

Landfill Services

AECOM has performed solid waste projects at many sites worldwide. We have encountered and solved nearly every type of challenge faced by the industry. Our landfill development engineers are accomplished professionals who have succeeded under varied site conditions so that you can benefit from our experience. Our wide-ranging services include landfill design, groundwater investigations and monitoring, remedial investigations, landfill construction services, landfill gas management and utilization systems, landfill leachate management, landfill closure and post-closure end use, community relations, waste to energy, and solid waste planning.

We have developed specialized, state-of-practice approaches that are cost-saving and effective in facilitating successful project completion. We pride ourselves on a strong orientation toward meeting each client's needs, with a focus on the ultimate objective. During the past decade, personnel from AECOM have completed:

- Landfill siting, investigations, design and construction quality assurance for more than 400 facilities;
- More than 300 hazardous waste investigations and cleanup designs;
- Engineered more than one-fourth of all landfill gas-to-energy projects in the United States.

Our solid waste professionals have a deep reserve of expertise that is available instantly to every staff member via our Technical Practice Network, which includes Technical Practice Groups that connect our staff world-wide. Combining our knowledge of local conditions and regulations with our network of experts allows us to address any facet of landfill investigation, design and construction with real-world experience. This expertise is available instantly to every staff member via our Technical Practice Network.

The following is a general description of how AECOM will approach the items included in the scope of services. The exact approach used will depend on the specific assignment. Because of our experience and blend of staff, we can adjust our approach to each assignment as is most appropriate for the situation.

- **Site Evaluations:** Assigned project personnel have conducted similar evaluations, including, for example, Duluth Dump No. 1 project under the MPCA Multi-Site contract. AECOM has manual sampling tools (hand auger, shovels, etc.) and monitoring equipment (4-gas meters, etc.) to assist staff with these field activities.
- **Site, Cover, Geology and Investigations:** Project personnel have conducted field sampling, and oversight of soil borings and monitoring well installations in Minnesota, including at the Minnesota Valley Landfill in Savage, Minnesota.
- **Construction Plans and Specifications (Design):** Our staff has many years of experience in landfill design and construction projects in Minnesota. These include landfill closures and gas extraction systems. Our project team brings an exceptional volume of similar experience in Minnesota and neighboring states.
- **Construction Cost Estimates:** Construction cost estimates are a typical part of the scope of services for landfill construction and remediation projects, and have been completed by the project staff on a routine basis.
- **Bidding Assistance:** AECOM project staff provide bidding assistance services on a routine basis for landfill construction, investigations and remediation projects. Services include issuing plans and specifications, answering questions from bidders, evaluating bids and contractor qualifications, and recommending contractors for selection.
- **Construction Stormwater Pollution Prevention Plans (SWPPP):** AECOM prepares SWPPPs for construction projects on a regular basis. Project team members have prepared SWPPPs for landfill construction and many major construction projects, including for large-scale industrial development and transportation projects.
- **Project Management and Construction Oversight:** Management and oversight of landfill and remediation construction projects is a major area of expertise for the AECOM staff. AECOM provides construction management/oversight for major Landfill Construction projects.
- **Construction Documentation:** AECOM staff routinely prepare construction documentation reports for landfill and investigation/remediation projects.
- **Prepare Operation and Maintenance (O & M) Manuals:** Preparation of O&M manuals is a typical task for landfill construction and remediation. Manuals are assembled as part of the construction documentation process to assist facility owners.
- **Subcontractor oversight:** Subcontractor oversight is a regular task performed by AECOM staff on landfill-related and investigation/remediation projects. This includes oversight of drillers and other specialty contractors. Subcontractor administration is handled at the Minneapolis office.
- **Pilot Studies:** Design and implement pilot studies to determine a technology's applicability for the Site.
- **Landfill Gas to Energy Recovery Systems:** As noted above, AECOM has extensive world-wide experience in landfill gas systems. Our project team has experience with gas-to-energy projects in Minnesota, along with design, construction and operation of gas migration control systems such as those installed at the Oak Grove and Washington County landfills.

AECOM has conducted Site Investigation, Remedial Investigation, and Remedial Design on the following Landfill projects within Minnesota:

- Duluth Dump – Site Investigation, Remedial Investigation and Feasibility Study Activities
- MN Valley Landfill – Work Plan Preparation and Phase II Investigation
- Washington County Landfill – Engineering Services and Construction Quality Assurance for Closure
- WDE Landfill Operation Modification – Landfill Operations Design
- WDE Landfill Gas to Energy Cooling System Evaluation – Engineering Services to Evaluate the Cooling System
- WDE Sanitary Landfill – Improvements to Gas to Energy
- Brown County Landfill – Landfill Final Cover
- US Steel Duluth Works CL Landfill – Develop Work Plan for Investigation Activities

Superfund Services

AECOM Minneapolis staff provides the full spectrum of Superfund related services required by the contract. In addition, AECOM's total corporate and regional staff is available to service the contract as required. Services include site assessments, remedial investigations, feasibility studies, remedial design/remedial action plans, response action oversight, removal and remedial actions, long-term response action/operation and maintenance activities, ecological and human health risk assessments, and five-year reviews. In addition to these services, AECOM has other company capabilities which have proven valuable in our existing contract. These capabilities include civil engineering design, architectural services, geotechnical engineering, materials engineering, air quality permitting/design, environmental management systems engineering, and structural engineering.

Our Superfund experience dates back to the enactment of CERCLA in 1980 and continue to expand our experience on Superfund project since that time. For example, in the early 1980s we provided services such as remedial investigation, groundwater modelling, soil sampling and chemical analysis, geophysical exploration and operation and maintenance activities on notable Minnesota projects such as the Twin Cities Army Ammunition Plant (TCAAP), Reilly Tar and Chemical, and Brainerd Tie Treating Plant. Current work includes investigative work at the Naval Industrial Reserve Ordnance Plant (NIROP) in Fridley, assessment and remedial action research and planning support at Pigs Eye Landfill, and O&M at the MacGillis & Gibbs Site. Tables 2 through 4 in Appendix A demonstrate our staff and project experience locally and throughout the Midwest Region. The key personnel have extensive experience working with state, federal and local clients on Superfund issues. Additional details of our depth, breadth and experience are presented throughout the remainder of this proposal.

Additional Services

AECOM has additional specialized expertise to assist the MPCA/MDA needs. These specialty services include ecological risk assessment, as well as toxicological and human health risk services. In addition, engineering services associated with the design of municipal well and water treatment system engineering have been utilized by MPCA. AECOM is also providing specialized hydrogeologic modelling services under the existing master contract. An example is three dimensional representations of contaminants and use of AECOM's Environmental Sequence Stratigraphy at the MacGillis Gibbs Superfund site. We are also calculating mass flux of contaminants migrating across the site.

Industry leading expertise exists throughout the AECOM system. This expertise can be drawn upon seamlessly by MPCA/MDA as required. The extent of these services has been demonstrated on several projects under the existing Master Services Contract. Of particular note is our wide-ranging work with PFAS contaminants in neighbouring states (See Appendix B and below in this section) and use of our treatability lab in Austin, TX. AECOM is currently using the treatability lab in Texas to test alternatives for treating PFAS impacted water at Pigs Eye Landfill.

AECOM has also utilized staff and expertise in our Water Services Department for municipal water treatment design services. AECOM's water group has provided engineering services for MPCA on projects in Bayport, Spring Park, and St. Louis Park. All of these projects have either been constructed or are in the process of construction.

Resumes of Key Staff

Abbreviated resumes for our key staff members for this contract are included in Appendix A. Resumes detail the educational background for each individual, as well as their licenses and/or certifications, and examples of major project experience. Each resume also provides the classification(s) for that individual, as listed in the RFP.

The key staff member resumes have been provided in alphabetical order for your review.

Personnel Classifications Matrix Table

The AECOM Personnel Classifications matrix table (Table 1) in Appendix A on the following page summarizes staff education, work experience and licenses and/or certifications held for each individual assigned to the contract. It also provides the location of these individuals (local – L or out of state office - O) and their assigned classification(s) for this contract. Resumes for the key staff members in this table are included in Appendix A.

With few exceptions, every staff member offered for services in this proposal has worked on projects directly for the MPCA. This familiarity with MPCA and MDA processes significantly increases the projects successful delivery. This experience covers all of the services listed under this contract including petroleum, superfund, agricultural sites, and closed landfill. Some are among industry leaders in their area of expertise.

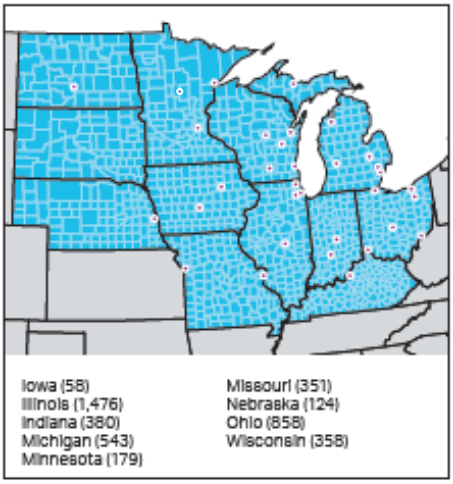
The personnel matrix in Table 1 identifies many AECOM staff with capabilities to assist the MPCA/MDA. Key personnel include individuals from the Minnesota offices which will be utilized for the vast majority of the work completed under this contract. Resumes from a minimal number of additional key staff from outside the Minnesota offices have also been included. AECOM will provide additional resumes to the MPCA/MDA for approval prior to using any additional AECOM staff on the Master Contract.

AECOM Offices

AECOM headquarters is located in Los Angeles, California. We operate presently from two main offices in Minnesota including Minneapolis and Duluth, in addition to a project office in Brainerd. The address for the Minneapolis and Duluth offices are as follows:

- Minneapolis: 800 LaSalle Ave., Suite 500, Minneapolis, MN 55402 612-376-2000
- Duluth: Duluth Technology Village, 11 East Superior Street, Suite 150, Duluth MN 55802 218-625-8768

These offices will be the base from which all services will be provided and all projects will be managed. This allows us to deliver services locally with great familiarity to MPCA and MDA processes, procedures, and expectations.



Midwest Region (Total Staff)

AECOM has offices throughout the Midwest and United States. Other offices in AECOM's Midwest Region that may be involved in projects during the course of the contract are shown on the Midwest Region map.

Experience – Federal & State

AECOM has significant contract experience and completed comparable project work with other State and Federal Agencies and Departments. AECOM currently has or recently had contracts with:

- MPCA: Master, TMDL, Air Toxics, Closed Landfill (through Dept. of Admin)
- MDA: Master
- Minnesota Department of Transportation: Contaminated Property Investigation and Asbestos and Regulated Waste, Transportation Design / Engineering Services, Project Controls and Scheduling, Travel Modelling, Architecture
- Minnesota Department of Administration: Engineering Services
- Metropolitan Council Environmental Services: Geotechnical and Environmental Engineering
- Metropolitan Council/Metro Transit: Design Services
- Metropolitan Council: Central Corridor LRT and Southwest LRT Project - West
- U.S. Army: Toxic and Hazardous Materials Agency (USATHAMA)
- United States Army Corps of Engineers (St. Paul, Detroit, Rock Island Districts): Environmental, Geotechnical and Exploration Services
- U.S. EPA: Alternatives Remedial Contract (ARC)
- U.S. Department of Agriculture/Forest Service: Environmental and Engineering Services
- U.S. Air Force: Environmental and Engineering Services
- U.S. Coast Guard: Environmental and Engineering Services
- U.S. Navy: Environmental and Engineering Services
- U.S. Postal Service: Environmental and Engineering Services
- Various State Agencies: AECOM has experience with most state agencies in the United States. Examples of a few Midwest states where we hold contracts include: Wisconsin, Illinois, Iowa and Michigan including Departments of Administration, Departments of Transportation, Departments of Environmental Quality, Departments of Natural Resources, and Community Development Agency
- Various Counties, Cities, and Townships Examples include: Minneapolis, St. Paul, Duluth, and Brown County.

The scope of services on the aforementioned contracts has included research, remedial investigation/feasibility studies, engineering and design, construction oversight, removal and remedial

actions, cost estimating, corrective action design, risk assessments, remedial action, long-term operation and maintenance, monitoring, closure and permit application consulting.

PFAS

AECOM has developed and become an industry leader on **PFAS**. As of 2018, AECOM has conducted PFAS investigation and remediation at nearly 200 sites in US, supporting federal, government, state, private and Department of Defense clients. A full description of AECOM's PFAS-related services is provided in Appendix B. AECOM has also conducted numerous research and development studies on PFAS and is in constant collaboration with leading academics, including the University of Georgia. AECOM has been the primary Consultant for the Michigan Department of Environmental Quality (MDEQ) on PFAS sites for over 5 years. This has evolved into working on dozens of individual PFAS project sites as well as providing state-wide PFAS support to the MDEQ and the Michigan PFAS Action Response Team (MPART).

Support on PFAS sites has dealt with the aqueous film forming foam (AFFF) at multiple DOD facilities and airports, textile protective coatings (Scotchgard) at a former tannery, application of biosolids applied to farm fields from wastewater treatment plants (chromium platter source), and landfills. Support provided has included:

- Historical research of PFAS uses at facilities and potential contributing sources
- Identification of potential human health and environmental receptors
- Extensive residential and municipal well sampling (over 2,000 locations)
- Surface water and foam sampling
- Biota sampling
- Remedial investigations to delineate the extent of PFAS impact in soil and groundwater via soil borings, vertical aquifer sampling, and installation of monitoring wells
- Developing conceptual site models (CSM)
- 2D and 3D models depicting distribution and fate and transport of PFAS impact in groundwater
- Developing and managing large databases to house all site data including thousands of sampled locations
- Development of figures and graphical tools to depict site conditions and PFAS plume extent including residential sampling maps, plume maps, heat maps, potentiometric surface maps, 2D and 3D cross sections
- Preparing various reports detailing various investigations and findings
- Level 2 and 4 data validation

AECOM also assists Michigan and MPART with multiple PFAS issues under a state-wide PFAS contract with the MDEQ. The MPART team was enacted by the governor by Executive Directive 2017-4 to ensure comprehensive, cohesive, timely response to continued mitigation of PFAS substances across Michigan and is comprised of a cooperative relationship of 10 Michigan agencies. AECOM has worked closely with the MPART teams' senior management advising on overall strategy and policy for dealing with PFAS and assisting with the following tasks:

- State-wide sampling over 1,300 municipal drinking water supplies
- Developing PFAS specific standard operating procedures (SOPs) for multiple media (groundwater residential sampling, surface water, wastewater, sediment, soil, deer, fish, foam sampling)
- PFAS training for state staff
- Developing a summary of feasible remedial technologies
- Developing a state-wide quality assurance project plan (QAPP)
- Providing analytical method evaluation and support
- Level 2 and 4 data validation
- Residential, municipal, wastewater treatment plant, landfill, and groundwater monitoring well sampling

MPCA VIC Guidance Documents

AECOM's experience utilizing the MPCA VIC guidance documents is generally during consulting services provided by voluntary parties conducting site evaluations and clean-ups associated with non-petroleum and non-Ag-chemicals. In most cases, the results of the site work lead to the issuance of "Written Assurance letters" by the MPCA. AECOM's work in the VIC program dates back to the early 1990s with work completed by our staff for the City of St. Louis Park, City of Minneapolis, Dakota County, Ramsey County Regional Rail, and the Minnesota Department of Transportation. Guidance documents were developed as the program matured to assist consultants and voluntary parties in meeting the requirements and the expectations of the MPCA staff and the VIC program requirements.

Guidance documents 1 through 7 provide general information for voluntary parties which provide information relative to the VIC program, applicable laws, written assurances, consultant selection and project scheduling. Guidance documents 8 through 19 provide direction for the phased investigation, evaluation, design and documentation of a response action. Guidance documents 20 and 21 provide a summary of program costs as well as available financial incentives for the volunteer. These documents are informational for the volunteer to assist in their planning and budgeting for project activities.

Also applicable to the Brownfield/VIC program are the guidance documents for soil vapor assessments and vapor mitigation response actions.

AECOM's knowledge with the VIC Guidance Documents is demonstrated by our depth of project experience. We have completed numerous VIC projects as demonstrated from the projects AECOM has worked on listed below.

- Wayzata Home Laundry
- Specialty Manufacturing Building
- Minnegasco Meter Sites (30 sites)
- Dale Street Shops
- US Banks Headquarters
- MnDOT Owatonna Truck Station
- Northern Asphalt - Blaine
- Lost Lake Dump
- Pioneer Metal Finishing - Minneapolis
- Koehler's Addition to Mound
- (Former Tonka Main Plant Site)
- 750 Pelham Boulevard
- Shoreham Yard
- Northtown Shopping Center
- Minnetonka AAMCO Transmission
- St. Louis Park II Apartments
- Minnehaha Mall
- Maplewood Transfer Center
- St. Louis Park Recreation Center
- Robbinsdale Cleaners
- Shiloh (Union Brass)
- Brooklyn Park Vapor
- Halifax Park
- Park Rapids Dump

- Wuolett Bakery – Robbinsdale
- MnDOT Windom Truck Station
- LA Fitness – Roseville
- South Halifax Park - Robbinsdale
- True Value District – Mound
- Shiloh Baptist Church
- Village Creek
- Dale Street Shops
- Anoka/Ramsey Derailment
- Former Red Wing MGP
- Former Excelsior MGP
- Navarre Corporation – New Hope
- Brainerd Shops
- High Bridge Power Plant
- Former Stillwater MGP
- Continental Properties – W. St. Paul
- MCES Mound Interceptor
- Harness Track – Columbus Township
- LA Fitness - Roseville
- Lost Lake Dump – Mound
- Former Wilkins Pontiac – St. Louis Park
- I-35E Cayuga Corridor
- TH 61/63 Red Wing Bridge Corridor
- TH 61 Hastings Bridge Corridor
- Benson ADA Corridor
- I-94 St. Paul Corridor
- MnDOT Arden Hills Training Facility
- 25th and Granary (Minneapolis) Corridor
- 33rd and Talmage (Minneapolis) Corridor
- TH 169 (Champlin) Corridor
- TH 4 (St. James) Corridor
- DSPA Parcel – Duluth
- TH 62/I-35W Corridor – Minneapolis
- Maryland Avenue Bridge, St. Paul
- TH 149 High Bridge
- East Maintenance Facility, Minneapolis
- Hiawatha Yard Redevelopment, Minneapolis
- I-35W North MnPASS Corridor, Roseville to Blaine
- BF Nelson Park Site
- Boom Island Park Site
- Union Depot, St. Paul

- Crosby Lake Redevelopment, St. Paul
- HCCRA West Corridor, Minneapolis
- Main Street Bridge, Minneapolis
- Cepro Ramp, Minneapolis
- Former Best Buy Headquarters, Eden Prairie
- TH 13/CSAH 5 Corridor, Burnsville
- Richfield Lake Dump Sit

Knowledge of MERLA, Land Recycling Act, CERCLA, RCRA, National Oil and Hazardous Substances Contingency Plan and State & Federal Remediation

AECOM is intimately familiar with the Minnesota Environmental Response and Liability Act (MERLA), the Land Recycling Act (LRA), the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) as amended, the Resource Conservation and Recovery Act (RCRA), the National Oil and Hazardous Substance Contingency Plan (NCP), and pertinent state and federal regulations. This familiarity is best demonstrated by the various projects completed by AECOM staff under each statute.

MERLA Projects: AECOM reviewed the present and past Minnesota Permanent List of Priorities (PLP) often referred to as the State Superfund List. AECOM Minnesota has been involved with numerous PLP sites. A list of the PLP sites with which AECOM personnel have provided services is presented below:

- Anoka Municipal Sanitary Landfill (SLF)
- Bassett's Creek/Irving Ave. Dump
- Boise Cascade/Onan
- Brooklyn Park Dump
- Flying Cloud SLF
- Fridley Commons Park Well Field
- Hanson SLF
- Hopkins SLF
- LeHillier Mankato
- Redwood County SLF
- Robbinsdale Development Site
- St. Louis River/Interlake/Duluth Tar
- South Andover
- Twin Cities Air Force Reserve Base
- U of M/Rosemount Research Center
- West River Parkway Site
- Joslyn Manufacturing
- Schloff Chemical
- Valentine Clark
- Koppers Coke, Energy Park
- Westgate/280 Landfill
- Ritari Post and Pole
- Brainerd Tie Plant
- Anoka/Ramsey Derailment Site
- Arrowhead Refining Co.
- Boise Cascade/Medtronic
- Brainerd Former City Dump
- Doc's Auto Salvage
- FMC Corp./Fridley Plant
- Grand Rapids Area SLF
- Highway 96 Dump
- Isanti Solvent Site
- Minnegasco / Minneapolis Gas Mfg.
- Reilly Tar and Chemical
- Former Tonka Main Plant Site
- St. Louis River/U.S. Steel
- Trio Solvent Site
- Twin Cities Army Ammunition Plant
- Union Scrap - St. Paul
- Woodlake SLF
- West Duluth Industrial Site
- Pig's Eye Landfill
- Reserve Mining
- Edina Well Field
- Park Penta Site
- Washington County Landfill

- Waite Park Wells Site
- Waite Park Cark Shop Site
- BJ Carnie Wood Treating Site
- East Bethel Landfill
- WLSSD Landfill

Land Recycling Act (VIC) Sites: AECOM Minnesota has significant experience with the Minnesota Land Recycling Act, which in 1992 was enacted to allow parties to clean up polluted sites and go forward with new economic development with protection from liability. Since 1992, AECOM has worked on over 75 MPCA Voluntary Investigation and Clean-up (VIC) project sites.

AECOM became very active in the VIC program shortly after the Land Recycling Act was enacted. In 1994, AECOM staff prepared a paper to help professional peers understand and expand the use of the program. Their paper was entitled "Minnesota Voluntary Investigation and Clean-up Program Voids Superfund and Provides Assurance of No Action" (Proceedings of Environmental Restoration and Waste Minimization, 1994). The paper provided an outline of the VIC program and a case history of the clean-up of the former Wilkins Pontiac Site located near the St. Louis Park Medical Center.

CERCLA Sites: AECOM has also been involved in numerous CERCLA sites. NPL sites in Minnesota on which AECOM Minnesota has had significant involvement include:

- Twin Cities Army Ammunition Plant
- Reilly Tar and Chemical
- Joslyn Brooklyn Center
- MacGillis and Gibbs
- Baytown Township Groundwater Contamination
- Arrowhead Refinery
- Brainerd Burlington Northern Tie Plant
- FMC Corporation Fridley Plant
- St. Louis River/Interlake/Duluth Tar
- Navy Industrial Reserve Ordinance Plant
- Oakdale Dump
- St. Regis Paper
- Waite Park Wells
- Ritari Post and Pole Site

Work included remedial investigation, groundwater modelling, system design, system installation oversight, risk assessment, public presentations, and five-year reviews.

The AECOM contract team in this proposal has also worked on a number of other NPL sites throughout the Upper Midwest. These include:

- Marina Cliffs, Wisconsin
- Midstates, Wisconsin
- Spickler, Wisconsin
- Fox River, Wisconsin
- Torch Lake, Michigan
- Peerless Plating, Michigan
- High Mill Site, Michigan
- Savannah Army Depot, Illinois
- Wausau Groundwater Contamination, Wisconsin
- Outboard Marine Corp., Wisconsin
- Himco Dump, Indiana
- International Paper, Cass lake
- Main Street Project, Indiana
- Waite Park Well/Car Shop
- Koppers Coke, Energy Park

A portion of this work was performed directly for the U.S. EPA under the Alternative Remedial Contract (ARC).
RCRA Projects: AECOM RCRA experience includes the following projects:

- Stora Enso Lead Vault
- North Star Steel
- CN Proctor
- Waupaca Foundry

- Grede Foundry
- Cannon Equipment, Cannon Falls
- Brainerd Tie Plant
- Paxton Mitchell Foundry
- Weyerhaeuser CSC
- Coal City RFI
- Mittal Steel
- Motor Wheel
- Proctor Railyard

Services have included Part A and B permit submittals, Work Plan preparation, RCRA facility investigations (RFIs), development of risk-based clean-up goals, corrective action design and corrective action implementation. AECOM also assisted with the remediation of RCRA wastes by bioremediation. Bioremediation permitted the reclassification of these materials from hazardous waste to a special waste.

National Oil and Hazardous Substance Contingency Plan (NCP): Several of the NPL sites listed above were required to be completed in accordance with NCP procedures. Sites which followed strict NCP procedures include:

- Marina Cliffs
- Midstates
- Spickler
- Fox River
- Master Disposal

The above projects were all projects completed by AECOM under contract to the RPs.

AECOM was also directly involved in assisting with the negotiation of the Record of Decision (ROD) for the following three sites:

- Midstates
- Spickler
- Master Disposal

Other Pertinent State and Federal Regulations: AECOM is familiar with other pertinent state and federal regulations that may be required to be addressed on a projects-specific basis. Pertinent federal regulations may include the following:

- Toxic Substance Control Act (TSCA)
- Hazardous Materials Transportation Act (HMTA)
- Clean Air Act - CAA
- Clean Water Act - CWA
- OSHA - Site Safety
- Safe Drinking Water Act (SDWA)
- Asbestos Hazardous Emergency Response Act (AHERA)

Pertinent state regulations may include the following:

- MDH Asbestos Inspection and Assessment, Minnesota Rules, Part 4620.3460
- Duty to Notify and Avoid Water Pollution, Minnesota Stat. § 115.061
- Land Treatment of Petroleum Contaminated Soils, Minn. Rules Chapter 7037
- MDH Rules governing monitoring well installation/abandonment
- Minnesota Surface Water Quality Standards, Minn. Rules Chapters 7050 and 7052

AECOM

C

PROJECT DESCRIPTIONS

Section 3 - Project Descriptions

Following are descriptions of two remedial investigation or remedial design specific to solid waste facilities conducted by AECOM within the last five years. Both projects include site investigation and MPCA approved actions.

AECOM has selected the Duluth Dump #1 located in Duluth and Minnesota Valley Landfill located in Savage. Both of these projects have been conducted by AECOM for the MPCA. Following is the information requested for these projects.

Duluth Dump #1 – Duluth, Minnesota

Project Information

Duluth Dump #1
Duluth, Minnesota

Client Contact

Eric Pederson
Minnesota Pollution Control Agency
St. Paul, MN
Phone: 651-757-2645

Site Description

The Site operated from 1954 to 1959, accepting mixed municipal solid wastes, which filled in portions of a wetland area. Some unsanctioned dumping of wastes may have continued after this time. Official closure was in 1962. Demolition wastes were disposed of in the northwestern portion of the Site until at least 1988. The responsible party was determined to be the City of Duluth.

A Remedial Investigation was conducted in 1995. Remedial Phase I activities (consolidation, soil cover, gas vents) were completed by the City of Duluth from 1999 – 2002. In 1999 to 2002, the east side of the dump was consolidated and moved out of the East Branch of Chester Creek and its wetlands. In 2006, fill on the southeast side of the dump and under power lines was moved to the western side of the current dump. In addition, buildings (except the barn on the southwest corner of the dump) were razed and incorporated into the western side of the current dump. Periodic groundwater, surface water and residential well monitoring have been performed since approximately 1989.

Based on the analytical data, the contaminants of concern at the Site include arsenic, benzene, vinyl chloride, iron, lead, manganese and low level mercury.

Project Description

AECOM was tasked with conducting a test pit trenching investigation to delineate the amount of waste present in the landfill that required remedial action. Areas targeted for investigation and resultant remediation was due to the waste either being exposed or located off the property limits established for the landfill. The results of the waste delineation activities were then used, in conjunction with previous monitoring activities and results, to evaluate the risks and future remedial activities that may be needed to support site closure.

AECOM oversaw the completion of 13 test pits/trenches around the northern, western and southern perimeters of the existing dump. AECOM directed the excavation contractor to extend each of the test pits and/or test trenches to native soil conditions below waste material encountered at each location. The trenches began near the toe of the dump and extended outward to delineate the lateral and vertical extent of unconsolidated waste material. Trenches were extended outward from the dump as long as waste was observed in the trench. Once native soil was observed at depth, the trench was stopped and another location investigated. This general procedure was conducted at each investigation location. At each test pit location, AECOM classified and documented the thickness of the existing cap material, the thickness and type of waste material and the depth to native or non-waste material. Site investigation work was overseen by a Minnesota licensed professional geologist. Excavation materials were screened utilizing a PID equipped with an 11.7 eV lamp.

The results of the waste delineation activities were used to conduct a Focussed Feasibility Study (FFS) to address the waste that presented unacceptable risks. The FFS included:

- List of four suitable alternatives
- Description of each alternative
- Comparison and screening of each alternative
- Cost Estimate for each alternative

The comparison and screening process included using Hydrologic Evaluation of Landfill Performance (HELP) software developed by the U.S. Army Engineer Waterways Experiment Station for the U.S. Environmental Protection Agency Risk Reduction Engineering Laboratory. The HELP software provided an expected performance result for each alternative that made for quantitative comparisons across the alternatives. The performance result combined with the alternative description and cost estimate was presented in the FFS to the MPCA for further site closure decisions.

AECOM Personnel: Darin Albrecht, Dan Cervin, Joe Pearson, Daryl Beck, Cliff Shierk, Ben Klaus

Project Tasks

- Health and safety planning
- Remedial Investigations
- Monitoring Well installation
- Quarterly groundwater monitoring
- Petroleum Fingerprint Analysis
- Remedial action implementation oversight
- Receptor (manhole) abandonment
- Geoprobe drilling investigations

Subcontracted Tasks

- Excavation – Test pits

Subcontractors: Veit

Minnesota Valley Landfill – Savage, Minnesota

Project Information

Contributing Area Investigation
Naval Industrial Reserve Ordnance Plant
Fridley, Minnesota

Client Contact

Steve Schoff
Minnesota Pollution Control Agency
St. Paul, MN
Phone: 651-757- 2701

Site Description

The Minnesota Valley Landfill project is being completed under the Minnesota Superfund Program. Waste disposal at the Minnesota Valley Landfill began in the early 1960s and continued into the 1970s. Sources of disposed wastes included household, commercial, industrial, agricultural and institutional. Wastes were likely deposited in close proximity to groundwater and bedrock. A 900,000 gallon fuel oil release which occurred in the dump area prior to waste deposition and releases from an oil storage facility adjacent to the south side of the dump also likely impacted soil and groundwater. Previous environmental subsurface assessment activities were completed in the early 2000s on the northern portion of the Site with no activities being conducted on its southern portion.

AECOM was tasked with conducting a comprehensive subsurface investigation to assess conditions on the southern portion of the site which included:

- Excavating six test pits
- Advancing five soil borings which were completed as monitoring wells
- Collecting groundwater samples from each of the installed monitoring wells
- Sampling sediment at five locations

- Sampling surface water at three locations
- Installing two soil vapor probes to collect soil vapor samples

Prior to completing the field assessment work, AECOM assisted MPCA staff with securing access agreements and arranging access to the site to complete the subsurface assessment activities described above.

The results of the subsurface assessment work provided the MPCA with information that progressed the Site towards focused receptor-specific action plans and remedial action.

AECOM Personnel: Tony Coryell, Ryan Doherty, Daryl Beck, Al Gorski

Project Tasks

- Health and safety planning
- Test pit oversight and documentation
- Soil boring advancement, soil sample collection, and lithology documentation
- Monitoring well installation and groundwater monitoring
- Sediment sampling along boundary of the landfill
- Conducting soil vapor sampling
- Reporting preparation

Subcontracted Tasks

- Laboratory services
- Drilling
- Waste Disposal

Subcontractors: Thein, Pace Analytical, Clean Harbors

AECOM

C SCOPE OF SERVICES

Section 4 – Scope of Services

Category C – Scope of Services

Tables 2, 3 and 4 present a summary of our personnel and project experience for each of the service areas listed in the RFP. The following sections provide a narrative of AECOM experience with each of the scope of services.

1. Design remediation systems and strategies for remediation of subsurface contamination, including soil, solid waste, groundwater, methane, and/or other vapor

AECOM has extensive remedial action design experience. In Minnesota we have designed over 100 active remedial action systems for both private and public sector clients. We have completed comprehensive remedial action design services on a number of landfill and solid waste site as well as Petroleum, Superfund, and Agricultural Chemical Site dating back to 1985. A comprehensive list of remedial systems and technologies that AECOM has evaluated and progressed through design and implementation are listed below:

- Hydrogen peroxide infiltration
- Biopiles/biomounds
- Oxygen release compound (ORC)
- Groundwater cutoff walls
- Peat treatment systems
- Air Sparging
- Constructed wetland remediation systems
- Vacuum enhanced product recovery
- Dual Phase Extraction
- Phytoremediation
- Hydrogen release compound
- Thermal oxidation
- Vapor extraction
- Natural attenuation
- Ozone treatment
- In situ bioremediation
- Incineration
- Reactive Barrier Walls
- Metal stabilization
- Carbon treatment
- Reverse osmosis
- Landfilling
- Chemical fixation
- Reaction trench
- Funnel and Gate Applications

- Deep soil mixing and stabilization
- Source Removal
- Slurry Walls
- Bioventing
- Groundwater pump and treat
- Geosynthetic liner cap design
- Thermal desorption
- Metal filings
- Photolysis
- LNAPL and DNAPL Assessment and Recovery

Remediation systems our Minnesota staff have designed include soil excavation, groundwater recovery wells, soil vapor extraction systems, in-situ chemical oxidation, air sparging systems, dual phase extraction, skimmer / product recovery systems, air strippers, mitigation of petroleum vapors in sewer systems/buildings, sewer or building ventilation systems, soil treatment, enhanced natural attenuation with oxygen supplementation (ORC), and bioremediation (bio-piles, land spreading, bio-venting, biological treatment of soils through infiltration galleries, bio-treatment of surface water, etc.).

The work for Remedial Action Design Plans includes preparing plans for construction of remedial/corrective action systems for soil, groundwater, surface water and sediments including all necessary evaluations, computations, specifications and engineering cost estimates to enable preparation of a biddable construction contract. This work also includes providing operation and maintenance plans for the treatment systems and cost estimates for operation and maintenance for the duration of the clean-up. Examples of projects include MacGillis & Gibbs, LF Knutson, MDA – Cedar Services, and Pigs Eye Landfill.

AECOM has recently provided engineering support services to the MPCA for activities at the Duluth Dump#1 Site in Duluth.

AECOM also has direct experience in utilizing the MPCA Purchasing Manual to procure subcontract as well as contracted services through the Department of Administration (MDA). Examples of projects completed under contracts through MDA include; LF Knutson, AC Oil-Clearbrook, Duluth Dump #1, and CS Services.

2. Oversee or Conduct Bench-Scale Lab Treatability Studies, Pilot Testing and Field Demos

AECOM has conducted bench-scale treatability studies in our labs in various offices. AECOM is currently conducting a 2-part approach to evaluating the effectiveness of remedial activities conducted at the Pigs Eye Landfill in the early 2000s. To attenuate PFAS impacted groundwater located within the footprint from migrating to Battle Creek and Pigs Eye Lake, a permeable barrier of highly organic content soil, commonly referred to as Select Fill, was placed along a section of Battle Creek and Pigs Eye Lake. AECOMs current work is to evaluate the effectiveness of the existing Select Fill installation by collecting groundwater samples through the section of Select Fill.

- First sample within the landfill body
- Next sample partially into the Select Fill
- Next Sample further through the Select Fill
- Last Sample point at the surface water edge

The intent of the study is to determine if the existing installation is sufficient to attenuate the PFAS compounds prior to discharge to Battle Creek/Pigs Eye Lake or if a thicker or higher organic content Select Fill layer is needed.

The second part of the study consists of bench scale testing centered on varying components of the Select Fill to make it more effective. The testing includes adding more organic material, testing different types of organic material and the addition of enzymes that have shown promise in PFAS destruction in other tests.

AECOM also conducted bench scale and pilot scale testing during the engineering and design activities for the City of St. Louis Park Water Treatment System. The benchscale and pilot testing was conducted to address removal of VOCs, ammonia, metals, radium, and a variety of emerging contaminants. Testing of the treatment technologies included, chlorination, filtration, air stripping, ozone and hydrogen peroxide advanced oxidation process (AOP), and granual activated carbon. The bench and pilot scale testing results were subsequently used in the design of the water treatment plant at well #4.

AECOM completed two bench-scale laboratory treatability studies and a pilot test at the Minnesota department of Agriculture Former Cedar Services Wood Treatment Facility in Bemidji, MN (Site). The first bench-scale study was completed prior to the pilot test to evaluate soil oxidant demand (SOD) at the Site. SOD testing provides an estimate of the combined effects of natural demand due to the soil and demand due to the contaminant. Soil and groundwater samples were collected from the pilot test areas for analysis of SOD. SOD reactors were prepared with a known quantity of Site soil and groundwater and were dosed with sodium persulfate (an oxidant). The SOD tests were conducted with alkaline activation of the sodium persulfate to demonstrate likely conditions of field injection.

The primary objective of the pilot test was to initiate remediation of subsurface contaminants at the Site while collecting data in order to optimize design and implementation of future, larger-scale remediation. Preliminary remediation activities were completed at two locations on the Former Cedar Services Property near the contamination source area and at two downgradient locations approximately 600 feet from the source area. The source area pilot test consisted of two remediation areas where two different chemical agents (Provect-Ox and alkaline activated persulfate) were injected in a grid pattern via injection points or wells. The down gradient pilot test consisted of two remediation areas. A chemical agent (BOS 200) was injected in a linear patter via injection points at one of the areas. Oxygen releasing compound socks were installed into injection wells at the other area.

A second bench-scale study was completed after the pilot test to determine which persulfate activation method should be proposed for the full scale remedial design. AECOM evaluated the treatability of Site contaminants in Site soils and groundwater by alkaline- and iron-activated persulfate. Soil buffering capacity and the required dosing to effectively implement alkaline-activated persulfate was also assessed during the bench test.

3. Prepare Corrective Action Design Documents (e.g., CAD Design Reports, Pilot Test Reports, Installation Notification Reports, Monitoring Reports, Plans, and As-Built Reports)

AECOM prepares reports and documents in accordance with MPCA Guidance Document formats to the maximum extent possible. Use of the standardized format assures that the MPCA obtains the information required and minimizes the MPCA staff review time.

AECOM has been the prime consultant for over 350 remedial system installations and/or tank removal projects in Minnesota. AECOM prepares plans and specifications and subcontracts remedial installation work and provides construction oversight and system installation monitoring and documentation. On MPCA sites we prepare plans and specifications following the MPCA Purchasing Manual. This includes completing bid documents in accordance with the MDA procurement requirements for projects over $50,000. AECOM is familiar with using the requirements of Disadvantaged / Minority Business Enterprises as well as prevailing wage requirements for state contract work.

AECOM documents the construction activities performed by the contractor and prepares implementation reports. The implementation report identifies the construction activities and any deviations required for construction. As-built drawings are included in the reports, if appropriate given the size and complexity of the project.

AECOM has provided services related to corrective action design, procurement and/or subsequent implementation reporting to the MPCA, including:

- Cedar Services
- Middle River Gas Station

- Bridal Veil/Valentine Clark
- CS Services
- LF Knutson & Sons

4. Prepare Health and Safety Plans (HASPs)

AECOM routinely prepares site specific Health and Safety Plans (HASPs) for our work on all identified petroleum, hazardous materials and Ag-chemical release sites in accordance with OSHA 1910.120. Additionally, we prepare HASPs for all tank removal projects where there is a potential for a release to the environment. The HASPs include a description of the project site, emergency contract information, the anticipated chemicals of concern, task hazard analyses, action levels for donning protective personal equipment and/or stopping work as well as directions and a map detailing the quickest route to a hospital in the advent of an exposure or accident on the site.

Each HASP is reviewed by the AECOM Regional Safety Officer or his designated alternate. The Regional Safety Director has direct responsibility for final approval of all HASPs prepared by AECOM. AECOM requires all subcontractors to be in compliance with the project HASP. Individuals that are not in compliance with the HASP will be removed from the project site.

5. Oversee Site Investigation Services for Soil Boring Advancement and Monitoring Well Installation Using Both Standard Drilling Methods and Push Probes

AECOM has conducted numerous site investigation projects across the entire state while encountering a variety of weather conditions. AECOM staff has direct experience in overseeing and performing site investigations including a full variety of subsurface exploration methodologies. Examples of the type of drilling performed include: hollow stem augers, mud rotary, sonic, flight augers, air rotary, bedrock coring and sampling and push probe sampling. AECOM also has experience with sampling of sediments using drilling equipment on barges and through ice on frozen water bodies. Specialty sampling methodologies must be used in order to successfully sample sediments.

Some project examples where AECOM has provided site investigation services using soil boring and monitoring well technique include Smith Ave – St. Paul; Middle River Gas Stations – Middle River; Longville, MN; LF Knutson – Warren; Cedar Services in Bemidji, and MacGillis & Gibbs Site in New Brighton.

6. Conduct Ground Water, Soil, Surface Water, Sediment, and Air Sampling and Monitoring

AECOM follows the appropriate MPCA Petroleum Remediation Program (PRP) Guidance Documents and Voluntary Investigation and Clean-up (VIC) Guidance Documents for sampling groundwater, soil, surface water, sediments and air media for investigation and clean-up activities in Minnesota. AECOM personnel have significant experience in the sampling of environmental media. A brief description of our sampling capabilities in each of these areas and a few recently completed projects demonstrating our experience in specific media sampling are provided below.

Groundwater Sampling and Monitoring for PRP Sites - AECOM collects groundwater samples on petroleum release sites in conformance with the protocols defined in MPCA Guidance Document 4-05 - Groundwater Sample Collection and Analysis Procedures. When appropriate, our personnel also obtain groundwater samples or complete in-field measurements required to assess natural attenuation at petroleum release sites (MPCA Guidance Document 4-03). This information can be supplemented with additional protocols described in the 1995 MPCA Groundwater Sampling Guidance Manual. AECOM groundwater sampling experience includes collection of samples from excavations, push probes, temporary wells, monitoring wells, water supply wells, and recovery wells. AECOM also has experience in collecting water samples using lysimeters, and specialized sampling equipment. AECOM submits these environmental samples to State Contractor laboratories certified by MDH or the MDH Environmental Laboratory per the project requirements. Quality control/quality assurance samples, including trip blanks, field blanks, equipment blanks and duplicate samples, are also collected as required per Section 6.4 of Guidance Document 4-05.

Groundwater sampling methodologies utilized by our staff include using dedicated well pumps, submersible pumps, peristaltic pumps, bladder pumps, diffusion samplers, bailers, Grundfos pumps, Solinst multilevel system. In addition to retrieval of samples, AECOM collects field data during groundwater monitoring including groundwater level, concentrations of dissolved oxygen, specific conductivity, temperature, pH and redox potential and other data as required for assessment of natural attenuation at petroleum release sites. Sampling is documented on Sampling Forms and samples are transported under Chain-of-Custody record. The sampling documentation is included in each report.

Groundwater monitoring on a typical remedial investigation site includes several sampling events, trend analysis and reporting. AECOM plots data results to provide a visual representation of the information, saving MPCA staff review time. Results are reported in accordance with Guidance Document 4-08 Monitoring Report.

Project examples where AECOM has provided ongoing groundwater sampling and monitoring for the MPCA PRP include L.F. Knutson and Sons, Wally's Spur, Middle River Gas Stations, and CS Services.

Groundwater Sampling and Monitoring for Superfund, VIC and RCRA Sites - AECOM collects groundwater samples on these sites in conformance with the protocols defined in the MPCA VIC Guidance Documents and in conformance with an MPCA approved quality assurance project plan (QAPP) and sampling and analysis plan (SAP), as required. AECOM submits these environmental samples to State Contractor laboratories certified by MDH or the MDH Environmental Laboratory per the project requirements. Quality control/quality assurance samples, including trip blanks, field blanks, equipment blanks and duplicate samples, are collected as required per the QAPP or SAP.

In addition to retrieval of samples, AECOM collects field data during groundwater monitoring including; groundwater level, concentrations of dissolved oxygen, specific conductivity, temperature, pH and redox potential and other data as required for assessment of natural attenuation at petroleum release sites. Sampling is documented on Sampling Forms and samples are transported under Chain-of-Custody record. The sampling documentation is included in each report.

Project examples where AECOM has conducted groundwater sampling and monitoring for the MPCA include Pigs Eye Landfill, MacGillis and Gibbs, and Cedar Services.

Soil Sampling and Monitoring for PRP Sites - AECOM collects soil samples on petroleum release sites in conformance with the protocols described in MPCA Guidance Document 4-04 Soil Sample Collection and Analysis Procedures. AECOM soil sampling experience includes using a variety of sampling methods including the following:

- Manual methods that include grab samples, spade, soil tube and hand auger borings
- Field screening of soil samples
- Soil sampling using the split-spoon sampler, and Shelby tube samplers
- Sampling for volatile contaminants using Method 5035
- Direct-push sampling methods using “discrete” and “Macrocore” samplers
- Soil samples retrieved from test pits conducted by backhoes and other large equipment
- Stockpile sampling required for characterization of materials for off-site treatment/disposal
- Composite soil sampling

Soil samples are analysed for contaminants of concern by State Contract laboratories. AECOM collects QA/QC soil samples in accordance with Guidance Document 4-04 including methanol trip blanks for VOC/GRO samples and blind duplicate samples where required. Soil samples are collected in laboratory provided sample bottles with associated preservative (if required), placed immediately in a cooler on ice and delivered to the laboratory under chain-of-custody record.

Soil field screening activities are completed where a PID or FID are used to identify impacted soil and segregate materials. AECOM follows the MPCA polyethylene bag headspace procedure for field screening soil. Biomound monitoring is an example of soil sampling to develop degradation trend leading to facility closure.

Petroleum soil sampling projects completed by AECOM include L.F. Knutson and Sons and Middle River Gas Stations.

Soil Sampling and Monitoring for Superfund, VIC and RCRA Sites - AECOM collects soil samples on these sites in conformance with the protocols defined in the MPCA VIC Guidance Documents and/or in conformance with an MPCA approved QAPP and SAP, as required. Quality control/quality assurance samples including are collected as required per guidance or as outlined in the QAPP or SAP.

AECOM soil sampling experience includes using a variety of sampling methods including the following:

- Manual methods that include grab samples, spade, soil tube and hand auger borings
- Field screening of soil samples
- EnCore™ and TerraCore™ Samplers
- Soil sampling using the sonic sample core, split-spoon sampler, and Shelby tube samplers
- Sampling for volatile contaminants using Method 5035
- Direct-push sampling methods using “discrete” and “Macrocore” samplers
- Soil samples retrieved from test pits conducted by backhoes and other large equipment
- Stockpile sampling required for characterization of materials for off-site treatment/disposal
- Composite soil sampling

Soil samples are analysed for contaminants of concern by State Contract laboratories. Soil samples are collected in laboratory provided sample bottles with associated preservative (if required), placed immediately in a cooler on ice and delivered to the laboratory under chain of custody record.

Soil field screening occurs where a PID or FID are used to identify impacted soil and segregate materials. AECOM follows the MPCA polyethylene bag headspace procedure for monitoring soils with a PID. Soil sampling projects completed by AECOM include St. Louis Park Plume Investigation, Pigs Eye Landfill, and MacGillis & Gibbs.

Surface Water Sampling and Monitoring - AECOM collects surface water samples as part of the site investigation activities on a project site, if sufficient risk or potential for surface water impacts exists. AECOM has completed surface water sampling for lake monitoring surveys, contaminant surveys, and habitat studies. Sample collection includes grab sampling, and discrete-depth sampling conducted using the "Kemmerer" or other triggerable sampling devices. AECOM has experience in conducting surface water monitoring using automated sondes or other electronic probes deployed for long-term monitoring efforts. Surface water monitoring conducted by AECOM has included flow measurement, habitat surveys, and hydraulic modelling. These services are available through the Minneapolis regional office for sites that have a potential for surface water impairment.

AECOM also has experience in providing continuous surface water monitoring. Sampling using interval equipment, such as ISCO samples, and data loggers provides a series of samples which can then be evaluated to determine trends.

Sediment Sampling PRP Sites - AECOM has completed sediment sampling on sites contaminated with petroleum and other contaminants. The origins of sediment contamination can be divided into point and non-point sources of pollution. A petroleum release from a leaking UST/AST would be an example of a pollution point source and an example of non-point source is urban run-off. AECOM has conducted sediment sampling from wetlands and other water bodies using a variety of methods. Direct sample collection is conducted using the thin wall sampler or similar device. Sediment samples retrieved from depth include samples retrieved using a syringe-like sampler for soft sediments, a plunger-activated sampler used for organic sediments that are somewhat more cohesive, and use of a variety of dredges (including the Ekman or LaMotte dredge) to grab samples of more dense sediments. AECOM also has considerable experience obtaining sediment samples from barge-mounted drill rigs during contaminant surveys in rivers and lakes.

Sediment Sampling Superfund, VIC, RCRA Sites – AECOM has completed sediment sampling on these sites in conformance with Section 9.0 of MPCA Draft Guidelines - Risk Based Site Characterization and Sampling Guidance or in accordance with an MPCA approved QAPP or SAP.

Minneapolis office personnel conducted sediment sampling at MPCA projects including the MacGillis & Gibbs and Pigs Eye Landfill sites. The contaminants of concern included heavy metals, organics, PFCs and PCBs. The sediment analysis was used to collect information to assess risk to human and ecological receptors and planning for potential corrective actions.

Air Sampling and Monitoring - AECOM has extensive experience in a wide variety of air sampling and monitoring. AECOM conducts air sampling and monitoring in accordance with MPCA Guidance Document 4-01 *Vapor Intrusion Assessments Performed During Site Investigations.* Air sampling includes soil vapor sampling associated with petroleum and chlorinated solvent plumes, sub-slab sampling, indoor air sampling of residences, remediation system sampling such as air strippers, soil vapor extraction systems and passive vent systems as well as sampling during construction activities including VOC, dust and particulate sampling.

AECOM has direct experience reviewing soil vapor data and interpreting the results based on comparison to the established Intrusion Screening Values (ISVs) to determine if further investigation or corrective action is warranted.

Air sampling performed by AECOM includes calculated low flow and high flow sampling pumps and a host of sampling vessels. We employ canister, charcoal tube absorbent trap, Tedlar bag, filter media and other approved devices compatible with laboratory analytical procedures.

AECOM has also performed passive air/vapor monitoring for point source release identification using GORE® Modules and Beacon passive vapor surveys. We have completed extensive work for the MPCA in St. Louis Park to assist in the identification of contaminant sources related to the chlorinated plume. We have completed numerous vapor investigations for MPCA under the current contract. Additional examples of projects completed utilizing air sampling and monitoring include Smith Ave, Minnesota Plating, CS Services, Pigs Eye Landfill, and the City of St. Louis Park Plume Monitoring.

7. Conduct Vapor/Air Monitoring for Health and Safety and Air Quality Criteria

AECOM develops a site-specific health and safety plan (HASP) for each project which provides action levels for upgrading of personnel protective equipment, notification of emergency response personnel if explosive gas conditions exist, etc. Vapor monitoring is critical on sites with free product or highly contaminated soils which provide a source for vapors.

AECOM has experienced personnel in the Minneapolis office available that conduct gaseous-phase monitoring for air quality criteria and health/safety purposes. Monitoring for health and safety purposes and for comparison to air quality criteria is included in the Health and Safety Plan. In our Minnesota office, we own and operate PID meters, flame ionization detectors, explosimeters, Jerome Mercury Vapor Analyzer, vapor pumps, vapor points, Draeger tubes, an Aircheck sampler and methane meters which can be used for monitoring vapors. In addition, other specialized equipment is rented on an as needed basis such as four-gas meter and dust / particulate meter. AECOM field personnel are trained and have experience in the operation and use of each piece of equipment. Calibration records are maintained with each instrument. AECOM has monitored vapors and air quality on literally hundreds of site investigations completed in Minnesota and throughout the Midwest. Our technicians have conducted vapor surveys at virtually every LUST site under AECOM investigation.

Vapor monitoring is conducted by AECOM during the vapor intrusion assessments of petroleum release sites, as required in MPCA Guidance Document 4-01a. Buildings and utility structures that extend through/near impacted soil or groundwater are monitored to evaluate vapor risks. Ongoing monitoring of vapors is conducted by AECOM using vapor observation wells, vapor probes, or other repeatable vapor monitoring locations.

8. Conduct and/or Oversee Site Assessment Activities (Phase I and Phase II), Limited Site Investigations and Remedial Investigations

AECOM has extensive experience in completing Phase I and Phase II site assessments, Limited Site Investigations (LSIs) and Remedial Investigations (RIs). Phase I and II assessments have been completed by AECOM under the MPCA/MDA Master Contract and for other government agencies, private industrial and commercial clients.

A Phase I site assessment provides the framework for the identification of recognized environmental concerns and chemicals of potential concern. AECOM completes Phase I environmental site assessments in accordance with the technical approach and methodology of the current American Society for Testing and Materials Standard Practice for Environmental Site Assessments (E 1527-05), which meets the requirements of the “All Appropriate Inquiry” Final Rule (40 CFR Part 312). A through records review is part of a Phase I and includes reviewing Sanborn maps, city directories, aerial photographs, libraries and local government records. The Phase I also includes a site visit, interviews, data evaluation and report.

Phase II site assessments are targeted to the area(s) of concern outlined in the Phase I report with the intent to confirm and quantify the presence of environmental impacts. AECOM has utilized a variety of cost effective methodologies in Phase II work to both identify and to obtain site-specific information. Methods include geophysical (EM survey, magnetometer survey, ground probing radar), soil gas (passive and active), push probe, soil boring exploration, monitoring well installation, vapor and air monitoring, and sampling of soil, sediment, surface water and groundwater.

AECOM performs site investigations (Limited Site Investigation - LSI or Remedial Investigation - RI) following MPCA guidelines. Investigations follow the underground storage tank and petroleum remediation Quality Assurance Project Plan (QAPP) and Guidance Document 4-01 *Soil and Groundwater Assessments Performed During Site Investigations*. MPCA policies in place at the time of this proposal require that the

site investigation include a vapor intrusion assessment performed during site investigations, as described in Guidance Document 4-01a. MPCA guidance requires the investigator to formulate a conceptual site model, to target areas that could be impacted by petroleum as it follows a migration pathway from the point of release. Each investigation location can consist of a soil boring or well placement such that samples of the soil and/or groundwater can be collected and analysed following MPCA Guidance Documents 4-04 (soil) and 4-05 (groundwater).

Documentation of the findings made during the investigation is prescribed by MPCA in Guidance Document 4-06 *Investigation Report Form*. The current form is utilized to document the results of a limited site investigation (LSI) for sites where a limited amount of investigatory work is sufficient to justify a decision for site closure. AECOM follows guideline provided in MPCA Guidance Document 4-01*Soil and Groundwater Assessments Performed During Site Investigations* for remedial investigations (RI) where additional investigation and monitoring are required based on the extent and magnitude of impacts. MPCA policies require that the severity of a release be identified, and the horizontal and vertical extent of impacts must be defined. Some sites may require significant investigatory and risk assessment work to define the severity and extent of impacts, and the risks to various receptors (soil contact, groundwater, or vapor intrusion (inhalation) pathways of risk exposure) to evaluate site conditions adequately. Project examples where AECOM has completed the above investigation types include; South Hibbing GW Solvent Plume, MacGillis & Gibbs, Duluth Dump, and Pigs Eye Landfill.

9. Conduct Surface Water, Ground Water, Air and Vapor Receptor Surveys

AECOM routinely completes surface water, groundwater and vapor receptor surveys on project sites. AECOM has completed approximately 350 receptor surveys and associated risk assessments in Minnesota over the last 20 years. We complete receptor surveys following the procedures outlined in MPCA Guidance Document 4-02 Potential Receptor Surveys and Risk Evaluation Procedures at Petroleum Release Sites. The risk evaluation is completed early in the project as a planning tool for future investigation/corrective action activities. If high or potential high risks to surface water, groundwater and/or vapors are identified, the site is considered an emergency or high priority site.

The remainder of this section outlines the procedures typically followed for surface water, groundwater and vapor receptor surveys and risk assessments on petroleum release sites.

Surface water receptor survey and risk assessments conducted by AECOM evaluate the potential for surface water impacts resulting from a contaminant plume or from an emergency response to a free product release. The surface water receptor survey includes locating all surface waters (including wetlands) within 1/4 mile of the site using USGS topographical maps and other surveys. Other potential surface water receptors are identified during the 500 foot walking survey. For example, storm sewers can act as a direct conduit to surface water. AECOM has seen free product transported more than 1/2 mile within a storm sewer.

If a surface water receptor is identified by the receptor survey, a boring or a monitoring well is placed between the surface water and the release source. Estimation of groundwater discharge into the surface water is prescribed by Section 9 of MPCA Guidance Document 4-06 *Investigation Report Form*. AECOM can also provide more detailed groundwater discharge modelling on sites where it is appropriate to do so. Discharge standards calculated for specific sites can be compared to Tier 1, Tier 2, and Tier 3 surface water standards established by MPCA for specific surface water bodies per Minnesota Rules 7050/7052.

Water well receptor survey and risk assessments include considering the concentration and distribution of contaminants encountered from a release site, and proximity to identified potential groundwater receptors. The water well receptor survey identifies water supply wells that may be at risk from the petroleum release and also provides information regarding geology and groundwater use near the release site. Following are the main components of the water well receptor survey and risk evaluation:

- A walking well survey within a 500 foot radius from site
- Public water supply confirmation with city or municipality water department
- Well records search and review using the MDH CWI database

- Drinking water supply management areas/source water assessment areas using Guidance Document 4-18 Public Water Supply Risk Assessment at Petroleum Remediation Sites
- Risk Evaluation to guide soil and groundwater investigation

Vapor receptor survey and risk assessments are conducted by AECOM on sites where a review of site conditions within 500 feet of the release source indicates a potential for vapor migration to buildings or structures. If the risk evaluation identifies potential vapor receptors, a Vapor Receptor Survey is completed. This sequence of investigation is described in MPCA Guidance Document 4-02. The highest vapor risk settings involve sites with free product or groundwater with high levels of dissolved petroleum and sites where groundwater intersects contamination and utility trenches, sewer lines and basements, etc.

Vapor risk surveys include field screening of subsurface structures including utilities, below-grade buildings or other openings, and consideration of the distribution and magnitude of impacts. Contact of the Local Fire Department and building occupants (during the 500 foot walking survey) is completed to determine if they have knowledge of petroleum vapor complaints or reports of vapors in the vicinity of the site. If the risk assessment identifies a concern, immediate action (evacuation, venting) is taken and additional air sampling is used to document vapor concentrations. This information is also used to assess risk and guide the site investigation and response action decisions.

Risks associated with vapor entry include health risks associated with the toxicity of volatile/semi-volatile petroleum compounds, and in severe cases the concentration of vapors can pose a risk of fire or explosion. The response to vapors identified by AECOM is tailored to the concentration of vapors and the nature of the vapor receptor. We are experienced with various exposure-based inhalation risk standards (HRV, RfC, etc.) as they apply to various occupancy types and site settings. Mitigation is required when an exposure occurs to the receptor above acceptable levels.

Examples of projects where AECOM has conducted receptor surveys, include: MacGillis & Gibbs, Duluth Dump, Longville Bible Chapel, and Rays Truck Stop.

10. Arrange for Transportation, Storage, and Proper Management of Wastes

AECOM has been involved in arranging the transportation and storage of exploration and corrective action generated wastes since 1986. Our experience ensures that proper management of generated wastes occurs in conformance with applicable regulations. Waste streams generated during investigation or corrective actions on petroleum release sites include contaminated soil, waste water, contaminated groundwater, tank bottoms/sludges and other wastes (asbestos, lead-based paint) which may be associated with a building required to be demolished as part of a corrective action. In Minnesota, AECOM has completed over 250 projects involving management, transportation and disposal of corrective action waste materials. This experience includes treatment/disposal of petroleum contaminated soils by land farming, thermal treatment, biomounds and landfilling. We have experience in management of tank bottom sludges, soils contaminated with elevated lead concentrations from leaded gasoline release sites and PCBs, PAHs, and metals from used oil releases. We also have experience managing wastes generated from building demolition, such as asbestos, lead paint and “special wastes”.

Management of wastes can also include wastes generated from normal operation of remediation systems. Wastes generated from remedial activities include spent granular activated carbon (GAC) from point of use treatment systems, and effluent discharge from pump/treat groundwater remediation systems. AECOM has experience with disposal management of these waste streams, including monitoring and reporting associated with National Pollutant Discharge Elimination System (NPDES) permits for pump and treat systems discharging to surface water. Pump/treat systems that discharge to sanitary sewers require similar monitoring and reporting procedures, depending on the wastewater treatment plant-mandated procedures. AECOM has experience in discharge monitoring and reporting for both surface water and sewer discharges from treatment systems.

Recent AECOM project examples that demonstrate our experience with waste handling include investigation derived waste with chlorinated compounds (St. Louis Park Chlorinated Plume Investigation), listed hazardous waste (MacGillis & Gibbs) excavation and land farming of petroleum contaminated soil (LF Knutson and Sons), hazardous waste and PCB disposal (Proctor Railyard) and asbestos containing material (ACM) disposal (numerous MnDOT projects and CP Railyard in St. Paul).

11. Evaluate the Need for and Oversee the Implementation of Alternative Drinking Water Supply, Including Point-Of-Use Treatment (i.e. Carbon Filtration)

AECOM has significant experience assisting the MPCA with evaluation of the need for alternative water and supplying alternative drinking water. We have also provided this service on projects for private clients. Severe release sites, or sites that have not experienced timely comprehensive corrective actions can result in impacts to drinking water sources. Often, MPCA master LUST projects are sites which have not had proactive corrective responses, raising the risk that drinking water impacts have occurred.

Supplying alternative drinking water typically requires an alternatives assessment to evaluate various means to restore a potable source of water for impacted receptors. In rural areas, a new private well completed with protected construction (and tapping a non-impacted aquifer) will suffice to restore impacted drinking water supply. Impacted municipal wells may require a new municipal well, or institutional controls that allow resumption of use for impacted wells at rates that would not extend a contaminant plume into the municipal well intake. Implementation of institutional controls requires modelling of the aquifers involved, and often would require a pump test. Models are used to estimate aquifer characteristics and the wells' capture zone.

Other means of providing safe drinking water to impacted users include installation of granular activated carbon (GAC) vessels for point-of-use treatment of mildly impacted waters, or providing bottled water for the point-of-use. The selected drinking water alternative usually requires performance monitoring to ensure that groundwater impacts are not extending into previously unimpacted wells, and to evaluate the remedial system/institutional controls used to manage the risks associated with groundwater impacts.

AECOM also provides comprehensive municipal drinking water treatment engineering and design services. This suite of services include treatment technologies to address:

- VOCs
- Emerging contaminants like PFAS and 1, 4-dioxane
- Radium
- Ammonia
- Metals

- Aesthetic concerns

The following matrix summarizes projects AECOM completed for private and municipal clients including various aspects of alternative water sourcing services.

Table 3-1 Completed Projects for Private and Municipal Clients

Site Name	Pilot and Bench Scale Testing	Alternatives Assessment	New Municipal Well (provided by others)	New Municipal Well Provided by MPCA and/or AECOM	Municipal Water Treatment System Design/ Engineering	Water Quality Modelling	GAC Treatment	Institutional Controls	Performance Monitoring	Bidding and Construction Related Services
Clearbrook (AC Oil BulkSite)		●		●				●	●	●
Longville Bible Chapel							●			
City of St. Louis Park – WTP #4	●	●			●	●	●	●	●	●
City of St. Louis Park – WTP #6	●	●			●	●	●	●	●	●
City of Spring Park		●			●	●		●	●	●
City of Elysian, MN				●	●					●
City of Hutchinson, MN	●	●		●	●	●		●	●	●
City of Mankato, MN		●		●	●	●	●	●	●	●
Edina Well 7/Edina WTP #6	●	●		●	●	●		●	●	●

AECOM also provides construction management during implementation of various alternative drinking water initiatives, so that treatment systems and/or new wells are installed in a manner that meets project objectives.

The Minnesota AECOM staff has specific experience with design, installation, operation and monitoring of point-of-use carbon treatment filters. This procedure was used by AECOM to temporarily provide residents of the City of Brook Park with a suitable source of drinking water. AECOM also modelled the area of influence of the newly installed supply well to assure protection of the replacement water source. AECOM also facilitated installation of carbon treatment filtration systems on multiple residential water supply wells and public supply non-community transient (PSNCT) supply wells with petroleum contamination for the Longville Bible Chapel site for the MPCA

12. Coordinate and Cooperate with other State-contracted Services such as Sampling and Analytical, Emergency Response Contractors, and Hazardous Waste Services

AECOM has worked with or subcontracted directly with the majority of the State's contracted laboratories, several of the emergency response contractors and hazardous waste services over the last 20 years. Laboratories we have worked with include: Interpoll Laboratories, Pace Analytical Services, Inc., Minnesota Valley Testing Laboratories, Legend Technical Services, Braun Intertec and A.W. Research Labs. In addition, AECOM has completed analysis with other agency-contracted “CLP” laboratories.

AECOM has worked with or had experience coordinating site responses with emergency response contractors that include Bay West, Oil Services Inc. (OSI), and Veolia, formerly known as Superior Special Services (Onyx). AECOM has also worked on hazardous disposal projects with several firms which have provided hazardous waste services for the State in the past. AECOM has worked with Clean Harbors under their State Contract for waste disposal at MPCA sites under the master contract. We are completely familiar with and understand their contracts and procedures.

We have also retained a State Contract Electrician for work on fund-financed MPCA petroleum release sites and Superfund Site. Use of State Contractors for small (<$50,000) assignments is a way to meet objectives with minimal cost for AECOM oversight.

AECOM provides successful teaming with other state contracted services by:

- Knowledge and understanding of the specific service industry
- Clear communication of expectations with the other firm(s)
- Providing strong project management skills
- Documentation of communication (i.e., memos, written correspondence, etc.)
- A positive team approach

AECOM has a policy of cooperation with other firms which are part of a project team. AECOM personnel involved with the contract have the necessary skills to interact with other firms providing contracted services to the State, resulting in reduced costs and a successful project. We have served as the prime contractor conducting site responses and have conducted specific tasks as a subcontractor to others. AECOM is comfortable serving project objectives in whatever role is appropriate to meet the State's needs.

AECOM is also working closely with U.S. EPA contractors associated with the MacGillis and Gibbs Superfund site. This site was transferred from U.S. EPA to the MPCA in October 2012. AECOM has worked closely with U.S. EPA contractor/consultant in order to maintain a smooth transition for the site and have maintained contact with key staff that have knowledge of the Site throughout the years.

13. Oversee Subcontractors and State Contractors during Investigation and Clean-ups and Tank Removals

AECOM has implemented corrective actions or completed oversight of corrective action on numerous petroleum and other chemical release sites in Minnesota. We manage the risk to our clients (including MPCA) by providing quality oversight during implementation of corrective actions. Oversight functions include selection of contractors based on qualifications and low cost, risk reduction through use of industry standard contract specifications and professional services agreements, quality assurance/quality control (QA/QC) efforts so corrective actions meet stated goals and monitoring efforts to adequately document outcomes, and follow-through on site closure documentation so that closure decisions are made in a defensible manner.

Project management by AECOM provides this high level of project oversight in a cost-effective fashion. Risk management policies followed by AECOM limit client liability that could result from disputes with subcontractors. Our management of site access procedures limits the exposure for clients (including MPCA) to adverse reactions from the public. Cost containment strategies employed by AECOM therefore result in a net savings to MPCA when corrective actions are required.

AECOM has overseen MPCA Contractors and State Contractors under the existing Master Contract. This has included preparation of Work Orders for State Contractors, review of performance and invoice review prior to authorization for payment. We have also overseen Contractors hired by Admin (>$50,000) and work subcontracted by AECOM to meet specific MPCA project needs not available through a State Contractor

14. Prepare and Evaluate Reports (e.g., Investigation Reports, Monitoring Reports, Free Product Recovery Reports)

MPCA has developed Guidance Documents that provide the outline for site evaluation and reporting. PRP Guidance Document 1-01 defines the Petroleum Remediation General Policy including criteria for site closure.

AECOM prepares reports in accordance with the specific Guidance Document format. These formats can be completed cost effectively. It also allows MPCA staff to minimize review time on reports. AECOM has significant experience preparing reports under the MPCA Guidance Document (GD) formats including the following;

- GD 1-03a Spatial Data Reporting Form
- GD 2-03 LNAPL Recovery Report
- GD 3-02 General Excavation Report Worksheet
- GD 3-02a Corrective Action Excavation Report Worksheet
- GD 4-06 Investigation Report Form
- GD 4-08 Monitoring Report
- GD 7-02 Conceptual Corrective Action Design Report
- GD 7-03 Focused Investigation Work Plan
- GD 7-04 Focused Investigation Report

AECOM also reviews and evaluates historic reports prepared by others for projects that we are asked to conduct site work on to familiarize us with the project history and help in scoping future investigation, monitoring and/or corrective action work for the site.

Report preparation for Superfund, VIC and MDA reports will vary dependent upon the deliverable required. In some cases, such as MDA, a report format has been established for a specific deliverable. In other cases, project specific reports are developed in accordance with the project requirements. AECOM discusses the proposed deliverable with the MPCA/MDA project managers prior to the completion of a work order proposal/work plan. The form of the report (deliverable) is defined within the proposal.

Draft reports are normally submitted to the MPCA PM for review prior to final submittal. This permits the MPCA PM and technical staff to comment on the content, conclusions and recommendations prior to finalizing of the documents.

15. Evaluate Invoices

AECOM has direct experience with MPCA requirements for subcontractor oversight. State Contractors and AECOM subcontractors submit invoices and data reports (well logs, lab reports, field reports) to AECOM directly. The AECOM Project Manager reviews the reports for conformance with the Work Order and/or project specifications. The Project Manager also reviews the invoice to the contract unit rates and total units billed. If the reports and invoices meet the contract, AECOM will recommend payment and includes costs on our AECOM invoice submitted to the MPCA for payment. AECOM pays the contractor invoice in accordance with our contract which is 30 days.

Contracts through Admin (>$50,000) are processed in a different manner. Invoices from the contractor are submitted to Admin, forwarded to the MPCA Project Leader and then provided to the AECOM Project Manager for review. The AECOM Project Manager provides a review of the invoice and reports documenting the work performed. A recommendation for payment includes signing the “Certificate for Payment”.

16. Collect and Manage Field and Laboratory Data for Electronic Submittal in a Format Specified by the MPCA

AECOM has a company-wide license with unrestricted access for the database system used by MPCA; Environmental Quality Information System (EQuIS) by EarthSoft Inc. The EQuIS database is supported by AECOM super users who in turn provide training for staff throughout the company.

AECOM has been using EQuIS for approximately 20 years. In Minnesota, projects have included:

- Input of over 10 years of field and laboratory data for the City of St. Louis Park; this was prepared by AECOM for Dave Scheer of the MPCA to create a 3D visualization model utilizing Mining Visualization System (MVS) software of the chlorinated VOC plume and hydrogeology of the area. The 3D model was utilized by Mr. Scheer for a technical presentation.
- Management of historical and current analytical data for the MacGillis and Gibb’s Site,

- Transfer of historic monitoring well and private well data in Excel format to the MPCA's EQuIS format for the Ray's Truck Stop Site,
- Data management and reporting for the NIROP Superfund Site in Fridley

For field activities, AECOM requests the MPCA unique sample IDs for use on the chain of custody forms. The MPCA's version of EDGE can be used to manage field data. Edge is used to routinely collect field results including, but not limited to, conductivity, dissolved oxygen, ORP, pH, temperature, turbidity, PID, and lithology, as needed. Edge is also used to populate chain-of-custody (CoC) forms for shipment of samples to the laboratory. The Edge EDD created by field staff is loaded to EQuIS by the database administrator. The use of Edge provides consistency and accuracy in the collection of field data.

17. Evaluate Data Quality and Data Verification Reports

Analytical results are evaluated to determine if the data quality achieved is sufficient to meet project objectives. The analytical data may be reviewed using procedures and control criteria in either the project specific Quality Assurance Project Plan (QAPP), the Minnesota Pollution Control Agency Laboratory Data Review Checklist Guidance (September 2011), or as contained in the *USEPA National Functional Guidelines for Organic Superfund Methods Da*ta *Review,* January 2017 *or USEPA National Functional Guidelines for Inorganic Superfund Methods Data Review*, January 2017, as required by the project.

Data quality is documented in a data verification report (DVR) and/or the MPCA Laboratory Data Review Checklist. Qualifier codes (such as U, J, or R) are placed next to results so that the data user can assess the qualitative and/or quantitative reliability of the results. The DVR will discuss the quality control exceedances, data qualifications, and whether the project required reporting limits were met. Any affect the outliers may have on data usability will also be discussed.

Cathy Larson has performed data quality evaluations as a project chemist for AECOM for the past 25 years. Project lead agencies have included MPCA, EPA Region 5, and the Department of Defense. She has reviewed data from laboratories throughout the country for a wide variety of analytical methods including volatile organic compounds (VOCs), poly- and perfluoroalkyl (PFAS) substances, semivolatile organics (SVOCs), metals, gasoline and diesel range organics. Project examples include:

- **Department of the Navy, Naval Industrial Reserve Ordnance Plant (NIROP), Fridley MN**. Project Chemist responsible for all aspects of the analytical data. Project work included authoring three Quality Assurance Plans (for various investigations), contracting the laboratory, and validating and presenting the results. Analytes of interest included trichloroethene (TCE), chromium and hexavalent chromium in soil, and analytes to evaluate the potential for monitored natural attenuation. Regulatory oversight is provided by the MPCA and USEPA Region 5.
- **Minnesota Pollution Control Agency.** Authored the quality assurance project plan (QAPP) for the Minnesota Superfund and Site Assessment Program. In addition to the MPCA, the document was approved by USEPA Region 5.
- **AFCEE, Confirmatory Soil Sampling, Port Heiden Radio Relay Station, AK.** This project had high potential for litigation and analytical results were requested by EPA's National Enforcement Center. Ms. Larson served as the Project Chemist responsible for confirmatory PCB sampling at approximately 350 soil sample locations. She authored the QAPP and coordinated USEPA Level IV data validation through a third party consultant. Additionally she oversaw preparation of the analytical data tables and chemical quality assurance reports.
- **AFCEC, Former Chanute Air Force Base, Rantoul, Illinois.** Project Chemist responsible for data validation, creation of data tables, and electronic data management for the annual groundwater monitoring events. Analytes of concern include the PFAS compounds PFOS and PFOA as well as VOCs and metals.

18. Arrange for Site Access

AECOM routinely assists our clients in preparing site access agreements to properties undergoing investigation and/or corrective action activities. The MPCA has a Standard Access Agreement format approved by the AG's office. AECOM obtains access agreements for the MPCA under the existing Master Contract. This may include mailing, phone calls, electronic mail and door-to-door contacts with the property owners. We have been very successful in obtaining these agreements and minimizing the MPCA staff time that would be required for this task.

The site access agreement provides a legal mechanism to allow the MPCA, its employees, agents and contractors to enter property for the purpose of investigations and/or corrective actions in response to a suspected or known petroleum release under Minn. Stat. §115C.03, subd. 7(2002). Many of the projects listed on Table 2 required AECOM to obtain access agreements or interact with property owners where access agreements are in place. Access agreements must be obtained before on-site work can proceed.

19. Coordinate Utility Locates by Contacting the Appropriate Entity and if Applicable Coordinate Traffic Control

AECOM coordinates utility locates for investigation and/or corrective action work on petroleum release sites on behalf of our clients. This work includes notifying the Gopher One Call system as to the location in which the work is to be performed. Gopher One call requires a minimum of 48 hours prior notice before setting up a site meet for location of utilities which could be affected by petroleum work. AECOM also routinely subcontracts with private utility locate companies for determining the locations of private utilities such as parking lot lighting, private sewer/cable lines, tanks (if possible) and other items which are not addressed through the Gopher One call system.

An on-site meeting is held with the each of the utilities notified by Gopher One Call as well as with private utility locater(s) before starting exploration and/or corrective action work. The location of the proposed work is provided to the locators and markings are put on to the ground surface to delineate the location of utilities. Lines of blue paint on the ground typically indicate water lines, yellow paint delineates a natural gas line(s), orange paint is used for telephone/cable, green is sewer line and red paint is for power, etc.

AECOM is providing utility clearance under subcontract for MPCA at the MacGillis and Gibbs site. MPCA is the utility owner and is required by law to respond to Gopher State One Call requests for utility clearance. AECOM is coordinating these utility clearances and participating in site meets as the MPCA representative.

AECOM has arranged traffic control for site investigations and remediation at several MPCA sites. These sites include Deer River Service and L.F. Knutson and Sons. We are also in the process of interacting with MNDOT on remediation activities that are being planned in Grand Marais that will impact traffic on Highway 61. AECOM also has coordinated and implemented traffic control for MnDOT associated with asbestos surveys on bridge structures

20. Prepare and Evaluate Bid Documents Plans and Specifications) Suitable for Advertisement for Bids, Including Landfill Cover Systems, Remediation Systems, Landfill Gas Systems and Erosion Repair Projects in Compliance with Minnesota Department of Administration and MPCA

AECOM has been the prime consultant for over 350 remedial system installations, tank removal, and landfill projects in Minnesota. Many of these projects progressed to a level where construction related services are needed to remedy the identified impacts. As part of this process, AECOM prepares plans and specifications following the Minnesota State Department of Administration (“Admin”) State procurement practices. AECOM has experience with these parties, including digital data file submissions to Admin.

In addition to complying with Admin practices and procedures, the bid documents are prepared in a manner so that respective contractors can provide bids to complete the construction efforts. Components of the bid documents include:

- Procurement and Contracting Requirements
- General Work Requirements
- Site Work Requirements
- Site Plans
- Supplemental Information

Example projects where AECOM has prepared bid specifications include; LF Knutson & Sons - Warren, CS Services – Grand Marais, A.C. Oil - Clearbrook and Bridal Veil Open Space – Minneapolis, And Washington County Landfill – Lake Elmo.

21. Prepare and Review Quality Assurance Project Plans (QAPP) and Sampling and Analysis Plans (SAP) in Accordance with State and Federal Requirements

AECOM has completed numerous Quality Assurance Project Plans (QAPPs) and/or Sampling and Analysis Plans (SAPs) to support MPCA projects over the last four years. QAPPs and SAPs were prepared to address a wide range of projects and chemicals of potential concern. Site exploration for these QAPPs include soil, groundwater and vapor sampling, push probe exploration, geophysical exploration, backhoe excavation, hand augers, sediment sampling and surface water sampling, Chemicals of potential concern included with these projects have been poly- and perfluoroalkyl (PFAS) substances, dioxins, PCBs, PAHs, metals, pesticides/herbicides and VOCs. Toxicity and bioaccumulation testing have also been included to assess the impacts of elevated contaminant concentrations. AECOM executed the site work in accordance with the QAPPs and SAPs.

Examples of QAPPs and SAPs prepared by AECOM Minnesota office include:

- A general, all-encompassing QAPP prepared for the MPCA's Superfund and Site Assessment Program; approved by both MPCA and EPA Region 5;
- SAP/QAPP addendum to investigate the potential for monitored natural attenuation at the NIROP Site in Fridley, MN, approved by both MPCA and EPA Region 5;
- SAP for the Environmental Investigation of Pig's Eye Landfill focusing on PFAS substances;
- SAP for the Ecological Assessment at Farrel's Wetland in association with the MacGillis & Gibbs Site, which included toxicity and bioaccumulation testing; and
- SAP for the St. Louis Park Soil Vapor Survey.

AECOM routinely prepares Health and Safety Plans (HASPs) for our work on all identified petroleum and hazardous substance release sites in accordance with OSHA 1910.120. Additionally, we prepare HASPs for all tank removal projects where there is a potential for a release to the environment. The HASPs include a description of the project site, the anticipated chemicals of concern, action levels for donning protective personal equipment and/or stopping work as well as directions and a map detailing the quickest route to a hospital in the advent of an exposure or accident on the site.

AECOM requires that subcontractors, State Contractors and contractors have an HASP where required. We review the HASP to determine if the document is appropriate for the project

22. Perform/Oversee Remedial Action Plans

AECOM has extensive comprehensive experience preparing remedial action plans and overseeing the implementation. In Minnesota we have overseen 100s of remedial actions for both private and public sector clients, including several closed landfill projects for the MPCA. Included in the remedial action oversight process are developing designed over 100 active remedial action systems for both private and public sector clients. We have completed comprehensive remedial action design and oversight services on Superfund sites dating back to 1985. Our Minnesota staff have overseen implementation of remediation systems including: soil excavation, groundwater recovery wells, soil vapor extraction systems, in-situ chemical oxidation, air sparging systems, dual phase extraction, skimmer / product recovery systems, air strippers, mitigation of petroleum vapors in sewer systems/buildings, sewer or building ventilation systems, soil treatment, enhanced natural attenuation with oxygen supplementation (ORC), and bioremediation (bio-piles, land spreading, bio-venting, biological treatment of soils through infiltration galleries, bio-treatment of surface water, etc.).

The work for Remedial Action Design Plans includes preparing plans for construction of remedial/corrective action systems for soil, groundwater, surface water and sediments including all necessary evaluations, computations, specifications and engineering cost estimates to enable preparation of a biddable construction contract. This work also includes providing operation and maintenance plans for the treatment

systems and cost estimates for operation and maintenance for the duration of the clean-up. Examples of projects include MacGillis & Gibbs, LF Knutson, MDA – Cedar Services, Pigs Eye Landfill, and Duluth Dump.

23. Conduct Surface Water, Ground Water, and Hydrodynamic Modeling

AECOM has experience modelling surface water and performing hydrological studies for a variety of clients and projects. We have modelled surface water for projects ranging from small, partial-acre commercial sites to large, urban watersheds using HydroCAD, HydraFlow Storm Sewers and AutoCAD. The types of projects included development of storm water management plans. One example of a recent project completed by AECOM is the Canadian Pacific Railroad site in St. Paul where analysis of their storm water sewer system was evaluated to determine where infrastructure upgrades should be employed to alleviate flooding.

MPCA and AECOM are presently evaluating the groundwater conditions at the MacGillis and Gibbs Superfund site. AECOM continues to provide 3D groundwater impacts and geologic setting modelling support. The model was presented to MPCA staff in a webinar based on groundwater data collected at the Site. The model was used to plan the exploration and to identify the best location to calculate mass flux for the site. Also conducted at the MacGillis and Gibbs Site, AECOM is in the process of developing a heterogeneity assessment tool (AECOM's Environmental Sequence Stratigraphy (ESS)) that compiles and reformats existing lithology data obtained by various methods into grain-size logs. The subsurface depositional environment is defined and predicted and used to correlate the geologic data. The resulting cross-sections provide a high resolution description of the aquifer architecture underlying the site and will serve as a robust design basis for the future Site planning activities.

AECOM is presently developing a groundwater flow and transport model for a taconite tailings management facility (TMF) in northern Minnesota. AECOM is utilizing the results of the modelling effort to inform TMF design and permitting efforts to assist with continued environmental compliance and permitting objectives. AECOM's modelling approach integrated several modelling tools to efficiently evaluate regional and local hydrologic conditions, and to account for surface water – groundwater interactions. A GFLOW analytical element model (AEM) was created to develop an understanding of regional groundwater flow surrounding the subject site in the taconite mining area on the Minnesota Iron Range. Results of the GFLOW model were imported into MODFLOW for simulating localized groundwater flow and solute migration. Solute transport modelling is being conducted using MODFLOW-MT3D software to predict solute concentrations laterally from the TMF towards sensitive surface water receptors.

24. Conduct Third Party Review and Analysis of Technical Information for the Purpose of Providing Conclusions and Recommendations to the State

AECOM has been providing the MPCA with third party reviews and analysis of technical information for the 3M PFC remediation projects. These projects include Oakdale, Woodbury and Cottage Grove sites. Our technical review have included a very wide range of technical information including: geotechnical conditions, excavation stability, sediment remediation, surface water quality control, Response Action Plans, Monitoring report reviews, Corrective Action Implementation Reports, Pore Water Sampling Plans and Groundwater Pumping Plans. AECOM's conclusion and recommendations are used by the MPCA to comment on the technical completeness of the documents submitted by 3M and their consultant.

Technical information is reviewed and analysed at several Superfund sites has preparation of Five Year Reviews (FYR). AECOM has completed several FYRs for MPCA including: Oakdale 3M Site and MacGillis and Gibbs. In each FYR AECOM provides recommendations for future action at the site based on our review of the technical information.

AECOM's technical review of the MacGillis and Gibbs site was very extensive. The entire remediation system including the operational, mechanical and monitoring systems were reviewed and evaluated for its performance, equipment life expectancy and anticipated cost of operations. This complete systems review was used by MPCA to identify required system upgrades requested from the USEPA prior to the transfer to the MPCA. It was also used to budget the cost to the MPCA for system operations.

25. Perform Five Year Reviews and Site Reviews

AECOM has direct experience in providing the MPCA with Five Year Reviews (FYR) on NPL sites. Under the recent contract, we have provided FYRs for MacGillis and Gibbs and the 3M Oakdale Site. We have also provided site reviews for the equipment evaluation of the MacGillis and Gibbs site prior to transfer of this site from the U.S. EPA to MPCA.

26. Review Groundwater Remediation Technologies and Recommend Alternatives and Optimization Options

AECOM evaluates technologies based upon not only cost considerations but also based upon proven ability to meet the clean-up objectives. Focus feasibility studies consider several available remediation options and provide recommendations and cost estimates associated with system installation, O&M costs, and projected remediation completion schedules. The following is a list of remediation groundwater technologies for which AECOM has direct experience:

- Hydrogen peroxide infiltration
- Oxygen release compound (ORC)
- Groundwater cutoff walls
- Peat treatment systems
- Air Sparging
- Constructed wetland remediation systems
- Vacuum enhanced product recovery
- Dual Phase Extraction
- Phytoremediation
- Hydrogen release compound
- Natural attenuation
- Ozone treatment
- Reactive Barrier Walls
- Carbon treatment
- Reverse osmosis
- Reaction trench
- Funnel and Gate Applications
- Slurry Walls
- Groundwater pump and treat
- Metal filings
- LNAPL and DNAPL Assessment and Recovery

27. Provide Evaluation and Design of Energy Recovery Systems Utilizing Landfill Gas

AECOM has been involved in many gas-to-energy projects including direct fuel gas use at landfill sites on a small scale, as well as electric power generation of up to 15 megawatts capacity. Experience includes contract negotiations, economic analysis, permitting, design, bidding, and construction-related services at gas-to-energy facilities employing both reciprocating and turbine engines. We also have provided startup services, operation and maintenance training, and troubleshooting services at these facilities.

With the recent promulgation of the New Source Performance Standards for municipal solid waste landfills and the implementation of Title V, air emissions permitting and compliance has become a major environmental concern for landfill owners. AECOM has provided emissions modeling and permitting services

for open and enclosed flares, turbines, reciprocating engines and landfill VOC emissions in several states. AECOM has performed QA/QC construction services for gas management systems as well as system startups, troubleshooting and assessments. We have also developed surface emission control systems for compliance with air pollution control requirements and for sites specifically requiring surface odor control in many states.

AECOM has designed over 100 gas collection systems utilizing conventional vertical gas extraction well technology, horizontal gas collection systems that are installed in landfills during the filling operation, and combined leachate extraction/gas collection wells and header systems. AECOM has provided numerous assessments of gas migration and prepared mitigation plans and designs. We have developed projects for lateral migration control involving gas extraction facilities both inside the waste mass and outside the refuse boundary.

28. Research, Evaluate and Implement Innovative Technologies

AECOM has a history of identifying through research and evaluating effectiveness through testing innovative technologies followed by successful full-scale implementation. This process often saves our clients significant costs and time to clean-up but also improving the understanding of the technology and its application. Recently, AECOM has been a leader in innovative assessment and remediation techniques for PFAS related Sites. AECOM is particularly active in the state of Michigan working directly for the MDEQ on developing policy, developing procedures, and actively working on project sites.

AECOM has also been active in evaluating science-based solutions for sites with LNAPL. AECOM participates in industry associations to develop best practices for overall management of LNAPL Sites, including development of conceptual site models (CSM), recoverability estimates through evaluation of LNAPL transmissivity and natural source zone depletion, and vapor intrusion pathway management. On complex sites, AECOM can utilize its Environmental Sequence Stratigraphy (ESS) tool. This tool utilizes all available subsurface information to further assess hydrogeological information for the site. The tool utilizes existing lithology data and reformats it into grain-size logs. The results are expected to exhibit a high resolution description of the aquifer and provide a basis for designing future remedies for the site.

AECOM has deployed passive diffusion “Gore® ” samplers for vapor intrusion investigations, and we were a very early user of directional drilling for remediation wells in difficult settings in Minnesota and other Midwestern states.

Our remediation design for surface water impacts from the Valentine Clark/Bridal Veil Superfund site in Minneapolis uses a combination of phytoremediation and photolysis to degrade pentachlorophenol levels in the surface water. The project’s permanent vegetative cover includes landscape features that will allow continued use as a neighbourhood Open Space, without the human contact exposures that triggered the response action. Our plans focused effort on remedial actions that could occur without ongoing energy inputs, and at reduced cost for waste disposal. AECOM’s on-going involvement and monitoring indicates sustainable performance of the remedial action system.

29. Prepare Presentations and Present Information at Meetings

AECOM is experienced in in conducting presentations at meeting with project stakeholders, MPCA and the public. The following are examples of recent presentations at meetings conducted by AECOM Minnesota staff:

- Naval Industrial Reserve Ordnance Plant (NIROP), Fridley, MN: AECOM presented the results of the groundwater treatment plant optimization, land use control removal evaluation, human health risk assessment, PlumeStop pilot test results, source area investigation results with 3D visualization results, and sampling and analysis plan updates to the NIROP Partnering Team, which included the Navy, EPA, and MPCA, and project stakeholders.
- LF Knutson & Sons Site, Warren, MN: AECOM presented a summary of upcoming excavation activities to affected parties including the property owners, City of Warren, MnDOT and MPCA.
- City of St. Louis Park Water Treatment Design Project: AECOM conducted status presentations during the water treatment plant design project with the City of St. Louis Park and MPCA.

- Co-Presenter with MPCA to EQUIS Midwest User Group Meeting – “EQUIS as the Key to Unlocking the Potential of Data” (June 2015). This presentation discussed data needs for understanding contamination issues for PAH and VOC plumes in the City of St. Louis Park and showed how the EQUIS data management platform enables large-scale, standardized assessment of sampling results. Examples of EQUIS import and export tools and 3D visualization of reporting outputs were presented as well.
- I-35W North MnPASS project: Briefing MnDOT engineering design team members on the findings of an extended hydrogeological investigation with implications for storm water treatment retention/treatment basin construction (Summer 2017)
- Spirit Lake/Former U. S. Steel Duluth Works Site: Poster presentation during the Public Meeting Open House. The Poster presentation conveyed information on proposed remedy elements (Summer 2016)
- I-35E Cayuga (St. Paul) project: Multiple briefings with MnDOT construction engineers describing groundwater modeling findings with implications for future storm water treatment retention/treatment basin construction (2016).

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

AECOM routinely prepares storm water plans on our civil design work on residential and commercial properties as well as for our industrial clients to assist them with NPDES Permit Compliance as industrial permit holders. Storm water runoff is simply rain water or snow melt that runs off the land and into streams, rivers, and lakes. When storm water runs through sites of various land uses (e.g. industrial, commercial, active construction site) it may pick up pollutants and transport them into national waterways and affect commercial fisheries, restrict swimming areas, and affect the navigability of the nation's waters. AECOM prepared a Storm Water Plan for the Valentine Clark/Bridal Veil Open Space site, several Minnesota Canadian Pacific Railroad project sites, and the Canadian National Railroad Site in Proctor as an example of our work. AECOM’s engineers developed the grading plans and corresponding storm water management plans and provisions to supplement the earth moving activities of these project examples as well as the SWPPP and provisions for compliance with NPDES permit specific requirements.

To help curb the problem of storm water runoff pollution, the EPA (Environmental Protection Agency) has developed a program under the Clean Water Act. A major part of this program is the NPDES (National Pollution Discharge Elimination System) which requires industrial activities to register for a discharge permit

31. Prepare Erosion Control Plans and Oversee Implementation

Erosion control planning will start in the design and engineering phase with eyes on implementation during the construction phases. Existing site conditions should be gathered and be the basis for the developing the erosion control plan. The following existing conditions data should be collected and considered:

- Topography – existing contour elevations of not more than 2 feet
- Drainage patterns – Located and mark drainage associated with topography
- Soil type – Obtained from a soil survey published by local or state governmental entity
- Ground cover – Existing vegetation
- Adjacent areas – Delineate adjacent features including streams, roads, houses/buildings, wooded area
- Sensitive areas – Lakes, streams, wetlands, rare biological communities

Use of the existing site conditions will be utilized in conjunction with engineered components of the project to limit erosion and resulting adverse sedimentation associated with construction activities.

During construction of the project, installed erosion control measures are inspected routinely and especially following storm events to evaluate their effectiveness. If needed, improvements will be recommended to the contractor and follow-up monitoring conducted.

32. Provide Technical Assistance to the State in the Evaluation and Interpretation of Data and Information

AECOM has been routinely involved in developing and managing small and large environmental data collections and databases, evaluating the data in accordance with all the applicable guidance documents and analysing them with the use of a variety of statistical tools (including up-gradient and down-gradient of the source water quality data comparisons, correlation and trend analysis) and stochastic models (like Monte-Carlo simulations). We have been striving to always apply our best professional judgment while designing data collection programs, building databases and selecting evaluation methods to use the available budgets, time and resources in the most effective and efficient way to accomplish clearly defined goals.

The MPCA contracted AECOM to develop a database and evaluate trends for monitoring well data collected at the Pigs Eye Landfill PLP site. This work has provided basis for further investigation and remedial planning on the Site. The data is collected and used to prepare annual reports for use by the MPCA in site planning and current remedial planning for the Site.

AECOM reviewed and developed an ArcView Geodata base for the St. Louis/Interlake/Duluth Tar Site in Duluth Minnesota. Property information, environmental covenants, land use and environmental impacts were summarized into a single GIS data base. This system identifies the areas where site development controls are lacking. It also allows the MPCA to update information in the system as changes occur.

AECOM has been assisting the MPCA with the 3M PFC project data evaluation and interpretation. This includes data and information from three sites including Oakdale, Woodbury and Cottage Grove. AECOM participates in periodic meetings with staff from 3M, MDH, and MPCA. Site specific information that is technical in nature is reviewed by AECOM. The review includes and comments regarding the thoroughness, completeness, relevance, and accuracy of the generated information

33. Assist and Provide Training as Requested by the MPCA

On a number of occasions, AECOM staff team up with state officials to prepare and present technical topics either directly to state agencies or during conferences. In 2015, AECOM's Jim Herbreich Co-Presented with the MPCAs Dave Scheer to the EQUIS Midwest User Group Meeting. The title of the presentation was, "EQUIS as the Key to Unlocking the Potential of Data" (June 2015). This presentation discussed data needs for understanding contamination issues for PAH and VOC plumes in the City of St. Louis Park and showed how the EQUIS data management platform enables large-scale, standardized assessment of sampling results. Examples of EQUIS import and export tools and 3D visualization of reporting outputs were presented as well.

AECOM is currently working closely with the Michigan Department of Environmental Quality (MDEQ) regarding PFAS issues across the state of Michigan. AECOM staff are assisting in developing PFAS specific standard operating procedures (SOPs) for multiple media sampling (groundwater residential, surface water, wastewater, sediment, soil, fish, and foam) and have provided training associated with these sampling related SOPs to MDEQ staff.

34. Follow MPCA Green Practices/Procedures for Remediation Projects

AECOM has been following MPCA Green practices and procedures on site investigation and remediation projects over the last several years. AECOM provides a Green Practice Work Plan Attachment summarizing proposed Green practices for each Work Order proposal we prepare for MPCA projects under our existing master contract. We also provide Work Order Summary Report at the close of each Work Order that summarizes the Green practices implemented for the project in relation to what was proposed in the Green Practice Work Plan Attachment.

AECOM is committed to incorporating GSR practices. Green practices are incorporated in AECOM's day-to-day operations as a key part of our company's Core Values. AECOM has been at the forefront in establishing technical and regulatory guidance regarding GSR and we have significant experience

developing GSR policies and programs. The following examples illustrate AECOM's involvement with developing GSR guidance:

- Engagement with Suppliers Regarding Green and Sustainable Practices
  - Subcontractors: AECOM uses a subcontractor pre-qualification questionnaire which includes questions to assess the sustainability performance of our business partners. This information is considered along with other criteria during partnership selection processes.
  - Suppliers: AECOM actively seeks new ways to work with our suppliers to minimize the environmental impact of the goods and services they provide. We do this by including sustainability related requirements in many of our contracts with suppliers and hosting co-sponsored green and sustainability events and promotions

- Participation in Leading Organizations Developing GSR Programs:
  - *Wisconsin Initiative for Sustainable Remediation and Development (WISRR) – AECOM provided* assistance in developing Wisconsin DNR's Green & Sustainable Remediation Manual and provided Site Specific Sustainable Remediation System Evaluations on Several projects for Wisconsin DNR's Site Specific Sustainability Analysis Guidance Document – Dave Henderson and Greg Brooks of AECOM, Milwaukee office.

- GSR Tools Development – AECOM served as a key innovator in the development of GSR tools including:
  - Sustainable Remediation Tool (SRT™) – developed for the U.S. Air Force for use in evaluating selected sustainability metrics such as GHG emissions and water use for certain common remediation technologies; and
  - GSRx™ - an Excel™ based tool that assists users in the identification of Best Management Practices (BMPs) which can be used to incorporate GSR into projects.

In addition to our work in the GSR area, AECOM also has a proactive sustainability program including the following:

- AECOM is an EPA Green Power Partner;
- Office Recycling Programs including paper, aluminium and beverage containers;
- Purchasing of recycled and green office products; and
- AECOM was named by *Newsweek* magazine in its Greenest Big Company Listing

35. Oversee Hydrogeologic Investigations including Fate & Transport Modelling

Over the years, AECOM staff has been involved in designing and executing numerous hydrogeologic investigations that involved tracer studies, modelling contaminant fate and transport in various environmental media, in-field testing of low hydraulic conductivity glacial tills and classical aquifer tests. One example of a contaminant fate and transport analysis project was modelling the 5.5-mile long TCE groundwater plume migrating through terrace sands and "open-framework gravels" at Ellsworth Air Force Base, South Dakota, using MT3D software.

AECOM staff was also involved in carrying out cutting-edge technology field tests, like using a standing pipe method and DEAST apparatus to slug-test wells screened in a very low hydraulic conductivity media.

AECOM is presently conducting a hydrogeological evaluation of the MacGillis and Gills Superfund site for the MPCA. Historically, we utilized 3D modelling (MVS) to visualize groundwater impacts and to target exploration including LIF borings to define groundwater impacts. The MVS model identified optimum locations to complete mass flux calculations of the contaminate plume(s). Currently, AECOM is developing geologic cross-sections using Environmental Sequence Stratigraphy (ESS) to further assess hydrogeological information for the site. The tool utilizes existing lithology data and reformats it into grain-size logs. The results are expected to exhibit a high resolution description of the aquifer and provide a basis for designing future remedies for the site.

36. Complete Capture Zone Analysis

AECOM has conducted capture zone analysis for pump and treat systems as well as determining the capture zone of a specific well in relation to a nearby groundwater plume. Capture zone analysis is conducted to determine hydraulic containment of a ground water contaminant plume as part of the design phase of a pump and treat system. Capture zone analysis is also conducted to determine the potential for a specific well to affect groundwater flow direction within an impacted aquifer and/or the potential for a well to become impacted by a contaminant plume. Capture zone analysis projects that AECOM has completed for the MPCA include; the MacGillis & Gibbs Superfund Site. For the MacGillis and Gibbs site, a limited capture zone analysis was completed to compare pre and post extraction well shutdown data to identify any measurable changes in the pentachlorophenol (PCP) plume behavior in the absence of non-source area extraction well operation. This was completed in June 2017.

37. Perform and Oversee Aquifer Pump Tests

AECOM was involved in development of a new water supply well for the City of Clearbrook. As part of the work, AECOM was involved in determining the hydraulic capacity of the well/aquifer associated with the new well through conducting a pump test. After the successful conclusion of the pump test, the new well site was further developed and incorporated into the City's water supply system

38. Perform/Oversee Evaluation of Soil Borings, Test Pits, Environmental Boring and Soil Testing to Determine Cover Integrity and Availability of Suitable Soils

AECOM has extensive experience in Minnesota conducting soil boring and test pit investigations as part of site assessment activities, including at landfill sites to determine cover integrity and availability for suitable soil. As with any subsurface disturbance work, the state one-call system and private utility owners should be notified so that below ground utilities can be marked and identified to prevent damage.

A combination soil boring investigation and test pit activities are useful to systematically evaluate an entire cover system. Test pits are used to obtain a comprehensive visual inspection of the soil cover material and its interface with the waste material. The following information can be obtained during test pit activities: soil cover type, soil cover thickness, soil cover interface with water material, and general type of waste material encountered. Typically the test pit will be completed in a narrow but sufficiently deep trench so the entire trench wall can be observed and detailed notes taken. As necessary, soil samples are collected for soil testing to determine suitability for future use during soil cover construction.

39. Arrange for Geophysical Activities

AECOM has utilized geophysics to provide cost effective site delineation and locate underground features such as USTs. Our utilization of geophysics in Minnesota dates back to the early 1980s. AECOM geophysical capabilities include resistivity profiling, seismic surveys, electromagnetic (magnetometer) surveys, infrared thermography, and use of ground penetrating radar. AECOM owns and operates all of these devices and can reduce the raw data through various software programs. The use of a particular tool and data management system is dependent on site conditions and clean-up objectives. The considerable experience of AECOM ensures the appropriate tool is deployed to obtain the target information.

AECOM has performed electromagnetic surveys, magnetometer surveys and ground probing radar investigations to delineate waste disposal areas and target site exploration for cost effective data collection. AECOM has also performed seismic (refractive and reflective) and EM surveys to delineate karst conditions in southeastern Minnesota. Down-hole geophysics capabilities include natural gamma logging, video imaging, caliper testing and cross-hole seismic analysis. Down-hole investigations have been used to characterize soil and bedrock conditions and to identify and target contaminant transfer zones.

Recently, AECOM employed geophysical tools and services on the Middle River Gas Station Project. The geophysical survey was used to investigate the near surface deposits at the site to determine if potential underground storage tanks (USTs) associated with the previous gas station operations were removed from the site. The survey was performed using a combination of electromagnetic (EM) metal detection, and three-dimensional (3D) ground penetrating radar (GPR).

We also coordinated additional down-hole work performed by the Minnesota Geological Survey which saved the State money on the project.

40. Conduct/Oversee Studies of Hydrogeology, Geology and Soils Utilizing Geophysical Studies, Modeling, and Dye Trace Studies

Over the years, AECOM staff has been involved in designing and executing numerous hydrogeologic investigations that involved tracer studies, modelling contaminant fate and transport in various environmental media, capture zone analysis, in-field testing of low hydraulic conductivity glacial tills and classical aquifer tests. One example of a contaminant fate and transport analysis project was modelling the 5.5-mile long TCE groundwater plume migrating through terrace sands and “open-framework gravels” at Ellsworth Air Force Base, South Dakota, using MT3D software.

AECOM staff was also involved in carrying out cutting-edge technology field tests, like using a standing pipe method and DEAST apparatus to slug-test wells screened in a very low hydraulic conductivity media.

AECOM is presently conducting a hydrogeological evaluation of the MacGillis and Gills Superfund site for the MPCA. Historically, we utilized 3D modelling (MVS) to visualize groundwater impacts and to target exploration including LIF borings to define groundwater impacts. The MVS model identified optimum locations to complete mass flux calculations of the contaminate plume(s). Currently, AECOM is developing geologic cross-sections using Environmental Sequence Stratigraphy (ESS) to further assess hydrogeological information for the site. The tool utilizes existing lithology data and reformats it into grain-size logs. The results are expected to exhibit a high resolution description of the aquifer and provide a basis for designing future remedies for the site.

AECOM has conducted capture zone analysis for pump and treat systems as well as determining the capture zone of a specific well in relation to a nearby groundwater plume. Capture zone analysis is conducted to determine hydraulic containment of a ground water contaminant plume as part of the design phase of a pump and treat system. Capture zone analysis is also conducted to determine the potential for a specific well to affect groundwater flow direction within an impacted aquifer and/or the potential for a well to become impacted by a contaminant plume. Capture zone analysis projects that AECOM has completed for the MPCA include; the MacGillis & Gibbs Superfund Site. For the MacGillis and Gibbs site, a limited capture zone analysis was completed to compare pre and post extraction well shutdown data to identify any measurable changes in the pentachlorophenol (PCP) plume behavior in the absence of non-source area extraction well operation. This was completed in June 2017.

AECOM was involved in development of a new water supply well for the City of Clearbrook. As part of the work, AECOM involved in determining the hydraulic capacity of the well/aquifer associated with the new well through conducting a pump test. After the successful conclusion of the pump test, the new well site was further developed and incorporated into the City's water supply system.

41. Prepare Construction Cost Estimates Using Standard Engineering Practices

An important component of determining the appropriate remedial approach for solid waste projects is the preparation of construction cost estimates at various stages of the project. AECOM staff has extensive experience in using available data during the investigation phase to develop preliminary costs for several remedial options. These initial cost estimates are typically rough order of magnitude (ROM) costs based on unit rates for similar local projects and estimated quantity take-offs. An evaluation of the costs early in the project helps to determine which design approaches may provide the most cost-effective solution.

Narrowing down the list of feasible remedial options in the early stages of a project can also provide valuable input to guide which investigation approaches may provide the most useful data to aid in the design phase. AECOM staff of different disciplines have a proven track record of using investigation and design experience to create a "feedback loop" that serves to efficiently arrive at the most appropriate solution for solid waste projects. By using this approach, the scope of the investigation phase can be narrowed to collect only the data needed for the design.

Once the data from the investigation have been collected, the preliminary design options are refined to further evaluate which option provide the most effective and economical solution. AECOM staff may utilize a number of estimating procedures at this stage of the project depending on the accuracy of the estimate required. For example, estimating software such as Sage Timberline that use established databases to determine both indirect and direct construction costs may be used to develop a +/-10% estimate if the project requires this level of accuracy during the design phase.

42. Assist the MPCA During the Bidding Process

AECOM has assisted the MPCA on a number of projects with construction related services that required solicitation, collection, and evaluation of bids. AECOM has prepared plans and specifications following the Minnesota State Department of Administration ("Admin") State procurement practices. AECOM has experience with these parties, including digital data file submissions to Admin. In addition to complying with Admin practices and procedures, the bid documents are prepared in a manner so that respective contractors can provide bids to complete the construction efforts. Components of the bid documents include:

- Procurement and Contracting Requirements
- General Work Requirements
- Site Work Requirements
- Site Plans
- Supplemental Information

AECOM has led bid walk meetings to introduce respective bidders to the project. These meetings would typically include an inspection of the project area and review and summary of the request for proposal. It is typical to have meetings with third or affected parties during the bid process to inform them of the project and provide a forum to receive and address concerns.

Throughout and at the end of the bidding process, AECOM assists in receiving and answering questions from respective bidders. As needed, addendums to RFB will be prepared and issued to clarify the intent of the design and RFB. At the conclusion of the bidding process, AECOM will assist in evaluating bids received from the bidders. The evaluation process may include reviewing technical details associated with the bid, cost comparisons, reviewing and interviewing references, and providing recommendations for selection.

43. Provide Project Management and Construction Oversight

AECOM has provided overall project management and construction oversight on numerous closed landfill and new landfill construction projects in Minnesota and the upper Midwest. These activities would typically include:

- Preconstruction conference
- Construction staking
- Surveying
- Contract administration
- Shop drawing and submittal review
- Construction schedule review and progress reports
- Construction coordination meetings
- Client-contractor-agency liaison
- Resident engineering/representation
- In-house geotechnical and geosynthetic laboratory
- Construction Quality Assurance
- Final inspection

Critical to constructing solid waste management facilities that meet design requirements are the services of a qualified Quality Assurance (QA) team. The QA team observes and documents the activities of the contractor in sufficient detail and continuity to provide the required level of confidence that the work product complies with the design drawings, specifications and applicable regulatory requirements. AECOM personnel have experience with both factory and field QA programs and are thoroughly trained in the installation and testing of geosynthetic liners, soil liners, composite liners, geosynthetic capping, soil capping, leachate collection, conveyance and storage facilities, landfill gas management systems, and other solid waste related projects.

Prior to construction, AECOM will conduct testing, as appropriate, to determine the adequacy of selected soils, and to establish the field procedures required to meet the design specifications and permit requirements.

During construction, AECOM provides field services to document the limits of construction, observe subgrade preparation prior to liner placement, observe and document staged soils placement, and provides field and laboratory soils conformance tests to ensure that construction is completed to design requirements.

Field density testing is performed with a nuclear soil moisture-density gauge, and checked against laboratory measurements. Other soils engineering parameters are also evaluated against project requirements. Many clients ask AECOM to perform factory QA services and conformance sampling during geomembrane liner manufacturing. QA services at the manufacturing facility saves time for the owner/operator by having only pre-approved material delivered to the construction site.

AECOM provides documentation and continuous observation of geosynthetic liner material deployment including geomembrane liner, geonet, geotextiles, geocomposites, geocomposite clay liners, and geogrid. This effort includes inventory of all geosynthetic liner materials brought to the site, and examination of factory quality control tests for the materials. Conformance sampling and testing is performed, and the materials are visually observed for damage and cleanliness prior to deployment. Continuous observation and documentation occurs during liner panel placement, welding machine trial tests, panel seam welding, non-destructive seam testing, destructive seam sample selection, and liner repairing. All efforts are monitored and documented. Any deviations from the design and standards are immediately reported to the owner.

AECOM will arrange for and lead periodic status meetings to discuss construction progress. Agenda and other supporting documents will be developed and distributed so that the meetings can be effective and concise.

44. Prepare Construction Documentation Reports

AECOM maintains daily field logs detailing the work performed, personnel and equipment involved, weather conditions, sampling, testing, meetings, and telephone conversations throughout the landfill construction process. Field data is logged in a computer program to enhance back checking and cross checking of geosynthetic deployment activities. Photographic documentation is provided throughout the construction period showing typical construction procedures, details, and any special or critical installation techniques or conditions.

Documentation drawings are prepared showing soil subgrade and clay liner elevations and coordinate locations, geomembrane panel placement, patches and repairs, drainage and protective cover layer elevations, alignment and elevation of leachate piping, cap construction, and other details. AECOM's documentation report includes a narrative describing the CQA program, the project construction history, results of all test data, field data, and a statement by the certifying professional engineer regarding the quality of the construction.

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

Providing the end user with detailed instructions regarding operation and maintenance of constructed systems is of the utmost importance before transferring to the owner. AECOM has been involved on numerous landfill construction projects that involve components and systems that require detailed documentation regarding O&M. AECOM standard practice is to develop the O&M Plan throughout the construction documentation process, bringing aspects of the as-built system into the Plan.

O&M Plans will typically include the following areas:

- Seek to Familiarize O&M personnel with various components of the landfill including detailed and conceptual level drawings and figures
- Provide O&M personnel with applicable safety, emergency, and contingency guidelines and planning documents
- Provide a detailed description of the Site systems so that the O&M personnel may better understand the detailed operations instructions
- Provide detailed instructions regarding inspection, operation and maintenance of appropriate components of the various systems
- Describe environmental monitoring and testing for groundwater, surface water, leachate, and landfill gas
- Identify the responsibilities of the O&M personnel regarding reporting, maintaining up-to-date precise and complete records.

AECOM

C

SCENARIO C

MINNESOTA POLLUTION CONTROL AGENCY
520 Lafayette Road North
St. Paul, MN 55155-4194

Example Workplan

Project Title: Closed Landfill Program Scenario C

1. Project Summary:

The Owner/operator of a closed landfill wishes to enter the MPCA's Closed Landfill Program. The site meets the definition of a qualified facility according to the Landfill Cleanup Act. It began as a non-permitted dump in 1965 but was permitted by the MPCA in 1972 for the disposal of municipal waste. The Landfill closed in 1983.

2. Statement of Problems, Opportunities, and Existing Conditions

Purpose

AECOM Technical Services Inc., (AECOM) proposes a site investigation that uses a phased approach to assess potential immediate and future risks. The phased approach uses readily accessible information to evaluate data gaps for subsequent investigation. Phasing allows for more efficient and effective planning and investigation.

The purposes of this project are:

1. Evaluate the nature and extent of existing and potential impacts at the closed landfill;
2. Assess the potential risks associated with human health, safety and the environment related to these impacts;
3. Evaluate potential remedial alternatives that are effective, protective, and fit the site's desired future use.

Based on our approach, the site investigation progresses through the following phases:

PHASE 1 – Immediate Actions and Preliminary Assessment

1) **Immediate (Emergency) Actions** – Based on current anecdotal accounts (dead corn and smelly water), immediate actions may be necessary. In coordination and cooperation with the MPCA and other Local Government Units (LGUs) we would address potential human health and environmental risks with complete exposure pathways. These activities may range from informational public notice to environmental sampling of water supply, soil vapor, and surface soil.

2) **Initial Site (Desktop) Review** – An assessment of readily available information and resources will be undertaken to develop an initial Conceptual Site Model (CSM). The previous Limited Site Investigation would be augmented with additional information from public sources for the regional geology, hydrogeology, current and historical land uses, property records, and development plans. Interviews may also be conducted for accounts of disposal practices, nearby commercial and industrial enterprises, and other observations that could provide insights regarding the history and character of the site and area.

3) **Site Inspection** – A site visit will be conducted to assess the visible character of the site and nearby surroundings including vegetative cover, topography, surface drainage and land use. During the site visit, surface geophysics will be used to provide data to help evaluate limits of waste and potential investigative targets. The existing monitoring wells and gas vents will also be assessed to determine their condition and whether they are useful for environmental monitoring and sampling. If so, monitoring data and samples will be collected and analyzed.

4) **Scope Development** – The site investigation scope will be developed based on site review and inspection findings. The investigative elements are anticipated to include direct-push hydraulic probes, soil and waste borings, monitoring well and gas probe installations, and environmental monitoring and sampling of soil, groundwater, and landfill gas. Under this task, the site investigation work plan and accompanying sampling and analysis plan will also be prepared.

PHASE 2 – Site Investigation (Two-Parts)

5) **Site Reconnaissance** – After assessing the information gathered during Phase 1 activities, a direct push hydraulic probe will be mobilized to conduct a systematic survey of the landfill property subsurface to confirm the limits of waste, the thickness and quality of the landfill cap, nature and extent of landfill gas, and potentially provide information about waste thickness and any liquids that may be present.

6) **Site Investigation** – The field team, led by AECOM and including a State Drilling Contractor, will implement the investigative work plan. Real-time discussions with project team experts and field scientists regarding observations and monitoring data will allow for field decisions on boring depths, sampling intervals, monitoring well and gas probe construction. The objective will be to provide sufficient information to confirm the Conceptual Site Model (CSM) and minimize data gaps that may limit the ability to assess and design remedial alternatives.

PHASE 3 – Data Analysis, Alternatives Assessment, Reporting

7) **Data Analysis and Alternatives Assessment** – Data from the site investigation will be analyzed to confirm the CSM and provide an understanding of the waste mass, the landfill gas nature and migration, and the potential fate and transport of groundwater impacts. Based on these findings, potential remedial alternatives will be assessed that would appropriately address or mitigate unacceptable risks to human health and the environment.

8) **Site Investigation and Alternatives Reporting** – A comprehensive site investigation and remedial alternatives report will be prepared following completion of the data analysis and alternatives assessment. The report will include summaries of monitoring data and laboratory results, site drawings illustrating the CSM, and investigative results such as groundwater flow and isoconcentrations. Remedial alternatives will be developed to illustrate their recommended placement and implementation.

Based on our collective experience with numerous former dumps and closed landfills, AECOM staff is confident that this approach effectively and efficiently evaluates the nature and extent of existing and potential impacts at a closed landfill and allows for the development and selection of appropriate remedial alternatives to address identified risks to human health and the environment.

The following sections describe an example closed landfill scenario and present how AECOM would apply this approach.

General Description of the Landfill Scenario Project Area

Background (Given) Information - The owner/operator of a closed landfill wishes to enter the MPCA Closed Landfill Program. The site meets the definition of a qualified facility according to the Landfill Cleanup Act. It began as a non-permitted dump in 1965 but was permitted by the MPCA in 1972 for the disposal of municipal solid waste. The landfill closed in 1983.

The landfill is located in rural Minnesota near a growing city whose east boundary is adjacent to the landfill parcel. A quaint residential housing development exists west of the landfill with the closest homes being about 150 feet from the landfill property boundary. Another residential development is located about a half-mile south along a mid-sized river which flows east. Both developments are served by municipal water and sewer but not all residents were required to connect to city water; some residents still have shallow wells for irrigation purposes. Approximately a quarter mile to the east is a farm that has a private drinking water well that also supplies water to about 75 cattle. The depth of the well is unknown. The City's comprehensive plan guides the city for additional residential development south and west of the landfill, between the existing developments and the landfill.

Possible (Assumed) Conceptual Site Model – The site background for this closed landfill describes a common Midwestern scenario, with enough information to start forming a working conceptual site model. Given the time-frame for which dumping activities began, we often find these sites were used as a borrow source for sand and gravel. The resulting holes became default locations for local government units to operate small dumps. While records of waste placement are usually incomplete, we often find that the original borrows were limited vertically by encountering the water table, and horizontally by the property boundaries. Of course, the extent of sand and gravel being mined also could provide limits to the borrow area and consequently the limits of waste placement.

Recognizing the glacial geological setting and close proximity to mid-sized river, we anticipate that depth to groundwater is relatively shallow and that bedrock is at a depth substantially below the glacial deposits. Regional groundwater flow is expected to be towards the river, which is typically a groundwater discharge point; however, locally groundwater flow may be influenced or captured by water supply wells such as the irrigation wells or the farmer private well.

Depending on the depositional environment that placed the glacial deposits, the extent and interconnection of sand layers can be varied. Because these sand layers are often horizontally and vertically discontinuous, they are not usually exploited for water supply use. Water supply wells are more often developed in thicker sand and gravel deposits associated with glacial outwash (alluvial) environments or underlying bedrock aquifers. Nonetheless, interconnected sand seams and fracturing of the glacial till may still allow for migration of impacts through glacial till deposits and into adjacent aquifer units.

Waste in the landfill may be variable in its composition and distribution. In many instances, small dumps not only received typical household wastes, but also solid and potentially liquid wastes from commercial and industrial enterprises in the area. As a consequence, substances could be discovered such as foundry sands, solvents, petroleum, paints, or other waste products. Furthermore, some operators regularly open-burned wastes or operated incinerators, which may have a substantial effect on the volume of putrescible waste that may be present to contribute to the generation of landfill gas, or lead to variable settlement across the landfill. Given the size and age of the landfill in this scenario, the volume of remaining putrescible waste is likely small and located in isolated pockets.

Given that the existing landfill cover is generally flat but has ponding in many locations, the cover could be expected to be of low permeability material, but may have experienced differential settlement since its original placement. The resulting low areas that now result in ponding of storm water rather than effective drainage away from the underlying waste. The placement of gas vents across the landfill also suggests a low permeability cap material. However, the uniformity and composition of the existing cap could still be varied, especially if only local glacial deposits were used and indiscriminately placed rather than as an engineered cover (e.g. compacted clay).

Reason for the Project

The Minnesota Legislature has appropriated $350,000.00 to evaluate the site before its entry into the Closed Landfill Program. The Closed Landfill Program is seeking additional information about site conditions before it accepts the landfill into the program and takes over its long-term care. The program is also interested in a long-term remedy for the landfill itself to best protect human health, safety, and the environment.

Site investigation work is required to evaluate the nature and extent of the landfill impacts and to evaluate the risks to potential receptors including: residential development, water supply wells, agricultural activities, and surface water.

Known, Suspected and Potential Problems

The landfill's waste footprint is about 30 acres but its waste volume is unknown. During the landfill's operation, waste was placed very near the east, south, and west property boundaries; within 20 feet in many locations. The existing landfill cover is rather flat and ponding occurs in multiple locations. It is speculated that the cover material across the site is inconsistent. In fact, some of the cover along the south side is rumored to be gravel. Twenty passive gas vents are scattered across the cover, but the farmer that grows corn on the adjacent property east of the landfill claims his corn within 30 feet of the landfill property grows poorly.

A limited remedial investigation was conducted after the site closed and VOCs and metals were detected at elevated concentrations, some exceeding health risk limits near the landfill. However, few monitoring points were installed further away from the site. Because the landfill is beyond its post-closure care period, monitoring in recent years has been limited. A few residents south of the landfill have complained to the City about "strange odors" emanating from their irrigation wells. Boring logs indicate that the geology is glacial till with sand layers intermixed with clay.

Opportunities for Success

Opportunities for project success include removing or mitigating unacceptable risks to human health and the environment. This objective will be achieved through a comprehensive site investigation to characterize the landfill and associated impacts, to develop an accurate conceptual site model for an understanding of fate and transport, and evaluate appropriate remedial alternatives that effectively address the environmental impacts and risks in a sustainable manner. Additional opportunities for success may include enhancing the environment or creating a public asset. In those regards, AECOM has helped with landfill redevelopment in a variety of recreational greenspaces, commercial building sites, or renewable energy projects. While planning for these types of developments are beyond the scope of this site investigation scenario, we believe that having a vision for what is possible for any site is important so that opportunities are not missed and efforts are not wasted.

Organization Information

The project work will be coordinated with the MPCA Project Team including the Project Leader and Hydrogeologist. The project work will be conducted in accordance with the MPCA Closed Landfill Program (CLP) established Guidance Documents.

3. Goals, Tasks, and Subtasks

Project goals include the following;

1. Evaluate the nature and extent of existing and potential impacts related to disposal activities at a closed landfill;
2. Assess the potential risks associated with human health, safety and the environment related to these impacts;
3. Evaluate remedial alternatives that prepare the site for future use.

These eight tasks outline the process of accomplishing project goals. The final product, a site investigation and remedial alternatives report, will document how each goal was accomplished, and will position the site for future remedy selection and end use.

Assumed within each task is AECOM's use of and adherence to Minnesota Pollution Control Agency and Closed Landfill Program guidance documents. AECOM also provides with each project a set of standard operating procedures, specifications, technical requirements and quality procedures, including site health and safety standards and protocol that are required for site worker and public safety.

Task 1: **Immediate (Emergency) Actions**

The first step in any site investigation is to coordinate with the Local Government Unit (LGU) to ensure there is no immediate danger to human health or the environment. In this hypothetical project, at least four potential immediate dangers exist;

- Affected private/irrigation wells pose a risk to humans and livestock.
- Nearby existing homes may be threatened by landfill gas.
- Potential future excavation during residential development may pose a risk to gas exposure.
- Vegetation near the landfill may show signs of chemical uptake, and potentially should not be used as a food source.

In each case, it's important to work with the LGU to make sure there is a public liaison, and to contact the potentially affected people about safety concerns. AECOM has experience working in public notification, and can also support the LGU to evaluate where immediate action is necessary.

Responsible Party: AECOM Project Manager, Engineer 2/Scientist 2, Engineer 3, LGU

Task 2: Initial Site (Desktop) Review

A thorough assessment of readily available information and resources will help develop an initial Conceptual Site Model (CSM).

The previous Limited Site Investigation would be augmented with additional information from public sources for the regional geology, hydrogeology, current and historical land uses, property records including private well logs and development plans. Interviews may also be conducted for accounts of disposal practices, nearby commercial and industrial enterprises, and other observations that could provide insights regarding the history and character of the site and area. Initial contact would be established for determining access notification.

Specifically, the site would be evaluated with the completion of an Evaluate Site Risk List (MPCA), a review of MPCA Closed Landfill Use Plan (CLUP), Local Government Units (LGUs) for future use plan and an evaluation of town history including manufacturing. A summary of the initial research findings would be compiled including documentation of the site information, source, and action items need to complete the CSM.

Also prior to site access, a site safety plan must be developed for all personnel entering the site.

Responsible Party: AECOM Project Manager, Engineer 2/Scientist 2, Engineer 1/Scientist 1

Task 3: Site Inspection

Site inspection provides basic information that will guide the site investigation. Most landfill inspections include review of the maintenance plan and operation record, which may not exist for this site. Therefore, applying experience and knowledge of the basic elements of a maintenance plan, even with limited prior site knowledge, can provide an understanding of what exists at the site and potential issues for the site investigation.

The subtasks typically include the following:

- Basic topography and initial site survey;
- Well integrity survey and sampling;
  - Water levels for flow direction/depth to water,
  - Water sampling to evaluate potential contaminants of concern (Minnesota Dept of Health),
- Initial private residence contacts for future inspection/interview/access;
- Surface geophysics to estimate landfill foot print (EM and magnetometer survey);
- Private well/irrigation well sampling for initial plume identification/extent;
- Landfill cover inspection for stressed vegetation, seepage, erosion, exposed waste and evidence of ponding water;
- Gas vent inspection/sampling;
  - Evaluate gas vent integrity and depth,
  - Sample for indicator gasses to evaluate gas existence and content, and landfill performance,
  - Evaluate landfill liquid/leachate levels and potential of non-aqueous phase liquid,
  - Sample leachate to evaluate potential chemicals of concern and landfill activity.

Responsible Party: AECOM Project Manager, Engineer 3, Engineer 2/Scientist 2, Engineer 1/Scientist 1

Task 4: Field Work Scope Development

The site investigation scope will be developed based on site review and inspection findings. The working CSM will be defined, and the data quality objectives (DQOs) will be established for each task of the site investigation. Scoping includes evaluating the relevant local, state and federal regulations, as well as MPCA Voluntary Program rules and guidance. The regulations and rules guide field efforts, sampling protocol, reporting requirements and remedial options. The investigative elements are anticipated to include direct-push hydraulic probes, soil and waste borings, monitoring well and gas probe installations, and environmental monitoring and sampling of soil, groundwater, and landfill gas. Under this task, the site investigation work plan and accompanying sampling and analysis plan will be prepared. We anticipate that local and state regulators will be involved in scoping, so that the interested parties can agree on the project direction. At least one face-to-face meeting between AECOM and stake holders is necessary to help complete the process with a thorough scope review and agreement on the final work plan.

Responsible Party: AECOM Project Manager, Engineer 4, Engineer 3, Engineer 2/Scientist 2

Task 5: Site Reconnaissance

To allow for data collection over a broad area, we will use a direct-push hydraulic probe rig to complete environmental testing at the landfill property. The testing locations will be marked prior to performance in a systematic manner (e.g. uniform grid) to minimize the potential for data gaps (estimate 4 locations per acre based on MPCA guidance). The objectives for the hydraulic probe investigation would be to evaluate the following:

- Confirm limits of waste;
- Thickness and quality of the landfill cap;

- Nature and extent of landfill gas.

The hydraulic probe will be used to collect continuous soil samples to a depth of less than 12 feet below ground surface (most often 4 to 8 feet below ground surface). Soil samples will be logged to establish the shallow stratigraphy at the site such as the landfill cover, natural soil horizons, and presence of fill or waste. Visual and olfactory observations will also be recorded. The completed boring will be instrumented with a temporary vapor probe tip to allow for soil vapor/landfill gas testing. Gas testing will include:

- Landfill four-gas meter to monitor for the presence of methane, oxygen, carbon dioxide, and hydrogen sulfide;
- Photoionization detector (PID) to screen the vapor for the presence of volatile organic compounds (VOCs); and
- Compound specific colorimetric air sample tubes for target compounds (e.g. trichloroethene, vinyl chloride).

The collected data will be used to evaluate potential hotspots such as visible areas of waste mass, elevated concentrations of landfill gas, or elevated concentrations of VOCs. If areas of impacted soils (not waste mass) are discovered, soil samples may also be collected for laboratory analyses to characterize impacts in areas of direct contact risk or potential direct contact risk.

Based on this information, the hydraulic probe will be used to complete additional deep soil borings at select locations to evaluate the waste thickness, the presence of liquids in the waste mass, and depth to groundwater. If liquids or groundwater are encountered, samples may be collected for laboratory analyses; however, the opportunity may be limited depending on the ability to recover a liquid sample.

The shallow and deep hydraulic probe locations will provide data regarding areas of waste along with potential soil and groundwater impacts. Laboratory results from collected samples will confirm the contaminants of concern. Information about the landfill cover, waste location, and groundwater depth will help design the drilling program for borings to characterize the waste and complete a hydrogeologic study with installation of permanent monitoring wells.

Responsible Party: AECOM Project Manager, Engineer 3, Engineer 2/Scientist 2, Engineer 1/Scientist 1

Task 6: Site Investigation

Having completed the site reconnaissance, the collected information and data will be added to the working CSM to refine the drilling program for site investigation. During this phase, a licensed drilling contractor will be mobilized to the site to advance boreholes and install permanent monitoring points for these purposes:

- Collect waste characterization samples from the waste;
- Establish leachate wells, if liquids are present in the waste;
- Install perimeter gas probes to monitor for landfill gas migration;
- Collect hydrogeologic information, including stratigraphy, permeability, and gradients;
- Establish groundwater well nests to characterize water chemistry, contaminant concentrations, and flow direction.

Given this landfill scenario and our assumptions, the drilling program will be planned to consist of the following:

Inside Limits of Waste – Waste borings are completed into the landfill to confirm the waste thickness and characterize the waste. If liquids are encountered in the waste, some borings may be converted to leachate wells to evaluate landfill liquids. Borings inside the waste limits are planned at a rate of one per five acres.

To advance boreholes into the landfill and through the identified waste, a rotary drill rig will be used with a 12 to 18-inch diameter bucket auger. The bucket auger allows for recovery of a wide range of potential waste material, which provides better waste characterization. If liquids are encountered in the waste, the completed borehole has sufficient size for leachate well installation.

Outside Limits of Waste – Soil borings are completed around the landfill perimeter to evaluate stratigraphy and hydraulic parameters. Borings are planned on each side of the landfill. Additional borings may be specifically located at identified hotspots or in preferential pathways (e.g. south or east sides), if they have not already been investigated. Based on stratigraphy and the CSM, monitoring well nests will be constructed at appropriate locations to evaluate hydraulic gradients and layered stratigraphy. Existing monitoring wells will be considered for use in site monitoring and well nesting.

Rotary drilling techniques (hollow-stem auger, rotary wash, or sonic) will be used to advance boreholes around the landfill. The specific drilling techniques will be evaluated based on encountered site conditions and the objective for each boring. Site stratigraphy will be evaluated by using continuous soil sampling to either the bottom of an encountered unconsolidated aquifer, or bedrock, whichever is shallower. Screen elevations for nested monitoring wells will be evaluated at each location, based on site stratigraphy, the CSM, and field observation. Nested monitoring wells are anticipated to have screened intervals at the terminus of the selected soil boring and across the water table. Additional nested monitoring wells may be located between the water table monitoring well and the deep monitoring well, if a potentially significant high permeability zone (e.g. sand seam) is identified.

Each monitoring well nest location will have one continuous, deep boring for determining adjacent well nest depths. Borings for the shallow wells will be drilled without sampling unless a specific interval needs additional sample collection. If waste is discovered in contact with bedrock or impacts are believed to have migrated into bedrock, MPCA will be contacted immediately to revise the approach because of the significant challenges to assessing bedrock.

Following installation, monitoring wells will be developed to remove sediments and improve connection with the surrounding formation. Monitoring wells will be surveyed for coordinate location and vertical datum (e.g. mean sea level). In-situ hydraulic conductivity tests will be completed to assess groundwater flow rates.

Groundwater sampling will be conducted for contaminants of concern and natural attenuation parameters, if warranted. Sampling will be performed using low-flow methods and a flow-through cell to monitor field parameters for stabilization. Two rounds of water sampling are planned and will be scheduled approximately two months apart. Water levels will be measured during each sampling event to evaluate groundwater flow and gradients.

Investigation-derived wastes (IDW) will be containerized and staged onsite pending the return of laboratory analytical results to allow for proper waste determination. Once characterized, IDW will be disposed in accordance with state and federal regulations.

Responsible Party: AECOM Project Manager, Engineer 4, Engineer 3, Engineer 2/Scientist 2, Engineer 1/Scientist 1

Task 7: Data Analysis and Alternatives Assessment

Data evaluation is an ongoing process that begins as soon as site information is collected and field data is generated. While the field staff is still gathering data, project staff will be working on boring logs and other field forms, site figures, and field memoranda that can be completed. As analytical data becomes available, project staff will review data, compare to standards, and prepare summaries. Project staff will also verify that the scope is followed, and that agreed upon tasks are completed by field staff.

Once sampling is complete and results are compiled, project staff will update the CSM and evaluate contaminant fate and transport of compounds of concern (COCs) within and outside the landfill. Additional site figures and tables will be prepared to illustrate the affected media, extent of contamination, potential pathways, and possible data gaps that may exist. The results of the data analysis are included in figures, tables and text that will become part of the site investigation report.

Based on the updated CSM and understanding of contaminant fate and transport, a remedial alternatives analysis will be developed with a recommended range of possible remedies to address the contaminants of concern. Review of applicable regulations will also provide guidance as to the requirements for site cleanup and possibilities for future re-use. With direction from stake holders, future site use also helps develop the economic and technical feasibility of potential remedies.

In a setting where residential development is in high demand, barriers to exposure pathways for harmful compounds are important for an appropriate remedy. While still important, technical feasibility may not pose much as of an issue for a relatively small and old landfill. Economic feasibility for the preferred remedy will need to balance the acceptable risk to human health and the environment against the available resources and sustainability. Depending on the results of this analysis, examples of potential remedies may include the following:

- Landfill cover repair or installation (soil or composite);
- Landfill gas collection and control systems (active or passive);
- Groundwater pump and treat systems (source or gradient control);
- Groundwater flow barriers (slurry wall) or permeable treatment systems (zero valent iron);
- Waste consolidation or removal.

The remedial alternatives analysis will evaluate a range of recommended remedial alternatives and a discussion of their general technical and economic feasibility. Based on the input of stake holders for a selected remedy, the remedial alternatives analysis may be used to narrow the range of alternatives for future detailed analysis and subsequent remedial design and implementation.

Responsible Party: AECOM Project Manager, Engineer 4, Engineer 3, Engineer 2/Scientist 2, Engineer 1/Scientist 1

Task 8: Site Investigation and Remedial Alternatives Report

The investigation report documents the methods, data, and findings from project award through the site investigation and alternatives analysis. The report will describe methods and techniques used to investigate and collect data from the site. The report will be supported with documentation of collected data and analytical results presented in an organized manner with appropriate tables, figures, and drawings. to the report will include a sound CSM and an understanding of fate and transport for the contaminants of concern at the site. The remedial alternatives analysis will present a recommended range of potential remedies review their technical and economic feasibility. Using input from stake holders, remedial alternatives will be screened to provide focus to preferred remedies for future detailed analysis. Throughout preparation of the report document, an internal quality control and quality assurance process is followed. The document is prepared a draft for client review. Comments are addressed and necessary changes are incorporated before the final report is issued.

An example Remedial Investigation and Alternatives Report Table of Contents is attached.

Responsible Party: AECOM Project Manager, Engineer 4, Engineer 3, Engineer 2/Scientist 2, Engineer 1/Scientist 1

4. Project Schedule

The estimated project schedule is attached. The project duration, assuming 100% staff, contractor and regulator availability, is approximately five months from project award to a completed draft site investigation and remedial alternatives report. Report finalization in our experience takes an additional one to two months while the findings are reviewed and comments are addressed.

5. Project Effort Estimate

The estimate number of hours to implement the Tasks described above is presented in the attached table.

Table of Contents

List of Tables

List of Figures

MINNESOTA POLLUTION CONTROL AGENCY
520 Lafayette Road North
St. Paul, MN 55155-4194

Attachment B
*Example Scenario Project Spreadsheet

Project title: **Scenario C Category C - Landfill**

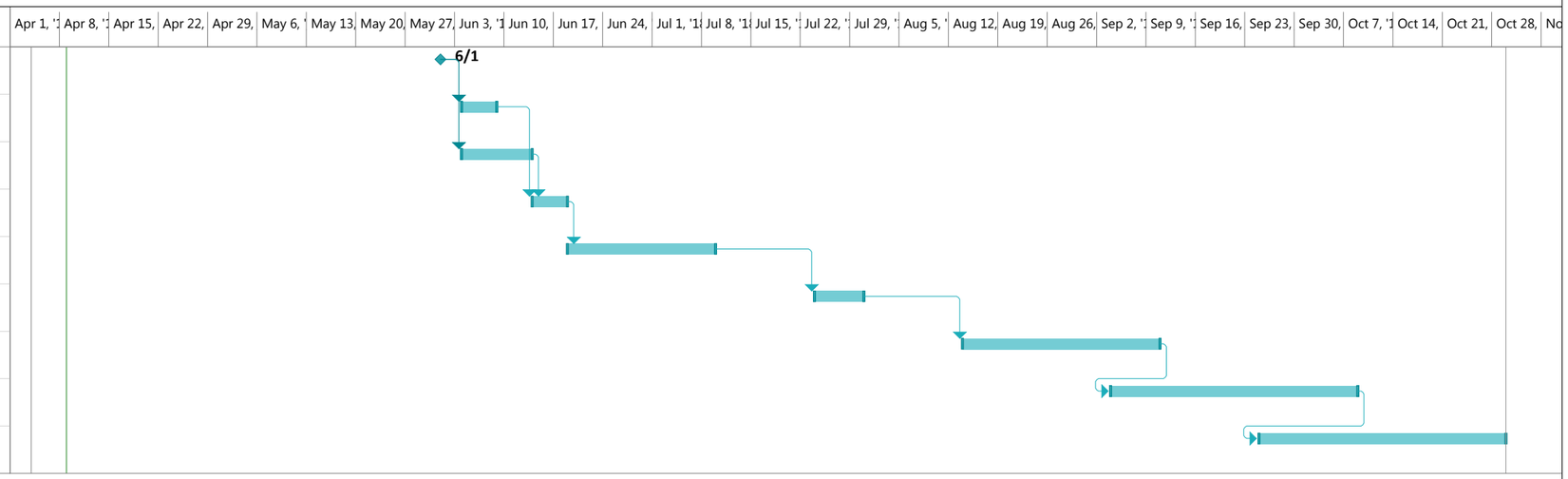
	1. Personnel						2. Subcontracting		3. Equipment	4. Other Expenses		Totals (Extended)
							Drilling	Analytical Lab		Mileage	Perdiem	
Project Budget	Project Manager	CADD/GIS Specialist	Engineer 1/ Scientist 1	Engineer 2/ Scientist 2	Engineer 3	Engineer 4						
Objective 1: Implement RI Sampling Work Plan												
Task 1 - Immediate Action	20			24	4							
Task 2 - Initial Desktop Review	8		20	24								
Task 3 - Preliminary Site Inspection	16		40	16	16			Per State Contract*	Cost Developed During Work Plan Proposal Preparation	Cost Developed During Work Plan Proposal Preparation	Cost Developed During Work Plan Proposal Preparation	
Task 4 - Field Work Scope Development	40			16	12	4						
Task 5 - Site Reconnaissance	16		40	40	8		Per State Contract*	Per State Contract*	Cost Developed During Work Plan Proposal Preparation	Cost Developed During Work Plan Proposal Preparation	Cost Developed During Work Plan Proposal Preparation	
Task 6 - Site Investigation	48	16	220	180	65	6	Per State Contract*	Per State Contract*	Cost Developed During Work Plan Proposal Preparation	Cost Developed During Work Plan Proposal Preparation	Cost Developed During Work Plan Proposal Preparation	
Task 7 - Data Analysis and Alternatives Assessment	40	32	100	220	120	12						
Task 8 - Remedial Investigation and Preliminary Alternatives Assessment	50	40	60	180	90	12						
Total for Objective 1 (Hrs)	**238**	**88**	**480**	**700**	**315**	**34**						

*** - AECOM will prepare/submit a scope of work to State Contractor. State Contractor will provide a quote with rates per State Contract for the scope of work.**

Scenario C
Closed Landfill Project Schedule

Minnesota Pollution Control Agency
Closed Landfill Program

ID	Task Name	Duration	Start	Finish	Predecessors
1	Project Award	0 days	Fri 6/1/18	Fri 6/1/18	
2	**Immediate (Emergency) Actions**	5 days	Mon 6/4/18	Fri 6/8/18	1FS+1 day
3	**Initial Site (Desktop) Review**	8 days	Mon 6/4/18	Wed 6/13/18	1FS+1 day
4	**Preliminary Site Inspection**	3 days	Thu 6/14/18	Mon 6/18/18	2,3
5	**Scope Development**	15 days	Tue 6/19/18	Mon 7/9/18	4
6	**Site Reconnaissance**	5 days	Tue 7/24/18	Mon 7/30/18	5FS+10 days
7	**Site Investigation**	20 days	Tue 8/14/18	Mon 9/10/18	6FS+10 days
8	**Data Analysis and Alternatives Assessment**	25 days	Tue 9/4/18	Mon 10/8/18	7FS-5 days
9	**Remedial Investigation and Alternatives Report**	25 days	Tue 9/25/18	Mon 10/29/18	8FS-10 days



AECOM

C APPENDICES

AECOM Personnel Classifications

Table 1 - AECOM Staff for MPCA Petroleum, Superfund, MDA and Closed Landfill Program

						Personnel Classifications															
						Level 1				Level 2					Level 3					Level 4		
Name	Total Years Experience	Years with AECOM	OSHA / Certifications / Licenses	Highest Degree	Discipline	Engineer 1	Field Technician	GIS/CADD Specialist	Scientist 1	Ecological Risk Assessor (Scientist 2)	Engineer 2	Human Health Risk Assessor (Scientist 2)	QA/QC Officer (Scientist 2)	Scientist 2	Ecological Risk Assessor (Scientist 2)	Engineer 3	Human Health Risk Assessor (Scientist 2)	On-Site Inspector	Project Manager	Engineer 4	Local (L) Outside Minnesota (O)	State (if not local)
					Labor Rates	$78.09	$78.09	$78.09	$78.09	$ 97.48	$ 97.48	$ 97.48	$ 97.48	$ 97.48	$ 137.52	$ 137.52	$ 137.52	$ 137.52	$ 137.52	$ 205.97		
Albrecht, Darin	11	4	PG - Minnesota, 29 CFR 1910.120 (OSHA HAZWOPER Safety Training)	BS/MS	Geology/Water Resources Science									X				X	X		L	
Allen, Shannon	7	6	PE - Wisconsin, 29 CFR 1910.120 (OSHA HAZWOPER Safety Training)	BS	Civil	X					X			X							O	WI
Barajas, PhD, Francisco	1	1	EIT - TX, 40-hr HAZWOPER, Treatability Study Lab Manager	PhD	Environmental Engineering	X			X												O	TX
Beck, Daryl	26	24	Professional Engineer (Environmental), Minnesota, 29 CFR 1910.120 (OSHA HAZWOPER Safety Training), CPR & First Aid,	MS	Environmental Engineering											X		X	X	X	L	
Berger, John	3	1	40-hr Hazwoper, Asbestos Inspector	BA	Geolgoist and Environmental Studies		X		X												L	
Bloecher, Matt	5	5	OSHA 40-hr HAZWOPER, Concrete Field Testing, Mine Safety & Health Administration, Annual Contractor Training	BS	Geotechnical Engineering and Geology	X					X										O	WI
Boehm Carlson, Chris	20	20	Professional Geologist, Minnesota, 29 CFR 1910.120 (OSHA HAZWOPER Safety Training), CPR & First Aid,	BA	Geology									X					X		L	
Bogdan, Dorin	9	9	Engineer in Training	PhD	Environmental Engineering						X										O	MI
Bratsch, Christopher	27	17	Professional Engineer	BCE (Bachelor of Civil Engineering)	Civil/Environmental Engineering											X		X		X	L	
Braun, P.G., Gary	19	19	Professional Geologist - IL, 29 CFR 1910.120 (OSHA HAZWOPER Safety Training), CPR & First Aid	MS	Hydrogeology/Ground water Modeling									X							O	WI
Brown, William (Bill)	11	11	29 CFR 1910.120 (OSHA HAZWOPER Safety Training), CPR & First Aid	High School Diploma	Environmental Technician		X											X			L	
Brownfield, Chris	11	11	PE - North Carolina	MS - Soil Science; BS Chemistry/	Chemical Engineering						X					X					O	NC
Buskey, Scott	23	19	OSHA HAZWOPER 40 hr, OSHA HAZWOPER Supervisor 8-hr Asbestos Inspector, 40-hr Wetland Delineation Training	BS	Anthropology and Geography			X	X					X				X			L	
Canino, Mary	12	10	Professional Geologist, MN 29 CFR 1910.120 (OSHA HAZWOPER Safety Training)	MS	Geology				X					X				X			L	
Cannon, John	9	5	OSHA 40-hr HAZWOPER, OSHA 10-hr Occupational Safety and Health Training, Minnesota Wetland Delineation Certification Program: Delineator-In-Training Certification (#5140)	MA	Impact Assessment and Permitting									X				X			L	
Cervin, Dan	23	4	PG, 29 CFR 1910.120 (OSHA HAZWOPER Safety Training)	MS	Geology									X				X	X		L	
Coryell, Anthony	19	19	29 CFR 1910.120 (OSHA HAZWOPER Safety Training), PPE Certified to Level A, CPR & First Aid; OSHA Confined Spaces Training	MS	Biology/ Ecology/ Toxicology									X	X			X	X		L	
Crane, Carl	33	26	40-hr HAZWOPER, PADI Open Water Diver	MS	Biology and Zoology										X		X				O	TN
Cuthberson, John	25	5	PG - Indiana, PG - AIPG; OSHA 40 Hr HAZWOPER; Midwest Region PFAS Lead	BS	Geology									X							O	MI
De Los Santos, Marie	1	1	29 CFR 1910.120 (OSHA HAZWOPER Safety Training), Asbestos Inspector	MS	Geosciences		X		X												L	
Diemer, Peter	12	8	Certified Hydrographer, ACSM/NSPS; Professional Engineer - WI	BS	Environmental Sciences									X		X					O	WI
Doherty, Ryan	12	12	29 CFR 1910.120 (OSHA HAZWOPER Safety Training), CPR & First Aid Trained, NRPP Residential Radon Measurement and Mitigation Provider	BS	Biology/Ecology									X				X	X		L	
Dryburgh, David	20	12	American Institute of Professional Geologists, OSHA Hazwoper	BS	Geology									X							O	MI
Durocher, Kristen	25	25	OSHA HAZWOPER Safety Training, OSHA HAZWOPER 8-hr Supervisor Training	BA - Env Sciences; MS - Nat Resource	Technical Leader - Ecological Risk Assessment										X						O	NH
Elias, Kim	31	29	OSHA Hazwoper, PG - WI	BS	Geology									X							O	WI
Fortun, Todd	6	5	40-hr Hazwoper; CPR/First Aid	MS	Environmental Chemistry		X		X					X				X			L	
Gebeau, P.E., Angel	17	17	Professional Engineer, Board Certified Environmental Engineer	BS	Process Engineering											X					O	WI
Geiser, Kurt	37	25	Professional Engineer, MN, 29 CFR 1910.120 (OSHA HAZWOPER Safety Training), CPR & First Aid	MS	Agricultural Engineering											X		X		X	L	
Gorski, Alan	26	4	29 CFR 1910.120 (OSHA HAZWOPER Safety Training), CPR & First Aid	BS	Natural Resources and Environmental Studies									X				X			L	
Henery, Eric	8	7	Professional Engineer - PA	MS	Civil Engineering - Water Resources	X					X										L	
Henning P.G., Russ	36	24	Professional Geologist, 29 CFR 1910.120 (OSHA HAZWOPER Safety Training); MSHA	MS	Geology/Geophysics									X							O	WI
Herberich, Jim	28	26	Hydrogeologist	BA	Engineering Sciences									X							O	MA
Herubin PE, Paul	26	23	Professional Engineer	BS	Civil Engineering											X				X	L	
Kalluri, P.E., Vasanta	18	18	Professional Engineer, WI, MN 29 CFR 1910.120 (OSHA HAZWOPER Safety Training)	MS	Environmental Engineering						X					X					O	CO
Klaus, P.E., Ben	5	4	PE - MN; HAZWOPER	BS	Civil/Environmental Engineering	X	X	X	X		X			X				X			L	
Koons, Brad	18	3	PE - MN, ASTM Committee Member - NAPL	MS	BS - Civil Engineering, MS - Environmental Engineering											X					L	
Lanning, Amanda	6	6	OSHA HAZWOPPER, Geologist in Training; CPR & First Aid	BS	Geology		X		X					X				X			L	
LaPointe, John	38	3	PE - MN, IA	BS	BS - Engineering Operations											X				X	L	
Larson, Cathy	31	31	29 CFR 1910.120 (OSHA HAZWOPER Safety Training), CPR & First Aid	BS	Chemistry								X	X							L	
Larson, P.G., Craig	32	27	Professional Geologist, MN 29 CFR 1910.120 (OSHA HAZWOPER Safety Training), CPR & First Aid,	BS	Geology								X	X							L	
Leroy, BJ	25	25	PG - MN, IL, WI	BS	Geology									X							O	WI
Linnemanstons, Leo	24	13	PG - WI	MS	Hydrogeology									X							O	WI
McCoy, James	2	1	30 CFR 1910.120 (OSHA HAZWOPER Safety Training); Asbestos Inspector - MN; Asbestos Contractor Supervisor - MN	BS	Geology & GIS		X	X	X												L	
Paulos, Petros	2	2	Engineer in Training - August 2015 (#149171), 29 CFR 1910.120 (OSHA HAZWOPER Safety Training), CPR & First Aid	MS	Civil Engineering - Environmental Engineering Focus	X	X	X	X									X			L	
Pearson, Joseph	4	1.5	Geologist in Training Minnesota, 29 CFR 1910.120 (OSHA HAZWOPER Safety Training) 40-hr Hazwoper, Construction SWPPP Design Certification, Construction Site Management-Erosion and Stormwater Management Certificate	BS	Geology		X	X	X									X			L	
Peterson, Terry	41	31	PE - MI, KY, and WI	BS	Civil											X				X	O	WI
Phelps, P.G., Dan	14	14	Professional Geologist, MN - 29 CFR 1910.120 (OSHA HAZWOPER Safety Training), CPR & First Aid	BS	Geological Sciences								X	X				X	X		L	
Pinnella, Ken	18	12	29 CFR 1910.120 (OSHA HAZWOPER Safety Training)	MS	Toxicology/Risk Assessment										X		X				O	CO
Poissant, Eric	25	18	Professional Geologist, MN - 29 CFR 1910.120 (OSHA HAZWOPER Safety Training), CPR & First Aid, Asbestos Inspector License (MN, IA, ND), Asbestos Supervisor (MN), Asbestos air sampling trained (MN)	BA	Geology									X				X			L	
Renville, Todd	30	15	OSHA Hazwoper, PG - MN, Construction Site Management - MN, SWPPP Certification - MN	BS	Geology									X							L	
Schulz, PE, Paige	7	2	PE - MN; 40-hr hazwoper, First aid/CPR	MS	Civil Engineering						X							X			L	
Shierk, Cliff	8	4	PE - MN, FL, ND, WI, and WY, OSHA Hazwoper	MS	Civil Engineering Solid Waste						X										O	WI
Tarara, Andrew	21	19	29 CFR 1910.120 (OSHA HAZWOPER Safety Training), CPR & First Aid	BA	Geology								X	X				X	X		L	
Vavra, Sarah	6	5	29 CFR 1910.120 (OSHA HAZWOPER Safety Training)	BS	Earth Sciences: Meteorology				X												L	
Wilson, Seth	12	12	29 CFR 1910.120 (OSHA HAZWOPER Safety Training), CPR & First Aid	BS	Environmental Science				X				X	X				X			L	
Wintheiser, Paul	41	10	30 CFR 1910.120 (OSHA HAZWOPER Safety Training)	BS	Civil Engineering and Solid Waste											X				X	O	WI
Wolf, Michael	39	29	PG - MN, WI, WA, IL, IN	MS	MS - Geophysics and Hydrogeology									X							O	MI
Zimmerman, Meegan	15	15	29 CFR 1910.120 (OSHA HAZWOPER Safety Training), CPR & First Aid	BA/MPH	Toxicology/Risk Assessment							X		X			X				O	CO

AECOM

Table 2 - Key AECOM MPCA/MDA Master Contract Experience
Category C - MPCA Projects Experience
Environmental Services

Services

MPCA Project Name	1.1 Design Remediation System and Strategies for Remediation	1.2 Oversee and Conduct Bench-scale Lab Treatability Studies, Pilot-tests and Field Demos	1.3 Prepare & Evaluate Reports	1.4 Health and Safety Plans (HASPs)	1.5 Oversee Site Investigation Services for SB Advancement and MW Installation	1.6 Groundwater, Soil, Surface Water, Sediment, and Air Sampling	1.7 Vapor/Air Monitoring	1.8 Site Assessment Activities (Phase I & II), LSI & RI	1.9 Surface Water, Groundwater & Vapor Receptor Surveys	1.10 Arrange for Transportation, Storage, and Proper Management of Wastes	1.11 Evaluate Need and Oversee Implementation of Alternative Drinking Water Supply, Including Point-Of-Use Treatment Alt. Drinking Water	1.12 Coordinate & Cooperate with Other State Contracted Services	1.13 Oversee Contractors During Investigation, Cleanup and Tank Removals	1.14 Prepare & Evaluate Reports	1.15 Evaluate Invoices
Macgillis & Gibbs	X		X	X	X	X	X	X	X	X		X	X	X	X
Shorty's Cleaner - Stillwater			X	X		X	X	X	X			X		X	X
Audio by Design			X	X	X	X		X		X		X	X	X	X
Flame Metals			X	X	X	X		X		X		X	X	X	X
South Hibbing Groundwater Solvent Plume			X	X	X	X	X	X				X	X	X	X
Hibbing Chrysler			X	X	X	X	X	X				X	X	X	X
MDA Cedar Services	X	X	X	X	X	X		X				X	X	X	X
Arrowhead Cleaners			X	X	X	X	X	X	X			X	X	X	X
Duluth Dump	X		X	X		X	X	X	X	X				X	X
Middle River Gas Stations	X		X	X	X	X	X	X	X				X	X	X
Longville, MN	X		X	X	X	X		X	X		X		X	X	X
Duluth Harbor AOC Phase 1 and Interactive Mapping								X							X
AC Oil Co. Clearbrook	X		X	X	X	X			X		X	X	X	X	X
Smith Avenue - St. Paul	X		X	X	X	X	X	X				X	X	X	X
Former Twin City Metalseal - 11th Avenue Minneapolis			X	X	X	X	X	X				X	X	X	X
City of St. Louis Park Plume Investigation - Multiple Projects			X	X	X	X	X	X		X		X	X	X	X
MacGillis & Gibbs Ecological Investigations			X	X		X		X				X		X	X
Minnesota Valley Landfill			X	X	X	X		X				X	X	X	X
Pigs Eye Landfill	X	X	X	X	X	X	X	X		X		X	X	X	X
Rays Truck Stop	X	X	X	X	X	X		X	X	X		X	X	X	X
Former Red and White Station			X	X	X	X	X	X	X		X	X	X	X	X
Perchlorate Site Evaluation			X	X		X		X	X			X		X	X
PFOS / PFOA / PFBA Criteria Development & Pesticide/Herbicide Benchmark Study															
Minnesota Plating - Minneapolis	X		X	X	X	X	X	X				X	X	X	X
Bridal Veil/Valentine Clark	X	X	X	X	X	X	X	X	X			X	X	X	X
Olmsted Closed LF			X	X		X	X			X		X		X	X
Winona Closwed LF			X	X		X	X			X		X		X	X
Ironwwood Closed LF			X	X		X	X			X		X		X	X
Albert Lea Closed LF			X	X		X	X			X		X		X	X
CS Service - Grand Marais	X		X	X	X	X	X		X			X	X	X	X
Wally's Spur - Grand Marais			X	X		X	X		X					X	X
City of St. Louis Park Water Treatment Plant Design	X	X	X	X							X	X		X	X
Bayport Water Treatment Plant Design and Construction Oversight			X	X								X		X	X
LF Knutson & Sons	X		X	X	X	X	X	X	X	X	X	X	X	X	X
3M - PFC Services			X	X		X	X				X	X		X	X
Perchlorate Site Evaluation			X	X		X		X	X			X		X	X
Spring Park Water Treatment Plant Design	X		X	X								X		X	X
Edina Water Treatment Plant Design	X	X	X	X								X		X	X

MPCA Project Name	1.16 Collect and Manage Field and Laboratory Data for Specific Format Electronic Submittal to MPCA	1.17 Data Quality Evaluation & Data Verification Reports	1.18 Arrange for Site Access	1.19 Cordinate Utility Locates and Traffic Control	1.20 Preparation and Evaluation of Bid Specifications	1.21 Prepare and Review Site-specific QAPPs or SAPs	1.22 Perform/Oversee Remedial Action Plans	1.23 Surface Water and Groundwater Modeling	1.24 Third Party Review & Analysis of Technical Info.	1.25 Perform Five Year Review and Site Review	1.26 Review Groundwater Remediation Technologies and Recommend Alternatives and Optimization Options	1.27 Evaluation and Design of Energy Recovery Systems Utilizing Ladnfill Gas	1.28 Research, Evaluate, and Implement Innovative Technologies	1.29 Prepare Presentations and Present Info at Meetings	1.30 Prepare and Determine if StormWater Pollution Prevention Plans (SWPPP) are Being Following and Make Recommendations during Construction Projects
Macgillis & Gibbs	X	X	X	X	X	X	X	X	X	X	X		X		
Shorty's Cleaner - Stillwater		X	X	X	X										
Audio by Design		X	X	X											
Flame Metals		X	X	X											
South Hibbing Groundwater Solvent Plume		X	X	X		X					X				
Hibbing Chrysler		X	X	X		X									
MDA Cedar Services		X	X	X	X	X	X				X		X		
Arrowhead Cleaners		X	X	X											
Duluth Dump		X	X	X	X	X	X				X				
Middle River Gas Stations			X	X	X		X								
Longville, MN			X	X	X		X				X				
Duluth Harbor AOC Phase 1 and Interactive Mapping															
AC Oil Co. Clearbrook		X	X	X	X	X	X	X			X			X	
Smith Avenue - St. Paul		X	X	X	X		X								
Former Twin City Metalseal - 11th Avenue Minneapolis			X	X											
City of St. Louis Park Plume Investigation - Multiple Projects	X	X	X	X	X	X		X							
MacGillis & Gibbs Ecological Investigations	X	X	X	X	X	X									
Minnesota Valley Landfill		X	X	X		X	X								
Pigs Eye Landfill	X	X	X	X		X	X				X		X	X	
Rays Truck Stop	X	X	X	X	X		X	X						X	
Former Red and White Station			X	X											
Perchlorate Site Evaluation		X	X	X					X						
PFOS / PFOA / PFBA Criteria Development & Pesticide/Herbicide Benchmark Study									X					X	
Minnesota Plating - Minneapolis	X	X	X	X	X	X	X								
Bridal Veil/Valentine Clark		X	X	X	X	X	X	X	X				X	X	X
Olmsted Closed LF	X		X	X	X	X									
Winona Closwed LF	X		X	X	X	X									
Ironwwood Closed LF	X		X		X	X									
Albert Lea Closed LF	X		X		X	X									
CS Service - Grand Marais	X	X	X	X	X	X	X				X		X		
Wally's Spur - Grand Marais	X	X	X	X	X	X									
City of St. Louis Park Water Treatment Plant Design	X	X	X	X	X								X	X	
Bayport Water Treatment Plant Design and Construction Oversight	X	X	X	X	X								X	X	
LF Knutson & Sons		X	X	X	X	X	X				X				X
3M - PFC Services						X			X	X				X	
Perchlorate Site Evaluation		X	X	X					X						
Spring Park Water Treatment Plant Design	X	X	X	X	X								X	X	
Edina Water Treatment Plant Design	X	X	X	X	X								X	X	

MPCA Project Name	1.31 Prepare Erosion Control Planss and Oversee Implementation	1.32 Provide Technical Assistance in the Evaluation and Interpretation of Data and Information	1.33 Assist and Provide Training to MPCA and MDA	1.34 Follow MPCA Green Practices and Procedures for Remediation Projects	1.35 Oversee Hydrogeologic Investigations Including Fate and Transport Modeling	1.36 Complete Capture Zone Analysis	1.37 Perform and Oversee Aquifer Pump Tests	1.38 Perform/Oversee Evaluation of Soil Borings and Test Pits to Determine Cover Integrity and Suitable Soils	1.39 Arrange for Geophysical Activities	1.40 Conduct Oversee Hydrogeology, Geology, and Soils Studies Using Geophysical Studies, Modeling, and Dye Trace Studies	1.41 Prepare Construction Cost Estimates Using Standard Engineering Practices	1.42 Assist the MPCA During the Bidding Process	1.43 Provide Project Managment and Constuction Oversight	1.44 Prepare Construction Documentation Reports	1.45 Prepare Operation and Maintenance (O&M) Manuals
Macgillis & Gibbs		X		X	X	X			X		X	X			
Shorty's Cleaner - Stillwater				X								X			
Audio by Design				X											
Flame Metals				X											
South Hibbing Groundwater Solvent Plume				X											
Hibbing Chrysler				X											
MDA Cedar Services				X								X			
Arrowhead Cleaners				X											
Duluth Dump				X				X				X			
Middle River Gas Stations				X					X			X			
Longville, MN				X	X							X			
Duluth Harbor AOC Phase 1 and Interactive Mapping		X		X											
AC Oil Co. Clearbrook		X		X	X		X		X			X			
Smith Avenue - St. Paul				X								X			
Former Twin City Metalseal - 11th Avenue Minneapolis				X											
City of St. Louis Park Plume Investigation - Multiple Projects		X		X								X			
MacGillis & Gibbs Ecological Investigations		X		X								X			
Minnesota Valley Landfill				X											
Pigs Eye Landfill	X	X		X							X				
Rays Truck Stop		X		X	X				X			X			
Former Red and White Station		X		X											
Perchlorate Site Evaluation		X		X											
PFOS / PFOA / PFBA Criteria Development & Pesticide/Herbicide Benchmark Study		X													
Minnesota Plating - Minneapolis		X	X	X								X			
Bridal Veil/Valentine Clark	X	X	X	X	X						X	X			
Olmsted Closed LF	X	X		X								X			
Winona Closwed LF	X	X		X								X			
Ironwwood Closed LF	X			X								X			
Albert Lea Closed LF	X	X		X								X			
CS Service - Grand Marais				X								X			
Wally's Spur - Grand Marais				X								X			
City of St. Louis Park Water Treatment Plant Design		X		X							X	X	X	X	X
Bayport Water Treatment Plant Design and Construction Oversight		X		X							X	X	X	X	X
LF Knutson & Sons				X					X			X			
3M - PFC Services		X		X	X										
Perchlorate Site Evaluation		X		X											
Spring Park Water Treatment Plant Design		X		X							X	X	X	X	X
Edina Water Treatment Plant Design		X		X							X	X	X	X	X

Table 3 - Key AECOM Other Government and Private Client Experience
Category C - MPCA Projects Experience
Environmental Services

Services

Project Name	1.1 Design Remediation System and Strategies for Remediation	1.2 Oversee and Conduct Bench-scale Lab Treatability Studies, Pilot-tests and Field Demos	1.3 Prepare Corrective Action Design Documents	1.4 Health and Safety Plans (HASPs)	1.5 Oversee Site Investigation Services for SB Advancement and MW Installation	1.6 Groundwater, Soil, Surface Water, Sediment, and Air Sampling	1.7 Vapor/Air Monitoring	1.8 Site Assessment Activities (Phase I & II), LSI & RI	1.9 Surface Water, Groundwater & Vapor Receptor Surveys	1.10 Arrange for Transportation, Storage, and Proper Management of Wastes	1.11 Evaluate Need and Oversee Implementation of Alternative Drinking Water Supply, Including Point-Of-Use Treatment Alt. Drinking Water	1.12 Coordinate & Cooperate with Other State Contracted Services	1.13 Oversee Investigation, Cleanup and Removal for Tanks	1.14 Prepare & Evaluate Reports	1.15 Evaluate Invoices
Former Municipal Landfill Hartford, WI	x	x	x	x	x	x	x	x	x	x	x			x	x
Schuster Dr Landfill West Bend, WI	x	x	x	x	x	x	x	x	x	x	x			x	x
Duck Pond Landfill Fontana, WI	x			x	x	x		x	x	x				x	x
Olmstead Closed Landfill O&M				x			x			x		x		x	x
Winona Closed Landfill O&M				x			x			x		x		x	x
Ironwood Closed Landfill O&M				x			x			x		x		x	x
Albert Lea Closed Landfill O&M				x			x			x		x		x	x
BNSF Mandan ND Railyard	x	x	x	x	x	x	x	x	x	x				x	x
BNSF Brainerd Tie Plant	x	x	x	x	x	x	x	x	x	x				x	x
Condensate Release - Western North Dakota	x	x	x	x	x	x	x	x	x	x	x			x	x
Enbridge South Cass Lake	x	x	x	x	x	x	x	x	x	x				x	x
Waste Management - Settlers Hill	x		x	x	x	x		x						x	x
Waste Management - Willow run				x	x	x		x						x	x
Waste Manangement - Milam				x	x	x		x						x	x
Waste Management - DeKalb				x	x	x	x	x						x	x
Waste Management - Laraway				x	x	x		x						x	x
Outagamie County Landfill				x	x	x		x				x		x	x
Village of Grafton	x	x	x	x	x	x	x	x	x		x	x		x	x
Confidential Client - MI	x		x	x								x		x	x
Waste Management - Reclamation	x			x	x	x		x						x	x
KI Sawyer AFB	x			x	x	x		x				x		x	x
Conoco Phillips - Golden Eagle	x		x	x	x	x		x	x			x		x	x
Dept of Navy - Pearl Harbor	x		x	x								x		x	x
Dept of Navy - Great Lakes	x		x	x	x	x		x				x		x	x
Crandon Mine				x								x		x	x
Waste Management - Prairie Hill	x			x	x	x		x						x	x
Confidential Client - IN	x			x	x	x		x				x		x	x
Town of Sheboygan Landfill, Wisconsin	x		x	x	x	x	x							x	x
Doyne Park Landfill Milwaukee, Wisconsin	x		x	x	x	x	x							x	x
Hunts Disposal Landfill Caledonia, Wisconsin	x		x	x	x	x	x		x			x		x	
Byron Johnson Salvage Yard Byron, Illinois				x		x	x			x		x	x	x	x
Model City Landfill Model City, New York		x		x											
Mallard Lake Landfill Hanover Park, Illinios	x	x	x	x	x	x	x		x			x		x	x

Project Name	1.16 Collect and Manage Field and Laboratory Data for Specific Format Electronic Submittal to MPCA	1.17 Data Quality Evaluation & Data Verification Reports	1.18 Arrange for Site Access	1.19 Cordinate Utility Locates and Traffic Control	1.20 Prepare and Evaluate Bid Documents Plans for MPCA and MN Department of Admin	1.21 Prepare and Review Site-specific QAPPs or SAPs	1.22 Perform/Oversee Remedial Action Plans	1.23 Surface Water and Groundwater Modeling	1.24 Third Party Review & Analysis of Technical Info.	1.25 Perform Five Year Review and Site Review	1.26 Groundwater Remediation	1.27 Evaluation and Design of Energy Recovery Systems Utilizing Ladnfill Gas	1.28 Research, Evaluate, and Implement Innovative Technologies	1.29 Prepare Presentations and Present Info at Meetings	1.30 Prepare and Determine if StormWater Pollution Prevention Plans (SWPPP) are Being Following and Make Recommendations during Construction Projects
Former Municipal Landfill Hartford, WI		x	x	x		x	x	x			x			x	
Schuster Dr Landfill West Bend, WI		x	x	x		x	x				x			x	
Duck Pond Landfill Fontana, WI		x	x	x		x									
Olmstead Closed Landfill O&M	x	x	x	x	x	x									
Winona Closed Landfill O&M	x	x	x	x	x	x									
Ironwood Closed Landfill O&M	x	x	x	x	x	x									
Albert Lea Closed Landfill O&M	x	x	x	x	x	x									
BNSF Mandan ND Railyard		x	x	x		x	x	x			x		x	x	
BNSF Brainerd Tie Plant		x	x	x		x	x	x		x	x		x	x	
Condensate Release - Western North Dakota	x	x	x	x		x	x	x			x		x	x	
Enbridge South Cass Lake	x	x	x	x		x	x	x			x		x	x	x
Waste Management - Settlers Hill		x	x	x		x	x	x	x		x				
Waste Management - Willow run		x	x	x		x		x	x					x	
Waste Manangement - Milam								x							
Waste Management - DeKalb		x						x							
Waste Management - Laraway		x						x						x	
Outagamie County Landfill			x	x				x							
Village of Grafton		x	x	x		x	x	x	x		x			x	
Confidential Client - MI		x						x	x		x			x	
Waste Management - Reclamation								x							
KI Sawyer AFB		x	x	x		x	x	x	x		x				
Conoco Phillips - Golden Eagle			x	x			x	x	x		x		x	x	
Dept of Navy - Pearl Harbor		x				x									
Dept of Navy - Great Lakes		x	x	x		x	x	x						x	
Crandon Mine			x					x	x					x	
Waste Management - Prairie Hill						x									
Confidential Client - IN		x	x			x		x							
Town of Sheboygan Landfill, Wisconsin														x	
Doyne Park Landfill Milwaukee, Wisconsin			x	x								x	x	x	
Hunts Disposal Landfill Caledonia, Wisconsin		x	x	x		x	x	x	x	x	x			x	
Byron Johnson Salvage Yard Byron, Illinois		x	x	x		x									
Model City Landfill Model City, New York		x													
Mallard Lake Landfill Hanover Park, Illinios		x	x	x		x	x	x				x	x	x	

Project Name	1.31 Prepare Erosion Control Planss and Oversee Implementation	1.32 Provide Technical Assistance in the Evaluation and Interpretation of Data and Information	1.33 Assist and Provide Training to MPCA and MDA	1.34 Follow MPCA Green Practices and Procedures for Remediation Projects	1.35 Oversee Hydrogeologic Investigations Including Fate and Transport Modeling	1.36 Capture Zone Analysis	1.37 Perform and Oversee Aquifer Pump Tests	1.38 Perform/Oversee Evaluation of Soil Borings and Test Pits to Determine Cover Integrity and Suitable Soils	1.39 Arrange for Geophysical Activities	1.40 Conduct Oversee Hydrogeology, Geology, and Soils Studies Using Geophysical Studies, Modeling, and Dye Trace Studies	1.41 Prepare Construction Cost Estimates Using Standard Engineering Practices	1.42 Assist the MPCA During Bidding Process	1.43 Provide Project Management and Construction Oversight	1.44 Prepare Construction Documentation Reports	1.45 Prepare Operation and Maintenance Manuals
Former Municipal Landfill Hartford, WI					x	x		x	x	x			x	x	
Schuster Dr Landfill West Bend, WI					x	x	x	x					x	x	x
Duck Pond Landfill Fontana, WI					x			x							
Olmstead Closed Landfill O&M															
Winona Closed Landfill O&M															
Ironwood Closed Landfill O&M															
Albert Lea Closed Landfill O&M															
BNSF Mandan ND Railyard		x			x	x				x	x	x	x	x	x
BNSF Brainerd Tie Plant					x	x				x	x		x		x
Condensate Release - Western North Dakota		x			x	x		x		x	x		x		x
Enbridge South Cass Lake		x			x						x		x		x
Waste Management - Settlers Hill		x			x	x	x						x		x
Waste Management - Willow run		x			x	x	x		x				x		
Waste Manangement - Milam		x			x	x					x		x		
Waste Management - DeKalb		x			x	x	x	x					x		
Waste Management - Laraway		x			x	x		x			x		x		
Outagamie County Landfill		x											x		
Village of Grafton	x	x			x	x	x	x	x		x		x		x
Confidential Client - MI		x			x	x							x		
Waste Management - Reclamation		x			x	x							x		
KI Sawyer AFB		x			x	x	x	x	x		x		x		x
Conoco Phillips - Golden Eagle		x			x	x					x		x		x
Dept of Navy - Pearl Harbor		x											x		
Dept of Navy - Great Lakes	x	x			x			x			x		x		
Crandon Mine		x			x	x							x		x
Waste Management - Prairie Hill		x				x							x		
Confidential Client - IN		x					x	x	x				x		
Town of Sheboygan Landfill, Wisconsin	x	x									x		x	x	x
Doyne Park Landfill Milwaukee, Wisconsin	x	x			x			x	x	x	x		x	x	x
Hunts Disposal Landfill Caledonia, Wisconsin	x	x			x	x	x	x	x	x	x		x	x	x
Byron Johnson Salvage Yard Byron, Illinois	x												x	x	
Model City Landfill Model City, New York		x											x	x	x
Mallard Lake Landfill Hanover Park, Illinios		x			z	z	z	z	z	z	z		z	z	z

AECOM

Table 4 - Key AECOM MPCA/MDA Master Contract Staff Experience
Category C - Staff Services Experience
Environmental Services

Services

AECOM STAFF NAME	1.1 Design Remediation System and Strategies for Remediation	1.2 Oversee and Conduct Bench-scale Lab Treatability Studies, Pilot-tests and Field Demos	1.3 Prepare Corrective Action Design Documents	1.4 Health and Safety Plans (HASPs)	1.5 Oversee Site Investigation Services for SB Advancement and MW Installation	1.6 Groundwater, Soil, Surface Water, Sediment, and Air Sampling	1.7 Vapor/Air Monitoring	1.8 Site Assessment Activities (Phase I & II), LSI & RI	1.9 Surface Water, Groundwater & Vapor Receptor Surveys	1.10 Arrange for Transportation, Storage, and Proper Management of Wastes	1.11 Evaluate Need and Oversee Implementation of Alternative Drinking Water Supply, Including Point-Of-Use Treatment Alt. Drinking Water	1.12 Coordinate & Cooperate with Other State Contracted Services	1.13 Oversee Investigation, Cleanup and Removal for Tanks	1.14 Prepare & Evaluate Reports	1.15 Evaluate Invoices
Albrecht, Darin, P.G.		x	x	x	x	x	x	x	x						
Allen, Shannon			x	x	x	x				x				x	x
Barajas, PhD, Francisco	x	x		x		x								x	
Beck, Daryl	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Berger, John				x	x	x	x	x	x			x	x	x	x
Bloecher, Matt			x	x	x	x				x				x	
Boehm Carlson, Chris	x	x	x	x	x	x	x	x	x	x		x	x	x	x
Bogdan, Dorin	x	x	x	x	x	x	x	x	x	x					
Bratsch, Christopher	x		x	x	x	x	x	x	x	x		x	x	x	x
Braun, P.G., Gary	x			x	x	x	x	x	x	x				x	x
Brown, William (Bill)				x	x	x	x	x	x	x		x	x		
Brownfield, Chris	x	x	x	x	x	x	x	x	x	x					
Buskey, Scott				x	x	x	x	x	x	x			x	x	
Canino, Mary	x		x	x	x	x	x	x	x	x		x	x	x	x
Cannon, John				x		x		x	x					x	x
Cervin, P.G., Dan	x		x	x	x	x	x	x	x	x	x	x	x	x	x
Coryell, Anthony			x	x	x	x	x	x	x	x		x	x	x	x
Crane, Carl				x		x		x	x					x	
Cuthberson, John	x	x	x	x	x	x	x	x	x	x		x	x	x	x
De los Santos, Marie				x	x	x	x	x	x	x		x	x	x	
Diemer, Peter			x	x		x				x				x	x
Doherty, Ryan			x	x	x	x	x	x	x	x		x	x	x	x
Dryburgh, David	x			x	x	x	x	x	x	x		x	x	x	x
Durocher, Kristen				x		x			x					x	
Elias, Kim			x	x	x	x		x		x		x		x	x
Fortun, Todd				x	x	x	x	x	x			x		x	
Gebeau, P.E., Angel	x	x		x		x					x			x	
Geiser, Kurt	x		x	x	x	x	x	x	x	x	x		x	x	x
Gorski, Alan	x		x	x	x	x	x	x	x	x		x	x	x	
Henery, Eric				x										x	
Henning P.G., Russ	x			x	x	x	x	x	x			x		x	
Herberich, Jim						x						x		x	
Herubin PE, Paul				x								x	x	x	x
Kalluri, P.E., Vasanta	x	x	x	x	x	x	x	x	x	x		x	x	x	x
Klaus, P.E., Ben	x	x	x	x	x	x	x	x	x	x				x	x
Koons, Brad	x	x	x		x			x				x		x	

AECOM STAFF NAME	1.16 Collect and Manage Field and Laboratory Data for Specific Format Electronic Submittal to MPCA	1.17 Data Quality Evaluation & Data Verification Reports	1.18 Arrange for Site Access	1.19 Cordinate Utility Locates and Traffic Control	1.20 Prepare and Evaluate Bid Documents Plans for MPCA and MN Department of Admin	1.21 Prepare and Review Site-specific QAPPs or SAPs	1.22 Perform/Oversee Remedial Action Plans	1.23 Surface Water and Groundwater Modeling	1.24 Third Party Review & Analysis of Technical Info.	1.25 Perform Five Year Review and Site Review	1.26 Groundwater Remediation	1.27 Evaluation and Design of Energy Recovery Systems Utilizing Ladnfill Gas	1.28 Research, Evaluate, and Implement Innovative Technologies	1.29 Prepare Presentations and Present Info at Meetings	1.30 Prepare and Determine if StormWater Pollution Prevention Plans (SWPPP) are Being Following and Make Recommendations during Construction Projects
Albrecht, Darin, P.G.		x	x	x	x	x	x	x	x				x		
Allen, Shannon			x	x	x		x	x						x	
Barajas, PhD, Francisco								x			x		x	x	
Beck, Daryl	x	x	x	x	x	x	x		x	x	x		x	x	x
Berger, John	x	x	x	x	x	x							x	x	
Bloecher, Matt			x	x	x								x	x	
Boehm Carlson, Chris		x	x	x	x	x	x	x	x	x	x		x	x	x
Bogdan, Dorin			x	x	x	x	x		x	x	x		x	x	
Bratsch, Christopher	x		x	x	x	x	x		x		x			x	x
Braun, P.G., Gary			x	x	x	x	x	x	x	x	x			x	
Brown, William (Bill)				x			x								
Brownfield, Chris			x	x	x	x	x		x	x	x		x	x	
Buskey, Scott	x	x	x	x		x	x	x	x					x	
Canino, Mary		x	x	x	x	x	x				x			x	x
Cannon, John			x	x									x	x	x
Cervin, P.G., Dan	x	x	x	x	x	x	x	x	x		x		x	x	x
Coryell, Anthony	x	x	x	x	x	x	x	x		x				x	
Crane, Carl		x				x		x	x	x					
Cuthberson, John		x	x	x	x	x		x	x	x	x		x	x	x
De los Santos, Marie		x	x	x					x						
Diemer, Peter			x		x								x	x	
Doherty, Ryan	x	x	x	x	x	x	x						x		
Dryburgh, David	x		x	x	x		x		x		x	x		x	
Durocher, Kristen						x			x					x	
Elias, Kim		x	x	x	x	x	x		x	x				x	
Fortun, Todd	x	x	x	x		x	x		x					x	
Gebeau, P.E., Angel					x						x		x	x	
Geiser, Kurt	x		x	x	x	x	x		x	x	x		x	x	
Gorski, Alan	x		x	x	x	x	x		x	x	x		x	x	
Henery, Eric								x						x	x
Henning P.G., Russ	x				x	x		x	x	x	x		x	x	
Herberich, Jim	x					x		x	x					x	
Herubin PE, Paul					x				x				x		
Kalluri, P.E., Vasanta	x	x	x	x	x	x	x	x	x		x		x	x	x
Klaus, P.E., Ben			x	x	x		x				x				x
Koons, Brad					x	x	x	x	x	x	x		x	x	

AECOM STAFF NAME	1.31 Prepare Erosion Control Planss and Oversee Implementation	1.32 Provide Technical Assistance in the Evaluation and Interpretation of Data and Information	1.33 Assist and Provide Training to MPCA and MDA	1.34 Follow MPCA Green Practices and Procedures for Remediation Projects	1.35 Oversee Hydrogeologic Investigations Including Fate and Transport Modeling	1.36 Capture Zone Analysis	1.37 Perform and Oversee Aquifer Pump Tests	1.38 Perform/Oversee Evaluation of Soil Borings and Test Pits to Determine Cover Integrity and Suitable Soils	1.39 Arrange for Geophysical Activities	1.40 Conduct Oversee Hydrogeology, Geology, and Soils Studies Using Geophysical Studies, Modeling, and Dye Trace Studies	1.41 Prepare Construction Cost Estimates Using Standard Engineering Practices	1.42 Assist the MPCA During Bidding Process	1.43 Provide Project Management and Construction Oversight	1.44 Prepare Construction Documentation Reports	1.45 Prepare Operation and Maintenance Manuals
Albrecht, Darin, P.G.	x	x		x			x	x		x	x	x			
Allen, Shannon	x	x									x	x			x
Barajas, PhD, Francisco		x									x				
Beck, Daryl	x			x			x	x	x		x	x	x	x	x
Berger, John		x		x					x			x			
Bloecher, Matt		x							x		x	x			
Boehm Carlson, Chris		x			x	x	x	x		x		x			
Bogdan, Dorin		x					x				x	x			
Bratsch, Christopher	x	x			x	x	x		x		x	x		x	x
Braun, P.G., Gary		x			x	x	x	x	x	x		x			
Brown, William (Bill)	x			x											
Brownfield, Chris	x	x								x	x	x		x	x
Buskey, Scott	x	x		x	x				x						
Canino, Mary	x	x		x	x	x	x		x	x	x	x			
Cannon, John	x	x													
Cervin, P.G., Dan	x	x		x			x	x	x	x		x			
Coryell, Anthony	x	x		x				x	x			x			
Crane, Carl		x													
Cuthberson, John		x			x	x	x			x		x			
De los Santos, Marie		x													
Diemer, Peter		x									x	x			
Doherty, Ryan	x	x		x				x	x			x			
Dryburgh, David		x			x	x			x			x			
Durocher, Kristen		x													
Elias, Kim	x	x					x				x	x			
Fortun, Todd	x	x													
Gebeau, P.E., Angel	x	x		x			x				x	x			
Geiser, Kurt	x	x		x	x		x		x	x	x	x	x	x	x
Gorski, Alan	x	x		x	x	x	x	x		x	x	x			
Henery, Eric											x				
Henning P.G., Russ		x	x		x	x	x	x	x	x		x			
Herberich, Jim		x			x	x									
Herubin PE, Paul		x									x	x			
Kalluri, P.E., Vasanta	x	x			x	x			x		x	x	x	x	x
Klaus, P.E., Ben	x			x							x	x			
Koons, Brad	x	x	x				x		x	x	x	x			

AECOM

Table 4 - Key AECOM MPCA/MDA Master Contract Staff Experience
Category C - Staff Services Experience
Environmental Services

Services

AECOM STAFF NAME	1.1 Design Remediation System and Strategies for Remediation	1.2 Oversee and Conduct Bench-scale Lab Treatability Studies, Pilot-tests and Field Demos	1.3 Prepare Corrective Action Design Documents	1.4 Health and Safety Plans (HASPs)	1.5 Oversee Site Investigation Services for SB Advancement and MW Installation	1.6 Groundwater, Soil, Surface Water, Sediment, and Air Sampling	1.7 Vapor/Air Monitoring	1.8 Site Assessment Activities (Phase I & II), LSI & RI	1.9 Surface Water, Groundwater & Vapor Receptor Surveys	1.10 Arrange for Transportation, Storage, and Proper Management of Wastes	1.11 Evaluate Need and Oversee Implementation of Alternative Drinking Water Supply, Including Point-Of-Use Treatment Alt. Drinking Water	1.12 Coordinate & Cooperate with Other State Contracted Services	1.13 Oversee Investigation, Cleanup and Removal for Tanks	1.14 Prepare & Evaluate Reports	1.15 Evaluate Invoices	1.16 Collect and Manage Field and Laboratory Data for Specific Format Electronic Submittal to MPCA	1.17 Data Quality Evaluation & Data Verification Reports	1.18 Arrange for Site Access	1.19 Cordinate Utility Locates and Traffic Control	1.20 Prepare and Evaluate Bid Documents Plans for MPCA and MN Department of Admin	1.21 Prepare and Review Site-specific QAPPs or SAPs	1.22 Perform/Oversee Remedial Action Plans	1.23 Surface Water and Groundwater Modeling	1.24 Third Party Review & Analysis of Technical Info.	1.25 Perform Five Year Review and Site Review	1.26 Groundwater Remediation	1.27 Evaluation and Design of Energy Recovery Systems Utilizing Ladnfill Gas	1.28 Research, Evaluate, and Implement Innovative Technologies	1.29 Prepare Presentations and Present Info at Meetings	1.30 Prepare and Determine if StormWater Pollution Prevention Plans (SWPPP) are Being Following and Make Recommendations during Construction Projects	1.31 Prepare Erosion Control Planss and Oversee Implementation	1.32 Provide Technical Assistance in the Evaluation and Interpretation of Data and Information	1.33 Assist and Provide Training to MPCA and MDA	1.34 Follow MPCA Green Practices and Procedures for Remediation Projects	1.35 Oversee Hydrogeologic Investigations Including Fate and Transport Modeling	1.36 Capture Zone Analysis	1.37 Perform and Oversee Aquifer Pump Tests	1.38 Perform/Oversee Evaluation of Soil Borings and Test Pits to Determine Cover Integrity and Suitable Soils	1.39 Arrange for Geophysical Activities	1.40 Conduct Oversee Hydrogeology, Geology, and Soils Studies Using Geophysical Studies, Modeling, and Dye Trace Studies	1.41 Prepare Construction Cost Estimates Using Standard Engineering Practices	1.42 Assist the MPCA During Bidding Process	1.43 Provide Project Management and Construction Oversight	1.44 Prepare Construction Documentation Reports	1.45 Prepare Operation and Maintenance Manuals
Lanning, Amanda				x	x	x	x	x	x	x		x		x		x	x															x													
Lapointe, John		x		x		x		x			x		x	x			x		x	x				x				x	x	x		x	x	x							x	x			x
Larson, Cathy			x	x	x	x	x	x	x					x		x	x				x	x		x	x						x	x													
Larson, P.G., Craig	x		x	x	x	x	x	x	x	x			x	x	x				x	x	x	x		x	x	x		x	x		x	x			x	x	x		x	x		x			
Leroy, BJ	x			x	x	x		x				x		x	x	x		x	x	x	x	x	x	x	x	x	x		x		x	x			x	x		x	x		x	x	x	x	x
Linnemanstons, Leo	x				x	x	x	x	x	x			x	x	x			x	x	x	x	x	x	x	x	x	x		x		x	x			x			x	x			x	x	x	x
McCoy, James			x	x	x	x	x	x	x			x	x	x	x	x	x	x	x	x	x	x						x	x			x		x	x	x			x			x			
Paulos, Petros	x		x	x	x	x	x	x	x	x		x		x	x	x	x	x	x		x	x	x					x	x			x		x					x		x				
Pearson, Joseph			x	x	x	x	x	x	x	x		x		x	x	x	x	x	x		x	x	x					x	x	x	x	x		x	x	x			x						
Peterson PE, Terry	x			x		x				x				x	x			x	x	x			x	x		x			x	x	x	x					x		x		x	x		x	
Phelps, P.G., Dan	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x		x		x			x	x		x	x	x	x		x	x		x			
Pinnella, Ken				x		x			x					x							x			x					x			x													
Poissant, Eric	x			x	x	x	x	x	x	x			x	x	x			x	x		x	x				x			x		x	x							x						
Renville, Todd	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x		x	x	x	x	x		x	x	x		x			x	x	x		x		x	x			
Schulz, PE, Paige	x		x	x	x	x	x	x	x	x		x	x	x	x		x	x	x			x				x			x	x	x	x			x	x			x		x				
Shierk, Cliff	x			x	x	x		x				x		x	x	x		x	x	x	x	x	x	x	x	x			x		x	x			x	x			x		x	x	x	x	x
Tarara, Andrew	x		x	x	x	x	x	x	x	x			x	x	x		x	x	x	x	x	x	x		x	x		x	x		x			x	x	x	x		x		x	x			
Vavra, Sarah				x			x							x	x		x		x		x			x																					
Wilson, Seth	x	x	x	x	x	x	x	x	x	x		x	x	x	x		x	x	x	x	x	x	x	x	x	x		x	x	x	x	x			x							x			
Wintheiser, Paul	x			x	x	x		x				x		x	x	x		x	x	x	x	x	x	x	x	x	x		x		x	x			x	x	x	x	x	x	x	x	x	x	x
Wolf, P.G., Michael	x			x	x	x		x						x								x	x	x	x	x		x	x		x	x			x	x	x	x	x	x			x		
Zimmerman, Meegan				x		x		x						x								x			x				x			x													

AECOM

Darin R. Albrecht
Project Manager/On-Site Inspector/Scientist 2

Education
B.S. Geological Sciences
University of Minnesota Duluth, 2001
M.S. Water Resources Science
University of Minnesota, 2005

Years of Experience
With AECOM: 4
With Other Firms: 7

Registrations/Trainings
Minnesota Professional Geologist - #55362
40-Hour Hazwoper Certified

Professional Affiliations
2013-2014 Mesabi Range Geological Society – Secretary/Treasurer
2014-2015 Mesabi Range Geological Society – Vice President
2015-2016 Mesabi Range Geological Society – President
Duluth Propeller Club – Vice President

Mr. Albrecht has 11 years of experience in the environmental field with an emphasis on geological and hydrogeological site assessments, site remediation and business development. He has direct experience and extensive knowledge of regulatory requirements and methodologies for soil, groundwater and soil vapor sample collection as well as data reduction and interpretation.

Project Experience

State of Minnesota Department of Admin. Contract, Various MN Sites. Project manager providing support related to on-going site investigation, remedial action plan development, active remediation and maintenance, and conceptual corrective action design procedures. Experience with advanced real-time drilling methods including LIF, hydraulic profiling tool (HPT) and vertical aquifer profiling (VAP) and geophysical investigation techniques. Experience with hollow stem auger, direct push, roto-sonic drilling methods. Managed additional site characterization and soil excavations at an abandoned closed dump site. Managed a large scale Phase I project related to the Duluth Harbor Area of Concern. Familiar with MPCA state contracting procedures.

Enbridge Energy Site Investigations, Cass Lake, MN. Project manager for work related to remedial action plan implementation, active remediation and additional investigation. Experience with advanced site investigation methods (Laser Induced Fluorescence) techniques. Experience with LNAPL bail down testing, and recovery. Ongoing quarterly monitoring.

Enbridge Energy Site Investigation, Swan River, MN. Project manager for site investigation related to former operations at a closed and demolished truck stop. Managed soil boring and monitoring well installations and geophysical investigation related to possible in-place infrastructure at the site. Manage ongoing monthly and quarterly monitoring.

TransCanada Emergency Response – Freeman, SD. Field lead overseeing junior field staff completing soil borings, soil sampling and water sampling. Soil management and contractor oversight. Significant waste disposal and disposal coordination experience.

AECOM

Shannon Allen, P.E.
Scientist 2/Engineer 2/Engineer 1

Professional History
10/2011 - Present, AECOM Engineer

Education
BaArchSci, Civil Engineering, University of Wisconsin - Platteville, 2011

Years of Experience
With AECOM: 6
With Other Firms: 1

Professional Affiliations
American Society of Civil Engineers

Registrations
Professional Engineer, Wisconsin

Training
OSHA 8-Hour Confined Space Operations Entry/Attendant Training Nuclear Density Gauge Operator Training OSHA 40-Hour HAZWOPER Training
E-Rail Safe

Ms. Allen is a civil engineer in the Oshkosh, Wisconsin office and has gained experience in a variety of geotechnical, civil site design, hydro dam, industrial and municipal solid waste, and environmental permitting projects.

Project Experience

Georgia-Pacific Consumer Products LP, Project Cuatro - Balance of Plant Design, Palatka, Florida. Developed the site plan for a building expansion totaling approximately 500,000 square feet. Involved with developing plan sets for the environmental resource permit, construction general permit, dewatering approval, and development review committee required by the state and county as well as construction packages related to ground improvements and site access/site preparation. Project included coordinating conflicts between various utilities including storm sewer, combined storm and sanitary sewer, fire protection, effluent force main, fiber optic, electric, and natural gas. Vehicle turn analysis was determined for semi-truck trailer parking, semi-truck movements at loading docks, and vehicle movements throughout the site for emergency vehicles, waste pick up vehicles, and semi-trucks.

Neenah Paper, Engineering and Environmental Permitting, Neenah, Wisconsin. Developed the site plan for a new building construction project. Development of the site includes an erosion control plan; demolition plan of existing features; pavement layout to accommodate semi-truck turning, emergency vehicles, and parking spaces for regular vehicles; new utilities (sanitary sewer, storm sewer, water, gas, electric, and communication) and their connection to existing utilities while meeting state and city code requirements; design of a biofilter and filter strip for total suspended solids removal; and a grading plan. The project involves direct communication with the client and city of Appleton.

City of Oshkosh, Boatworks Restroom and Parking Lot Construction Observation, Oshkosh, Wisconsin. Designed a parking lot on a vacant lot to access the city riverwalk system and ADA kayak and canoe launch. The project also included construction of a restroom facility. The site plans were developed in accordance with city site plan review and were approved through common council. Stormwater management features including a biofilter were incorporated to achieve Wisconsin Department of Natural Resources and city requirements for total suspended solid reduction. Project plans, specification, and bidding documents were also developed.

City of Oshkosh, Riverside Parking Lot, Oshkosh, Wisconsin. Developed a phasing design which incorporated a grading and storm sewer plan for Phase I and final build out. Analyzed the storm sewer system with HydroCAD in accordance with city codes. Two bioretention ponds were designed with RECARGA modeling and WinSLAMM. Plan sets were created in AutoCAD Civil 3D for Phases I and II construction. Project specifications and bid documents were developed. Stormwater management and erosion control plans were submitted to the city. A notice of intent was submitted to the Wisconsin Department of Natural Resources. Assistant project manager during both phases of project construction responsible for reviewing contractor submittals, attending weekly progress meetings, adjusting the design based on construction challenges, and providing communication and coordination with adjacent property owners.

City of Oshkosh, Capital Improvement Projects, Oshkosh, Wisconsin. Participated in the project to screen for contaminated soils in the city's street reconstruction projects. Created the site location diagrams in AutoCAD for various CIP project sites which showed the proposed areas of contaminated soil. Screened contaminated soils using a photoionization detector (PID) and wrote the manifests for the trucks to haul the contaminated soils to the landfill.

City of Oshkosh, Water Filtration Plant - Storage Building Construction Management, Oshkosh, Wisconsin. Submittal and field construction manager for construction of a storage facility at the water filtration plant. Duties included review and approved submittals and pay applications, periodic site visits to oversee construction to confirm the storage building was built per project documents, communicated directly with contractor and consulted with the owner, and maintained project files to develop the construction documentation report.

American Transmission Company LLC, Bay Lake North Appleton to Morgan - Phase 3 Geotechnical, Various Locations, Wisconsin. Coordinated the subsurface drilling effort for 175 soil borings and 214 rock probes by working with the subcontracted drill crew, AECOM field crews, private property owners, and various subconsultants. Following completion of the field work, worked with other staff to develop soil parameters for each boring and prepare a geotechnical report for the use in transmission line pole foundations. Project included performing soil borings and rock probes along a proposed transmission line.

Basin Electric Power Cooperative, Ash Pond Study and Compliance Services, Various Locations. Developed the emergency action plan for five coal combustion residual surface impoundments for the Laramie River Station in accordance with section 257.73 of the US Environmental Agency (EAP) Final Rule: Disposal of Coal Combustion Residuals from Electric Utilities.

AECOM

Francisco Barajas, PhD, EIT
Scientist 1/Engineer 1

Professional History
11/2016 - Present, AECOM Treatability Laboratory Manager/Environmental Engineer

Education
BS, Chemical Engineering, Universidad de Sonora, 2007
PhD, Environmental Engineering and Science, Clemson University, 2016

Years of Experience
With AECOM: 1
With Other Firms: 0

Certifications
40 hour HAZWOPER
Engineer in Training (EIT), Texas

Dr. Barajas is a project environmental engineer and treatability study laboratory manager at Austin, TX working on areas that include soil and groundwater remediation of chlorinated solvents and emerging contaminants, among others.

Dr. Barajas' experience includes laboratory research on the biodegradation of the emerging contaminant 1,4-dioxane comingled with chlorinated solvents and other organic contaminants, as well as abiotic oxidation mediated by ferrous iron oxidation, experimental work for enzymatic degradation of PFAS-contaminated slurries, PFAS adsorption on organic media, electrochemical oxidation of PFOS and PFOA, and mine tailings waste treatment by algae and fungi. In addition, he has experience on groundwater and subsurface contaminant transport modeling applications to predict the performance of 1,4-dioxane *in situ* bioremediation.

Project Experience

Pigs Eye Landfill Pilot Study, St. Paul, Minnesota. Performed the experimental design, planning, costs estimation, and execution for the bench scale activities to evaluate the effectiveness of an existing remedial approach to remove PFAS from groundwater at the Pigs Eye Lake site. The treatability study focuses on improving the composition of the Select Fill of a permeable barrier that is being considered for full-scale implementation.

FY18 Cedar Services Groundwater Monitoring and Remediation Design, Bemidji, Minnesota. Conducted a treatability study to evaluate three activation approaches (iron, alkaline and hydrogen peroxide) for persulfate oxidation of pentachlorophenol in contaminated soil and groundwater.

US Air Force Center for Engineering and the Environment, Broad Agency Announcement PFC Remediation, Athens, Georgia. Performed a bench-scale treatability study to evaluate the effectiveness of a novel PFC (PFAS) remediation scheme via enzyme-catalyzed oxidative coupling (ECOC) reactions induced in situ by the amendment of the enzyme laccase.

EO Reactor Demonstration, Environment Center for Excellence. Performed bench-scale and pilot-scale testing for an electrochemical oxidation approach to destroy PFAS in synthetic (lab prepared), process-effluent water, and groundwater. Assisted with the operation, maintenance and troubleshooting of the pilot-scale reactor on a daily basis, as well as with sample collection and data interpretation.

DeepEarth Technologies, Inc. (DTI), Racine PCB Bench Study, Racine, Wisconsin. Conducted a treatability study on the use of the proprietary oxidant Cool-Ox® activated with hydrogen peroxide to degrade PCBs in contaminated soils in order to demonstrate whether or not significant contaminant mass could be destroyed.

US Air Force Center for Engineering and the Environment, BAA Bioaugmentation to Enhance Biodegradation of 1,4-Dioxane, Orange, California. Performed computer-based model simulations to predict biodegradation of 1,4-dioxane by the metabolic bacteria culture *Pseudonocardia dioxanivorans* CB1190 using the kinetic properties of the

bacteria culture.

Farrell Road Pilot Test Design, Bloody Brook, New York. A treatability study was conducted to evaluate different remediation approaches to address groundwater contaminated with 1,1-DCE, 1,1-DCA and 1,4-dioxane. The study consisted of anaerobic, biostimulated and bioaugmented microcosms to promote reductive dechlorination of 1,1-DCE and 1,1-DC, and aerobic microcosms to evaluate cometabolism of 1,4-dioxane by propane-oxidizing bacteria.

HITCO Carbon Composites, Gardena, California. Designed and executed a bench-scale treatability study to evaluate the reductive dechlorination of PCE and TCE by different amendments (lactate, ethanol) with and without bioaugmentation (KB-1 Plus®) in anaerobic microcosms incubated for several months.

Select Publications

Barajas, F.J.; Freedman, D.L. *Aerobic Biodegradation Kinetics for 1,4-Dioxane under Metabolic and Cometabolic Conditions*. J. Hazard. Mater. doi:10.1016/J.JHAZMAT.2018.02.030.
Barajas, F.J.; Freedman, D.L.; Murdoch, L.C.; Chiang, Dora. *Evaluation of In Situ Bioremediation of 1,4-Dioxane by Metabolic and Cometabolic Bacteria Using a Contaminant Transport Model*. Battelle Fourth International Symposium on Bioremediation and Sustainable Environmental Technologies. Miami, FL: May 2017.
Barajas, F.J.; Freedman, D.L.; Murdoch, L.C. *Modeling of In Situ Biodegradation of 1,4-Dioxane by Metabolic and Cometabolic Bacteria*. 2016 Clemson University Hydrogeology Symposium. Clemson, SC: March 2016
Barajas, F.J.; Freedman, D.L. *Kinetics of Aerobic Cometabolism of 1,4-Dioxane by Propane Oxidizing Bacteria*. Battelle 2015 Bioremediation and Sustainable Environmental Technologies Symposium. Miami, FL: May 2015

Achievements and Awards

Making a Difference (MAD) Award for contributions to the 2017 AECOM Global Challenge, AECOM
Clemson University 2016 Hydrogeology Symposium; Best presentation award
ACS Travel Scholarship, New Orleans, LA; Scholarship to attend the 2013 ACS National Meeting
Society for Advancing Hispanics/Chicanos and Native Americans in Science (SACNAS) Conference, Seattle, WA; Best presentation award
US-EC Task Force in Biotechnology Research, Lausanne, Switzerland; Scholarship to attend the 2011 Course in Environmental Biotechnology

AECOM

Daryl R. Beck
Engineer 4/Project Manager/On-Site Inspector/Engineer 3

Professional History
03/1994 - Present, AECOM Project Director, Project Manager, Senior Engineer
06/1991 - 08/1992, Huntingdon-Chen Northern Staff Engineer

Education
BS, Civil Engineering, Montana State University, 1991
MS, Environmental Engineering, Montana State University, 1994

Years of Experience
With AECOM: 24
With Other Firms: 1

Registrations
Registered Groundwater Professional, Iowa
Professional Engineer (Civil/Environmental), Iowa
Professional Engineer, Illinois
Professional Engineer (Environmental), Minnesota
Professional Engineer – North Dakota

Training
OSHA HAZWOPER 8-Hour Refresher Training
OSHA HAZWOPER 40-Hour Training
Hazardous Materials Operations Training
First Aid/CPR
HazMat Transportation Workshop

Mr. Beck has served as the MPCA Multi-Site Contract Program Manager since 2014. In addition to his Program Manager role, Daryl also manages several MPCA projects and provides technical oversight for AECOM's MPCA projects. Mr. Beck specializes in environmental engineering, environmental subsurface investigations, design/implementation of remedial systems, wastewater/stormwater management engineering, water supply well abandonment, construction management, and emergency spill response.

Project Experience

MPCA Multi-Site Contract Manager. Managed the MPCA Multi-Site Contract for AECOM since 2014. Responsibilities include contract, work order and subcontractor review, quality control review, and individual project assignments. Project Manager and Senior Engineer for evaluation and design of both Superfund and Petroleum contaminated sites.

Pigs Eye Landfill. Project Manager for the Pigs Eye Landfill Remedial Options Evaluation. AECOM is conducting both field level pilot study and bench scale activities to evaluate the effectiveness of the existing remedial option to address PFC impacted water migration to Battle Creek and Pigs Eye Lake. Field work centers on evaluating the effectiveness of the Select Fill Installation where PFC impacted water is absorbed in a organics-rich layer prior to discharge to Battle Creek and Pigs Eye Lake. Bench scale activities are centering on improving the make-up of the Select Fill where full-scale implementation at the Site is being considered.

CS Services and Wally's Spur. Technical Engineer for the CS Services/Wally's Spur located in the center of Grand Marais's commercial district. AECOM has conducted additional site delineation work that is currently being used to develop an excavation design to remove petroleum impacted soil at two areas. Although much of the delineation work had been conducted prior AECOM's involvement, AECOM organized the presented the decade's worth of delineation information into a Conceptual Site Model (CSM) so that a remedial plan could be developed and designed. The design work is being conducted in concert with a MNDOT led project to reconstruct Highway 61, beneath which is a plume of petroleum impacted soil.

LF Knutson & Sons. Project Manager and Lead Engineer for remedial design and implementation of petroleum impacted soil in the center of Warren's commercial district. AECOM completed a full delineation of the petroleum impacts and used that information to plan, estimate, design, and implement soil remediation activities. A component of the project involved interacting with affected businesses and MNDOT, due to the excavation zone located on a State Highway. Petroleum impacted soil was excavated and land-applied to an MPCA-approved site.

Crude Oil Pipeline Company, Subsurface Environmental Assessment and Remediation for Pipeline Release, South Dakota
Managed comprehensive subsurface environmental assessment and subsequent remediation for a 300 barrel crude oil pipeline release. Activities included environmental assessment utilizing soil boring and soil sampling and field screening techniques during excavation activities. Remediation

AECOM

included excavation and disposal of impacted soil above and beneath the pipeline. Excavation activities conducted beneath the pipeline required support of the pipeline while excavation activities took place. Arranged for geotechnical evaluation of the pipeline support system.

Class I Railroads, Subsurface Environmental Investigations and Remedial Action Planning and Design, Various Locations. Managed, planned, and supervised investigation and remediation of hydrocarbon impacted soils and groundwater surrounding leaking underground storage tanks, transportation fueling facilities, and spill sites. Managed and designed subsequent remedial actions, including risk-based corrective action evaluations, natural attenuation, free product recovery systems (well-based vacuum enhanced skimming, trench (total fluids pumping and groundwater depression with skimming), vacuum-enhanced total fluids removal (bioslurping), bulk soil/source removal, soil vapor extraction, air sparging, and manual removal), bioventing, and groundwater pump and treat. Locations included: Illinois – 14 Sites; Iowa – 10 Sites; Minnesota – 22 Sites; Montana – 15 Sites; North Dakota – 8 Sites; South Dakota – 4 Sites; Washington – 2 Sites; Wisconsin – 8 Sites; Wyoming – 4 Sites

Class I Railroad Company, Railroad Emergency Spill Response, Various Locations. Provided emergency response services and project management for over 75 derailments and spills in Minnesota, Wisconsin, North Dakota, Iowa, Illinois, and Oregon. Activities included 24-hour on-call support, rapid-mobilization, remedial planning, on-site supervision of cleanup investigation and remediation, report preparation, regulatory interaction and communication, long-term remediation oversight and planning, and reporting. Project highlight was managing the response to 270,000 gallon catastrophic anhydrous ammonia release. Activities included preliminary health and safety planning, impacted soil delineation involving over 200 soil sampling points, large-scale soil removal (i.e., 90,000 tons) planning and implementation, limit of excavation soil sampling, impacted groundwater delineation involving 30 monitoring wells and 100 push-probe water sampling points, modeling and planning to evaluate groundwater remedy, overseeing installation of pumping wells and associated infrastructure for groundwater remedy, and follow-up groundwater monitoring.

Class I Railroad Company, Wastewater Management Improvements at Railyard, Minnesota. Project manager and construction manager for the design and construction of multiple locomotive track-pan projects. Managed and planned all phases of design, subcontractor procurement, installation, and project closeout of two parallel sets of concrete locomotive track pans used to collect fluids dripping from parked locomotives. The trackpans were connected to the facility's industrial wastewater pretreatment system. Construction manager for related projects at the same facility in included oil water separator, underground piping, catch basins, grit drying bed, grit chamber, and control building. Also supervised sewer re-routing to use an oil/water separator used previously for industrial wastewater to treat stormwater. Supervised cleaning and demolition of structures.

AECOM

John T. Berger
Scientist 1/Field Technician

Professional History
05/2017 - Present, AECOM Geologist
11/2015 - 05/2017, Bay West LLC Environmental Scientist

Education
BA, Geology, Gustavus Adolphus College, 2015
BA, Environmental Studies, Gustavus Adolphus College, 2015

Years of Experience
With AECOM: 1
With Other Firms: 3

Registrations
Certified Asbestos Inspector, Minnesota
OSHA HAZWOPER 40-Hour Training

Training
OSHA HAZWOPER 8-Hour Refresher Training
Hazardous Materials Operations Training
BNSF eRailSafe training and BNSF contractor certified
CN- On-Track Safety
Bobcat Equipment Operator certificate Mini Excavator and Skidsteer.
Confined Space Training
Herc-U-Lift Aerial lift/Boom lift
First Aid/CPR

Mr. Berger specializes as an entry level geologist and environmental scientist for multiple construction oversight and Phase I ESA investigation field work projects. John also has experience with Soil Vapor Intrusion sampling and mitigation construction oversite, monitoring well development and sampling, Soil boring and core logging, hazardous materials safety and awareness, and emergency spill response.

Project Experience

MPCA project Field Work. Conduct field work/sampling on multiple MPCA projects including Pig's Eye Landfill, Macgillis and Gibbs, and multiple sub slab vapor intrusion sampling. Mr. Berger's primary role in these projects is conducting the majority of the field work for sampling events as well as help compile data from sample analysis for the report submittals.

Pigs Eye Landfill. Environmental Scientist for the Pigs Eye Landfill Remedial Operations Evaluation. AECOM is conducting both field level pilot study and bench scale activities to evaluate the effectiveness of the existing remedial option to address PFC impacted water migration to Battle Creek and Pigs Eye Lake. Field work centers on evaluating the effectiveness of the Select Fill Installation where PFC impacted water is absorbed in a organics-rich layer prior to discharge to Battle Creek and Pigs Eye Lake. Bench scale activities are centering on improving the make-up of the Select Fill where full-scale implementation at the Site is being considered.
Mr. Berger is one of the lead scientists for field work and sampling efforts.

Power plant Coal Ash Landfill Extension (Bismarck, North Dakota).
Mr. Berger provided QA/QC and documentation of landfill liner for a 16 acre landfill extension. John's primary role in this project included: Daily oversight, progress reports, liner seaming sampling and documentation, and construction oversight. This site also included the development of a 6 acre leachate pond.

Asbestos Inspection/Survey. Mr. Berger has had experience conducting multiple commercial surveying and inspection projects. John's primary role in these projects are completing inspections and determining potential asbestos containing material which would be sampled and submitted for analysis. John has aided in creating tables and figures of the results to these surveys in submittal ready format for each report.

Environmental Construction Monitoring.
During the construction season, Mr. Berger aids in AECOM's effort in overseeing construction projects that include the excavation of contaminated soils. John has aided in managing impacted soils and regulated material for multiple construction projects throughout Minnesota. Mr. Berger also completes daily reports and detailed records of manifests, and photo logs for each of the projects he is a part of.

AECOM

Matt Bloecher
Engineer 2/Engineer 1

Professional History
07/2013 - Present, AECOM Geotechnical Staff Engineer
09/2002 - 09/2008, US Air Force

Education
BSCE, Geological Engineering and Geology, University of Wisconsin, 2013
Diploma, Information Systems, Community College of the US Air Force, 2007

Years of Experience
With AECOM: 5
With Other Firms: 0

Professional Affiliations
American Society of Civil Engineers

Training
Concrete Field Testing
OSHA 40-Hour HAZWOPER Training
Mine Safety and Health Administration Annual Contractor Training

Mr. Bloecher is a mid-level geotechnical staff engineer in the AECOM Oshkosh, Wisconsin office. He works on a variety of geotechnical projects involving subsurface exploration, slope stability modeling, geophysical testing, and recommendations for structure foundations. In addition, Mr. Bloecher has worked on projects involving environmental sampling, QA/QC oversight and documentation.

Project Experience

American Transmission Company, Bay Lake Project, Wisconsin. Provided field oversight during geotechnical drilling for proposed transmission structures. Oversight consisted of coordinating mobilization of drill rigs, ensuring approved access routes to boring locations was followed, and documentation of encountered subsurface profiles.

Waste Management, 2017 Ridgeview Cell Liner 2B Construction Quality Assurance, Whitelaw, Wisconsin. Provided QA/QC duties during installation of a base liner system for a landfill expansion. Duties consisted of ensuring subgrade met installation specifications and documenting installation and testing of the geosynthetic liner.

US Coast Guard, District 9 Dredging Program, Wisconsin. Created site survey reports, wrote specifications, and created cost estimates for various US Coast Guard station dredging projects.

City of Oshkosh, Boat Works Pedestrian Bridge and Riverwalk - Design, Bidding, Construction, Envi, Oshkosh, Wisconsin. Provided QA/QC for installation of a deep foundation system consisting of steel piles. Ensured piles were installed in accordance with design drawings.

Foundation Service Corporation, City Garage Geopier QC, Oshkosh, Wisconsin. Provided oversight and QA/QC duties for installation of a deep foundation system consisting of aggregate geopiers. Ensured installation followed specifications and noted any alterations made in the field for as-built drawings.

City of Oshkosh, Wastewater Treatment Plant Repairs, Oshkosh, Wisconsin. Monitored replacement of water treatment system. Documented contractor efforts and noted installation for as-built drawings.

US Air Force - Michigan, 2017 Calumet Air Force Station Water Sampling, Michigan. Performed water sampling duties for a groundwater model study at a closed Air Force Radar Station in Houghton County, Michigan.

AECOM

Dorin Bogdan, PhD
Engineer 2

Professional History
11/2013 - Present, AECOM Environmental Engineer
01/2008 - 05/2012, University of Illinois at Chicago Graduate Teaching Assistant
01/2008 - 05/2011, University of Illinois at Chicago Graduate Research Assistant

Education
PhD, Environmental and Water Resources Engineering, University of Illinois, Chicago, 2012
BS, Civil Engineering, University of Illinois, Chicago, 2007

Years of Experience
With AECOM: 4
With Other Firms: 5

Registrations
Engineer in Training, Illinois, #061037804, Issued 01/07/2014

Training
CN On-Track Training
DOT Hazardous Materials Shipping for Environmental Professionals
BBS Module 1 - Awareness Training
BBS Module 2 - Awareness Training
Hazardous Material Awareness/Shipping
Incident Investigation Awareness Training
Mobile and Heavy Equipment Operations Awareness
Natural Biological Hazards Awareness Training
Railroad General Roadway Worker Protection (FRA)
Excavation and Trenching Awareness
Hazard Communication Training
E-Railsafe Badge
OSHA HAZWOPER 40-Hour Training
DOT Level 1 Shipper (TDG)

Dr. Bogdan is an environmental engineer from the Grand Rapids office with over eight years of experience in soil, sediments, and groundwater remediation, innovative technologies, and hazardous waste. His responsibilities include assistance in engineering feasibility studies, remediation investigation, and report writing. Dr. Bogdan has experience with the environmental fate and transport of Poly- or Perfluoroalkyl substances (PFASs) including bioaccumulation in the food webs. Dr. Bogdan is the AECOM PFAS Technical Practice Group Leader.

Experience

Michigan Department of Environmental Quality - Remediation and Redevelopment Division, Former Wurtsmith Air Force Base, Oscoda, Michigan. The base is a 5,223-acre site. Responsible for overseeing tasks such as residential well sampling at over 350 homes, municipal sampling, surface water, groundwater, and surface water foam sampling, including biota. Provide technical assistance for the completion of multiple phases of remedial investigations to delineate PFAS impact in groundwater plumes both emanating from the base and other sources around the base, development of the site conceptual site model (CSM), laboratory QAQC with Level 2 data validation, and developing an EQuIS and GIS database to manage all data associated with the project. Review past and recent environmental reports are done by the Air Force (i.e., sampling and work plans, remedial investigations, feasibility studies, five-year review, annual reports, pump and treat optimization, groundwater modeling, etc.) in order to provide recommendations to the ongoing environmental work. Responsible for providing technical PFAS expertise on the chemistry, analytical tools, environmental fate and transport, plant and biota uptake, and remedial technologies of PFAS.

Minnesota Pollution Control Agency, Pigs Eye Landfill, Minnesota. PFAS Project Chemist. AECOM is conducting both field level pilot study and bench scale activities to evaluate the effectiveness of the existing remedial option to address PFC impacted water migration to Battle Creek and Pigs Eye Lake. Provided assistance with bench scale design activities in support of the full-scale implementation at the Site.

Michigan Department of Environmental Quality, Statewide PFAS Support, Michigan. PFAS Technical Expert. Tasks include: write up of PFAS specific standard operating procedures (SOPs) for multiple media (groundwater residential sampling, surface water, wastewater, sediment, soil, deer, fish, foam sampling), PFAS training of staff, assisting with the development of summary of PFAS feasible remedial technologies, developing a statewide quality assurance project plan (QAPP), statewide analytical support, level 2 data validation, residential well sampling, municipal sampling, wastewater treatment plant sampling, groundwater monitoring well sampling, remedial investigations to determine source of PFAS impacts, laboratory QAQC with Level 2 data validation, and developing an EQuIS and GIS database to manage all data associated with the project.

Michigan Department of Environmental Quality (MDEQ), Rockford, MI. PFAS Technical Expert. Provided support for work plan development and field investigations for PFAS source investigation of PFAS related wastes

generated by a shoe leather manufacturer. Oversee the collection of residential well sampling and review of data for hundreds of residential wells. Provided support with novel analytical methods in fingerprinting and screening of PFAS in aqueous and soil media as well as waste materials. Provided technical expertise on the conceptual site model (CSM) of PFAS environmental fate and transport.

Michigan Department of Environmental Quality, Statewide Municipal Sampling, Michigan. Project task leader responsible for overseeing the collection of about 2,000 municipal water supplies across the State of Michigan. Tasks include municipal sampling, laboratory QAQC with Level 2 data validation, and developing an EQuIS and GIS database to manage all data associated with the project.

Michigan Department of Environmental Quality, Air National Guard, Alpena, Michigan. PFAS Technical Expert. Tasks include: completing residential well sampling at over 100 homes, laboratory QAQC with Level 2 data validation, and developing an EQuIS and GIS database to manage all data associated with the project.

Michigan Department of Environmental Quality, Army National Guard Grayling Airfield, Grayling, Michigan. PFAS Technical Expert. Tasks include: completing residential well sampling at over 600 homes, municipal sampling, completing remedial investigations to delineate PFAS impact in groundwater plumes emanating from the base and other sources around the base, development of the site conceptual site model (CSM), laboratory QAQC with Level 2 data validation, and developing an EQuIS and GIS database to manage all data associated with the project.

Michigan Department of Environmental Quality, Lapeer WWTP biosolids, Lapeer, Michigan. PFAS Technical Expert is responsible for overseeing the response to PFAS release to the environment resulting from the application of biosolids to agricultural fields. AECOM developed a scope of work to investigate soils and groundwater for the presence of PFAS including the installation of groundwater monitoring wells, surface water sampling, laboratory QAQC with Level 2 data validation, and establishing an EQuIS and GIS database to manage all data associated with the project.

Air Nation Guard, Multiple Bases, USA. PFAS Technical Expert. Provided assistance with regulatory criteria and document review for PFAS site investigations at 18 ANG bases. Provided support with work plan writing including, but not limited to, groundwater, surface water, and sediment sample locations. Provided support with regulatory criteria for PFAS and response to state regulator comments. Performed review of the site investigation (SI) reports for all 18 ANG bases.

AECOM

Chris Bratsch, PE
Engineer 4/On-Site Inspector/Engineer 3

Areas of Expertise
Project Management
Staff Management and Development
Safety Performance Management
Multi-disciplined Engineering and Detailed Design Project Management
Sewer Systems
Process Safety Information (PSI)
Environmental Remediation and Compliance

Education
Bachelor Civil Engineering/1991/ University of Minnesota Institute of Technology

Registration/Certification
Professional Engineer - Minnesota (#24054)
Certified Project Manager (AECOM)

Years of Experience
With AECOM: 17
With Other Firms: 10

Professional Affiliations (inactive)
National Society of Professional Engineers (NSPE)
Project Management Institute (PMI)

Military Service
United States Army Active Duty and Reserve (1981-1987) – Honorable Discharge

Mr. Bratsch has a twenty-seven year track record of successfully completing large, multi-disciplinary engineering, design and construction projects, primarily in the oil & gas industry. Mr. Bratsch's primary responsibilities include development and management of project teams, safety performance of the team; scope, budget and schedule development and compliance; quality control of engineering deliverables; quality management and continuous improvement processes; and staff mentoring.

Selected Project/Program Experience

Program and Project Manager, Water Management Program – Multiple Natural Gas Compressor Stations – Confidential Client, Tinley Park, IL. January 2017 – Present. Mr. Bratsch is responsible for programmatic and project management of multiple projects under the client's Water Management program. Scopes of work consist of topographic and boundary surveys, drain line investigations, soil investigation and remediation, engineering and design at multiple natural gas compressor stations throughout the central United States. The intent of the program is to develop an understanding of the existing site conditions, particularly the process and storm water drain line systems, and the nature, operation and integrity of the facility process and storm water flows as they relate to the need for process/storm water segregation.

Project Manager, Major Projects Facilities – Confidential Client, Duluth, MN. July 2014 – Present. Mr. Bratsch is responsible for management of geotechnical, civil and structural engineering and design for eight (8) new crude oil pipeline pump station facilities and two (2) existing pipeline terminals; and serves as Facilities liaison to Gating, Environmental, Regulatory, Legal and Land/ROW departments. He also leads many components of the Facilities project development and project management activities, including preparation and on-going change management for Design Basis Memoranda; Project Management Plans; Facilities Construction Management Plans; Constructability Reviews; and Construction Bid Documents for both terminal and station construction activities. The project is between the Issue for Bid and Issue for Construction levels of completion, with a projected in-service date of 2019.

Transition Team Lead, Interim Site Manager for Small Projects Team (SPT) - BP Cherry Point Refinery, Blaine, WA. July 2013 – February 2014. In July 2013, AECOM was selected to become the new on-site small projects contractor for the BP Cherry Point Refinery. Upon award, AECOM implemented an aggressive transition plan to staff the team which was led by Mr. Bratsch, a seasoned AECOM Site Manager. Within six weeks of award, AECOM had the team fully staffed with 14 employees who included local hires, AECOM transfers, and some temporary AECOM staff until local staff could be hired to complete the hiring process. Of the 14 team members, just four came from the incumbent contractor.

AECOM continues to provide project engineering, detailed design and verification, document control, instrument database (SPI), start-up support and project close-out activities for the BP Cherry Point Refinery Small Projects Team (SPT). The AECOM on-site team includes six (6) project managers, four (4) discipline engineers (process, mechanical, instrumentation and civil/structural), seven (7) designers; and one (1)

AECOM

administrative/document control position. The team is co-located with BP staff at the refinery.

Projects performed by AECOM include small-cap and rev-ex (unit funded) projects with TIC up to $6MM. Projects are executed using BP's Capital Value Process, which is their phased gate approach to executing projects. Projects typically start at the Define stage (FEL 3), and work through construction, start-up and close-out. Projects are performed across all process units, tank farms (blending), terminal facilities, wastewater plant and utilities.

Highlights from client (BP Cherry Point) satisfaction survey results: *"Chris's strengths are coaching and training. He does a good job of working the bugs out with the team. We (Small Projects Team) are better in every discipline. We are a much stronger team."*

Fourth quarter 2013 performance evaluation score of *"Exceeds Expectations"* based on compiled results of scorecards distributed to BP leadership throughout the refinery.

Personal recognition award from BP Cherry Point Refinery at the completion of the interim assignment stating: *"Your vision, personal sacrifice and leadership have successfully accomplished our goals of building a world class Owner/Contractor Site Engineering and Small Projects Team."*

Branch Office and Site Team Manager, Northern Tier Energy/Marathon Petroleum Refinery On-site Engineering Design Team, St. Paul Park, MN. April 2008 – June 2013. Manager of the on-site engineering design office at the St. Paul Park refinery. The team provided engineering design, Process Safety Information (PSI) documentation and verification, document control, instrument database development and maintenance, and administrative support to the refinery's engineering and turnaround (TAR) groups.

Site Manager responsibilities include:

- Site Safety Officer
- QA/QC – Development and implementation of continuous improvement processes
- Design schedule development and compliance
- PE Certification of Critical Lift Plans
- Development of design standards for mechanical, electrical and instrumentation disciplines.
- Construction package standardization and streamlining
- The Site Team baseline staffing included three (3) engineers; eight (8) designers; two (2) administrative support staff; one (1) document control position, and one (1) redline drafter. The team staffing level was adjusted based on annual project workload, support to TAR and Major Projects, and to support special initiatives (e.g., OSHA NEP)
- Key highlights of the key performance indicators (KPIs) on which the Site Team was evaluated include:
- Client satisfaction survey results averaging 95% for the on-site engineering design team;
- Strong safety performance characterized by no recordable incidents since inception, and 100% rating on all annual client safety audits;
- >90% design schedule compliance;
- Engineering design costs less than 8.5% of TIC
- Best-in-class PSI as judged by refinery's independent auditor; and
- Staff retention of greater than 90% annually.

Project Manager, Benzene Waste Operations NESHAP (BWON) Wastewater Treatment Plant Upgrade, Marathon Petroleum Company LLC St. Paul Park Refinery, St. Paul Park, MN. Managed the BWON project from feasibility phase through implementation in the field. The project was required to be completed by Marathon's consent decree with USEPA. The project included engineering and detailed design for nitrogen blanketing and venting wastewater treatment plant components to a thermal oxidizer. A multi-faceted team of engineering and design professionals was required including process modeling, air permitting, data management for the BWON-regulated components, detailed engineering and design, construction cost estimating and scheduling.

Project Manager, NSPS Subpart QQQ Sewer Upgrade Project, Marathon Ashland Petroleum LLC St. Paul Park Refinery, St. Paul Park, MN. Served as Project manager for NSPS Subpart QQQ refinery sewer system upgrade. The project was required as a result of a Court Order and Judgment against Ashland, Inc. related to a 1997 explosion and sewer fire at their St. Paul Park refinery. Managed a 20-person project team that consisted of mechanical, civil and environmental engineers, surveyors, and CAD technicians. Project deliverables consisted of detailed designs for over 800 individual sewer system component upgrades, construction cost estimates, refinery-wide sewer system drawings (in AutoCAD), updated P&IDs and electronic compliance management system for over 1,200 regulated components. Over 30,000 hours of project field work were safely completed by AECOM employees, without a reportable incident. AECOM subsequently performed QQQ-compliance inspection and auditing assistance services at the refinery.

Project Manager, Compilation of Underground Utility Drawings, Marathon Ashland Petroleum LLC St. Paul Park Refinery, St. Paul Park, MN. The project was contemplated by new refinery management when faced with the lack of comprehensive, up-to-date underground utility drawings and was awarded as a sole-source opportunity based on the successful completion of the QQQ Sewer Upgrade Project. Deliverables for this project included layered AutoCAD drawings depicting active and abandoned process, instrumentation, fiber optic, fire water, telephone and sewer lines and electrical duct banks. The project staff examined close to 20,000 historic drawings in order to compile a comprehensive set of over 200 final drawings.

Project Manager, Refined Products Pipeline Terminal Expansion, Magellan Pipeline Company L.P. Aurora Terminal, Aurora, CO. Served as consultant project manager for a 400,000-BBL facility expansion and laboratory building design and construction project. The scope of work required surveying, geotechnical, environmental, natural resource, architectural, structural, mechanical, electrical and civil disciplines. Scope items included feasibility-level construction cost estimating; surveying; establishment of city utility easements and pipeline crossing licenses; water main extension and hydrant relocations; geotechnical engineering; foundation design for five storage tanks, six pumps, over forty pipe supports, bio-diesel unloading containment and three buildings; tank dike expansions; bid packages for civil work, storage tanks and building construction; construction staking; and project support during construction. Permitting activities included direct interface with the City of Aurora related to their multi-step permitting processes, as well as NPDES, Fire Marshal and construction permitting. This project was completed on a condensed schedule to meet client commercial contract deadlines.

Project Manager, Rail Car and Truck Unloading SPCC Containment Upgrades, Magellan Pipeline Company, LP Minneapolis Terminal, Minneapolis, MN. Managed the engineering, detailed design, AFE-grade cost estimating, construction bidding assistance and as-built drawing

preparation for new rail pan and truck unloading containment systems, including a trunk storm sewer and containment pond. AECOM was retained to evaluate and assist in implementing compliance options for SPCC compliance for denatured ethanol unloading areas at the terminal. Project scope included review and verification of compliance deficiencies, evaluation and recommendation of options to meet compliance, preparation of design drawings and bid documents in accordance with client design standards, project permitting and coordination of access agreement with adjoining property owner, bidding assistance, post-construction as-built surveys and as-built drawing check in.

Project Manager, RCRA Closure and Demolition, 3M Cottage Grove Hazardous Waste Incinerator Facility, Cottage Grove, MN. Served as project manager for design and implementation activities for RCRA closure and demolition of 3M's obsolete corporate hazardous waste incinerator. Directed the preparation of the partial closure plan, sampling and analysis plan and quality assurance project plan. Managed engineering staff performing structural, civil, electrical and mechanical design activities as well as field staff performing construction/demolition documentation, field sampling, waste tracking and as-built drawing preparation.

Compliance Auditing Team Member, Multi-Media Compliance Audit, Flint Hills Rosemount Refinery, Inver Grove Heights, MN. Served on compliance auditing team for two multi-media environmental compliance audits. The refinery was required under a Consent Order with the USEPA to conduct environmental compliance audits on an eighteen-month interval. Compliance areas evaluated for the refinery included NSPS Subparts K, Ka, Kb and UU; MACT Subpart CC and the facility's aboveground storage tank major facility (state) permit and underground storage tanks.

Senior Field Engineer, Schnitzer Superfund Site Remediation, Minneapolis/St. Paul, MN. Senior Field Engineer responsible for on-site management of the remediation of a former automobile salvage yard. Managed implementation of cleanup activities over a five-month period, which consisted of the excavation, on-site treatment, and off-site disposition of over 50,000 tons of lead and PCB impacted materials. Supervised an eight person technical staff, tracked analytical data for several thousand media samples, coordinated the efforts of twenty subcontractors, and prepared cleanup documentation reports for submittal to the MPCA.

This multi-faceted project involved both MPCA Site Response Section (Superfund) and VIC Program oversight. The remediated site achieved unrestricted land use status, was de-listed from the Permanent List of Priorities, and the client received a Certificate of Completion from the MPCA. The project received an Honor Award for the project from the Consulting Engineers Council of Minnesota in the 1998 Engineering Excellence Awards Competition.

Design Engineer, Aboveground Storage Tank Compliance and Upgrade Design Manual, Minnesota Petroleum Marketers Association. Led development of AST system compliance and upgrade design manual. The manual provided instructions for evaluating AST system compliance with Minnesota Rules Chapter 7151 - Aboveground Storage of Liquid Substances; and included over 100 pages of specifications, drawings and drawing details for upgrading multi-tank AST facilities. The manual was reviewed for compliance with Chapter 7151 and was endorsed by the MPCA for distribution to MPMA members.

Design Engineer, Aboveground Storage Tank System Upgrades, St. Peter Regional Treatment Center Steam Plant, St. Peter, MN. Responsible for upgrade design of a 600,000-gallon fixed-roof aboveground storage tank system. The AST stored fuel oil (#2 and #6) for on-site

consumptive use by a steam plant serving 32 buildings on a 160-acre campus. Developed plans, specifications and bidding documents for tank system cleaning, inspection, repairs, upgrading and re-insulation. Upgrades included installation of a new tank heater, a new composite tank bottom, interior lining, and modern exterior insulation.

AECOM

Gary M. Braun
Scientist 2

Professional History
07/1999 - Present, AECOM Project Manager, Senior Hydrogeologist

Education
BS, Hydrogeology, University of Wisconsin-Oshkosh, 1997
MS, Environmental Geology, Bowling Green State University, 2000

Registrations
Professional Geologist, Illinois

Years of Experience
With AECOM: 19

Training
OSHA HAZWOPER 8-Hour Refresher Training
OSHA HAZWOPER 40-Hour Training
First Aid/CPR
HazMat Transportation Workshop

Mr. Braun serves as a lead senior hydrogeologist/geologist who is primarily a technical lead in groundwater related issues, while also focusing on project management and client account advocacy. Technical focus is the on the acquisition, interpretation and presentation of geologic and hydrogeologic data on high profile projects. His project experience encompasses a variety of projects including mine permitting, environmental impact assessments, solid waste compliance and permitting, water supply evaluation / protection, as well as wetland source protection.

Project Experience

Mine Tailings Modeling, St. Louis County, Minnesota. Lead Hydrogeologist for the groundwater modeling assessment of a planned expansion of an existing mine tailings storage facility in Northern Minnesota. Duties included the review of existing hydrologic, geochemical and geotechnical data for modeling methodology development and presentation of approach to MPCA reviewers. Modeling in-progress after MPCA approved technical approach.

Former Calumet Air Force Station, Keweenaw County, Michigan. Lead Hydrogeologist/Geologist for the Remedial Investigation (RI) of the former Air Force Station. Duties included development of Work Plan, coordination of sub-contractors, review of all hydrologic data summaries, hydraulic calculations and preparation RI and Risk Assessment report. Characterized complex hydrostratigraphic environment which had hydraulic conductivity variation of over 10 orders of magnitude with chlorinated volatile organic compound exceedances in fractured bedrock. Also provided senior peer review of the feasibility study of remedial actions.

Fermi National Accelerator Laboratory (Fermilab), Long-Baseline Neutrino Experiment (LBNE) Facilities in Batavia, Illinois. Served as lead Hydrogeologist/Geologist for the near-field subsurface investigation in AECOM's Geotechnical Team. Mr. Braun lead AECOM's hydraulic characterization effort by preparing of work plans/bid specs; oversight of field data collection efforts; downhole geophysical borehole logging; identification of stratigraphic breaks in core; and conducted multi-level monitoring and testing.

Copperwood Project, Mine Permitting, Gogebic County, Michigan. Lead Hydrogeologist for the Environmental Impact Assessment (EIA) for the proposed copper mining facility. Duties included review of all hydrologic data and hydraulic calculations. Prepared 3-D MODFLOW groundwater flow model. Characterized complex hydrostratigraphic environment which varied 10 orders of hydraulic conductivity magnitude and had groundwater ages from recent to saline groundwater millions of years old. Contaminant transport modeling package used to simulate leakage from tailings storage facility for design consideration and development of a groundwater monitoring program. Numerous recommendations for incorporating hydrology into the mining plan and operation were provided.

Hydrogeologic Evaluation of Empire Mine, Palmer, Michigan. Conducted a hydrogeologic assessment of the Cliffs Empire Mine in Palmer, Michigan for evaluating post-mining hydraulic controls. Potential receptors were identified and one-dimensional transport modeling was conducted to evaluate worst-case scenarios. Recommendations for post-mining operations included establishing maximum water levels goals for individual pits. Analytic advection-dispersion modeling was used to quantify low potential for groundwater impacts

Romeoville Quarry, Mine Permitting, Will County, Illinois. Lead Hydrogeologist for the groundwater modeling and monitoring of a quarry expansion within the breeding habitat of the endangered Hines Emerald Dragonfly. High-profile project because of the large number of federal and state agencies, as well as environmental groups seeking to protect the dragonfly. In addition, production wells for a local community's water supply system have been mitigated by demonstrating stability in long-term water level changes and by optimizing well field efficiencies. Significant portions of the property have been approved for mining. Additional expansion is currently being sought through zoning negotiations and evaluation of further groundwater modeling simulations at the breeding areas and water supply wells.

Western Illinois Landfill Expansion, Groundwater Impact Assessment, Illinois. Project manager and lead Hydrogeologist for a Groundwater Impact Assessment (GIA) conducted for an approved expansion of a western Illinois landfill. Responsible for the development of 2-dimensional contaminant transport modeling that simulated contaminant transport migration of leachate throughout post-closure period of the facility. Through revised well spacing modeling and negotiations with Illinois EPA, the site's new groundwater monitoring plan approval resulted in a reduction of over 25% of the existing monitoring wells and several hundred thousand dollars in sampling and analysis cost savings.

Chicago Underflow Plan (CUP) – McCook Reservoir, Chicago, Illinois. Served as project manager and lead hydrogeologist for the groundwater controls design characterization for the US Army Corps of Engineers. The reservoir is designed to store combined sanitary and storm sewer discharge from the Chicago deep tunnel system. Developed a 3-D MODFLOW groundwater flow model depicting several bedrock formations, tunnels, quarries, rivers and canals. This work was performed to develop recommendations to control groundwater interaction between groundwater and the reservoir. Scenarios were evaluated for groundwater protection control consisting of the use of hydraulic barriers (injection/extraction wells) and physical barriers (cut-off walls). Recommendations were provided for the groundwater control based on the flow and particle transport modeling. Recommended groundwater scenario helped modify the Corps design plan to potential save several million dollars. Most recent work included verification of existing bedrock conditions and grout curtain installation at the massive Chicago construction site.

AECOM

William M. Brown
On-Site Inspector/Field Technician

Years of Experience
With AECOM: 11

Training and Certifications
OSHA HAZWOPER 40 hr. Safety Training and current 8 hr. Refresher Training CPR and First Aid Trained
e-RAILSAFE Safety Trained
Hazardous Waste Shipper Certified

Mr. Brown has eleven years of experience with AECOM as a field technician and systems operator in the environmental remediation industry. He serves as a field technician for services involved with the MPCA's Closed Landfill Program contract including operation and maintenance, gas emission management, troubleshooting of system operations and subcontractor oversight. Mr. Brown has also worked on CERCLA, RCRA and state Superfund cleanup sites performing various water, air, soil and landfill leachate sampling. He has been involved in the installation and maintenance of an aquifer air injection system and has experience utilizing applicable field instrumentation and data collection equipment.
Mr. Brown also has eight years of experience performing indoor air monitoring of workers within a retail setting. This work includes corresponding with site managers and operators to conduct the necessary testing and calibration of instrumentation.

Project Experience

MPCA Closed Landfill Contract – Operation and Maintenance, MN. Serves as a field technician for the MPCA Closed Landfill Program work. Duties include operation and maintenance, overseeing site improvement activities, collecting gas measurements at gas wellheads, optimizing flare operation and troubleshooting site issues.

BNSF Tie Plant – Brainerd, MN. Conduct routine groundwater sampling using slow purge sampling techniques. Perform maintenance on the air compressor and other air injection system components. Conduct weekly RCRA inspections. Collect quarterly landfill leachate samples for laboratory analysis. Maintain a landfill leachate collection system. Operated a groundwater pump and treat system.

Enbridge Site – Cass Lake, MN. Conducted operation and maintenance for oil skimming activities. Performs monthly maintenance on compressor as well as vapor monitoring and semi-annual respiration testing on a bio-venting system. Conduct quarterly ground water monitoring and annual transmissivity testing on wells containing LNAPL. Conducted avian survey prior to removal of vegetation.

Enbridge – Pinewood, MN. Conducted transmissivity testing as well as hydraulic conductivity testing in wells containing LNAPL.

Home Depot Stores – MN. Coordinate and conduct quarterly air monitoring of forklift emissions.

BNSF Former Car Shops – West Burlington, IA. Coordinates and conducts semi-annual groundwater monitoring

Oneok Garden Creek- Watford City, ND. Assisted with implementation of product recovery system. Conducted transmissivity testing

CP Railyard- Harvey, ND. Coordinates and conducts semi-annual groundwater monitoring

BNSF Car Shops Site – Brainerd, MN. Conduct groundwater sampling. Perform remediation system maintenance. Operated and maintained an oil skimming system.

BNSF Former Car Shops Site – Waite Park, MN. Conduct quarterly landfill inspections and collect landfill leachate samples for laboratory analysis. Site health and safety officer overseeing various subcontractors.

BNSF Railyard – Minneapolis, MN. Conducted soil stockpile sampling for disposal profiling.

MDA Former Cedar Services Site, Bemidji, MN. Conduct quarterly ground water sampling. Conducted oversight during chemical injection process.

BNSF Railyard – Mandan, ND. Conducts bi-annual transmissivity testing in wells containing LNAPL. Performing semi-annual ground water sampling events.

City of Clearbrook- Clearbrook, MN. Conducted oversight during the construction of a new city supply water well building.

CP Rail/Salestrom Leak - Farmont, MN. Conducted groundwater monitoring.

AECOM

Christopher S. Brownfield, P.E.
Engineer 3/Engineer 2

Education
M.S. Soil Science, North Carolina State University (2007)
B.S. Chemical Engineering, North Carolina State University (2004)
B.A. Chemistry, North Carolina State University (2004)
Park Scholar

Professional Registrations and Affiliations
Professional Engineer - North Carolina (038566), North Dakota (10951)
Member, American Institute of Chemical Engineers

Years of Experience
With AECOM: 11

Training and Certifications
Confined Space – Site Specific Performance Training
HAZWOPER 40-Hour Training
HAZWOPER 8-Hour Refresher Training

Publications
Jordan, M, N. Shetty, M. Zenker, and C. Brownfield, 2013. Remediation of a Former Dry Cleaner Using Nanoscale Zero Valent Iron. *Remediation*: Winter, 2013. 31-38.

Mr. Brownfield specializes in designing and implementing remediation strategies for environmental media impacted with chlorinated solvents and petroleum hydrocarbons. His core competencies are as a lead designer and in operations support for remediation strategies that require biogeochemical or mechanical processes as treatment strategies. His project experience includes implementation of pilot and full scale applications of in-situ technologies including enhanced and intrinsic bioremediation, enhanced reductive dechlorination, and chemical oxidation; implementation of free-phase non-aqueous liquid recovery systems, process replacements for groundwater treatment systems; and process design for air sparging, soil vapor extraction, and bioventing technologies. He also has significant experiencing developing environmental liability estimates for feasibility comparisons, detailed project budgeting, and regulatory compliance.

Project Experience (Domestic)

LNAPL Recovery System Design, Western North Dakota, USA (Oil and Gas Client). Supported budget forecasting and strategy development efforts for remediation of a natural gas condensate release. Conducted initial pilot testing. Lead the design and supported installation and operation of a 50-barrel per day liquid pumping network in accordance with the Owner's process safety management requirements. Design elements included selection of appropriate pumps, piping, and storage solutions in accordance with applicable ASME, API, and NFPA standards and recommended practices. Installation and operational elements included co-ordination with the Owner's contractor and AECOM staff to support startup, troubleshooting, and process improvement tasks.

Air Injection System Design and Installation, Commerce City, Colorado, USA (Oil and Gas Client). Lead the design and supported installation of a 2,200 cubic feet per minute (cfm) air injection system for petroleum impacted groundwater at an active refinery. System design involved special coordination with client's capital projects development group. System installation included siting two equipment buildings and over a dozen instrumentation and distribution manifolds with piping for delivery of compressed air to approximately 90 injection wells.

Bioventing System Design and Installation, Cass Lake, Minnesota, USA (Oil and Gas Client). Lead the design and supported installation of a 120 cfm bioventing system at an active crude oil pumping station. System installation involved modification of existing mechanical and electrical equipment and installation of new instrumentation, relocation of the modified equipment to the project site, installation of new above-ground and below ground piping in the active pump station, and installation of new bioventing wells for air injection. Project site was located on reservation lands and required special permitting.

Design of Soil Excavation, Mobile, Alabama, and Memphis, Tennessee, USA (Oil & Gas Client). Lead the design of excavation of approximately 20,000 cubic yards of soils impacted with lead and arsenic at former fertilizer manufacturing facilities in Alabama and Tennessee. Design involved special regulatory coordination and project estimating with client's capital projects development group. Design also included special coordination with discipline designers for stream relocation and restoration.

Source Removal and On-Site Treatment Using MFR, Winston-Salem, NC (Manufacturing Client). Engineer of Record for a 4,000 cubic yard, PCE-source removal project performed in cooperation with NCDEQ Division of Waste Management Superfund Section. Major project components included phased building demolition followed by excavation to facilitate on-site management of high-concentration source area soils using ex-situ application of modified Fenton's reagent (MFR). The application of MFR minimized hazardous waste disposal quantities and facilitated expedited preparation of the property for re-sale and redevelopment. A value-added engineering approach was used to design and install a subsurface extraction/infiltration system in the former release area and will be used for future remedial action phases.

Enhanced Reductive Dechlorination, Abiotic Reduction, and Sorptive Quenching for Hot-Spot Groundwater, Winston-Salem, NC (Manufacturing Client). Supervising engineer for the design and implementation of a tiered hot spot reduction strategy for PCE-impacted groundwater at an NCDEQ REC Program site to achieve reductions in contaminant concentrations at a downgradient surface water feature. The injection program involved pre-injection pH modification in the hot-spot area followed by application of 3,000 gallons of aqueous carbohydrate solution via permanent wells and 6,300 gallons of zero-valent iron suspension via direct push points. Downgradient of the hot spot area, 8,300 gallons of PlumeStop® Liquid Activated CarbonTM was delivered to saprolite and partially weathered rock to rapidly reduce high concentrations upgradient of the surface water discharge point. The combination of source area flux reduction and downgradient sorption achieved an average reduction in PCE concentrations of more than 70 percent, and surface water was brought into compliance with NC standards immediately downgradient of the injection area.

Capillary Barrier Evaluation, Jersey City, New Jersey (Chemical/ Manufacturing Client). Project engineer for the design, implementation, and evaluation of a large-scale field study to evaluate the height of capillary rise at a chromium-impacted site with shallow groundwater. The results of the field study were used to design an effective capillary break to prevent the upward migration of groundwater toward the soil surface by capillary forces.

Environmental Liability Estimating, Southeastern USA Sites (Multiple Sites). Conducted liability estimating in accordance with ASTM E-2137 for multiple sites with soil, groundwater, and surface water impacted by chlorinated volatile organic compounds.

Feasibility Study for Arsenic and Chlorinated Pesticides, Jacksonville Florida, USA (RP Group). Conducted feasibility costing for remedial alternative evaluation at a CERCLA Site impacted with arsenic, chlorinated volatile organic compounds, and organochlorine pesticides. Feasibility costing involved evaluation of multiple strategies including but not limited to excavation, in situ stabilization/solidification, enhanced reductive dechlorination, in situ chemical oxidation, in situ chemical reduction, pump and treat, and monitored natural attenuation.

Design of Barrier Structures for Groundwater Remediation, Adel, Georgia, USA (Manufacturing Client). Lead the design of a 6,000 vertical square foot subsurface permeable reactive barrier for remediation of groundwater impacted with chlorinated volatile organic compounds at an existing metal fabrication facility. The design involved selection of sand/reactive zero valent iron media mixture, optimization of reactive barrier placement using numerical groundwater monitoring, and identification of site preparation requirements for the use of special installation equipment.

Groundwater Treatment System Design and Installation, Gastonia, North Carolina, USA (Manufacturing Client). Lead designer for the design and installation of a groundwater pump and treat system at a RCRA facility impacted with chlorinated volatile organic compounds. The work involved the decommissioning of an existing system, including pipe flushing, demolition, and residuals disposal. The new treatment system included new well vaults with upgraded instrumentation and a new treatment system consisting of flow equalization, particulate filtration and air stripping unit processes. Provides support for operations as needed.

Groundwater Treatment System Design, Installation, and Operations, Winston-Salem, North Carolina, USA (Manufacturing Client). Lead designer for the design and installation of a groundwater pump and treat system at a RCRA facility impacted with chlorinated volatile organic compounds. The work involved the decommissioning of an existing treatment system, including pipe flushing, tank cleaning, and residuals disposal. The new treatment system was housed within an existing building and consisted of flow equalization, particulate filtration, air stripping, and activated carbon adsorption unit processes. Provides support for operations including investigation and of biofouling and development of management strategies.

Pump and Treat Operation, Mebane, North Carolina, USA (Chemical/ Pharmaceuticals Client). Provided engineering and operations and maintenance support for a groundwater pump and treat system designed for the removal of chlorinated aliphatic hydrocarbons. System included six extraction wells and treatment unit processes consisting of flow equalization, filtration, air stripping and activated carbon adsorption processes.

Full-Scale In-Situ Chemical Oxidation, Aberdeen, North Carolina, USA (Manufacturing Client). Lead the design and oversaw implementation of full-scale in situ remediation of a small perchloroethene plume using potassium permanganate at a former manufacturing facility.

AECOM

Scott M. Buskey
On-Site Inspector/Scientist 2/Scientist 1/GIS & CADD Specialist

Professional History
08/1999 - Present, AECOM GIS Specialist, Environmental Scientist, Archaeologist
04/1998 - 08/1999, Institute for Minnesota Archaeology, Field Archaeologist
1997 – Blue Earth County Historical Society, Archaeological Internship
1996 – US Forest Service, Rio Grande National Forest, Field Archaeologist

Education
BS, Geography/Anthropology, 1998, Minnesota State University at Mankato

Years of Experience
With AECOM: 19
With Other Firms: 4

Training
OSHA HAZWOPER 8-Hour Refresher Training
OSHA HAZWOPER 8-Hour Supervisor Training
OSHA HAZWOPER 40-Hour Training
Certified Asbestos Inspector (Minnesota)
Wetland Delineation 40-Hour Training (Minnesota)

Mr Buskey has a uniquely diverse skillset which he has utilized throughout his professional career. His GIS background encompasses numerous transportation, planning, and permitting projects and involves all aspects of data development, management and analysis, map production, and support for field efforts. He has worked on numerous private and public sector projects involving soil, and groundwater contaminant investigations and remediation, underground storage tank removal, geotechnical testing, wetland delineations, and environmental management and compliance. Mr. Buskey also has an extensive background as an archaeologist with cultural resource management experience ranging from large scale transportation and pipeline corridors, mining projects, to small scale development projects. In addition, Mr. Buskey has several years of experience as a construction surveyor with a firm knowledge of data collection as it relates to construction design and management. Specific duties that Mr. Buskey has been responsible for include field work coordination and supervision, data interpretation, and technical report preparation. A partial list of recent projects Mr. Buskey has been involved with include: Elk River U.S. Post Office Phase I Cultural Resources Investigation; I-35W MnPASS Phase II drilling investigation; TH 61 Hastings Bridge Replacement Phase II drilling investigation and construction monitoring; I-35E Maryland Interchange, Cayuga and MnPASS Phase I/Phase II ESAs and construction monitoring; I-494 from I-394 to I-94 Phase II ESA; and Phase I/Phase II ESAs along the I-94 corridor in St. Paul, Minnesota.

Project Experience

GIS Specialist, Iowa Department of Transportation Interstate 35 Diversion Project, Ankeny to the Minnesota Border, 2017 – Present). Mr. Buskey currently serves as the GIS specialist for the design and mapping portion of diversion routes for the Iowa Department of Transportation's Traffic Incident Management system. Diversion routes for Interstate 35 through the northern half of Iowa were designed to re-route traffic in the event of an incident related road closure. The final diversion routes in GIS format are to be incorporated into the Iowa Department of Transportation's online Traffic Incident Management Map for real time notifications and directives in the event of Interstate 35 closure.

GIS Specialist, EDP Renewables North America LLC Proposed Wisconsin Wind Projects, WI (2017). Mr. Buskey served as the GIS specialist for a site characterization study of critical environmental aspects for four proposed windfarm sites located throughout Wisconsin. Specific GIS duties included mapping of potential biological, cultural, land use, and environmental permitting issues for the proposed project. All corresponding mapping data was compiled according to GIS industry standards as a final deliverable to the client.

GIS Specialist, Badger Mining Corporation Wetland Mitigation Bank, Jackson County, WI (2017 - Present). Mr. Buskey currently serves as the GIS specialist for a proposed wetland mitigation bank located in Jackson County, Wisconsin. Specific GIS duties include wetland mapping and data management for the ongoing proposed.

GIS Specialist, Hwy 210 County Rd 151 (Jay Cooke Rd) to Hwy 23 in Jay

Cooke State Park, Carlton County, MN (2016). Mr. Buskey performed topographic surveys of four remnant segments of the historic Grand Portage Trail as part of an effort to protect cultural resources under Section 106 of the National Historic Preservation Act. Mr. Buskey was then tasked with the post-processing of all data collected and development of site specific digital elevation models for use by the State Historic Preservation Office for historic review.

Archaeologist/GIS Specialist, CSAH 101 Reconstruction Archaeological Monitoring, Minnetonka, MN (2014). Mr. Buskey served as the field archaeologist responsible for monitoring at a known Native American Burial Mound Site during construction activities along CSAH 101 in Minnetonka. Specific archaeological responsibilities included monitoring and documentation during grading activities and consultation with Tribal Representatives, the Minnesota State Archaeologist, and the Client.

GIS Specialist/Environmental Scientist, Phase I & II ESA, TH 61/63 Red Wing Bridge Reconstruction, Red Wing, MN (2012 to Present). Mr. Buskey serves as AECOM's GIS specialist and environmental scientist during the Phase I ESA and Phase II drilling investigations relating to the replacement of the TH 61/63 Red Wing Bridge over the Mississippi River in Red Wing, MN. Mr. Buskey's GIS responsibilities include field support, data analysis, development and management, and map production.

GIS Specialist, St. Joseph Area Long Range Transportation Plan, St. Joseph, MO (2004 - Present). Mr. Buskey serves as one of AECOM's GIS specialists for the ongoing Long Range Transportation Plan for the City of St. Joseph and Buchanan County, MO. Mr. Buskey's responsibilities include the development and analysis of all aspects of transportation data, and the development of comprehensive maps to assist the Client in conveying the importance of understanding the transportation/land use connection leading to informed transportation infrastructure decisions.

GIS Specialist/Environmental Scientist, Phase I & II ESA and Construction Monitoring, I-35E Corridor, St. Paul, MN (2010 to the Present). Mr. Buskey served as one of AECOM's GIS specialists and environmental scientists during the execution of linear corridor Phase I & II ESAs and construction monitoring programs along the I-35E alignment from University Avenue to CSAH 96. Specific GIS responsibilities include the management of the environmental database, field support, and map production. The I-35E Cayuga project corridor is entering its fifth active construction season and Mr. Buskey continues to be involved with GIS management and environmental monitoring.

GIS Specialist/Environmental Scientist, Phase II Drilling Investigation, I-35W Corridor, Roseville to Blaine, MN (2015- 2016). Mr. Buskey served as AECOM's GIS specialist and environmental scientist during the execution of a linear corridor Phase II drilling investigation along the I-35W alignment from Roseville to Blaine. Specific GIS responsibilities included the management of environmental databases, field survey and support, data analysis, and map production.

Environmental Scientist /GIS Specialist, TransCanada Keystone Pipeline LP, Hutchinson County, South Dakota (2016). Mr. Buskey was part of AECOM's Emergency Response Team during the initial mobilization for a release of crude oil located approximately six miles east of Menno, Hutchinson County, South Dakota. Mr. Buskey was responsible for environmental monitoring and documentation during the delineation and removal of crude oil impacts at the release site. During the reporting process, Mr. Buskey served as the GIS specialist responsible for the management of field data and the creation of site specific maps.

AECOM

Mary Canino, PG
On-Site Inspector/Scientist 2/Scientist 1

Professional History
06/2007 - Present, AECOM Project Manager, Senior Geologist

Education
BS, Geology, University of Houston, 2004
MS, Geology, University of Houston, 2007

Years of Experience
With AECOM: 10

Training
OSHA HAZWOPER 8-Hour Refresher Training
OSHA HAZWOPER 40-Hour Training
OSHA HAZWOPER 8-Hour Supervisor Training

Ms. Canino has ten years of experience in environmental projects encompassing a wide array of technical disciplines. Ms. Canino has had a major role in the execution of large-scale site investigations, including two federal CERCLA sites, numerous MnDOT corridor Phase I and Phase II Environmental Site Assessments (ESAs), and several complex brownfield development projects. Her present responsibilities at AECOM include project management, development of technical approach, supervision of field staff, and data management and analysis.

Project Experience

Feasibility Study & Compliance Monitoring US Steel Superfund Site. Deputy Project Manager; Remedial Investigation, , Duluth, MN. Ms. Canino is responsible for all field and reporting tasks related to the ongoing remedial investigations and site monitoring at the 600-acre former Duluth Works Site. All reporting and field work has been performed in conjunction with Minnesota Pollution Control Agency (MPCA) approval and satisfaction of the United States Environmental Protection Agency (USEPA) St. Louis River Superfund Site (a portion of which includes the Subject Property) requirements. Ms. Canino has been involved with all aspects of project implementation since 2008 with project tasks having included scope of work preparation and cost analysis, client representation, field work coordination and supervision, data interpretation, and technical report preparations satisfying all submittal requirements for the MPCA Superfund program, Industrial Stormwater Program, Voluntary Investigation and Clean-up Program, and the Petroleum Remediation Program. Ms. Canino is currently involved in the preparation of a site-wide Feasibility Study in advance of a Final Remedy for the Site. Stakeholders include the Minnesota Pollution Control Agency, Great Lakes National Program Office, Minnesota department of Natural Resources, U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, and the Fond du Lac Tribe.

Union Depot Design-Build Project. Project Geologist, Brownfield Redevelopment, RCRRA, St. Paul, MN. Ms. Canino was responsible for field oversight and environmental reporting in conjunction with the design-build construction program of a fully functioning, multi-modal transportation hub. The project scope included completion of a comprehensive Phase II ESA of the entire Union Depot complex, development of a Response Action Plan and Construction Contingency Plan. Contingency actions included removal of an orphan underground storage tank and asbestos contaminated soils and debris.

132-Acre Purchase Property (US Steel and Duluth Seaway Port Authority). Deputy Project Manager, Brownfield Redevelopment, Duluth, MN. Ms. Canino designed and supervised a focused and comprehensive Phase II site investigation of the 132-acre property investigation in compliance with the MPCA's Voluntary Investigation and Cleanup Program on behalf of United States Steel Corporation and the Duluth Seaway Port Authority in advance of future industrial development and federal delisting from the St. Louis River Superfund Site. As Deputy Project Manager, Ms. Canino was responsible for scope of work preparation and acquiring agency approval, field effort implementation, report preparation, and project management tasks.

Phase II Investigation and Regulated Materials Management. Project Manager, , Dakota County, Empire Township, MN. Ms. Canino served as AECOM's project manager and technical director during the site investigation and subsequent response actions at a Dakota County owned parcel located adjacent the former Gopher Ordinance Works facility. Remedial actions, under the direction of Ms. Canino, included removal of approximately 5,500 square feet of asbestos containing material and contaminated soils management.

Hastings Bridge and TH 61 Corridor. Project Scientist, Phase I & Phase II ESAs, Mn/DOT, Hastings, MN. Ms. Canino completed field oversight and reporting duties in conjunction with pre-construction Phase I and Phase II environmental investigations. Objectives completed for this project, as a result of Phase I and II investigation activities, included preparing a Response Action Plan and Construction Contingency Plan to mitigate known and unknown environmental conditions to be encountered during future site construction, attaining MPCA approval for the management of certain impacted media, and attaining MPCA liability assurances for MnDOT for acquisition parcels in the form of a No Association Determination for non-petroleum related impacts along the construction corridor and within temporary and permanent easements.

Cayuga Bridge and I-35E Corridor. Project Geologist/Field Manager, Phase I & Phase II ESAs, St. Paul, MN. Ms. Canino completed reporting and field oversight duties in conjunction with pre-construction Phase I and Phase II environmental investigations. Phase I ESA activities were initiated along the heavily industrial and commercial 1.5 mile project corridor, with forty-six sites representing potential environmental concern subsequently identified. Given the potential for impacted media on potential acquisition properties, subsequent Phase II ESA efforts, including geophysical investigations, test pits, and 175 soil borings were performed in an effort to garner MnDOT liability assurances prior to property acquisition and aid in construction design.

Hydrogeologist Staff Augmentation Position; Minnesota Department of Transportation Central Office. Ms. Canino is currently fulfilling a staff augmentation role with the OES for Fiscal Years 2016-2019. In this role, Ms. Canino has worked to establish strong working relationships with District project managers and right-of-way staff having assisted on over 100 State Projects, predominately in Districts, 1, 2, 3, Metro North, and Metro East. Ms. Canino has assisted MnDOT's OES Project Managers at all stages of the environmental risk management approach. Completed tasks have included, P6 Scoping, responding to District ENM requests, advancing the Department's EDD process, preparing Phase I and Phase II ESA scopes of work, emergency contracting for drilling, preparing and amending contract documents, preparing notification letters for submittal to landowners, communicating with MPCA staff regarding liability assurances, preparing regulatory program applications, completing technical reviews, and providing technical guidance and recommendations to the CMMT team.

AECOM

John D. Cannon
On-Site Inspector/Scientist 2

Professional History
07/2013 – Present, AECOM
10/2011 – 07/2013, URS
5/2010 – 10/2011, Kadrmas, Lee & Jackson
3/2009 – 4/2010, KLD Consulting

Education
MA, Urban and Regional Planning, Environmental Planning Specialization, University of Minnesota – Twin Cities, 2009
BS, Environment and Natural Resources, Planning, Policy, and Law Specialization, University of Minnesota – Twin Cities, 2007

Years of Experience
With AECOM: 5
With Other Firms: 4

Certifications/Trainings
Minnesota Wetland Delineator Certification Program: Delineator In-Training Certification (#5140)
AECOM Certified Project Manager
E-Railsafe Certified
OSHA 40-hr HAZWOPER
OSHA 10-hr Occupational Safety and Health Training

John Cannon is an environmental planner and AECOM Certified Project Manager in our Minneapolis, MN office with over nine years of professional experience. Mr. Cannon provides our clients with environmental permitting and compliance, environmental inspection and monitoring, wetland management, NPDES compliance, and SWPPP management services for oil and gas, energy, and transportation projects throughout the Midwest. Mr. Cannon's responsibilities include project management, technical discipline task leadership, state and federal agency coordination, field work coordination and supervision, permit application preparation, client coordination, and technical report preparation.

Project Experience

Minnesota Pollution Control Agency, Western Lake Superior Sanitary District Landfill Decommission, Duluth, Minnesota. Mr. Cannon was the wetlands task lead for a wetland mitigation project associated with a landfill decommission project. John regularly monitored vegetation establishment and groundwater levels at three wetland mitigation sites. Yearly reports and coordination with USACE were also led by Mr. Cannon.

Blattner Energy Inc., **HQ Facility Expansion Project, Avon, Minnesota**. Mr. Cannon is the environmental lead for wetland delineation and environmental permitting activities at Blattner's 50 acre industrial facility expansion. Early in the planning process, Mr. Cannon worked with Blattner to identify the required permits that would be necessary for development. Mr. Cannon prepared the joint permit application, wetland replacement plan, stormwater permit, and negotiated the purchase of wetland credits. Mr. Cannon also oversees SWPPP inspections and wetland permit compliance activities during the construction phase.

Dairyland Power Cooperative, Alden to Mansfield 69kV Transmission Line Rebuild Project, Freeborn County, Minnesota. John is the project manager and biological and permitting task lead for DPC's 6-mile transmission line rebuild project. Mr. Cannon conducted wetland delineations and habitat assessments and prepared summary reports. John also prepared a SWPPP and obtained authorization from MPCA for discharge activities associated with construction. Mr. Cannon also obtained a license to cross public lands and waters from the MNDNR on behalf of DPC.

BNSF, Willmar Wye Project, Willmar, Minnesota. John managed the development of a Categorical Exclusion NEPA document for FRA as AECOM's environmental lead on BNSF's Willmar Wye rail connector and industrial access project. Specifically, Mr. Cannon was responsible for assessing potential impacts and developing mitigation strategies for sensitive resources including wetlands, cultural resources, protected species, floodplains, as well as other resource areas.

Canadian Pacific, Several Siding Extension Projects, Minnesota, North Dakota, Wisconsin, Iowa. Mr. Cannon served as the wetland delineation and regulatory permitting lead for 15 separate rail siding extension projects throughout the upper Midwest. In this role, John coordinated and managed field wetland delineation activities, preparation of technical reports, state and federal permit application preparation, and also provided mitigation

planning support to AECOM's engineering teams. Mr. Cannon also worked with CP staff to identify additional permit requirements on a project-by-project basis through completion of a CP environmental review matrix.

Enable Midstream Partners, Nesson Crude Oil Gathering System, Williams and Mountrail Counties, North Dakota. John serves as the project manager for environmental review, permitting, and compliance services for EMP's 96-mile crude oil gathering system pipeline project in western North Dakota. Mr. Cannon is responsible for managing AECOM and sub-consultant field survey efforts (biological and cultural resources), preparing technical reports and permit application packages, managing several NPDES permits, and environmental monitoring and inspection activities throughout construction. In addition, John also developed several supporting plans including SPCC, HDD Contingency, and a construction reclamation and monitoring plan. Mr. Cannon also worked closely with EMP environmental staff to ensure that the project met the requirements of USACE NWP 12.

Enable Midstream Partners, Bear Den Crude Oil Gathering System, McKenzie County, North Dakota. Mr. Cannon serves as the project manager for environmental review, permitting and compliance services for EMP's 68-mile crude oil gathering system pipeline project in western North Dakota. Mr. Cannon is responsible for managing AECOM field survey efforts for wetlands/waters of the U.S., threatened and endangered species habitat, and cultural resources. John also manages EMP's NPDES program by ensuring permit coverage for new lateral lines and developing associated SWPPPs. Mr. Cannon also oversees AECOM's environmental inspection and monitoring activities for this project.

Chevron Environmental Management Company, Pipeline Abandonment Project, Dawson and McCone Counties, MT. Primary responsibilities as field manager included developing a field work plan, securing site access with landowners, and supervising phase 1 pipeline identification activities for an abandoned 50+ mile petroleum pipeline in eastern Montana. Other specific tasks included identifying potential cold tap locations, identifying sensitive ecological areas, mapping above-ground features, and identifying potential release sites.

U.S. Federal Highway Administration, Federal Lands Access Program Roadway and Bridge Improvement Projects, North Dakota, Kansas, Colorado. As the biological task lead, Mr. Cannon was responsible for conducting field wetland delineations and surveys for threatened and endangered species habitats and migratory birds for several transportation improvement projects. Projects involved working closely with FHWA and USFWS environmental and biological staff to summarize potential impacts and develop measures for avoidance and minimization. Mr. Cannon also prepared USACE NWP applications and NEPA Categorical Exclusion documents.

AECOM

Dan Cervin
Project Manager/On-Site Inspector/Scientist 2

Professional History
07/2014 - Present, AECOM Project Manager/ Senior Geologist
01/2013 – 07/2014: Mine Planner/ Mine Geologist Cliffs Natural Resources
06/2010-01/2013: Hydrogeologist – MSA Professional Services
1994-06/2010: Construction Industry: General Contractor/ carpenter

Education
B.A. English
Northland College, 1993
B.S. Geology
Northland College, 2009
M.Sc. Geology
University of Minnesota, 2011

Years of Experience
With AECOM: 4
With Other Firms: 19

Registrations
Minnesota Registered Professional Geologist # 53185

Training
OSHA HAZWOPER 8-Hour Refresher Training
OSHA HAZWOPER 40-Hour Training
First Aid/CPR
Cold Weather Spill Response (Ice)

Mr. Cervin has >8 years of experience working as a geologist with an emphasis on environmental consulting and mining geology. His experience involves managing and executing projects to support clients with environmental compliance and permitting in the public sector as well as the rail road, mining, and pipeline industries. This experience includes scoping, estimating, and scheduling of technical projects. Job responsibilities include: managing technical teams, remediation of petroleum/chemical impacted sites; technical report writing; Senior-level field geologist versed in numerous drilling methods, sampling procedures, and subcontractor oversight. His work experience also includes work as a mine planner, mine geologist, and general contractor.

Experience

MPCA Multi-Site Project Manager/ Task Manager/Geologist. Responsibilities include project management, work order preparation, bid solicitation, State Contractor management following the MPCA Purchasing Manual and individual project assignments.

CS Service and Wally's Spur. Project Manager/ Senior Geologist for the CS Services/Wally's Spur Sites located in the center of Grand Marais's commercial district. AECOM has conducted additional site delineation work that is currently being used to develop an excavation design to remove petroleum impacted soil at two areas. Although much of the delineation work had been conducted prior AECOM's involvement, AECOM organized the presented the decade's worth of delineation information into a Conceptual Site Model (CSM) so that a remedial plan could be developed and designed. The design work is being conducted in concert with a MNDOT-led project to reconstruct Highway 61, and concurrent remedial excavation of petroleum impacted soil present within the right-of-way.

LF Knutson & Sons. Task Manager/ Senior Geologist for remedial design and implementation of petroleum impacted soil in the center of Warren's commercial district. AECOM completed a full delineation of the petroleum impacts and used that information to plan, estimate, design, and implement soil remediation activities. A component of the project involved interacting with affected businesses and MNDOT, due to the excavation zone located on a State Highway. Petroleum impacted soil was excavated and land-applied to an MPCA-approved site.

Longville Bible Chapel. Task Manager/ Senior Geologist for ongoing investigation that has delineated and defined source area petroleum contamination that has impacted local potable water supply wells. A component of the project involves interacting with affected potable well owners to complete ongoing testing.

Duluth Dump #1. Task Manager/ Senior Geologist for ongoing investigation to characterize & delineate (vertical & horizontal extent of in-place waste including volume calculations) to support development and design of a long term management strategy.

Iron Mining Company, Tailings Basin Management Facility (TMF) Groundwater Modeling to Support permitting objectives. Project Manager leading a technical team to successfully build a groundwater flow

AECOM

model of the TMF and surrounding hydrologic system. Lead the team to present groundwater modeling results to client and stakeholders.

Crude Oil Pipeline Company, Subsurface Environmental Assessment and Remediation. Project Manager/ Senior Geologist on multiple pipeline sites to support voluntary groundwater monitoring and regulatory-driven site investigation and assessment of hydrocarbon impacted soils and groundwater at pipeline facilities.

Class I Railroads, Subsurface Environmental Investigations and Remedial Action Planning and Design, Various Locations. Project Manager/ Senior Geologist leading the investigation and remediation of hydrocarbon impacted soils and groundwater surrounding leaking underground storage tanks, transportation fueling facilities, and spill sites.

AECOM

Anthony J. Coryell
Project Manager/On-Site Inspector/Ecological Risk Assessor 3/Scientist 2

Education
MS, Geography (Ecology), University of Memphis, 1998
MS, Toxicology, University of Florida, 2013

Years of Experience
With AECOM: 19
With Other Firms: 19

Training
American Red Cross First Aid/CPR
OSHA HAZWOPER 40 hr. Safety Training and current 8 hr Refresher Training
OSHA Confined Spaces Training

Mr. Coryell is a senior scientist with approximately 19 years of experience in the consulting field. Specifically, Tony has extensive experience with the development of surface water quality standards for the MPCA, Ecological Risk Assessments, and Environmental Assessments including Phase I and Phase II Environmental Site Assessments.

Project Experience

Toxicology and Risk Assessment

Minnesota Pollution Control Agency (MPCA), Water Quality Benchmark Development, Minnesota. Served as lead biologist for the development of surface water benchmarks for the protection of aquatic life for several pesticides including glyphosate, acetochlor, metolachlor, dimethenamid, isoxaflutole, 2,4-D, metsulfuron-methyl, pyraclostrobin and Permethrin for the Minnesota Department of Agriculture (in coordination with the Minnesota Pollution Control Agency and Environmental Protection Agency Region 5). Worked closely with EPA OPP evaluating bioassays performed on aquatic animals and plants.

Phase II of this work included a review and discussion of alternative plant methodologies for use in EPA methodology which currently lacks specific guidance. Presented project at a technical meeting at the EPA Region 5 Headquarters in Chicago, Illinois on behalf of the Minnesota Department of Agriculture and MPCA. The technical meeting was attended by interest groups and stakeholders including Monsanto, Crop Life of America, U.S. EPA, Minnesota Department of Agriculture, DOW Chemicals, DuPont and Bayer.

Minnesota Pollution Control Agency (MPCA), Ecological Risk Assessment, Minnesota. Assisted with the development of the tiered screening approach to Ecological Risk Assessments for the State. The tiered approach is used to screen the level of risk for contaminated sites in Minnesota.

Various Clients, ERAs, Minnesota and Indiana. Served as lead ecologist and biologist for Ecological Risk Assessments performed for large industrial clients on Lake Michigan and near the St. Croix River in Minnesota, These ERAs were required to determine the likely impacts of hazardous waste on local habitats and wildlife and were conducted in conformance with US EPA regulations.

Minnesota Pollution Control Agency (MPCA), Water Quality Standards Development, Minnesota. Served as lead aquatic biologist for the development of three surface water quality standards for the State of Minnesota. Initially performed an extensive literature search/ review of existing ecotoxicological research as well as available fate and transport studies for PFCs. Evaluated bioassays performed on aquatic organisms and wildlife determining the toxicity of perfluorooctanoic acid (PFOA), perfluorooctane sulfonate (PFOS) and perfluorobutanoic acid (PFBA). Worked with Minnesota Department of Health in the development of fish consumption criteria (FCC) associated with PFCs in Minnesota water bodies. Coauthored final reporting to the Minnesota Pollution Control

Agency. Below are links to the final documents for PFOS and PFOA through the Minnesota Pollution Control Agency website: http://www.pca.state.mn.us/index.php/component/option,com_docman/task,doc_view/gid,2869; http://www.pca.state.mn.us/index.php/view-document.html?gid=2866

Compliance

CenterPoint Energy, Minneapolis, Minnesota. Managed and prepared several Pollution Prevention Plans and various permit applications for the installation and removal of several large ethylene glycol aboveground storage tank systems on behalf of CenterPoint Energy in Minneapolis, Minnesota. The permits included the construction of secondary confinements for the AST systems.

Minnesota Department of Transportation (MnDOT), Minneapolis, Minnesota. Assisted in the investigation of the presence of asbestos and regulated wastes on numerous bridges for the Minnesota Department of Transportation. Locations included the I-35W bridge over the Mississippi River and all bridges associated with the reconfiguration of Crosstown/35W in Minneapolis, MN by MnDOT. Prepared several Asbestos and Regulated Waste reports for MnDOT.

Ecolab, St. Paul, Minnesota. Conducted an assessment of bulk aboveground storage tanks for Ecolab in Colorado, Texas, Minnesota, South Dakota, Iowa, Kansas, Nebraska, Oklahoma, Missouri, Arkansas and Illinois. This assessment included a review of aboveground storage tank regulations (state and local) for each of the aforementioned states. Site inspections were also performed for each facility in which ASTs owned by Ecolab were present. Recommendations were implemented by Ecolab as required by this inspection.

Environmental Site Assessments

Minnesota Pollution Control Agency (MPCA), Investigations at the Valentine-Clark Superfund Site and Bridal Veil Park, Minneapolis, Minnesota. Evaluated the potential of pentachlorophenol (PCP) migration via groundwater into a storm sewer in Minneapolis for the Minnesota Pollution Control Agency. The storm sewer daylights into a creek and eventually a pond which was previously identified as impacted with pentachlorophenol. The investigation included a confined space permitted entry into the flooded sewer with supplied air to evaluate sewer construction and integrity.

Supervised field work for the Valentine-Clark Superfund Site. Work included the collection and analysis of surface water (Bridal Veil Creek and Bridal Veil Pond), sediment, groundwater, soil samples and analysis of surface water-groundwater relationship to the impaired property to evaluate chemical impacts. Ongoing work includes periodic monitoring of a bioremediation “wetland” constructed by AECOM associated with Bridal Veil Creek prior to discharge to the Mississippi River.

Minnesota Pollution Control Agency (MPCA), Chlorinated VOC Plume in St. Louis Park, Minnesota. Project Manager associated with the investigation and identification of sources of cVOC contamination in municipal wells and soil vapor intrusion in commercial/residential buildings. Other services include managing the conversion of historical soil, soil vapor and groundwater analytical data into an EQuIS format and 3D model utilizing Mining Visualization System (MVS) software.

Minnesota Pollution Control Agency (MPCA), MacGillis and Gibbs Superfund Site, New Brighton, Minnesota. Project Manager for the

ecological assessment of a nearby wetland/lake which including sediment sampling for pentachloropehenol, dioxins and carcinogenic PAHs. In addition, provides oversight of the MacGillis and Gibbs groundwater pretreatment facility as required by the EPA ROD for the site. Work includes daily plant operations and maintenance of a facility used to pump and treat local groundwater contaminated with wood treatment chemicals as a result of former activities. Treated groundwater is discharged to the sanitary sewer system for further treatment.

Minnesota Pollution Control Agency (MPCA), Rays Truck Stop, Lakeland, Minnesota. Project Manager serving the MPCA for the Rays Truck Stop petroleum release plume in Lakeland, MN in which residential wells were impacted to a point in which municipal water connections were required by the MPCA. The final portion of the work involved development of a site conceptual model and elimination of risk receptors including well sealing. The release was closed by the MPCA in 2017.

Minnesota Pollution Control Agency (MPCA), Smith Avenue, St. Paul, Minnesota. Project Manager serving the MPCA for the Smith Avenue cVOC release plume in St. Paul, MN. Residential homes were impacted by vapor intrusion to a point in which several subslab depressurization systems (SSD) were required by the MPCA. The cVOC groundwater plume and associated vapor intrusion impacts are currently under investigation.

AECOM

Carl Crane
Human Health Risk Assessor 3/Ecological Risk Assessor 3

Areas of Expertise
Ecological and Human Health Risk Assessment
Terrestrial and Aquatic Toxicology
Sediment Contamination
Water Quality

Education
M.S./1985/ Biology /Tennessee Technological University
B.S./1978/ Zoology /State University of New York College of Environmental Science and Forestry

Years of Experience
With AECOM: 26
With Other Firms: 7

Trainings/Certifications
40-hour Hazardous Waste Operations & Emergency Response 29 CFR 1910.120
PADI International Open Water Diver

Mr. Crane's experience encompasses over thirty years performing ecological and human health risk evaluations, and biological, soil, water and sediment quality assessments. His expertise includes ecological and human health risk assessments, terrestrial and aquatic ecotoxicology, statistical analysis and interaction with regulators and project stakeholders. He has conducted evaluations for a broad spectrum of contaminants, including dioxins, PCBs, PAHs, pesticides, inorganics, explosives and radionuclides. He has experience working in a variety of regulatory environments (e.g., CERCLA, RCRA, MMRP, NPDES and multiple state voluntary programs). He was formerly a director of an ecotoxicology and ecology laboratory for over twelve years.

Experience

Project Manager/Lead Risk Assessor, Alcoa/Arconic (1992 to present). Manage a CERCLA investigation in Iowa to evaluate surface water and sediments of the upper Mississippi River (Mississippi River Pool 15) and soils of an adjacent industrial metals manufacturing site. The project is being overseen by USEPA Region 7. Conducted human health and ecological risk assessments and several supporting studies, including wetland surveys, endangered mussel surveys, benthic diversity studies, and fish tissue sampling. Prepared a feasibility study and developed a monitored natural recovery project plan (MNRPP) to support the record of decision.

Project Scientist, BP, San Juan River, Venezuela (1999). Supported water quality and hydraulic studies in the tidally influenced San Juan River. Spent seven weeks in the field supporting studies to evaluate potential impacts to the San Juan River and adjacent wetlands associated with natural resource exploration and development.

Lead Ecological Risk Assessor, USFWS (1999 to Present). Crab Orchard National Wildlife Refuge, Marion, Illinois (CERCLA) - Munitions were manufactured at Crab Orchard during WWII, and industrial activities are ongoing. Developed ecological risk work plans, conducted ecological risk modeling and collected field biological data to support risk evaluation and development of remedial goals. Lead ecological risk assessor for over 30 sites. Coordinated an ecological work group consisting of USFWS, Illinois EPA, USEPA Region 5 and potentially responsible parties.

Ecological Risk Assessment Lead, Bannister Federal Complex (BFC), Kansas City, Missouri (2000-2002; 2013-2016). Performed a Baseline Ecological Risk Assessment in support of property transfer and redevelopment. The BFC is the former site of a large General Services Administration (GSA) administrative center, and a large manufacturing facility for nuclear weapons components. The primary constituents of ecological concern at the facility were PCBs in bordering creeks/river, and associated riparian area. Evaluation consisted of both total PCBs and dioxin-like PCB congeners. Developed work plans and negotiated risk assessment approaches with both state regulators and USEPA Region 7. The risk assessment was approved by both USEPA and the Missouri Department of Natural Resources.

Lead Ecological Risk Assessor, Coast Guard, Anclote Key Lighthouse, FL (2015 - 2016). The Anclote Key Lighthouse is located at Anclote Key in

Pinellas County, Florida. Performed an ecological risk assessment for the US Coast Guard (in conjunction with site characterization and human health risk assessment) to evaluate lead and mercury in soils, sediments and surface water.

Lead Ecological Risk Assessor, U.S. Steel (2000 to 2016). Conducted **e**cological risk assessments for sites associated with an active steel manufacturing facility, including embayments along Lake Michigan in Gary, Indiana.

Lead Ecological Risk Assessor, Shell Oil (2016-present). Ecological risk assessment at an active oil refinery and adjacent waterways located in El Dorado, KS.

Project Scientist, BP, Azerbaijan (2011-2012). Supported development of a Position Paper on toxicity thresholds for water-based drilling muds in the Azeri Chirag Gunashli, a large complex of oil fields in the Caspian Sea.

Lead Ecological Risk Assessor, El Paso (2006 – 2012). Ecological risk assessment of former oil refineries and adjacent waterways located in El Dorado and Wichita, KS.

Lead Risk Assessor/Senior Risk Assessment Reviewer (2010 to present). Performing human health and/or ecological risk assessments for investigations at multiple military installations under the MMRP, CERCLA and RCRA programs, including: Sioux Army Depot, NE; Charleston AFB, SC; Shaw AFB, SC; Fort Gordon, GA; MacDill AFB, FL; Maxwell AFB, AL; Blue Grass Army Depot, KY; Mississippi Army Ammunitions Plant; Indiana Army Ammunition Plant; Iowa Army Ammunition Plant; Camp Ellis, IL; Mountain Home AFB, ID; Souix Army Depot, NE; Holloman and Cannon AFB, NM; Hill AFB, NV; Pole Mountain Target and Maneuver Area, WY; Vandenberg AFB and Beale AFB, CA; and Former Fort Glenn, AK. Responsible for authoring/reviewing work plans and human health and ecological risk evaluations and interacting with project stakeholders.

Ecological Risk Assessor, Naval Surface Warfare Center Dahlgren, Dalgren, VA (2016 to present). Ecological Risk Assessor for conducting a combustion risk assessment in support of RCRA Part B permit renewal at an active open burn/open detonation facility. Prepared a Work Plan to provide the detailed approach for conducting the risk assessment following the basic approach in EPA's Combustion Risk Assessment Guidance.

Project Scientist, BP Azerbaijan (2014-2016). Supported toxicity evaluation of commercial dispersant products and oil/dispersant mixtures to support licensing and regulatory approval for the dispersants in Azerbaijan.

Ecological Risk Assessor, Dow Chemical Company, Midland, Michigan (2013-2014). Completed an ecological risk screening effort for the urban project area that resulted in an in-depth evaluation of over 275 analytes resulting in the identification of only one chemical of concern. The screening involved the justification for and final selection of avian receptors as the only relevant receptor for an urban environment, the development of a hierarchy for identifying and selecting ecological screening levels, calculating a screening level benchmark, as necessary, and the development of a robust uncertainty analysis. As a result of the success of the ecological risk screening effort, the Michigan Department of Environmental Quality (MDEQ) has adopted this approach as an internal means of evaluating ecological exposure for other projects.

Ecotoxicologist (2015-Present). Coordinating biosurveys and chemical-specific sediment toxicity testing for a specialty metals manufacturer near

Elmore, OH. The work will be used to support remedial decision making in a stream and wetland area adjacent to the facility.

Ecological Risk Assessment, Umatilla Chemical Demilitarization Facility, Umatilla, Oregon (2012). Performed a multi-pathway ecological risk assessment using protocols established in USEPA combustion risk assessment and Oregon Department of Environmental Quality guidance to support closure of a chemical weapons (nerve and mustard agent) incinerator.

Lead Ecological Risk Assessor (2014-2016). Ecological risk assessment of PCBs in a creek in Mansfield, OH. Evaluation consisted of both total PCBs and dioxin-like PCB congeners.

Ecological Risk Assessment, Orphan Mine, Arizona (2012). Peer review for an ecological risk assessment at the Orphan Mine Site in Grand Canyon National Park. Included evaluation of both conventional contaminants as well as radionuclides.

Lead Ecological Risk Assessor (2013). Performed an ecological risk assessment in support of an Engineering Evaluation/Cost Analysis at Hillside Mine near Bagdad, Arizona for the Bureau of Land Management. Project included evaluation of radionuclides and application of the RESRAD-BIOTA model.

Ecological Risk Assessor (2011). Provided third-party review and strategizing for ecological risk assessment of Duck and Otter Creeks in Toledo, Ohio.

Project Manager/Lead Risk Assessor (2000 to 2014). Ecological and human health risk assessment at a former steel manufacturing facility on and adjacent to the St. Louis River near Duluth, MN. This is a CERCLA site administered by the Minnesota Pollution Control Agency (MPCA). Key role in developing risk evaluation strategies and working with the MPCA.

Lead Ecological Risk Assessor (2007-2009). Provided ecological risk assessment support for a former steel facility in Vineyard, Utah, including interaction with state regulators.

Project Manager/Lead Risk Assessor (2001 to 2006). Managed a project for evaluating a creek in north central Alabama impacted by PAHs. Sediment and floodplain soil investigations were completed, along with ecological and human health risk assessments that led to the removal of contaminated materials to reduce potential risks.

Lead Risk Assessor (2007 to 2010). Evaluated potential human health and ecological risks at a battery manufacturing facility in Attica, IN. The work was performed as part of a RCRA Facility Investigation overseen by USEPA Region 5.

Senior Scientist, Ecological Risk Assessment, Radionuclide Facilities West Valley Development Project, Ashford, New York (2005). Peer review and oversight for an ecological risk assessment which included a landfill and several lagoon or surface water treatment basins, evaluating both radionuclides and non-radionuclide constituents.

Ecological Risk Assessor (2001 to 2005). Worked with the US Navy and USEPA to develop a national program for sinking retired Navy vessels for the purpose of creating artificial reefs under the TSCA risk-based approval process. Residual solid-phase PCBs were the chemicals of interest. Provided support for development of a risk assessment model that evaluates the fate and transport of contaminants from vessels to the

surrounding water column, sediment, and food chain. Project supported approval for sinking the aircraft carrier ORISKANY off the Pensacola, FL coast in 2006.

Ecological Risk Assessor (~2000-2005). Performed/reviewed prospective ecological risk assessments of agricultural properties being considered for acquisition by the South Florida Water Management District under the Everglades Restoration Program.

Lead Ecological Risk Assessor (2000 to 2005). Indiana Army Ammunitions Plant – Drafted and provided oversight/review for ecological risk assessment activities at multiple sites. Key concerns were endangered bats. Led activities for biological sampling (bioaccumulation and invertebrate toxicity testing) in support of ecological risk activities.

Other Related Experience

Project/Task Manager/Investigator:

- Louisville, KY (2008) – Human health risk evaluation of former industrial site.
- Cattletsburg, KY (2004-2007) – Oil Refinery, Ecological Risk; Aquatic media.
- Fort Miles Military Reservation, DE (2005-2006) – Lead risk assessor for remedial investigation under Military Munitions Response Program.
- Badin, NC (2003-2008) – Former Metals Manufacturing Facility, Human and Ecological Risk evaluation in aquatic media.
- Kenova, WV (2007-present) – Ecological Risk, former oil refinery and terminal; aquatic media.
- Wurtsmith AFB near Oscoda, MI (2002-present) – Wetland area near landfill – sediment and surface water toxicity evaluations to support ecological risk assessment, as well as human health risk evaluation.
- Argonne National Laboratories, IL (2002) – Ecological Risk Assessment, Freund Brook (PAHs)
- St. Louis, MO (2002-2004) – Mississippi River Ecological Risk Assessment (chlorinated hydrocarbons)
- McIntosh, AL (1994 – 1997) – Olin Basin on Tombigbee River - Ecological Risk Assessment (Hg, DDT, HCB). Included fish and mussel sampling.
- Tinker AFB, Oklahoma City, OK (1993-1996) - Ecological Risk Assessment. Included biological tissue collection.
- Green River, Kentucky (1996) – Suspended solids impacts on mussel communities.
- North Fork Holston River, Saltville, VA (1992-1995) – Mercury fate and transport modeling and data review.
- Lavaca Bay, TX (1992-1994) – Mercury contamination program – Field data collection (sediment and biota), and sediment program task manager.
- Huntsville Spring Branch-Indian Creek, Redstone Arsenal, AL (1988-1989) – Evaluation of DDT in fish, including bioaccumulation modeling.
- Mississippi River near East St Louis, IL and Cordova, IL (1988-1992) - Water quality studies, including diffuser design studies using CORMIX. Conducted benthic habitat surveys and dye tracer studies in conjunction with mixing zone delineation.
- Red River, Ashdown, AR; Ouachita River, AR; East Fork Stones River, TN; Turtle River, GA; Duck River, TN (1986 -1992) – Water Quality Modeling (QUAL2E)/Assimilative Capacity Studies.

AECOM

John Cuthbertson
Scientist 2

Professional History
10/2013 - Present, AECOM Manager, Central Region PFAS Lead
06/2001 - 03/2013, GZA GeoEnvironmental Office Manager/Associate Principal
03/1997 - 06/2001, APT Environmental, Inc. Office Manager/Senior Project Manager
06/1991 - 02/1997, AARES Environmental, Ltd. Senior Project Manager

Education
BS, Geology, Calvin College, 1991

Years of Experience
With AECOM: 4.5
With Other Firms: 22

Registrations
Certified Professional Geologist, Indiana
Certified Professional Geologist, American Institute of Professional Geologists

Professional Affiliations
American Institute of Professional Geologists

Mr. Cuthbertson is a geologist with over 26 years of environmental consulting experience primarily in the Midwest. His experience affords him the ability to effectively manage and provide technical leadership for projects that vary in size and complexity. He is responsible for managing the investigation of sites contaminated with hazardous materials; the assessment of appropriate site-specific remedial methods and endpoints; the evaluation, design, and specification of cost-effective remediation measures; and the efficient construction, implementation, and operation of remedial systems. Mr. Cuthbertson offers a unique blend of technical expertise with regulatory negotiating experience that enables the development of sound strategies for site characterization, remediation, and closure that effectively balances risk, exposure, and cost for the client while preserving professional integrity. He works closely with clients to identify project goals and evaluate the technical, practical, and cost considerations in meeting those goals. Mr. Cuthbertson uses his expertise to assemble and manage technical and scientific personnel to ensure that project objectives are realized and managed efficiently, smoothly, and within budget.

Experience

Michigan Department of Environmental Quality, Former Wurtsmith AFB, Oscoda, Michigan. Project manager responsible for directing team to respond to PFAS release to the environment resulting from AFFF. Tasks include: completing residential well sampling at over 350 homes, municipal sampling, surface water an foam sampling, completing multiple phases of remedial investigations to delineate PFAS impact in groundwater plumes both emanating from the base and other sources around the base, development of the site conceptual site model (CSM), laboratory QAQC with Level 2 data validation, and developing an EQuIS and GIS database to manage all data associated with the project.

Michigan Department of Environmental Quality, Army National Guard Grayling Airfield, Grayling, Michigan. Project manager responsible for directing team to respond to PFAS release to the environment resulting from AFFF. Tasks include: completing residential well sampling at over 600 homes, municipal sampling, completing remedial investigations to delineate PFAS impact in groundwater plumes emanating from the base and other sources around the base, development of the site conceptual site model (CSM), laboratory QAQC with Level 2 data validation, and developing an EQuIS and GIS database to manage all data associated with the project.

Michigan Department of Environmental Quality, Air National Guard, Alpena, Michigan. Project manager responsible for directing team to respond to PFAS release to the environment resulting from AFFF. Tasks include: completing residential well sampling at over 100 homes, laboratory QAQC with Level 2 data validation, and developing an EQuIS and GIS database to manage all data associated with the project.

Michigan Department of Environmental Quality, North Kent (Wolverine Worldwide), Rockford, Michigan. Project manager responsible for directing team to respond to PFAS release to the environment resulting from Tannery waste with Scotchgard. Tasks include: completing residential well sampling at over 200 homes, municipal sampling, reconnaissance of over 100 potential disposal areas including reports documenting findings,

groundwater monitoring well sampling, remedial investigations to determine source of PFAS impacts, laboratory QAQC with Level 2 data validation, and developing an EQuIS and GIS database to manage all data associated with the project.

Michigan Department of Environmental Quality, Statewide PFAS Support, Michigan. Project manager responsible for directing team to assist MDEQ with multiple PFAS issues. Tasks include: developing PFAS specific standard operating procedures (SOPs) for multiple media (groundwater residential sampling, surface water, wastewater, sediment, soil, deer, fish, foam sampling), PFAS training for staff, developing summary of feasible remedial technologies, developing a statewide quality assurance project plan (QAPP), statewide analytical support, level 2 data validation, residential well sampling, municipal sampling, wastewater treatment plant sampling, groundwater monitoring well sampling, remedial investigations to determine source of PFAS impacts, laboratory QAQC with Level 2 data validation, and developing an EQuIS and GIS database to manage all data associated with the project.

Michigan Department of Environmental Quality, Statewide Municipal Sampling, Michigan. Project manager responsible for directing team to assist MDEQ to sample between 1,300 and 2,000 municipal water supplies across the State of Michigan. Tasks include: municipal sampling, laboratory QAQC with Level 2 data validation, and developing an EQuIS and GIS database to manage all data associated with the project.

Michigan Department of Environmental Quality, Lapeer WWTP biosolids, Lapeer, Michigan. Project manager responsible for directing team to respond to PFAS release to the environment resulting from application of biosolids to agricultural fields. AECOM developed a scope of work to investigate soils and groundwater for the presence of PFAS including the installation of groundwater monitoring wells, surface water sampling, laboratory QAQC with Level 2 data validation, and establishing an EQuIS and GIS database to manage all data associated with the project.

Michigan Department of Environmental Quality, Torch Lake Superfund Site, Houghton, Michigan. Project manager in charge of compliance with Record of Decision (ROD)**.** Project tasks include review of historical data accumulated for more than 30 years used to developed a conceptual site model for the copper contamination of surface water, completing annual soil cover inspections, annual report documenting findings and recommendations, oversight of operation and maintenance (O&M) of soil cover, and developing a GIS database to manage all data associated with the project.

Air National Guard, WW Kellogg Airport, Battle Creek, Michigan. Site manager responsible for directing team to perform site investigation (SI) to determine if AFFF released to the environment. Project tasks include reviewing historical data and AFF usage, developing of SI scope and work plan, on site kickoff meeting with regulators and stakeholders, and implementation of SI field work.

Air National Guard, Selfridge Base, Mt. Clemens, Michigan. Site manager responsible for directing team to perform site investigation (SI) to determine if AFFF released to the environment. Project tasks include reviewing historical data and AFF usage, developing of SI scope and work plan, on site kickoff meeting with regulators and stakeholders, and implementation of SI field work.

Air National Guard, Tucson Base, Tucson, Arizona. Technical lead responsible for initiating team to perform site investigation (SI) to determine if AFFF released to the environment. Project tasks include reviewing

historical data and AFF usage, developing of SI scope and work plan, on site kickoff meeting with regulators and stakeholders.

Air National Guard, Phoenix Base, Phoenix, Arizona. Technical lead responsible for initiating team to perform site investigation (SI) to determine if AFFF released to the environment. Project tasks include reviewing historical data and AFF usage, developing of SI scope and work plan, on site kickoff meeting with regulators and stakeholders.

Michigan Department of Environmental Quality, Clean Michigan Initiative, Edmore, Michigan. Responsible for managing and providing technical leadership for former gasoline station subsurface investigation, delineation of impact in soil and groundwater, feasibility study, remedial design, and construction oversight. Also responsible for managing the project budget, staff scheduling and utilization, and interaction with client.

AECOM

Marie De los Santos
Scientist 1/Field Technician

Professional History
05/2017 - Present, AECOM Staff Geologist

Education
MS, Geosciences (Isotope Geochemistry and Paleoclimatology), University of Arizona, 2016
BS, Geology, University of Houston, 2014
BBA, Business Administration (Marketing), University of Texas - Austin, 2009

Years of Experience
With AECOM: 1
With Other Firms: 0

Training
OSHA 40-Hour HAZWOPER Training, Asbestos Inspector

Marie is a staff geologist in the Minneapolis office who contributes to a range of environmental remediation projects throughout the state of Minnesota.

Marie's primary contributions include compiling field and analytical data, generating maps and figures using GIS, drafting reports for clients that include the Minnesota Department of Transportation (MnDOT), US Steel, BNSF Railway, and Canadian Pacific Railway, and reviewing various reports for quality assurance (QA) purposes. Marie's field work contributions include collecting data such as soil, groundwater, and air samples for various compounds of interest, sampling of potential asbestos-containing materials to manage appropriate disposal, and construction oversight.

Project Experience

US Steel, USS Duluth 2017, Duluth, Minnesota. Collected surface and groundwater samples at the US Steel former Duluth Works Site during the May 2017 monitoring event and assisted with compiling the annual monitoring report.

US Air Force - 772 ESS/PKS, AE13ES 2015-2022 - Environmental Services, Calumet AFS, Michigan. Assisted with on-going well development activities on the former US Air Force Base in Calumet, MI.

BNSF Railway, Ramsey 2017 Investigation, Ramsey, Minnesota. Collected groundwater samples from monitoring wells on the BNSF Ramsey Boulevard Site during the 2017 annual monitoring event, including field testing for arsenic, and assisted with report writing and compilation.

Minnesota Department of Transportation, TH55 Elbow Lake Ph II, Elbow Lake, Minnesota. Collected soil and groundwater samples and generated soil borings for the Phase II investigation, and assisted with report writing and compilation.

Minnesota Department of Transportation, I-94 Interchanges Phase I & II, St. Paul, Minnesota. Conducted a desktop study and site reconnaissance for the Phase I corridor investigation, collected soil and groundwater samples for the Phase II investigation, and assisted with writing and compilation of both reports.

Minnesota Department of Transportation, TH 149 High Bridge, St. Paul, Minnesota. Conducted construction oversight of excavations during the 2017 construction season in areas with known soil impacts during water main relocation.

Minnesota Department of Transportation, St. James Construction Monitoring, St. James, Minnesota. Assisted with construction oversight of excavations during the 2017 construction season.

Minnesota Department of Transportation, Red Wing Bridge Reconstruction Project, Red Wing, Minnesota. Collected ambient air samples and groundwater discharge samples, and assisted with construction oversight in areas of known soil and groundwater contamination.

Other Projects: Report QA, Writing, and/or Data Management

- TransCanada - US Pipelines, Emergency Response, Cushing, Oklahoma.
- BNSF RAILWAY COMPANY, Big Falls Arsenic and PRD Report, Big Falls, Minnesota
- Minnesota Department of Transportation, I-35E Cayuga Construction Monitoring, St. Paul, Minnesota.
- Minnesota Department of Transportation, Benson ADA Construction Monitoring, Benson, Minnesota.

Peer-Reviewed Academic Publications

De los Santos, M.G., Lawton, T., Copeland, P., Licht, A., and Hall, S., 2016, Magnetostratigraphy, age and depositional environment of the Lobo Formation, southwest New Mexico: Implications for the Laramide orogeny in the southern Rocky Mountains, *Basin Research* vol. 30, p. 401-423.

Licht, A., Quade, J., Kowler, A., **De los Santos, M.G.**, Hudson, A., Schauer, A., Huntington, K., Waldrip, R., Copeland, P., and Lawton, T., 2016, Impact of the North American monsoon on isotope paleoaltimeters: implications for the paleoaltimetry of the American Southwest, *American Journal of Science* vol. 317, p. 1-33.

Hudson, A., Quade, J., Ali, G., Boyle, D.P., Bassett, S., Huntington, K.W., **De los Santos, M.G.**, Cohen, A.S., Lin, K., and Wang, X., 2017, Stable C, O and clumped isotope systematics and 14C geochronology of carbonates from the Quaternary Chewaucan closed-basin lake system, Great Basin, USA: implications for paleoenvironmental reconstructions using carbonates, *Geochimica et Cosmochimica Acta* vol. 212, p. 274-302.

AECOM

Peter J. Diemer, P.E., C.H.
Engineer 3/Scientist 2

Education
BS, Environmental Sciences, University of Wisconsin, Green Bay, 1997

Years of Experience
With AECOM: 12
With Other Firms: 8

Professional Affiliations
American Society of Civil Engineers
National Society of Professional Surveyors (NSPS)

Training and Certifications
Professional Engineer, Wisconsin
Certified Hydrographer, ACSM/NSPS

Presentations
Western Dredge Association Midwest Chapter Conference Cincinnati, OH, April 2014
Eighth International Conference on Remediation and Management of Contaminated Sediments, New Orleans, LA, January 2015

Mr. Diemer is a project engineer specializing in survey, design, permitting, and construction management of civil and shoreline projects with a strong emphasis applied to lake, dam/reservoir, stream, river, and harbor design and construction. He utilizes geographic information systems and a variety of hydraulic modeling tools to develop site-specific design solutions. He uses river modeling software to analyze flood risks and to evaluate proposed construction elements and flood profile effects. Mr. Diemer is a Certified Hydrographer specializing in performing hydrographic surveys and has performed hundreds of surveys for a wide variety of projects. When designing projects, he uses AutoCAD Civil 3D; HEC-RAS, HEC-2, HEC-HMS, TR-55, HydroCAD, Trimble HydroPro, Globalmapper v.15.1, and SonarTRX v.12.1 computer software.

Project Experience

Water Resource Engineering and Hydrographic Surveys

USCG Station Hydrographic Survey, Various Stations on Great Lakes. From 2011 to present, performed 15 hydrographic surveys for the USCG. Survey information was used for assessment of need for dredging, and for the design of completed dredge projects.

Industrial Raw Water Intake Dredging, Naheola, Alabama. Performed pre-dredge hydrographic survey and prepared dredge design bidding and construction documents. Worked with State and Federal regulatory agencies to acquire permit for hydraulic dredging. Assisted with coordination of pre-dredge relocation of native clam species listed threatened and endangered list. Performed post-dredge hydrographic survey and determination of quantity reports. Completed November 2016.

USCG Station Little Creek Dredging Design, Little Creek, Virginia. Used hydrographic survey data to prepare construction document package, which included design plans, specifications, cost estimates, and timelines. Work included collection of in-situ sediment. Physical and chemical analysis of sediment was performed prior to the evaluation of available disposal locations. Final package delivered May 2017.

USCG Station Barnegat Light, Barnegat Light, New Jersey. Used hydrographic survey data to prepare construction document package, which included design plans, specifications, cost estimates, and timelines. Work included collection of in-situ sediment. Physical and chemical analysis of sediment was performed prior to the evaluation of available disposal locations. Final package delivered May 2017.

Commercial Dock Terminal Facility Upgrade, Green Bay, Wisconsin. Prepared conceptual design drawings, cost estimates, and construction timelines for a 500-foot long dock terminal and mooring slip. Design includes raising of low-lying floodplain dock area, extension of rail spur, structural upgrades to bulkhead, new crane pads, stormwater collection system, site lighting and docktender shelter. Ongoing July 2017.

Impacted Sediment Hydrographic Survey, Rhinelander, Wisconsin. Performed hydrographic survey of Wisconsin River in area of historic manufactured gas plant to be used for development of dredge design. Used

remotely-operated survey vessel for areas considered not navigable with manned vessel. Completed October 2016.

Hydrographic Survey of Commercial Dockwall, Marinette, Wisconsin. Performed hydrographic survey of commercial dockwall mooring slip. Survey was used to assess need for dredging. Completed June 2016.

USCG Station Annapolis Boat Launch Ramp, Annapolis, Maryland. On design team responsible for site survey, design, cost estimating, and permitting of vessel launch ramp to be used for exclusive use of USCG personnel for the purpose of reducing response time to boaters in distress.

Hydrographic Survey of Private Commercial Dockwall Mooring, Green Bay, Wisconsin. Perform regular surveys of commercial dockwall mooring slip located on Fox River, in Green Bay, Wisconsin. This mooring is used for distribution of liquid petroleum products.

Dredge Design of Recreational Boat Harbor, Door County, Wisconsin. Performed pre-dredge hydrographic survey and sediment sampling for recreational harbor located on the bay of Green Bay. Work included generation of a sediment sampling and analysis plan, identification of disposal facilities, feasibility analysis, preparation of bidding document, and oversight of dredging, including performance of post-dredge hydrographic survey and determination of dredge volumes.

Great Lakes Dock Terminal Surveys, Wisconsin, Michigan, Minnesota. Performed hydrographic surveys of nine (9) bulk storage and handling dock terminals in Spring 2017. Work included physical inspection of marine structures, single-beam acoustic hydrographic survey, and side-scan sonar survey of submerged features.

USCG Mobile Bay Mooring Dredging, Sturgeon Bay, Wisconsin. Performed hydrographic survey of mooring. Prepared sediment sampling and analysis plan and performed sediment sampling. Prepared dredge design, construction cost estimates, and timeline. Completed 2014.

USCG Station Sturgeon Bay Maintenance Dredging, Sturgeon Bay, Wisconsin. Performed hydrographic survey of mooring area located on east end of Sturgeon Bay channel at entrance to Lake Michigan. This area is prone to continued sedimentation. Prepared sediment sampling and analysis plan, performed sediment sampling, and used conditions of regulatory permits to prepare construction documents, cost estimates, and timeline. Completed 2014.

Sheboygan River EPA Cleanup Dredging, Sheboygan, Wisconsin. Performed weekly hydrographic surveys to evaluate progress of marine contractor dredging. Used survey data to develop weekly volume reports for agency review. Completed 2012.

Industrial Lagoon Hydrographic Survey, Mosinee, Wisconsin. Performed bathymetric survey in April 2017 of industrial lagoon with remote-control survey vessel for development of dredge volumes. Performed sediment sampling of substrate for physical/chemical analysis.

Commercial Dockwall Improvement Plan, Fox River, Green Bay, Wisconsin. Prepared conceptual site improvement design drawings and cost estimates for successful grant application. Ongoing June 2017.

Rosholt Dam, Rosholt, Wisconsin. Performed hydrographic survey of millpond reservoir. Project Engineer responsible for dam failure analysis.

Prepared DNR Municipal Dam grant application in January 2016. Preparing design of dam reconstruction plans, specifications, and regulatory permit applications**.** Ongoing June 2017.

Private Development on Fox River Dam, Neenah, Wisconsin. Project Engineer responsible for coordination with local, state, and federal agencies, including application for FEMA CLOMR concurrence, and LOMR approval. Ongoing June 2017.

Yellow Stone Lake State Park Dam, Blanchardville, Wisconsin. Project Management for survey, investigation, and design of repair for vertical slide gate dam. Completed in 2016.

Tailings Basin Hydrographic Surveys, Palmer, Michigan. Performed seven (7) reservoir hydrographic surveys for iron mining operation in 2016.

Amherst Dam, Amherst, Wisconsin. Project engineer and surveyor for the design of dam improvements including embankment stabilization, new concrete walls, demolition, and integration of new vertical slide gate to increase flow capacity to meet DNR requirements. Performed hydrographic survey of reservoir for use in design development. Completed December 2016.

Stevens Point Dam and Levee Accreditation, Stevens Point, Wisconsin. Prepare hydraulic modeling and assist community with FEMA Letter of Map Revision. Completed January 2015.

Pokegama Lake, Washburn County, Wisconsin. Project engineer for hydrologic and hydraulic modeling to support development of dam construction plans and specifications, including State of Wisconsin regulatory permissions.

Rapide Croche Lock and Dam Boat Transfer Feasibility Study, WI. Project engineer responsible for bathymetric survey of riverine areas upstream and downstream of this lock and dam. Mr. Diemer assisted in preparation of design drawings and construction cost estimates for feasibility study, which was prepared for the purpose of evaluating the future boat lifting and cleansing system, proposed to limit the introduction of aquatic invasive species upstream of dam.

Republic Dam Removal Feasibility Study, MI. Project engineer responsible for bathymetric survey of areas in the upstream reservoir and areas downstream of the existing dam structure. Mr. Diemer developed hydraulic models using HEC-RAS which included projection of seasonal river water levels used for comparison of dam-in-place scenarios and dam removal alternatives.

AECOM

Ryan P. Doherty
Project Manager/On-Site Inspector/Scientist 2

Professional History
04/2006 - Present, AECOM Project Manager , Scientist II and I

Education
BS, Biology, University of Minnesota, Mankato, 2004

Years of Experience
With AECOM: 12
With Other Firms: 0

Training and Certifications
OSHA HAZWOPER 40 hr. Safety Training and current 8 hr. Refresher Training
CPR and First Aid Trained
NRPP Residential Radon Measurement and Mitigation Provider
e-RAILSAFE Safety Trained

Mr. Doherty has twelve years of experience in the environmental field serving as a project manager, project scientist, and field technician on MPCA fund financed sites and solidwaste handling facilities. Mr. Doherty serves as AECOM's project manager and field technician for services involved with the MPCA's Closed Landfill Program contract including operation and maintenance activities, gas emission management, and reporting.

Mr. Doherty has experience with environmental remediation projects involving site excavations, groundwater appropriation and treatment, and site investigation related activities. Mr. Doherty's experience includes technical and regulatory report writing involving site closure reports, monitoring reports, and limited site investigation reports. Mr. Doherty is well-versed with EQuIS data management relating to the collection, tabulation, and submittal of site related data.

Project Experience

MPCA Closed Landfill Contract - Operation and Maintenance, MN. Ryan has been working on the MPCA Closed Landfill sites in various roles for over 8 years. Ryan currently serves as project manager and field technician for the MPCA Closed Landfill Program work. Ryan coordinates the operations and maintenance activities with the MPCA project manager, coordinates staffing schedules for biweekly site visits and responding to system alarms, and completes required submittals. Duties include safety planning, operation and maintenance of gas collection and groundwater / leachate collection systems, troubleshooting gas collection and pumping systems, overseeing site improvements and cap maintenance activities, working with the MPCA Purchasing Manual for site related purchases and subcontracting, and reporting. Ryan completes billing and invoicing with Monthly Progress Reports, Quarterly Status Reports, quarterly EQuIS EDD submittals, Semiannual Usage Reports and MPCA Owned Equipment List.

Bridal Veil Open Space Superfund Site, Minneapolis, MN. Served as project manager and field technician for the MPCA Bridal Veil Open Space project. The project involved development of a bioremediation system for the treatment of stormwater run-off and infrastructure improvements to manage stormwater generated from the watershed. The project also consisted of three annual stream sampling events and general maintenance of the site including mowing, trash removal and cleaning of the grit collection chamber.

MN Plating Site, Minneapolis, MN. Project Manager associated with the investigation and identification of sources of cVOC contamination in soil and soil vapor intrusion in residential buildings. Directed and oversaw installation of sub-slab depressurization systems in residential buildings following current MPCA best management practices.

MacGillis and Gibbs Superfund Site, New Brighton, MN. Plant operator and field technician for the MacGillis and Gibbs Groundwater Treatment Facility. Duties include recording daily and weekly discharge readings to ensure compliance with discharge permits, troubleshooting groundwater extraction pumps, environmental sampling and assistance with site related purchases and subcontracting.

Owens-Brockway Closed Landfill, Rosemount, MN. Ryan is the project manager for the monitoring and maintenance of the Owens-Brockway closed landfill in Roseville, MN. The project involves semi-annual inspections, cap repairs (as needed), vegetative maintenance activities and reporting. The site inspections include observation of access, security, and vandalism, illegal use of the property, cover layer thickness, observation of erosion, burrowing, vegetative cover, ponding water, leachate seeps and outlets.

The Home Depot, Carbon Monoxide Monitoring, MN. Project manager/field technician for carbon monoxide monitoring of propane powered forklifts at all *The Home Depot* stores in Minnesota. Duties include contacting stores and coordinating monitoring events of the propane powered forklifts on a quarterly basis. Mr. Doherty also evaluates the collected data and prepares quarterly reports.

Reserve Mining, Landfill Construction, Silver Bay, MN. Served as a field technician for a landfill construction and liner installation project which included oversight of site excavation, earthwork, and utility installation. Performed subgrade compaction tests with a nuclear density gauge and monitored airborne particles with DustTrak™ aerosol monitor. Provided construction quality assurance testing of geo-fabric, geo-membrane, and geo-composite before and during installation.

Former Red and White Station, Brook Park, MN. Served as a field scientist collecting soil and water samples for analytical testing from soil borings. Documented the installation of permanent monitoring wells to further define the extent of the petroleum release. This involved classifying soils, determining well depth and ensuring adherence to installation specifications.

MnDOT Truck Station Hydraulic Hoist Release, Monticello, MN. Served as a project scientist and conducted a Limited Site Investigation of a hydraulic hoist release. Collected soil and water samples from temporary borings to determine the magnitude and the horizontal and vertical extent of contamination. Also, completed a water well receptor survey, a vapor risk assessment and risk evaluation associated with the identified release.

Former Rays Truck Stop, Lakeland, MN. Participated in a petroleum release investigation, including contacting residents, determining private residential well status, organizing well water sample collection from more than 50 homes. Also, provided construction oversight, soil confirmation sampling and report preparation for work that included removal and disposal of petroleum impacted soil. Organized and conducted annual sampling of existing monitoring wells.

Deer River Service Station, Deer River, MN. Performed construction oversight and field screening for work that included the removal and disposal of petroleum and lead impacted soil and water, demolition and removal of existing service station, and sanitary sewer utility improvements. Work was performed along MnDOT Right-of-Way along Highway 2 in Deer River, Minnesota.

AECOM

David V. Dryburgh, CPG
Scientist 2

Professional History
06/2006 - Present, AECOM
01/2001 - 06/2006, DLZ of Michigan, Inc.
Project Geologist
01/1998 - 01/2001, Weston Solutions
Project Geologist

Education
BS, Geology, Central Michigan University, 1997

Years of Experience
With AECOM: 12
With Other Firms: 8

Professional Affiliations
American Institute of Professional Geologists

Training
OSHA HAZWOPER 8-Hour Refresher Training
OSHA HAZWOPER 40-Hour Training
OSHA 8-Hour Confined Space Performance Training
e-RAILSAFE Contractor
First Aid and CPR
Site Health and Safety Coordinator Training

Mr. Dryburgh is a geologist with more than 20 years of experience in the environmental consulting industry in Michigan. He serves as a project geologist and project manager for the Environment business line in the Grand Rapids, Michigan office.

Mr. Dryburgh's experience includes involvement as the lead geologist and/or project manager of projects involving Phase I/II environmental site assessments, baseline environmental assessments and due care plans, remedial investigation/feasibility study projects, enhanced reductive dechlorination projects, RCRA facility investigations, and remediation system design. He has worked throughout the Midwest on a wide range of projects maintaining an excellent relationship with a variety of private, state, and federal clients.

Experience

Enbridge Energy Limited Partnership, Crude Oil Pipeline Leak - Compliance Support, Grand Rapids, Michigan. Project manager for the high-profile project to assist Enbridge in maintaining compliance with state and federal orders and regulations. The complexities and schedule demands of the project require active big picture management and regular meetings with Enbridge, Michigan Department of Environmental Quality, and US Environmental Protection Agency.

Shell Exploration & Production Co, Up Stream Production and Storage Cleanup and Closure, Kalkaska, Michigan. Project manager on this Up Stream O&G site. Completing investigation and remedial work to determine risk and bring the historic site toward an agreeable closure. Working closely with Shell and the State regulators to provide innovative solutions.

TDY Industries Inc., Groundwater Capture and Treatment System - 2015 Operations and Maintenance, Muskegon, Michigan. Project manager for this project involving O&M and compliance monitoring of a large groundwater and LNAPL capture and treatment system. The system maintains hydraulic control of groundwater preventing migration to surface water receptors. Also, planned and coordinated the injection of ERD substrates and bioaugmentation cultures necessary to treat impacted groundwater in situ.

Michigan Department of Environmental Quality, Contaminated Site Investigation, Wurtsmith AFB, Michigan. Underwent extensive experience completing project-related activities since 2001. The site is contaminated with a wide range of chemicals including chlorinated and non-chlorinated hydrocarbons, heavy metals, PCBs, and PFAS. Managed the coordination, implementation, and data processing for various investigative activities including monitoring well identification, survey, and sampling, test pit (source identification) activities, cluster well installation and sampling activities, and oversight and observation of Air Force contractor activities.

Michigan Department of Environmental Quality, Hoskins Manufacturing, Mio, Michigan. Project geologist and field manager in charge of coordinating and managing a large remedial investigation which included three rotosonic drill rigs and crews, two mobile laboratories, and two offsite fixed laboratories producing multiple data streams. In charge of

data compilation and review necessary to make real-time field decisions to drive ongoing investigation. The high-profile project involves chlorinated VOCs and heavy-metal soil and groundwater contamination migrating into sensitive surface water bodies in a small northern Michigan community. Also completed surface water and sediment sampling, a toxicity study, compiled multiple technical memoranda, and a feasibility study.

Michigan Department of Environmental Quality, M-13 Ramps, Saginaw, Michigan. Project manager for recovery of hazardous waste (PCB containing oil) from the groundwater. AECOM was tasked to recover the PCB oil using available technologies and stay within budget. Used a small Spider-Sonic rotosonic rig to install two 4-inch diameter recover wells to maximize oil recovery. Periodically vacuum extracted product from multiple wells.

Michigan Department of Environmental Quality, Dave's Shell Site, Buchannan, Michigan. Coordinated a geophysical study, delineation of free product, and soil and groundwater contamination. Implemented initial free product recovery, conducted a risk assessment, pathway evaluation, and receptor survey including indoor air sampling.

Michigan Department of Environmental Quality, Five A Oil, Whitehall, Michigan. Identified the individual USTs within the UST farm and completed characterization sampling. Coordinated and oversaw the decommissioning of the UST farm and associated pumps, piping, and dispensers. Conducted remedial investigation activities of residual contamination including the delineation of free product, soil and groundwater contamination and compliance monitoring of site monitoring wells. Prepared final assessment report, feasibility study, and corrective action plan for the site.

Michigan Department of Environmental Quality, Howard Street, Lapeer, Michigan. Coordinated and field implemented all activities including; a geophysical study using EM-31, EM-61, and GPR technology, two soil boring installation events, and a sanitary sewer survey identifying areas of likely contaminate infiltration into the sanitary line. Complied historic data and the results of the investigation, including boring logs, plume maps, cross sections, analytical data, and geophysical data into a GIS database.

Georgia-Pacific, GP Distribution Center Leaking Underground Storage Tank Site, Grand Rapids, Michigan. Conducted the compiling of historic information and managing of additional remedial investigation activities including monitoring well installation, quarterly monitoring well sampling, and hydrogeologic data interpretation. Worked closely with the client to obtain a deed restriction necessary to close the site. Obtained a restricted site closure from the MDEQ.

AECOM

Kristen Durocher
Ecological Risk Assessor 3

Professional History
11/1992 - Present, AECOM Ecological Risk Assessor and Sediment Technical Expert

Education
BA, Environmental Studies and Northern Studies, Middlebury College, 1990
MS candidate, Natural Resources, University of New Hampshire

Years of Experience
With AECOM: 25

Training
OSHA HAZWOPER 8-Hour Refresher Training
OSHA HAZWOPER 40-Hour Training
Hazardous Materials Operations Training OSHA HAZWOPER 8-Hour Supervisor Training

Ms. Durocher is a Senior Scientist with more than 25 years of experience in the field of ecological risk assessment of contaminated sites, and specializes in sediment assessment, integrating multiple lines of evidence including aquatic and benthic ecology data, laboratory and in situ toxicity testing, chemistry data, and potential food chain effects. She has worked on projects at more than 100 sites, in numerous states, across five EPA Regions, and under CERCLA, RCRA, CWA and state programs. She has experience in all facets of ecological risk assessment, including designing and implementing field programs, conducting laboratory toxicity tests and toxicity identification evaluations (TIEs), data analysis, regulatory negotiation, statistical analysis of complex data sets, and project management. Her expertise includes assessment of bioaccumulative constituents, including mercury, PCBs, and dioxins, as well as other inorganics and PAHs. Ms. Durocher has extensive experience with ecological toxicity testing and worked at AECOM's Houston Toxicology Laboratory conducting standard and customized bioassays. In addition to developing clean up goals, Ms. Durocher has particular expertise in data analysis, applied statistics, and conducting background evaluations using various statistical techniques. As a technical leader for the company's ecological risk practice, she strives to provide clients with balanced, endpoint-focused solutions that are technically sound and cost-effective.

Project Experience

MPCS, Various Project, Minnesota. Senior ecological risk assessor and sediment technical consultant for state-led cleanup projects in Minnesota. Work including coordination with toxicity testing laboratories and interpretation of toxicity testing data, development of alternative screening values, and senior oversight of ecological sampling design, program and reporting.

United Technologies Corporation, Rocky Hill, Connecticut. Senior ecological risk assessor for site with brook adjacent to a landfill. Successful at eliminating PAHs as constituent of concern based on consistency with background. Evaluated lead and zinc using multiple lines of evidence, including toxicity tests that showed no significant correlation between concentration and response in laboratory organisms. Developed remedial goals using a performance based approach that relies on the toxicity test data rather than numerical values.

United Technologies Corporation, Windsor Locks, Connecticut. Senior ecological risk assessor for large site adjacent to Bradley Airport. Provided senior technical leadership on the ecological risk assessment, including development of the field sampling plan and baseline ecological risk assessment. Primary contaminants included PCBs and mercury in a variety of ecological habitats, including a pond, stream, and wetland.

International Paper, Ecological Risk Assessment, Connecticut. Senior ecological risk assessor for complex, high profile site on a pond in Connecticut. Conducted and provided senior technical leadership for the baseline ecological risk assessment. The primary constituents of concern include PCBs and mercury. Performed detailed evaluation of background conditions for mercury, that addressed upgradient and regional conditions, including atmospheric input. The BERA has been submitted to the agencies.

Consolidated Edison, Surficial Sediment Data, New York, New York. Conducted an evaluation of surficial sediment data for former manufactured gas plant (MGP) on the East River. Background samples were collected from various locations in the river that matched the general bathymetry of the site, and a regional background concentration was developed. Patterns of PAHs were examined to determine the spatial extent of site-related PAHs compared to background PAHs. Using these tools, footprints of potential site-related PAHs and were developed. These footprints and relative concentrations will be used to develop remedial decisions. Background point estimates were developed to demonstrate urban background conditions in the East River.

US Bureau of Land Management, Programmatic Ecological Risk Assessment, Various Locations, US. Senior ecological risk assessor for evaluation of nine herbicides under use by the BLM in the western United States. The evaluation was part of a programmatic EIS. Tasks have included: protocol development (including compilation of scenario table managing over 1200 HQ comparisons for some chemicals); interaction with EPA on FOIA request; management of a variety of data sources to determine herbicide toxicity and physical characteristics; interpretation of detailed food web models and characterization of risks associated with herbicide use under several scenarios. Worked with BLM to provide development support for a tool to allow land managers to determine if there is potential ecological risk from application of herbicides on their sites, based on herbicide selected, method of application, meteorological conditions, and hydrologic and topographic conditions.

Confidential Client, Remedial Investigation/Feasibility Study, New Jersey. Part of a team conducting an RI/FS under CERCLA for an estuarine urban river site in the greater NY-NJ Harbor area. Constituents of primary interest include dioxins, mercury, PCBs, heavy metals, and PAHs. Key member of field team which sampled and characterized over 200 sediment cores from the river, ranging in length from two to over 20 feet. During development of tissue and benthic field sampling programs, worked with the lead ecological risk assessment partner company to AECOM to ensure data quality objectives relating to human health risk assessment were met in the sample collection design and data analysis. Led the multi-million dollar chemical water column monitoring aspect of an RI/FS under CERCLA for a riverine site. Primary purpose of the water sampling program was support of complex sediment and contaminant fate and transport model. Constituents of primary interest included dioxins, PCBs, heavy metals, and pesticides. Developed complex sampling strategy for the river and adjacent bay system that satisfied the clients and regulatory agencies involved. Implementation of each of the eight sampling events involves management of dozens of field staff and subcontractors, and produces thousands of data points. Events were conducted around river flow, season, tide phase, and over a full range of tide cycles. Developed and led effort to collect high volumes of water to support analysis of hydrophobic compounds of concern at ultra-low detection limits. Simultaneously collected solid-phase and operationally dissolved phase concentrations.

Kerr-McGee Chemical Corporation, Ecological Risk Assessment, Navassa, North Carolina. Conducted screening level ecological risk assessment (SLERA), problem formulation document, and baseline ecological risk assessment (BERA) work plan for this CERCLA site located adjacent to an extensive estuarine cedar swamp system. Chemicals of potential concern included by-products of creosote wood treatment, primarily polycyclic aromatic hydrocarbons (PAHs). BERA work plan document included benthic community metrics, toxicity testing results, and analytical data for sediment and hydric soil. After bankruptcy filing by PRP, the site became an EPA Region 4 led investigation. EPA RPM requested continued involvement of AECOM manager and risk assessors.

AECOM

Kim Elias
Scientist 2

Professional History
07/1988 - Present, AECOM Senior Scientist
01/1987 - 01/1988, Michigan Department of Transportation
01/1986 - 01/1987, Michigan Department of Natural Resources

Education
BS, Geology, Michigan State University, 1986

Years of Experience
With AECOM: 29
With Other Firms: 2

Registrations
Professional Geologist, Wisconsin
Professional Hydrologist, Wisconsin

Training
OSHA HAZWOPER 8-Hour Refresher Training
OSHA HAZWOPER 40-Hour Training
Hazard Communication Training
Hazardous Material Operations Training
District Business Development Training
First Aid/CPR Training

Overview

Ms. Elias is a Senior Geologist with 29 years of experience related to complex environmental projects, sediments investigation and serves as a regulatory and client point-of-contact. She applies her technical background in hydrogeology, hydrology, and sedimentology to provide innovative, cost-effective investigation design and remedial solutions. She has managed all phases' environmental projects from studies and analysis, to remedial design and construction oversight and implementation, including green and sustainable solutions. She is knowledgeable in state and federal environmental regulations and specialize expertise includes remedial design, conceptual site models, site characterization and assessment, sampling design, data analysis, fate and transport evaluations and report preparation. Some of Ms. Elias' relevant experience is noted below.

Experience

US Environmental Protection Agency - Region 5, Great Lakes Program Office Cleanup Services - Lincoln Park/Milwaukee River, Milwaukee, Wisconsin. 2014 - 2017. Lincoln Park and Milwaukee River Sediment Removal, Phase II Remedial Action. The USEPA Great Lakes National Program Office (GLNPO) and its partners sponsored a Great Lakes Legacy Act (GLLA) sediment cleanup project along the lower Milwaukee River within the City limits. This multi-million dollar complex project included contaminated sediment removal, transport, and disposal of non-TSCA material from nine deposits in four zones, utilizing cofferdam construction and dewatering isolation areas. AECOM provided construction support services to EQM for sediment excavation and remediation of contaminated deposits and habitat restoration along the residential and county park areas. Ms. Elias was responsible for the quality and efficiency of these support efforts as the AECOM Project Manager. She supervised on-going technical efforts, managed overall performance, developed and tracks strategies and plans and is responsible for cost/schedule controls to execute regulatory compliance and project completion. Restoration activities included restoring wetland habitat including the installation of log/root wads and boulder clusters to improve wildlife habitat.

Sheboygan River Habitat Restoration, Sheboygan County, Wisconsin. AECOM Project Manager for the Sheboygan Habitat Restoration 2013. Project funded by the Wisconsin Department of Natural Resources (WDNR) and managed through the City of Sheboygan. The project removed contaminated sediment/soil and invasive species and restored the areas to inhibit erosion and create natural habitats (i.e. wetlands, retile hibernaculum, log jams, crib walls, bird houses, planting of non-invasive species). AECOM prepared project plans, permits and Construction Site Quality Control Management. As Project Manager, Ms. Elias was responsible for the overall quality and efficiency of the support effort, including both technical issues and business processes.

US Navy, Glenview Landfill, NAVFAC Mid-Atlantic, Great Lakes Naval Station, Glenview, IL (CERCLA). Project Manager for Remedial Investigation, Eng Eval/Cost Analysis, background study, remedial selection and oversight of waste removal at a former landfill. Prepared a site-specific SAP/QAPP, a RA analysis to determine the extent to which the former

landfill poses a risk to human health and the environment and a Feasibility Report to develop and evaluate potential remedies to reduce the hazard and environment for remedy selection. Prepared a Proposed Plan for public notice, and Draft ROD to involve community review of the proposed. Evaluated potential beneficial re-uses of this geographically challenging site.

US Navy, Great Lakes Naval Station, Illinois. NAVFAC Mid-Atlantic, Boat Basin -Naval Station Great Lakes, Great Lakes, IL (CERCLA). Project Manager for the development and evaluation of remedial alternatives to manage contaminated sediment that infilled a boat basin adjacent to Lake Michigan. Ms. Elias prepared an Eng Eval/Cost Analysis, a RA Analysis to determine the extent to which the Boat Basin poses a risk to human health and the environment and a Feasibility Report to develop and evaluate potential remedies to reduce the hazard and environment remedy selection. Currently underway she is preparing a Proposed Plan, Record of Decision to include the community in the final remedial selection of the Boat Basin Site.

Pfizer, Pond and Landfill Closure Support and Confirmation Groundwater Sampling, Terre Haute, Indiana. Project manager for pond and landfill closure support and groundwater sampling for two landfill sites. Managed preparation of post-construction requirements and remediation completion report to fulfill the of the voluntary remediation program. Managed field actives. Assisted the client with developing closure strategies and associated documentation for the existing wastewater treatment plant ponds. Managed preparation of a scope of work to accomplish regulatory planning and preparation of a closure work plan for the ponds. Managing preparation of technical assumptions, estimated costs for various alternatives to accomplish the WWTP shutdown and decommissioning, and schedule for project implementation. Managing additional sediment sampling, remedial alternatives risk analysis, and agency negotiations.

Waste Management of Wisconsin, Inc., Valley Trail Recycling and Disposal Facility, Green Lake County, Wisconsin. Provided design, implementation, and management of a long-term groundwater monitoring program for a site investigation and feasibility study. Interpreted the geologic and hydrogeologic conditions and constraints at the facility. Investigated the affects the proposed landfill facility would have on the hydrology of a nearby fen and wetland. Received the Waste Management's President's Award for Technical Excellence, first place in creative problem solving for a landfill expansion at Waste Management's Valley Trail RDF. Developed a unique combination of modeling techniques and investigative methods to demonstrate that the expansion would have no impact on a nearby state-protected fen, which consisted of a sensitive groundwater recharge area and many unique and endangered plants.

Waste Management of Michigan, Independent Landfill End-Use Plan, Muskegon, Michigan. Project manager for development of a unique end-use plan using the site-specific characteristics for the closed landfill providing immediate benefits including simplifying the RI/FS process, reduced mitigation costs, and potential long-term environmental benefits. The end uses include managing the site's existing high quality natural features (e.g., trout stream and wetland complex) and construction of a wetland bank. The wetland design strategy included groundwater modeling to evaluate design alternatives and potential effects on site groundwater and residential wells, monitoring wetland impacts, conversion of the wetland area to a nature preserve, and management of the site by a nature conservancy.

AECOM

Todd Fortun
On-Site Inspector/Scientist 2/Scientist 1/Field Technician

Technical Specialties
Permitting and Compliance
Data Management/Analysis
Site Investigation/Remediation

Education
MS, Environmental Chemistry, University of Alaska Fairbanks
BS, Meteorology, St. Cloud State University, Minnesota

Years of Experience
With AECOM: 5
With Other Firms: 1

Training
40-hour OSHA HAZWOPER
NIMS ICS 100, 200, and 300
Phase 1 EDD
eRailSafe
First Aid/CPR

Mr. Fortun has six years of experience providing environmental compliance, permitting, site investigation, and data management/analysis services. He has experience in developing air permits, compliance certifications, emission inventories, performing data analyses, regulatory reporting, investigative and remediation sampling, and environmental site assessments.

Representative Experience

Canadian Pacific Railroad, Well Investigation and Abandonment, Locations in South Dakota and Nebraska , 2017. Supervised a field crew abandoning historical cisterns and wells at railroad properties across South Dakota and Nebraska. Wrote a report for each site.

Minnesota Pollution Control Agency, Field Sampling, Savage, Minnesota, 2014. Collected soil, surface water, and groundwater samples from a former landfill to investigate potential contamination influx into a river.

Minnesota Pollution Control Agency, Field Sampling, New Brighten, Minnesota, 2014. Collected surface borings to sampled sediment from a pond to investigate potential PCP and heavy metals contamination.

Minnesota Pollution Control Agency, Field Sampling, Minneapolis, Minnesota, 2015. Conducted soil vapor sampling to delineate the extent of fuel contamination migration.

Minnesota Pollution Control Agency, Field Sampling, Warren, Minnesota, 2016. Conducted monitoring well water sampling at a gas station after it had undergone soil remediation for fuels. At the conclusion of the project, oversaw the abandonment of four monitoring wells.

TransCanada, Field Sampling and Site Remediation, Gruver, Texas, 2017. Collected water and sediment samples at a natural gas compressor station with low levels of PCBs. Tested soil with PID and conducted 4-gas measurements. Analyzed field conditions for future remediation efforts. Led a field effort (crew of 7) to clean pipes using a vacuum truck and inspect pipes using cameras.

Minnesota Pollution Control Agency, Fuel Spill Cleanup, Warren, Minnesota, 2015. Provided cleanup oversight of a gas station fuel line leak/spill. Primary duties included field screening of soil to provide direction on where contaminated soil excavation was necessary, soil sampling, and documenting site progress and incoming/outgoing soil quantities.

Various Clients, Remediation Investigative Sampling, Various Locations, 2012-2017. Conducted soil, water, air, and wipe remedial investigative sampling at sites across the country. Reviewed laboratory chemical data for completeness, usability, and data validation issues.

Various Clients, Chemical Reporting, Various Locations, 2013-2018. Completed annual SARA 311, 312 (Tier II), and 313 (Form R) chemical reporting for industries across the country.

Various Clients, Compliance Reporting, Various Locations, 2013-2018.

AECOM

Completed annual emission reports and annual compliance certifications for air permits for industries in multiple states across the country. Inventoried air emission equipment on-site and completed emission calculations. Conducted on-site records reviews and compliance monitoring.

Various Clients, Permit Application Preparation, Various Locations, 2013-2018. Completed air permit applications including Title V, construction, FESOP, and registration permits and administrative amendments for industrial facilities across the country.

Various Clients, Phase I Site Assessments, Various Locations, 2014-2017. Conducted a Phase I Environmental Site Assessment using the ASTM E1527 standard at properties across the Midwest. The assessments included examining historical documents, reviewing contamination release reports, conducting interviews, acquiring information from local sources, completing on-site investigations, and writing the reports.

AECOM

Angel Gebeau
Engineer 3

Professional History
05/2001 - Present, AECOM Drinking Water Project Engineer

Education
BS, Environmental Engineering, Michigan Technological University, 2001

Years of Experience
With AECOM: 17

Registrations
Professional Engineer, Wisconsin
Professional Engineer, Minnesota
Professional Engineer, North Dakota
Professional Engineer (Environmental), Texas
Professional Engineer, Virginia
Board Certified Environmental Engineer

Professional Affiliations
American Society of Civil Engineers
Wisconsin Water Association
Wisconsin Rural Water Association
American Water Works Association
American Academy of Environmental Engineers and Scientists

Training
IS System Marking Brief
OSHA 8-Hour Confined Space Entry Training
Wastewater Security Training: Reducing Vulnerability to Both Intentional Threats and Natural Disasters Program (Training in VSAT VA methodology)
AwwaRF Teleconference Video: Security Risk Assessment for Water Utilities (Training in RAM-WSM VA methodology)
Security Planning for Drinking Water Systems: An Operational Approach - AWWA
AwwaRF/Sandia Case Study for Small and Medium Water Utilities - Vulnerability Assessment Training

Ms. Gebeau is a senior engineer and the North America and Global Water Treatment Practice Area coordinator. She has worked on numerous water treatment systems throughout the US. Her focus has been in the design of new drinking water treatment facilities and the evaluation of current facilities. Angel Gebeau has 17 years of experience within water treatment. She has worked on 14 projects in Minnesota during that time. Outside of Minnesota she has worked on over a dozen water treatment systems that include non-native contaminant removal from the groundwater supply including TCE, nitrate, perchlorate, and mixed VOCs.

Project Experience

Minnesota Pollution Control Agency, Bayport Water Treatment Plant Improvements, Bayport, Minnesota. Designed water treatment facility upgrades consisting of chlorination system modifications to support additional flow to existing WTP from another well source.

Water Treatment Plant 6, City of Edina, Minnesota. Design engineer responsible for water treatment process design from pilot study protocol development through shop drawing review. Treatment capacity is 4,400 gpm (24mld) and treats water from four well sources. Facility designed for removal of iron, manganese, radium, and vinyl chloride. Treatment processes include oxidation/disinfection with chlorine gas, hydrous manganese oxide addition for radium adsorption, horizontal pressure filters with activated media for iron, manganese, and radium removal. Includes low profile air strippers with slide-out trays for vinyl chloride removal, high service pumping, and chemical feed systems for fluoride and polyphosphate. System had unique site constraints with construction in the lower level of an existing parking garage.

Water Treatment Plant 4, St Louis Park, Minnesota. Design engineer responsible for water treatment process design from pilot study protocol development through shop drawing review. Treatment capacity is 1,200 gpm. Facility designed for removal of iron, manganese, radium, VOCs, and future 1,4 dioxane treatment. Includes low profile air strippers with slide-out trays for VOC removal, high service pumping, and chemical feed systems for fluoride, gas chlorine, and HMO. System had site constraints with construction in the existing water treatment facility.

State of Minnesota, Spring Park Water Distribution Feasibility Study and Treatment Design, Spring Park, Minnesota. Process engineer for TCE treatment feasibility study and subsequent treatment design. Completed analysis of air stripping and GAC alternatives for TCE treatment. Cost estimates were provided. Completed the design of an air stripping system for TCE removal.

Minnesota Pollution Control Agency, Various Projects, Minnesota. Provided quality control review and other support services for Clearbrook, Grub & Pub, Park Region Coop, and Pelican River projects.

City of Mankato, Water Treatment Plant, Mankato, Minnesota. Process designer and start-up coordinator for ultrafilter membrane treatment process addition for the plant. Provided assistance in trouble-shooting hydrochloric acid system design and membrane system OEM relations. Water treatment

facility design included lime softening densators, recarbonation, membrane filtration, chemical addition, water storage, and final pump station. The final treatment facility will treat 12 mgd of groundwater under the influence of surface water. Ultrafiltration process uses Norit X-flow membranes, backwash from distribution system, chemical feed systems, and modified wastewater handling tanks and pumps. Assisted in development of preprocurement for membranes, contractor preapproval, and membrane system process performance guarantee.

City of Hutchinson, Water Study, Hutchinson, Minnesota. Completed membrane modeling using ROSA, RoPro, and WinFlows. Determined optimum membrane configuration and projected final performance. Compared lime softening to membranes using cost modeling software WWCost. Calculated theoretical chemical use for lime softening and membranes. Attended a client meeting to discuss membrane use and performance.

City of Zimmerman, Water Treatment System Design, Zimmerman, Minnesota. Quality Control Review for activated media iron and manganese removal at groundwater well site.

Ripon Water Utility, Well 9 TCE Alternatives Analysis and Subsequent Design, Ripon, Wisconsin. Project engineer completing a study of viable TCE treatment alternatives and cost estimates for TCE removal at Well 9. Process engineer for design of the low-profile air stripper system used for TCE removal.

Confidential Client, Perchlorate Treatment Facilities, Confidential. Designed plant layout, tabulated major process equipment and equipment specifications, sized air compressor, completed process flow schematic, reviewed equipment sizing, and tabulated equipment items for piping and instrumentation.

Confidential Client, Perchlorate Ion Exchange Media Resin, Riverside, California. Reviewed various IX resin available for perchlorate removal. Completed preliminary analysis of perchlorate treatment for each media and cost analysis for each media. Provided recommendations for media and treatment services for client. Reviewed resin replacement versus resin regeneration for expended resin.

Village of Whiting, Nitrate Removal System Modifications, Whiting, Wisconsin. Project engineer for the nitrate removal system modifications, which included new controls and two new ion exchange units to add additional treatment capacity for the village.

Robins Air Force Base, Granular Activated Carbon Breakthrough Review, Robins AFB, Georgia. Project engineer for a technical study of the GAC system at Robins AFB. Modeled GAC breakthrough for TCE, perchlorate, and miscellaneous compounds to determine the effect of increased TCE levels and changes in raw water quality on GAC performance. Determined the carbon life expectancy and provided suggestions for optimizing performance.

AECOM

Kurt M. Geiser
Engineer 4/On-Site Inspector/Engineer 3

Education
BS, Agricultural Engineering, University of Minnesota, 1979
MS, Agricultural Engineering, University of Minnesota, 1981

Licenses/Registrations
Professional Engineer (Civil), Minnesota, #16810, Issued 08/06/1984, Exp. 06/30/2014
Professional Engineer, Illinois, #062046016, Issued 07/25/1990, Exp. 11/30/2013
Professional Engineer, Indiana, #PE60890400, Issued 07/21/1989, Exp. 07/31/2014
Professional Engineer (Environmental), Iowa, #12946, Issued 04/14/1994, Exp. 12/31/2013
Professional Engineer, Wisconsin, #31838-6, Issued 11/08/1996, Exp. 07/31/2014

Years of Experience
With AECOM: 25
With Other Firms: 12

Training and Certifications
HAZWOPER 40-Hour Training
HAZWOPER 8-Hour Refresher Training
HAZWOPER 8-Hour Supervisor Training
CPR
First Aid

Mr. Geiser has environmental engineering experience. He specializes in project management, evaluation of remedial options and alternatives, regulatory negotiations, brownfield redevelopment, design and operation of remediation systems, construction management, and management of full-scale remedial action projects. Mr. Geiser also specializes in water well design and drinking water supply process design.

Project Experience

Class I Railroad, Large-Scale Petroleum Release in Downtown Setting, North Dakota. Responsible as project manager for activities for the remedial investigation, remediation construction, groundwater treatment system construction, litigation support, public communications activities. The project required conducting an extensive investigation in the downtown areas that resulted in the installation of over 200 borings in the downtown area. Remedial response actions required installation of a large scale trench system to recover impacted groundwater and fuel and construction of a 200 gpm treatment system to treat the recovered water. During these activities, organized and participated in numerous meetings with the city engineer and managers, the state agency and the general public to present project plans, report progress, also coordinated the data collection and reporting efforts for various environmental experts retained to provide expert testimony at a trial. Also, assisted with preparing the experts for the trial. Total project expenditures exceeded $20M.

Petroleum Coking Facility Superfund Site, Minnesota. Responsible as project manager for completion of CERCLA remedial design/remedial action pre-design field study. The Record of Decision (ROD) for the Site called for an extensive in situ biological treatment system using aquifer aeration. Led regulatory negotiations to obtain approval of an Explanation of Significant Differences (ESD) to the ROD, allowing approval of natural attenuation and institutional controls as the full-scale remedy. These efforts dramatically reduced the environmental costs of the project and facilitated delisting the site from the Superfund list.

Class I Railroad, Wood Treating Superfund/RCRA Site, Minnesota. Responsible as project manager for the design and construction of a RCRA cap to cover an approximately 4-acre closed land treatment unit at a former wood treating site regulated by CERCLA and RCRA. The project required meticulous planning, sequencing and consolidation of impacted materials into a landfill prior to capping. This project was completed on time and substantially under budget.

In Situ Treatment System Design. As project engineer, designed, installed and operated a wide range of environmental remedial systems including bio-slurping, soil excavation followed by thermal treatment, soil vapor extraction systems, air sparging systems and groundwater pump treatment systems requiring product separation and treatment of the ground water recovered before discharge. One of these systems, a bio-slurping system, has recovered over 35,000 gallons of diesel fuel.

Class I Railroad, Former Railyard, Minnesota. Served as senior project manager for site assessment, remediation, and redevelopment project, involving soil and groundwater investigation, remedial design, response

action implementation, and facilitation of property transfer negotiations. Provided oversight for all soil and groundwater investigation activities including completion of more than 250 soil borings, establishment of a 60-well groundwater monitoring network, and development of work plan to demonstrate natural attenuation as a viable remedy for petroleum free product and dissolved chlorinated hydrocarbon plumes. Supervised data management and evaluation activities, including a risk assessment of soil and groundwater impacts to develop site-wide response actions, in accordance with Minnesota state guidelines. Directed implementation of the response actions that included: excavation and disposal of 500 tons of hazardous waste containing chlorinated solvents; excavation, on-site treatment and off–site disposal of 14,000 tons of lead impacted soil, soil vapor extraction, light non-aqueous phase liquid (LNAPL) recovery, monitored natural attenuation (MNA). Other contaminates included asbestos and petroleum. Total project expenditures exceeded $4.5M.

Class I Railroad, Former Railroad Repair Shop Superfund Site, Minnesota. Responsible as project manager for the investigation of a former rail car repair facility listed as a CERCLA and MERLA site. The soil at the site contained elevated levels of lead, other metals and PCBs. Developed and implemented response actions to address over 100,000 cubic yards of lead impacted soil. Negotiated an ESD to allow the use of a risk-based approach to implementing the response actions. Supervised preparation of Response Action Plan, Health and Safety Plan, and Quality Assurance Project Plan consistent with meeting the requirements of the NCP, CERCLA, MERLA and VIC regulatory programs. This site is undergoing redevelopment as an industrial park and a city recreational area. Developed the response action plans to facilitate the construction of the recreational area and the industrial park. Represented the client at public meetings and meetings with the regulatory agency. Total project expenditures of over $10M.

Active wood treating site, Minnesota Ag VIC Program. Responsible as project manager for the implementation of soil and groundwater corrective actions at wood treating site that had historically used penta-chloro-phenol (PCP) mixed with diesel fuel as the treatment chemical. The site is listed as a state superfund site and is managed by Minnesota Department of Agriculture under the Minnesota Agriculture Voluntary Investigation and Cleanup program. Constituents of concern include PCP, diesel fuel, and dioxins. Remedy includes excavation and on-site treatment of PCP impacted soil and off –site disposal of dioxin impacted soil after treatment. Groundwater remedy has not been determined. Estimated project costs are approximately $500K.

AECOM

Alan D. Gorski
On-Site Inspector/Scientist 2

Professional History
03/1994 - Present, AECOM Project Director, Project Manager, Senior Engineer
06/1991 - 08/1992, Huntingdon-Chen Northern Staff Engineer

Education
B.S., Environmental Scientist
University of Minnesota, MN
Minneapolis, MN, 1992

Years of Experience
With AECOM: 4
With Other Firms: 22

Training
OSHA HAZWOPER 8-Hour Refresher Training
OSHA HAZWOPER 40-Hour Training
First Aid/CPR

Mr. Gorski has extensive experience in coordinating and preparing written deliverables for sites with a complex multi-decade history of environmental contamination, remediation and monitoring with a focus on optimizing site strategies and transitioning to more cost effective soil and groundwater remedies. Mr. Gorski has Twenty-six years of professional experience as an environmental scientist and project manager. Project experience includes site investigations; soil and groundwater remediation; hazardous waste management; implementation of project quality control programs; technical support and leadership for complex, multi-phased projects. My project management priorities have focused on establishing excellent client communication for complex, technically diverse projects by developing a clear understanding of project needs, and bringing projects to completion within time and budget constraints.

Project Experience

Akzo Nobel, Joplin, MO. Provided technical oversight for RCRA post-closure permit at 600 acre ammonium nitrate/TNT manufacturing facility. Project responsibilities included permitting, development strategies for complex explosives residuals contamination waste disposal, ex-situ composting, in-situ stabilization remedies, client and regulatory interface, project team coordination and project deliverable quality control.

BP, Neodesha Refinery, Neodesha, Kansas. Completed a Corrective Action Study and LNAPL Conceptual Site Model at a former petroleum refinery site with a complex, comingled groundwater and LNAPL plume. The CAS and LNAPL CSM incorporated several decades of monitoring data, interim action remediation system performance data, human health and ecological risk assessments to develop a comprehensive roadmap for site remediation and future site closure.

Former MacGillis and Gibbs Pole Treatment Facility, New Brighton, MN. Developed an implementation strategy for an existing and mature Minneapolis area pole treating site with active groundwater remediation to maximize operational and monitoring efficiencies and develop cost reductions while maintaining compliance with site decision documents.

City of St. Louis Park Chlorinated Solvent Groundwater Investigation, St. Louis Park, MN. Provided project leadership, technical oversight, and regulatory agency interface for a multi-site, regional chlorinated groundwater, soil vapor and vapor intrusion investigation for a high priority MPCA-led State superfund site.

Alliant Techsystems- Twin Cities Army Ammunition Plant, Arden Hill, MN. Project manager and lead technical oversight for a groundwater remediation system at the former munitions plant. Coordinated all site activities including treatment system operation and maintenance, sampling and reporting. During 13 years of project management, the treatment system had been operational greater than 97% of the time with no instances of VOC effluent discharge exceedances.

BNSF- Former Tie Treatment Yard, Big Falls, MN. Provided technical support, regulatory agency interface and client communications for multi-PRP former wood treater site. Project activities have included alternative

investigation strategies to maximize data that will lead to cost-effective, risk-based remedial actions**.**

BNSF- Former Tie Treatment Yard, Brainerd, MN. Developed a comprehensive groundwater cleanup assessment evaluation for the site remedy's consistency with EPA guidance, evaluated the potential for returning site groundwater to beneficial re-use and provided an assessment of the technical practicability for site restoration.

United States Fish and Wildlife Service- 40th Avenue West, St. Louis River AOC- Duluth, MN. Project Manager for ecological investigation of sediment and benthic community sampling in preparation for sediment remediation and habitat restoration of 450 acre project site in the industrial corridor of the St. Louis River near Erie Pier and the Hubbard Power Plant.

United Technologies Corporation- Little Mississinewa River, Randolph County, IN. Project manager and contract oversight for an 8 year remedial investigation/feasibility study and removal action on a 7.5 mile reach of the Little Mississinewa River that was performed under EPA Region 5's Emergency Response and Remedial Response Branch. The project included the removal of 130,000 tons of PCB-impacted soil and sediments and restoration of over seven miles of river channel and floodplain.

Shell Oil Products US, Rand Avenue Site, Hartford, IL. Prepared a Remedial Objectives Report/Remedial Action Plan at a multi-owner, heavily congested rail corridor site. Project sites includes multiple freight and commuter rails, and aboveground and below ground petroleum pipelines originating from surrounding refineries where historical petroleum and benzene releases have occurred. The ROR/RAP included evaluation of multi-strata remediation system performance and a risk-based technical impracticability evaluation for phasing out future groundwater remediation.

BNSF, Argentine Yard Elevator A, Kansas City, MO. Evaluated railyard site with over 20 years of monitoring data and developed a detailed and updated site conceptual model, qualitative risk assessment and implementation strategy for providing substantial long term reductions in O&M costs while maintaining exposure risk protectiveness and regulatory compliance.

AECOM

Eric Henery, PE
Engineer 2/Engineer 1

Areas of Expertise
Water Resources Engineering
Stormwater Management
Drainage
Erosion & Sedimentation Controls
Site Development
Civil Engineering

Education
MSCE/Civil & Environmental Engineering/2011/Carnegie Mellon University
BSCE/Civil Engineering/ 2008/University of Nebraska

Registration/Certification/Training
2017/MPCA Design of Construction SWPPP Certification
2014/Professional Engineer/PA
2012/Hydraulic Methods and HEC-RAS Training (PennDOT)
2012/E&S Manual Training (PADEP)
2008/Engineer in Training/NE

Years of Experience
With AECOM: 7
With Other Firms: 1

Professional Societies/Affiliates
American Society of Civil Engineers - EWRI
Chi Epsilon – President (2007-2008)
University of Nebraska - Omaha

Chronology
6/2017 - Present: AECOM, Minneapolis, MN
10/2014 - 5/2017: AECOM, Conshohocken, PA
6/2011 - 10/2014: URS Corporation, Fort Washington/ Conshohocken, PA
8/2010 - 5/2011: Carnegie Mellon University, Pittsburgh, PA
5/2010 - 8/2010: Benesch, Omaha, NE
5/2007 - 4/2009: DLR Group, Omaha, NE
8/2004 - 5/2008: University of Nebraska, Omaha, NE

Mr. Henery has experience in civil and water resources engineering designing stormwater management, drainage and erosion and sedimentation controls. His experience encompasses urban transportation projects and site development. Mr. Henery has a working knowledge of AutoCAD and Microstation as well as various stormwater modeling programs including: HEC-RAS, HEC-HMS, PondPack, HydroCAD, Bentley InRoads Storm and Sanitary and AutoCAD Civil 3D Stormwater Analysis.

Project Specific Experience

SEPTA Wawa to Elwyn – Contract R3-3 – Leading the design team for stormwater management, drainage and erosion and sedimentation designs. The project involves the construction of a new station, parking garage, bus and car drop-off circle and a new SEPTA employee welfare center with associated parking. NPDES permits will be obtained and land development approvals will be acquired through the township.

SEPTA Wawa to Elwyn – Contract R3-2 – Leading the design team for stormwater management, drainage and erosion and sedimentation designs. The project involves 4 bridge improvements, 3 culvert improvements and rehabilitation of nearly two miles of track bed. The NPDES permit is under review with construction set to start in June of 2018.

Blattner Support Buildings – SWPPP designer for the development of the 50 acre site in Avon, MN. SWPPP activities include the drainage layout and design, stormwater management, and erosion and sediment control activities. Providing continued support through construction.

SR 0095, Girard Avenue, Phase GR4 – Design team oversight for stormwater management and erosion and sedimentation designs while leading the drainage design team. The majority of the stormwater management design carried over from the previous design section but needed some modifications and additional detail before being bid for construction. The Stormwater Consistency and NPDES permits were renewed.

SR 0095, Girard Avenue, Phase GR3 – Design team lead of 6 in designing the stormwater management of sections GR3 and GR4. Eric coordinated a cohesive design between all of the members and set forth design procedures and standards so that the product was consistent throughout the project. He consulted on challenges faced through each of the designer's segments to ensure the permit requirements would be met, the review agencies would buy-in and the client would be more than satisfied. He also prepared the E&S plan for this section.

SR 0095, Girard Avenue, Phase GR2 – Designer for the stormwater management of section GR2. Eric developed the BMP concepts to fulfill the permit requirements within the available ROW. He also prepared the permit applications. The stormwater management won an Honor Award from the ACEC of Pennsylvania in 2017. Eric and his manager presented the project at the 2017 StormCon in Seattle, WA.

PennDOT District 5 PM & Review Assist – Reviewed several H&H submissions on behalf of the district for accuracy and completeness.

Comments were provided to the design consultant until approval was recommended.

SR 0202, Section 610 Improvements – Designed the removal of a dam that had breached and was causing stream bank deterioration and subsequent stream restoration in the immediate area of the dam. These activities were done as remediation for stream impacts not able to be remediated within the highway improvement projects bounds.

SR 2002, Sec BE1 – State Road – Developed stormwater treatment concepts including curbside rain gardens, street side parking and intersection bump outs to facilitate the SWM and improve safety along the highway corridor. Presented the concepts to DEP and township officials.

CSX Drainage Reviews – Coordinates and quality checks the drainage review of projects neighboring or impacting CSX right of way. Many projects involve a bridge or at grade crossing. CSX has specific criteria for acceptable activities and impacts that are allowable in proximity to their property and these reviews ensure compliance.

PTC NE Extension A20-30 Widening & Improvements – Assisted in the development of a PCSM plan for improvements to the Pennsylvania Turnpike. Developed innovative outlet structure modelling technique for the stormwater basins that allowed the design to meet the requirements put forth by the permitting agencies.

ANR Water Management Program – Developed a model to evaluate a localized flooding issue on the industrial site. A temporary pump system was recommended as a short term solution. The client is evaluating their options for a long term solution.

AECOM

Russell J. Henning, P.G.
Scientist 2

Education
M.S., Geology and Geophysics, Eastern Kentucky University
B.S., Geology, UW-Oshkosh

Licenses/Registrations
Professional Geologist, Wisconsin, Kentucky, Wyoming, Missouri

Years of Experience
With AECOM: 21
With Other Firms: 13

Professional Affiliations
National Groundwater Association
American Geophysical Union
Geological Society of America
Environmental and Engineering Geophysical Society

Awards
Waste Management Presidents Award

Mr. Henning has 34 years of experience in geology, geophysics, and mathematics. His environmental experience includes geology, geophysics, hydrogeology, computer modeling and statistics.

Mr. Henning is a technical lead for design and analysis of aquifer tests and groundwater and contaminant transport modeling. He has experience in the application of one-, two- and three-dimensional finite difference, finite element and analytical element groundwater flow and transport models including MODFLOW, GFLOW, GSFLOW, MT3D, MODPATH, UNSAT-H, PTC, POLLUTE and MULTIMED.

Mr. Henning has design, field and analysis experience in aquifer testing including slug, packer and pump tests.

Mr. Henning has experimental design, field, and statistical analysis experience in environmental sampling and statistical sampling plan design.

Mr. Henning has design, field, and analysis experience in geophysical surveying. His experience includes land and marine gravity, magnetics, electromagnetics, and downhole logging.

Selected Project Experience

U.S. Army Corps of Engineers (USACE) – St. Paul District, Crandon Mine Model, Minneapolis, Minnesota, 2002-2005. Senior Groundwater Modeling Lead for high-profile underground mining permit evaluation. Performed groundwater modeling for the USACE for submission to WDNR. Composed model report, presented and negotiated public meetings with USACE, USEPA, WDNR, USGS, Native American Tribes and opposition groups as part of the mine application approval process. Created a three-dimensional MODFLOW model using Groundwater Vistas to simulate flow and transport for pre-, concurrent and post-mining processes.

METRO Wastewater Sewerage District, Minneapolis, St. Paul, Minnesota. Designed and constructed a three-dimensional groundwater model to evaluate flood stage water levels for the waste water treatment plant. Used MET model to refine a smaller area and predict the site's ability to remain dry during high flood water on the Mississippi River. Incorporated barrier walls, drain tiling, deep production wells and flood relief wells to optimize groundwater extraction. Completed presentation showing results of over 100 model scenarios and water extraction capabilities.

Xcel Energy, Minnesota Pollution Control Agency, AS King ADF EIS, Groundwater Flow and Contaminant Transport Modeling, Minneapolis, Minnesota. Senior Groundwater Modeling Lead for design and implementation of MODFLOW, MODPATH and MT3D models to evaluate the efficiency and effectiveness of proposed ash landfill design.

Waste Management of Wisconsin, Inc., Valley Trail RDF Groundwater Flow Model, Green Lake County, Wisconsin. Conducted groundwater modeling in support of a Feasibility Study to WDNR. The purpose of the model was to predict groundwater flow from upgradient recharge areas to fens located adjacent to a proposed landfill expansion area. Regional and site specific groundwater flow was modeled using a two-dimensional cross-

sectional MODFLOW model. Next, the flow model was modified to predict the effects of removing a portion of the upgradient recharge area on the overall flow to the fen area.

U.S. Department of Energy (DOE), Fermi National Accelerator Laboratory, NuMI Facility Groundwater Flow and Particle Transport Model, Batavia, Illinois. Conducted three-phase groundwater and particle transport modeling for predicting the effects of constructing a tunnel for the NuMI Facility on private wells adjacent to the site. First the regional groundwater flow was modeled using a three-dimensional MODFLOW model. Next, the regional flow model was modified to incorporate the site specific characteristics and adjacent private wells to develop a site flow model. Next, particle path lines were modeled using MODPATH. Modeling was performed using Department of Defense Groundwater Modeling System (GMS).

Indianapolis Department of Public Works, Belmont/ Southport Interplant Connection Groundwater Flow Modeling, Indianapolis, Indiana. Senior Groundwater Modeling Lead for design and implementation an MODFLOW model to evaluate the efficiency and effectiveness of groundwater extraction system for dewatering as part of a feasibility study for the construction of a 12-foot diameter pipe connecting two wastewater treatment plants.

USAF, Groundwater Flow and Contaminant Transport Model, Altus AFB, Oklahoma. Conducted groundwater and contaminant transport modeling in support of a corrective measures study. Groundwater flow, contaminant transport and optimization using Argus One, finite element Princeton Transport Code, and optimization Outer Approximation Method was completed.

FEMA, Task Order HSFEHQ-10-J-0003 Groundwater Inundation Study Spring Green, FEMA DR-1766-WI, Spring Green Lone Rock, Wisconsin, May 2010-May 2011. A coupled climate, surface water, vadose zone and groundwater flow model was created to model groundwater flooding using USGS GSFLOW Model for Spring Green and Lone Rock, Wisconsin. Groundwater flooding recurrence intervals were estimated by the model. Model peer reviewed by WGNHS.

U.S. Army, Pueblo Chemical Depot, SWMU 34, Magnetic Geophysical Survey, Pueblo, Colorado, June 2010-May 2014. Analyzed magnetic data associated with UXO for target area located in SWMU 34. Analysis included using Geosoft Oasis montaj UX-Detect, EVS and ArcMap Geostatistical Analyst. Composed final report, performed VSP UXO analysis and created anomaly dig-sheets for verification of UXO removal.

U.S. Army, Pueblo Chemical Depot, SWMU 60, EM Geophysical Survey, Pueblo, Colorado, April 2010-June 2010. Designed and executed an electromagnetic (EM) survey using a Geonics EM31 to map trenches and trench boundary features associated with burial of Pershing II missiles in subsurface. Analyzed EM data using EVS and ArcMap Geostatistical Analyst.

U.S. Army, Pueblo Chemical Depot, SWMUs 2, 4, 5, 6, 7, 8, and 10, EM Geophysical Survey, Pueblo, Colorado, April 2013-Present. Developed work plans and specifications. Designed and executed an electromagnetic (EM) surveying using a Geonics EM31 to map trenches, burn pits and disposal features associated with the disposal of MEC on the surface and in subsurface. Analyzed EM data using Oasis montaj.

Pump Test Analysis, Anoka County, Minnesota. Analyzed pump test data using AQTESOLV.

Waste Management of Wisconsin, Inc., Metro RDF Slug Test Analysis, Franklin, Wisconsin. Analyzed slug test data using AQTESOLV.

Waste Management of Missouri, Inc., Cedar Hollow RDF Pump and Packer Test Analysis, Owensville, Missouri. Designed, executed, and analyzed pump and packer tests.

Waste Management of Illinois, Inc., Cottonwood Hills RDF Packer Test Analysis, Marissa, Illinois. Designed, executed, and analyzed packer tests.

Waste Management of Illinois, Inc., Cottonwood Hills RDF Pump Test Analysis, Marissa, Illinois. Designed, executed, and analyzed pump tests.

Waste Management of Wisconsin, Inc., City Disposal Pump Test Analysis, Dane County, Wisconsin. Analyzed pump test data for remediation system design.

Waste Management of Wisconsin, Inc., Muskego Landfill Pump Test Analysis, Muskego, Wisconsin. Analyzed pump test data for remediation system design.

Waste Management of Illinois, Inc., DeKalb RDF Pump Test Analysis, DeKalb, Illinois. Analyzed pump test data for remediation system design.

Waste Management of Illinois, Inc., Prairie View RDF Pump Test Analysis, Will County, Illinois. Designed, executed, and analyzed pump tests.

AECOM

James F. Herberich
Scientist 2

Professional History
06/1988 - Present, AECOM Senior Hydrologist
05/1986 - 09/1987, Cambridge Analytical Associates, Inc. Environmental Scientist

Education
BA, Engineering Sciences, Harvard University, 1985

Years of Experience
With AECOM: 29
With Other Firms: 2

Training
FEMA Flood Hazard Mapping Training
OSHA HAZWOPER 40-Hour Training
OSHA HAZWOPER 8-Hour Refresher Training

Mr. Herberich is the leader of the AECOM Northeast Region Data Management and Presentation group. With AECOM since 1988, he has extensive experience in water resources-related technical analysis, and in the support of this work has become a leader in advancing AECOM Environment's GIS, Data Management, and 3D Data Visualization capabilities. His areas of expertise also include database design and planning, scientific programming, and systems integration. Mr. Herberich is responsible for AECOM's global implementation of the EQuIS data management system. He has directed the data management and GIS tasks for numerous environmental site investigation and remediation projects including multi-party, multimedia RI/FS, infrastructure management, and hydrologic and hydraulic modeling and floodplain mapping.

Project Experience

Resolution Consultants JV, US Navy CLEAN Data Management, USA. Data management task leader with primary responsibility for planning and executing all of AECOM's data management activities for CLEAN program task orders. Led development of EQuIS tools and procedures to receive data from and provide data to the NIRIS online database for locations, borings, wells, samples, field measurements and lab results, including valid value translation. Created custom reports for tabular and graphical database output for use program-wide.

Shell Oil Products US, Bakersfield Refinery, Bakersfield, California. Data management task leader with primary responsibility for planning and executing all of AECOM's data management activities for groundwater monitoring and air sparge/soil vapor extraction treatment system operation and maintenance at Bakersfield refinery site. Performed migration of historic data from custom database to EQuIS including valid value translation and data cleanup. Build new workflows for loading field data from existing file types via custom EDD formats. Create reporting workflows to duplicate existing table and figure types from new EQuIS database.

Enbridge, Line6b Pipeline Spill, Marshall, Michigan. Data management task leader with primary responsibility for planning and executing all of AECOM's data management activities including field recording, lab EDDs, database, reporting, and client and agency delivery for the Line 6b Spill emergency response. Responsible for assembling and managing the team and its procedures responsible for accurately and efficiently recording field sampling information, receiving lab EDDs and loading into the database, facilitating data validation and its updates of results, and reporting to project stakeholders, including USEPA and MDEQ, in a variety of formats. Provided training to a diverse set of Environmental Scientists for their roles in data capture and reporting.

Cooperating Parties Group, Lower Passaic River RI, New Jersey. Data management task leader with primary responsibility for planning and executing all of AECOM's data management activities including field recording, lab EDDs, database, reporting, and client and agency delivery for the Lower Passaic River remedial investigation. Responsible for design and execution of innovative visual data presentations for reports and stakeholder meetings.

AK Steel Corporation, Data Management, Ohio. Data management task lead for CERCLA remedial investigation at former steel mill site where approximately 1,200 samples were collected from over 450 locations in seven months. Responsible for all aspects of data management from field, through labs, validation, and reporting. Implemented EQuIS 5 software running on SQL Server to enable data access from anywhere on AECOM network. Created custom electronic forms for transcription of field data records (e.g., boring logs, well construction), and code to move transcribed data into the database. Wrote custom procedures in GIS to enter GPS or surveyed coordinates into the database in both state plane and UTM systems. Interfaced with labs to ensure correct EDD formats, and troubleshoot lab data issues. Provided instruction to and supervision of staff for recording data, loading lab EDDs, entering validation updates, generating reports, and mapping in GIS.

City of St. Louis Park, Data Management, St. Louis Park, Minnesota. Supervised population of database of groundwater monitoring data with field sampling information and laboratory results. Developed procedures for data updates and maintenance, totals of analyte group results, as well as custom reporting.

ConocoPhilips, Data Management, Alabama. Provided senior database consulting for marine study in support of offshore LNG terminal permitting. Assisted staff at Dauphin Island Sea lab in managing the database of biological sampling events and results. Made recommendations on improving database structure. Provided templates and guidance for streamlined reporting. Automated data import routines, improving data quality and drastically reducing labor hours per sampling event. Built data reports for AECOM scientists to analyze and summarize data.

BP, Data Management, Hartford, Illinois. Provided senior database consulting. Managed transition from MS Access-based EQuIS 3 to SQL Server-based EQuIS 5 system. Provided custom report templates, including T-SQL coding. Performed audit of data management workflow, and made recommendations for process changes to improve efficiency and data quality.

AECOM

Paul J. Herubin
Engineer 4/Engineer 3

Education
BS, Civil Engineering - Structural/Geotechnical, University of Wisconsin, Platteville, 1992

Years of Experience
With AECOM: 23
With Other Firms: 3

Registrations
Professional Engineer, Illinois, #062056825, Issued 06/17/2003, Exp. 11/30/2019
Professional Engineer, Wisconsin, #30888-6, Issued 06/02/1995, Exp. 07/31/2018
Professional Engineer (Civil), Minnesota, #45243, Issued 11/13/2006, Exp. 06/30/2018

Professional Affiliations
Water Environment Federation
American Water Works Association

Mr. Herubin is a senior engineer with more than 25 years of experience with water and wastewater infrastructure from planning and design through construction. His primary skills are in water distribution systems, construction engineering, collection systems, and facility planning.

Representative Project Experience

Metropolitan Council for Environmental Services, Blue Lake WWTP Levee Accreditation, Shakopee, Minnesota. Project Manager for the preparation of a levee accreditation report for the original levee protecting the Blue Lake WWTP. This report specifically addressed levee freeboard, levee closures, embankment protection/stability, interior drainage, operations, and maintenance in accordance with 44 CFR 65.10 requirements. Performed hydraulic analysis, assisted Client with document gathering, coordinated sub-consultant with embankment stability analysis, and preparation of report for Client to submit to FEMA for accreditation. [04/01/2013-12/01/2013].

City of Minneapolis, Nicollet Mall Sanitary Sewer Replacement, Minneapolis, Minnesota. Process Engineer assisting City with identifying and assessing the feasibility of applying proven trenchless sewer constructability methods and constructability issues for a sanitary sewer replacement along the Nicollet Mall corridor. This sewer replacement project consists of 3,500 feet of sanitary sewer ranging from 12 inch to 24 inch with numerous conflicting underground utilities. Responsibilities included: identifying proven trenchless sewer installation methods; assessing directional drilling and micro-tunneling methods; assessing constructability and staging; and cost estimate.

Minnesota Pollution Control Agency, Bayport Raw Water Main, Bayport, Minnesota. Process engineer for the design an 8 inch diameter 2,400 foot directionally drilled raw water main along City street right-of-way. This raw water main linked existing Well 3 to the City's water treatment plant. Tasks included: hydraulic analysis; risk assessment; borehole stability analysis; constructability analysis; and bidding package.

Minnesota Pollution Control Agency, Clearbrook, Minnesota. Project designer for a municipal well house in Clearbrook, Minnesota (LEAK 3093). Well house building elements included concrete footings, concrete block walls, well pump and all piping and appurtenances, chlorine and fluoride injection for a complete installation. Responsibilities included: pump sizing calculations; chemical feed equipment selection; engineering discipline coordination; contract document preparation; and bidding assistance.

Minnesota Pollution Control Agency, Warren, Minnesota. Project designer for a petroleum impacted soil cleanup project in Warren, Minnesota (LEAK 7997). The excavation for this cleanup impacted MnDOT's US Highway 75 right-of-way and the neighboring Cenex gas station property. Design aspects included: water main replacement; roadway underdrain replacement; fuel dispenser piping replacement; bituminous and concrete replacement. Responsibilities included: CCAD preparation; EDCAD preparation; contract document preparation; and bidding assistance.

City of Edina, Edina Water Treatment Plant No. 6, Edina, Minnesota. Resident engineer responsible for on-site inspection to ensure contract compliance; conflict resolution between contractor and client; change order negotiation and preparation; concrete and soil testing coordination with AECOM testers and laboratory; design change and clarification coordination with multi-office AECOM design team; pay application review and verification; and plant start-up coordination.

City of Minneapolis, Fridley Ammonia Building, Fridley, Minnesota. Resident Project Representative for the construction of a $4.6 million ammonia storage and injection facility. Responsibilities include: on-site inspection to ensure contract compliance for architectural, structural, mechanical, and electrical disciplines; conflict resolution between contractor and client; change order negotiation; special inspection coordination with third party testing firm; pay application review and verification.

City of St Louis Park, SLP 4 WTP Improvements, St Louis Park, Minnesota. Resident engineer responsible for on-site inspection to ensure contract compliance; conflict resolution between contractor and client; change order negotiation and preparation; concrete and soil testing coordination with 3rd party testers and laboratory; design change and clarification coordination with multi-office AECOM design team; pay application review and verification; and plant start-up coordination.

Metropolitan Council for Environmental Services, Victoria, Minnesota. Project Manager for the installation approximately 7,100 lineal feet of 72 inch diameter FRP in soft ground conditions. Responsibilities included coordinating field construction inspector activities; and project administration.

Metropolitan Council for Environmental Services, Brooklyn Park and Fridley, Minnesota. Project Manager for the installation of a new 100 lineal foot 42-inch dual barrel forcemain underneath the Mississippi River linking existing Lift Station L32 in Brooklyn Park with a gravity interceptor in Fridley. Responsibilities included coordinating field construction inspector activities; and project administration.

Metropolitan Council for Environmental Services, Minneapolis, Minnesota. Project Manager for the rehabilitation of MCES Interceptor MN-341 in Minneapolis. Project involved the televising, cleaning, and install CIPP liner of 10,500 lineal feet of interceptor sewer ranging in diameter from 27 inches to 60 inches. Temporary conveyance systems were incorporated during the work. Responsibilities included coordinating field construction inspector activities; and project administration.

AECOM

Vasanta M. Kalluri
Engineer 3/Engineer 2

Professional History
1999 - Ongoing, AECOM

Education
MS, Environmental Engineering, Michigan Technological University, 1999
BS, Civil Engineering, Osmania University India, 1996

Registrations/Certifications
Professional Engineer - Wisconsin, 36933-006, Minnesota, 53668,
AECOM Certified Project Manager

Years of Experience
With AECOM: 18
With Other Firms: 0

Training
OSHA 40-Hour Hazardous Waste Site Worker Certification
OSHA 8-Hour HAZWOPER Refresher
Roadway Worker Protection Awareness Certification
Managing AECOM Projects Certification
Quality Management System Certification

Ms. Kalluri serves as a Senior Project Engineer in the Remediation Engineering group of AECOM Environment. Her area of practice includes managing and implementing various investigation, remediation, and risk assessment projects in Colorado, Illinois, Minnesota, Ohio and Wisconsin.

Her professional experience includes assessing and addressing environmental issues related to federal, industrial, commercial, and residential properties; site assessment; development of remedial action plans for petroleum fuel, solvent, dioxin and pesticide-impacted subsurface sites; design and preparation of construction plans and specifications for subsurface treatment and assessing financial risk and uncertainty by performing Probabilistic Cost Modeling using Decision Tree and Monte Carlo analyses.

Project Experience

Subsurface Investigation and Remediation

Class I Railroad Company, Site Investigation, Remedial Action and Risk Assessment, Northern Minnesota. Managing a large, active yard with multiple environmental management units under Minnesota Pollution Control Agency's RCRA and Petrofund programs. The project includes assessing and addressing various metals, volatile and semi-volatile organic compounds and PCBs in soil, groundwater, sediment and surface water through a combination of active remediation and risk assessment. Project involves extensive negotiations with multiple divisions of the Minnesota Pollution Control Agency.

Class I Railroad Company, Subsurface Investigation and Groundwater Treatment, Southern Illinois. Managing on a turnkey basis a 98-acre site with an active groundwater containment and extraction system to address tetrachloroethene contamination in fractured bedrock. Assessing subsurface characteristics and tetrachloroethene distribution on an ongoing basis at this hydrogeologically complex site. Evaluating state of the art remediation technology on an ongoing basis to clean tetrachloroethene in weathered and fractured bedrock environment.

Class I Railroad Company, Site Investigation, Remedial Action and Closure, Central Wisconsin. Managed an active railroad yard project comprising of site investigation and remediation that lead to site closure (after four decades of environmental corrective action). Successful in obtaining significant reimbursement for the Client from Wisconsin's PECFA program.

Former Electrical Parts Manufacturing Facility, Site Investigation and Remediation of Chlorinated Solvents, Closure with Limited Liability under the VPLE Program, Two Rivers Wisconsin. Performed site investigation, soil, groundwater and vapor remediation, evaluated remediation technologies and data, evaluated natural attenuation, assessed contaminant exposure risk and obtained closure for a long term (25+ years) project. The closure was obtained under Wisconsin's Voluntary Party Liability Exemption (VPLE) program.

Air Force Base, Feasibility Study, Colorado. Performed a feasibility study of a site primarily impacted with chlorinated solvents and dioxin. The FS included evaluation of remedial technologies, preliminary design and costing using RACER. The FS was completed in general accordance with Colorado Department of Public Health and Environment and United States Environmental Protection Agency requirements and was the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) process.

Brownfields Redevelopment

City of Manitowoc, Redevelopment of Former Industrial Site, Manitowoc, Wisconsin. Performed site assessment and remedial actions to redevelop a brownfield site into an active mixed used property. Prepared grant applications and obtained funding from WDNR's Site Assessment Grant to address site environmental issues. Designed a soil management plan to complement the site redevelopment plan for a cost-effective solution. Obtained liability exemptions to attract potential buyers to the redeveloped property.

Flintstone Properties, Redevelopment of Multiple Brownfield Sites, De Pere, Wisconsin. Performed site, assessment of multiple brownfield sites with residential, commercial and light-industrial usage to facilitate redevelopment. Prepared grant applications and obtained funding from WDNR's Site Assessment Grant. Obtained liability exemptions and insurances limiting liability under WDNR's Voluntary Party Liability Program that removed all liability related to the property's historical environmental issues.

Contaminant Exposure Risk Assessment, Hydrogeologic Evaluations and Fate and Transport Evaluations

Paper and Pulp Landfill, Arsenic Evaluation, Chillicothe, Ohio. Performed a hydrogeologic and geochemical evaluation with focus on arsenic source, fate, and transport. The study resulted in significant scaling back of the ongoing remediation system and consequent monetary gains for the client.

Municipal Landfill, Chlorinated Solvents Evaluation, New London, Wisconsin. Performed groundwater evaluation and natural attenuation study of chlorinated solvents to assess the risk of downgradient impacts. The evaluation resulted in reduction of the site risk score and helped move the site to the Long-Term Monitoring Phase.

Probabilistic Cost Modeling (PCM)

Class I Railroad Company, Multi-projects Portfolio, Various Locations, United States. Executed risk-based PCM to estimate costs for a portfolio of more than 35 sites with high monetary value and/or third-party risk exposure**.** The cost estimated using this method was used by the company for internal financial planning. PCM included using decision trees, probability analysis and applying Monte Carlo routines to evaluate various available pathways for environmental closure or other end points. Successfully planned, managed and executed the quick-turn, critical deadline project by managing multiple AECOM project teams, multiple (AECOM and non-AECOM) consultants, and multiple Railroad project managers. Received special recognition by the client for meeting the project goals.

Paper and Pulp Client, Redevelopment of Large Former Industrial Site, Washington. Evaluated multiple redevelopment scenarios of a large shoreline industrial site with remediation and ecological restoration aspects, by estimating costs using RACER and performing PCM. These costs were

used for financial planning, property sale and turn-key redevelopment evaluations by the client.

Industrial Client, Project Environmental Liability Estimation, Rhode Island. Performed PCM using Decision Tree and Monte Carlo analyses to establish risk based environmental liability cost for a remediation project. The resulting risk versus estimated cost graph was used to allocate funding for the project life cycle and used to estimate the cost of liability for potential buyout in future.

AECOM

Benjamin J. Klaus
On-Site Inspector/Scientist 2/Engineer 2/Scientist 1/GIS & CADD Specialist/Field Technician/Engineer 1

Professional History
09/2013 – Present, AECOM
Environmental Engineer

Registrations
Professional Engineer - Minnesota

Years of Experience
With AECOM: 5
With Other Firms: 1

Training
OSHA HAZWOPER 40 hr. Safety Training and current 8 hr. Refresher Training
CPR and First Aid Trained
e-RAILSAFE Safety Trained
ExxonMobil LPS Trained

Mr. Klaus is a project engineer with six years of experience. Primarily, his skills are used to assist project managers with computer aided design (AutoCAD and ArcMap) for generating figures, acting as field support by collecting samples and subcontractor oversight and reducing data for tables. He has experience in engineering design and soil classification in addition to monitoring well, soil and air sampling (including sub-slab and ambient air). He has also provided excavation and construction oversight.

Representative Project Experience

Environmental Investigation

MPCA, St. Louis Park Investigation, St. Louis Park, Minnesota. Field engineer for overseeing subcontractor drillers. Tasks include installing and sampling soil vapor points, temporary monitoring wells and soil borings. Inspection of VOC mitigation systems inside homes around the city with a representative of the Minnesota Department of Health is also performed. Additionally, passive soil vapor samplers of Amplified Geotechnical Imaging are installed and retrieved. Also acted as project coordinator between field staff and project management and updated the report with applicable data.

MPCA, Marathon Vapor Mitigation System, St. Louis Park, Minnesota. Field engineer for oversight of subcontractors installing vapor mitigation system. Tasks included vapor point installation and sampling, oversight of and verification of system function and post-installation confirmation sampling. Completed report, figures and tables for State form requirements.

MPCA, Smith Avenue, St. Paul, Minnesota. Project Engineer serving the MPCA for the Smith Avenue cVOC release plume in St. Paul, MN. Residential homes were impacted by vapor intrusion to a point in which several vapor mitigation systems were required by the MPCA. The cVOC groundwater plume and associated vapor intrusion impacts are currently under investigation.

MPCA, Former Poplar Hill Investigation, Hibbing, Minnesota. Field technician for sampling indoor air quality, sub-slab vapor sampling, gauging and collecting water samples from monitoring wells and coring through concrete slabs to obtain soil samples for analysis and source area determination.

MPCA, Grub and Pub Well Installation, Hillman, Minnesota. Field engineer performing oversight of subcontractors installing a well and connecting to new equipment utilizing horizontal drilling techniques. New equipment installed including water softener, water tank and new plumbing.

MPCA, MacGillis and Gibbs Superfund Site Cost Analysis, New Brighton, Minnesota. Project engineer for identifying potential cost savings by transitioning remediation system on-site from a bio-reactor to ozone treatment. Utilizing a prior pilot study, new analytical and flow data is used to scale the pilot study to present site conditions and combined with outside vendors an annual cost is calculated.

MPCA, L.F. Knutson & Sons, Warren, Minnesota. Field engineer performing oversight of subcontractors excavating contaminated soil from a

historic storage tank leak. Soil testing is conducted on-site to determine contamination using a PID to identify clean and contaminated material. Water main replacement is observed including main isolation, removal, installation and disinfection.

MPCA, Clearbrook Well House, Clearbrook, Minnesota. Field engineer performing oversight of subcontractors constructing a new well house for the city of Clearbrook. Duties included verifying materials on-site are consistent with those specified in the spec book and that the materials are being installed correctly. Photo documentation is also performed.

ONEOK, NAPL Recovery/Elimination Pilot Testing, North Dakota. Field engineer for oversight and monitoring of two different NAPL extraction and treatment technologies for a natural gas condensate release. Tasks included monitoring and adjusting vacuum pressures at well heads, monitoring soil gas chemical composition and operating equipment safely on an active petroleum plant.

Canadian Pacific, Historic Well Abandonment, South Dakota. Field technician for oversight of subcontractors excavating areas of suspected historic wells. Maps from the early 1900's were reference to determine locations and using present day geography to locate and fill in hand dug wells and cisterns historically used to supply trains and stations with water.

Canadian Pacific, Rail Yard Storm Water Investigation, St. Paul, Minnesota. Project engineer for assisting in collecting storm and industrial sewer manhole invert elevations, pipe diameters and pipe materials. Data is used in a storm water modeling program to determine where in the network flows are restricted.

Canadian Pacific, Rail Yard Storm Water Retrofit, St. Paul, Minnesota. Design engineer for retrofitting existing storm water treatment system. Current system has been underperforming causing water to back up into the yard and failing to meet discharge criteria. Worked with Senior Engineers to design a new system to accept more water and treat to a higher level.

Chevron Environmental Management Company, Well Gauging and Sampling, Ohio. Field technician for well gauging and sampling of historic gasoline/diesel spills on Chevron properties. Data is used to determine extent of contamination and, if appropriate, effectiveness of mitigation or containment technologies.

MPCA, Artificial Wetland Berm Construction, Minneapolis, Minnesota. Project engineer for assisting in creating preliminary design to remedy flooding issues of previously constructed artificial wetland. Wetland is used to perform natural attenuation for contaminants and during high rain events is prone to flooding due to incorrectly sized sewer pipes.

AECOM

Brad W. Koons
Engineer 3

Education
BCE, Civil Engineering, University of Minnesota, MN, 1997
MS, Environmental Engineering, University of Minnesota, MN, 1999

Years of Experience: 17

Registrations
Professional Engineer - Minnesota, MN

Technical Specialties
Petroleum Site Assessment
Light Nonaqueous Phase Liquids (LNAPL)
Dense Nonaqueous Phase Liquids (DNAPL)
NAPL Conceptual Site Models
Site Strategy Development
Remediation Technology

Professional Associations
American Society for Testing and Materials (ASTM), Subcommittee E50.04 Corrective Action, Task Group on LNAPL Mobility in Sediments, March 2018 to present
American Society for Testing and Materials (ASTM), Subcommittee E50.04 Corrective Action, Task Group on Guide for Evaluating LNAPL Transmissivity. September 2009 to October 2011

Mr. Koons is a global technical expert on nonaqueous phase liquid (NAPL) site assessment and remediation. In this role he provides technical guidance on NAPL projects world-wide related to site strategy development, site investigation and assessment, and remediation technology screening and implementation. He has an extensive background in NAPL-impacted site characterization, NAPL conceptual site model development, and selection, design, and operation of soil and groundwater remediation systems. He has provided NAPL technical training to numerous regulatory agencies and actively participates in an ITRC committee that is generating best practices for LNAPL site assessment and conceptual site development. Brad has directed field research projects on LNAPL transmissivity measurement and natural source zone depletion (NSZD) and has provided technical leadership on NAPL projects in over 30 US states, Canada, Europe, Africa, Australia, Asia, and South America.

Project Experience

LNAPL Mobility Assessment Best Practices Manual, LNAPL Transmissivity Technical Bulletin, ExxonMobil. Authored a corporate best practices manual for LNAPL mobility and recoverability assessments and a technical bulletin on the benefits of using LNAPL transmissivity and appropriate LNAPL transmissivity measurement methods. These documents are used by ExxonMobil's global team of environmental remediation project managers to guide site assessment activities at LNAPL-impacted sites.

LNAPL Assessment at an Active Refinery, Alaska Led a multi-disciplinary and multi-consultant team in developing an LNAPL conceptual model and negotiating with state regulators to secure favorable LNAPL remedial objectives for the site. A structured evaluation of the LNAPL recovery program and systems resulted in increased recovery efficiency and decreased cost. LNAPL mobility, recoverability, and natural depletion were evaluated. Provided regulatory technical training to advocate for risk-based LNAPL recovery endpoints.

Site Closure Using Risk-Based LNAPL Remediation Objective Union Pacific Railroad, Chicago, Illinois. Characterize LNAPL plume geometry using laser-induced fluorescence techniques and collected petrophysical and LNAPL transmissivity data to support an advanced LNAPL mobility evaluation. The data were used to build up an LNAPL conceptual site model that demonstrated that the LNAPL plume was stable in support of a site-specific risk analysis allowing in-place management of the LNAPL impact. Met with IEPA stakeholders to discuss and gain approval of LNAPL mobility assessment approach. Project was granted closure with LNAPL in place based on demonstrated lack of mobility and risk.

Portfolio of Natural Gas Plants, ExxonMobil, Texas and Oklahoma. Technical director for a portfolio of 11 gas compressor stations in Texas and Oklahoma. The client retained environmental liability following divesture of the sites, most of which were still active facilities leading to potential, and in some cases actual, comingled contamination. Provided technical advocacy training to Texas RREC to facilitate acceptance of site closure with LNAPL

in place. 8 of 11 of the gas plants received closure from Oklahoma and Texas regulators within 3 years of project initiation.

LNAPL Transmissivity and NSZD Study, Pipeline Release Site in Victoria, Australia. Provided technical direction, training, and analysis review for an LNAPL transmissivity study and NSZD study to support development of remediation endpoints for an active LNAPL remediation system in Australia.

Multi-Plume LNAPL Remediation, RACER Trust, Buick City Site, Flint, Michigan. LNAPL technical lead for characterization and remediation of 15 LNAPL plumes at the Buick City site in Flint Michigan. Worked collaboratively with EPA Region 5 to use this site as to assess conventional and innovative LNAPL remediation approaches. This program included extensive comparative bench-scale testing of five LNAPL recovery technologies, a broad natural source zone depletion study, and LNAPL transmissivity monitoring.

Technical Trainings for Regulatory Agencies

Manitoba, Ontario, and New Brunswick Ministry of Environment, 3 training session in 2016, *Science-Based Approaches for LNAPL Management*
Minnesota Pollution Control Agency – July 2014 and May 2015. *Light Nonaqueous Phase Liquids: Transmissivity Testing Methods*
Railroad Commission of Texas – September 2013. *LNAPL Technical Training*
Illinois Environmental Protection Agency – January 2013. *LNAPL Mobility and Recoverability*
Michigan Department of Environmental Quality – June 2012. *LNAPL Site Characterization*
New Jersey Department of Environmental Protection – January 2012. *LNAPL Tracer Testing: Concept and Practice*
Alaska Department of Environmental Conservation – November 2011. *LNAPL: Theory and Application*
Minnesota Pollution Control Agency – July 2010. *LNAPL: Theory and Application*

Patents

Process for Groundwater Remediation. US Patent No. 7,476,320. Patent describes a process for enhancing aerobic bioremediation through injection of oxygenated water and the use of ozone to control biofouling in remediation systems.

Apparatus for Groundwater Remediation. US Patent No. 7,704,389. Patent describes an apparatus for creating a high-efficiency gas/liquid contactor within remediation wells and/or trenches for efficient delivery of dissolved gasses to the subsurface

Publications

Pennington, Andrew, Jonathon Smith, Brad Koons and Craig E. Divine. 2016. *Comparative Evaluation of Single-Well LNAPL Tracer Testing at Five Sites.* Groundwater Monitoring & Remediation, 36:2, pp 45 to 58.
Suthersan, Suthan, Brad Koons and Matthew Schnobrich. 2015. *Contemporary Management of Sites with Petroleum LNAPL Presence*. Groundwater Monitoring & Remediation, 35:1, pp 23 to 29.

AECOM

Amanda E. Lanning, G.I.T.
On-Site Inspector/Scientist 2/Scientist 1/Field Technician

Professional History
11/2014-present: AECOM, Minneapolis, Minnesota
02/2013 – 11/2014: AECOM, Atlanta, Georgia
05/2012 – 02/2013: USGS

Education
BS, Honors Geology (Magna Cum Laude)/2012/Georgia State University

Years of Experience
With AECOM: 5
With Other Firms: 1

Training
OSHA 40-hour HAZWOPER Certified
8 Hour HAZWOPER Refresher Training 2017
First Aid/CPR

Ms. Lanning is currently a Graduate Environmental Scientist at AECOM's Minneapolis, Minnesota office. She has 5 years of experience with a range of environmental projects, including environmental compliance audits, remediation work, and due diligence projects (including Phase I & II Environmental Site Assessments [ESAs]) for public and private sector clients. Ms. Lanning has also participated as a team member in onsite Environmental Compliance Review (ECR) site visits.

Project Experience

U.S. Postal Service/Environmental Compliance Reviews, 2013 – Present
Since February of 2013, Ms. Lanning has been an integral member of a much larger team conducting Environmental Compliance Reviews (ECRs) across the country for Postal Service Process & Distribution Centers, Network Distribution Centers, and Vehicle Maintenance Facilities. Key responsibilities for each site include an onsite environmental compliance assessment, data collection of asset/aspect information for environmentally related equipment and programs, establishing and organizing a standardized filing system, and report preparation.

For ease of data collection and archival, Ms. Lanning gained extensive experience navigating and employing USPS's environmental database and a tablet data collection application platform in order to transfer site-specific environmental data from the client database to field teams' tablet data forms to a format for final database update and entry. Ms. Lanning simultaneously conducts initial and final technical and quality data review.

Ms. Lanning coordinates directly with the senior compliance leads conducting the ECRs and the project management team, and conducts detailed quality control and assurance reviews for asset and aspect data collection and inventory. Ms. Lanning has also participated as a team member on over 20 ECRs.

Chevron Environmental Management Company/Midwest and Southwest Regional Remediation Sites, 2015 – Present
In support of this regional portfolio of Chevron clean-up sites, Ms. Lanning has compiled and reviewed monitoring, investigative, and remedial reports for numerous sites spanning through several states pursuant to Environmental Laws as directed by regulators/regulations, under consent order, and/or by Chevron contract obligations needed to protect the public or environment. These activities have included conducting the initial research into remediation programs specific to state and local regulatory requirements, report writing, analytical data assessment, quality review, and final deliverable submittal to relevant regulatory agencies.

BNSF Railroad, Environmental Audit Program, 2015 – Present
Since May of 2015, Ms. Lanning has been an integral member of a much larger team conducting Environmental Audits across the country for BNSF Railroad facilities. Key responsibilities for each site include an onsite environmental compliance assessment and report preparation.

Ms. Lanning coordinates directly with the senior compliance leads conducting the audits and the project management team, and is responsible

for compiling notifications, collecting relevant environmental records prior to the audits, and all final report uploads and submittals. Ms. Lanning has also participated as a team member on a local audit in August of 2017.

Phase I and Phase II ESAs, 2013 – Present
Ms. Lanning has participated in the completion of Phase I and Phase II Environmental Site Assessments at various properties in Georgia, Minnesota, and North Dakota.

Phase I activities included: review of existing environmental data concerning the site and surrounding properties; walk-through of the site; meetings with property owners of the site and surrounding sites; review of existing property information; and preparation of final report and recommendations. In addition, since October of 2014, Ms. Lanning has been a key contributor to four corridor Phase I reports for MnDOT and the City of Minneapolis, all of which have resulted in subsequent Phase II Drilling Investigation reports.

Phase II activities included: collecting soil and groundwater samples; data quality control and review; creating soil logs; and preparation of final report and recommendations.

Valspar, SARA 312 Reporting, Facilities across U.S., 2017
Completed SARA 312 Tier II chemical inventory reports for several paint production plants around the United States. Reporting tasks included verifying submittal requirements for State Emergency Response Commissions, Local Emergency Planning Committees, and local fire departments; identifying anomalous data; entering data into state online databases or the Tier2Submit software program; and preparing cover letters for submittals**.**

U.S. Steel / Geotechnical Borings, 2015
Ms. Lanning assisted in the supervision over geotechnical drilling activities at U.S. Steel Corporation's former Duluth Works Facility. Ms. Lanning's duties included logging boreholes and collecting disturbed and undisturbed (Shelby Tubes) geotechnical soil samples. Following completion of field work, Ms. Lanning conducted soil boring log review and compilation.

Publications

Williams LJ, Raines JE, Davis JB, Lanning AE. (2013) "Geophysical Log Database for the Floridian Aquifer System and Southeastern Coastal Plain Aquifer System in Florida and Parts of Georgia, Alabama, and South Carolina." US Geological Survey Data Series 760.

AECOM

John Lapointe, PE
Engineer 4/Engineer 3

Education
BS, Engineering Operations, Iowa State University, Ames, Iowa 1978

Licenses/Registrations
Professional Engineer, Minnesota, #21143, 1991
Professional Engineer, Iowa, #12125, 1991

Years of Experience: 39

Professional Associations
American Water Works Association (Chair of the MN Section AWWA 2005 – 2006)
AWWA International Membership Committee (1998 – 2002)

John Lapointe has been involved in the water system engineering field since 1978. His experience with the Iowa Department of Natural Resources (IDNR) and Minnesota Department of Health (MDH) included performing inspections of water treatment facilities and reviewing plans and specifications for compliance with state regulations and standards. He provided potable water treatment system design services to municipal, state and federal clients while employed at consulting firms in Iowa and Minnesota. He has expertise in the field of industrial water treatment, in particular the design of cold lime softening systems for industrial applications. He assisted on pilot studies which were used to develop the process for radionuclides removal using hydrous manganese oxides (HMO) treatment.

Some of John's water treatment, storage and distribution system experience is provided in the project summaries below.

Project Experience

Municipal Water Treatment

Minneapolis Water Works, Columbia Heights Membrane Filtration Plant, Minneapolis, Minnesota. Provided construction engineering services on the $80 million ultrafiltration membranes treatment facility.

Minneapolis Water Works, Rehabilitation of Pump No. 14, Pump Station No. 4, Minneapolis, Minnesota. Project Engineer on the design and installation of a new 30 MGD centrifugal pump. Project included the installation of a new 1500 HP motor and a new 30-inch diameter ball valve.

Minneapolis Water Works, Lagoon Overflow Treatment Plant, Minneapolis, Minnesota. Provided construction engineering services for a $1.6 million addition to the waterworks to accommodate recycling of the supernatant from the on-site lime sludge lagoons.

Chicago South Water Treatment Plant Facilities Planning, Chicago, Illinois. Project Engineer on a study of the 480 MGD Chicago - South Water Treatment Plant to identify capital improvement needs and associated costs.

Saint Paul Regional Water Services, Water Treatment Plant Aquatic Invertebrate Study, Saint Paul, Minnesota. Project Manager on an investigation to determine the sources of an infestation of aquatic invertebrates (caddis and midge flies) in the water treatment system. Prepared a report containing recommendations for controlling the aquatic invertebrate infestations.

Mankato Water Treatment Plant Lime Sludge Handling Facility, Mankato, Minnesota. Design Engineer for site work and Construction Manager for entire project which involved a new lime sludge filter press dewatering system.

Hutchinson Ground Storage Reservoir and Well No. 8, Hutchinson, Minnesota. Project Engineer for a 1.5 MG prestressed concrete water storage reservoir and 1100 GPM water supply well.

Robbinsdale Water Treatment Plants Upgrades, Robbinsdale, Minnesota. Design and Construction Engineer for the rehabilitation of three (3) iron and manganese removal horizontal pressure filtration plants.

Preliminary Engineering Report on Radium Removal, Forest City, Iowa. Prepared a report which evaluated options for radium removal including; lime softening, ion exchange softening, reverse osmosis and hydrous manganese oxides (HMO) treatment.

Federal Government Water

Ellsworth Air Force Base Water System Improvements, US Army Corps of Engineers – Omaha District. Design Engineer for a series of water system improvements projects including a comprehensive study of the water distribution system, major water main improvements, and a new booster station serving the high pressure zone at Ellsworth AFB.

Industrial Water Treatment

ICM Ethanol Plants – High Purity Water. Approximately 100 dry grain ethanol plants have been constructed across the United States using the ICM plant design. These ICM designed ethanol plants were provided with a high pressure boiler. Feed water for the boilers was treated by a combination of Reverse Osmosis (RO) and Ion-Exchange (IX) water treatment units. Assisted on the design and installation of a majority of the high purity water systems serving ICM designed ethanol plants.

Pacific Ethanol Inc. (PEI) Ethanol Plants – High Purity Water. Four (4) dry grain ethanol plants were constructed by Pacific Ethanol Inc. in California, Idaho and Oregon using a plant design provided by the engineering firm Ford, Bacon and Davis (FB&D). All FB&D designed ethanol plants were provided with a high pressure boiler. Feed water for the boilers was treated by a combination of Reverse Osmosis (RO) and Ion-Exchange (IX) water treatment units. Assisted on the design and installation of the high purity water systems serving the PEI ethanol plants.

Cold Lime Softening Treatment Systems For Ethanol Plants. Provided process design and operational assistance on nine (9) cold lime softening systems ranging in size from 1.0 MG to 2.0 MG serving ethanol plants across the United States. Treatment components included solids contact clarifiers, gravity filters, lime feed systems and solids dewatering facilities.

Zero Liquid Discharge Treatment System, Bushmills Ethanol, Atwater, Minnesota. Design Engineer and Project Manager for a 1.0 MGD cold lime softening water treatment system which allows the ethanol plant to operate under integrated zero liquid discharge conditions.

Horizontal Pressure Filter Treatment Systems For Ethanol Plants. Design Engineer for a 1.7 MGD horizontal pressure filter serving the Columbia Pacific BioRefinery in Clatskanie, Oregon and a 1.5 MGD horizontal pressure filter serving the White Energy ethanol plant in Hereford, Texas.

Agrium Industries, Borger, Texas. Project Engineer on a complete water balance study conducted at the Agrium Industries nitrogen fertilizer manufacturing facility in Borger, Texas. Industrial wastewater re-use opportunities were presented for discharge streams including RO concentrate and cooling tower blowdown.

Wacker Chemicals, Adrian, Michigan. Project Engineer on a complete water balance study conducted at the Wacker Chemicals silicones

manufacturing facility in Adrian, Michigan. Industrial wastewater re-use opportunities were presented for discharge streams which included RO concentrate and cooling pond effluent.

Starbucks – Evolution Fresh. Project Engineer on a comprehensive water use study to determine how much water is being used and discharged. Water mass and ionic balances were developed. The water balances were used to determine the means/methods required to comply with discharge limitations imposed by the City of Rancho Cucamonga and the Inland Empire Utilities Agency (IEUA). The water study led to the design and construction of an industrial wastewater treatment and re-use system.

AECOM

Catherine M. Larson
Scientist 2/QAQC Officer (Scientist 2)

Education
BS, Chemistry, University of Wisconsin, Green Bay, 1986

Years of Experience
With AECOM: 30

Training and Certifications
First Aid/CPR
HAZWOPER 40-Hour Training
HAZWOPER 8-Hour Refresher Training

Environmental chemist with over 30 years of experience at sites with soil and groundwater contamination. Responsibilities include project planning, data evaluation, data validation, report preparation, quality control, and client/agency liaison. Project experience ranges from Brownfield investigations to multimillion-dollar federal remediation contracts.

Project Experience

Minnesota Pollution Control Agency (MPCA), Ray's Truck Stop Lakeland, Minnesota. Completed the Site Conceptual Model (SCM) which ultimately provided the documentation to allow Site closure. The Site had been the focus of several investigations over time, in part because it was considered to be a source for an area wide groundwater plume in the City of Lakeland and Lakeland Shores. The SCM summarized data and investigation results performed since the early 1990's to show that impacts from the Ray's Site were relatively localized and Site closure was recommended (2017).

Minnesota Pollution Control Agency (MPCA), Pig's Eye Landfill Annual Monitoring Report. Authored the 2016 report which evaluated the use of "select fill" in reducing concentrations of perfluorochemicals (PFCs). PFCs are present in groundwater beneath the landfill but groundwater data shows that concentrations are reduced as they migrate through the select fill material, installed in 2001-2002, to limit contaminant migration from the landfill to Pig's Eye Lake. The conclusion that contaminant reduction occurred was the basis for a treatability study being completed to determine if expanded use of select fill at the Landfill could further improve water quality at Pig's Eye Lake (2017).

Department of the Navy, Mid-Atlantic, Naval Industrial Reserve Ordnance Plant (NIROP), Fridley, Minnesota. Project Chemist responsible for all aspects of the analytical data. Project work has included authoring a Quality Assurance Project Plan using the UFP QAPP format for a trichloroethene (TCE) source investigation, contracting the laboratory, and validating and presenting the results. Other analytes of interest have included chromium and hexavalent chromium in soil. Data validation is also completed for the site's annual long term monitoring events. Regulatory oversight is provided by the Minnesota Pollution Control Agency and USEPA Region 5. [10/2012 – present]

Minnesota Pollution Control Agency (MPCA), MacGillis and Gibbs Superfund Site, New Brighton Minnesota. Authored the fourth Five-Year Review.

US Environmental Protection Agency, Region 1, Participated on the validation team for the Phase I and Phase II sampling efforts for the Walton & Lonsbury Superfund Site in Attleboro Massachusetts. Performed the Tier 1 Plus Stage 2B and Tier 2 Stage 3 electronic/manual data validation, or senior level review of the validation, for approximately 40 data packages for metals analysis in both soil and water. Contract laboratory program (CLP) analyses were performed using ICP/MS and ICP/AES as well as modified

CLP analyses for mercury and cyanide. [2014]

Minnesota Pollution Control Agency (MPCA), Site Assessment Program. Authored the Quality Assurance Project Plan (QAPP) for the Minnesota Superfund and Site Assessment Program. In addition to the MPCA, the document was approved by USEPA Region 5. [2014]

U S Army Engineers District, Alaska, Remedial Investigation and Limited CON/HTRW Removal, Caton Island, Alaska. Project Chemist responsible for all aspects of the analytical data. This included authoring the Quality Assurance Project Plan using the UFP QAPP format, contracting the laboratory and validation companies, and overseeing the presentation of results. Site work included removal of all potential sources of contamination to include above ground storage tanks, drums and contents, fuel cans, batteries, lead wire, transformers, dynamite, and any contaminated soil or sediment. Samples were collected to delineate remaining on-site contamination and included on-site screening for petroleum, lead, and PCBs as well as off-site laboratory analysis. The remote location of the site required an on-site camp to support site activities which added to communication and sample management challenges. [10/2011 – present]

AFCEE, Confirmatory Sampling at the New Class III Landfill and Soil Washing Area, Port Heiden Radio Relay Station, AK. Project Chemist responsible for confirmatory PCB sampling at approximately 350 soil sample locations. Authored the Quality Assurance Project Plan and coordinated laboratory procurement and USEPA Level IV data validation through a third party consultant. Oversaw preparation of analytical data tables, analytical data packages, and chemical quality assurance reports. The project had high potential for litigation and analytical results were requested by EPA's National Enforcement Investigations Center. [3/2101-1/2011]

US Army Corps of Engineers - Omaha District, ERSC - Nuclear Reactor Site Sundance AFS, Wyoming. Project manager for annual long-term monitoring and for site closure activities at the former nuclear reactor site decommissioned in 1969. Closure activities included radiological clearance and disposal of drummed liquids and soils generated during site investigations and preparation of closure documents for regulatory approval. Annual monitoring included collection of surface soil and groundwater samples at and near the top of Warren Peak. Managed monitoring for radiologic contamination on persons and equipment exiting the Air Force-owned portion of the site. [03/2008 - 2012]

Enbridge Energy, Marshall, Michigan Pipeline Release. Co-ordinated the Monthly Progress Report which documented all activities conducted to support the cleanup efforts for an oil spill into the Kalamazoo River. On-site workers numbered approximately 600 and multiple consultants submitted text, tables, and figures for the report. [7/2011 – 9/2011]

US Air Force, Soil and Groundwater Analysis, Clear AFB, Alaska. Project Chemist responsible for several projects at Clear AFB including the Phase II Remedial Investigation at Site 15 (Lake Sansing), the Release Investigation at Site 26, and the In-Situ Pilot Test at Former UST 37. Responsibilities included establishing chemical QA/QC procedures in the project work plans, laboratory procurement, coordination between the samplers and the laboratory, assessment of chemical data quality including chemical data validation in compliance with USEPA Level IV functional guideline requirements, development of chemical quality assurance reports, and authoring the Supplemental Remedial Investigation, Former Underground Storage Tank 37. Work was conducted under guidance from the AFCEE QAPP and the Alaska Department of Environmental Conservation (ADEC) checklists. [4/2008 – 11/2011]

AFCEE, Remedial Action – Site Cleanup Point Lay Long Range Radar Station Deactivated Landfill Site LF001, Point Lay, AK. Project Chemist responsible for analytical data quality and reporting for the site. LF001 was a deactivated landfill located along the coastline of the Arctic Ocean. Investigation work was conducted in 2009 and removal of contaminated debris for disposal at a Subtitle C or D landfill, as appropriate, occurred in 2012 and 2013. Analytical testing for volatile organics, metals, gasoline and diesel range organics and polynuclear aromatic hydrocarbons was completed with a three day turnaround time to aid field logistics. [2009 – present]

US Army Corps of Engineers, TERC Cleanup, Ellsworth AFB, South Dakota. Senior Chemist for the $45 million cleanup at this Superfund site. A wide variety of analytical work was required at the base to support restoration activities that included investigation and remedial design. Developed sampling and analysis plans and quality assurance project plans which established procedures for chemical sampling procedures, QA/QC requirements, and project Data Quality Objectives (DQOs). Reviewed and interpreted the analytical results to recommend changes to the monitoring program and the remediation systems. Coordinated these recommendations with the Air Force, the EPA, and the state of South Dakota. Chemicals of concern included VOCs, metals, petroleum products, and radiological wastes. [1996 – 2005]

Hennepin County, Hamel Road Phase II Investigation, Medina, Minnesota. Project manager for a soil and groundwater investigation at a commercial-industrial property, which included 12 soil borings, three temporary groundwater wells, and a half day of test pits. Managed analysis of samples for volatile organic compounds (VOCs), semi-volatile organic compounds, and priority pollutant metals. Work was conducted under the Brownfield's assessment grant program. [12/2006 - 06/2007]

Federal Cartridge Corporation, Twin Cities Army Ammunition Plant - Outdoor Firing Range, New Brighton, Minnesota. Project chemist and field manager for a Phase II remedial investigation to determine the extent of lead contamination in soils. Developed an approach to evaluating quality control information for lead results (obtained using a field screening technique), which convinced regulators that the screening results could be used to meet project objectives. This greatly minimized the number of samples for the project. Subcontractors included an unexploded ordnance company and drilling contractors. [2005]

AECOM

Craig B. Larson
Scientist 2/QAQC Officer (Scientist 2)

Professional History
02/1991 - Present, AECOM Senior Geologist/Project Manager
09/1989 - 02/1991, Capsule Environmental Engineering, Inc.
03/1989 - 09/1989, Warzyn Engineering, Inc.
02/1986 - 03/1989, DPRA, Inc.

Education
BS, Geology, University of Minnesota, 1986

Years of Experience
With AECOM: 27
With Other Firms: 5

Registrations
Professional Geologist, Minnesota

Professional Affiliations
Minnesota Groundwater Association

Training
OSHA HAZWOPER 40-Hour Training
OSHA HAZWOPER 8-Hour Refresher Training
First Aid/CPR

Mr. Larson serves as project manager and task manager for the Minneapolis Environmental Services Department. His professional training is in groundwater geology. He has over 25 years of experience in a wide range of environmental projects including CERCLA remedial investigation and feasibility studies, phase I and phase II property assessments, RCRA compliance, and long-term monitoring programs. He has managed small projects such as underground storage tank clean-ups and voluntary cleanups for private sector clients and large CERCLA and RCRA sites for the US Department of Energy and US Department of Defense.

Project Experience

MPCA Multi-Site Contract. Provided technical assistance for the Spring Park, Ray's Truck Stop, 3M and the Pigs Eye Landfill sites. Responsibilities included well construction specifications, interpretation of groundwater flow conditions and quality, and reporting.

Canadian Pacific Railway. Managed multiple projects in the midwest including Phase I and Phase II Environmental Site Assessments (ESAs) for over 20 sites, Development Remedial Action Plans (preparation and implementation) for construction activities at contaminated railroad yards, Limit Site Investigations for the MPCA's Petroleum Program, and well investigation and sealing activities for historic wells on railroad right-of-way associated with supplying water to steam locomotives.

Honeywell International, Hydrogeologic Investigation and Remediation, Minneapolis, Minnesota. Project manager and lead hydrogeologist responsible for the investigation and remediation of chlorinated solvents under the MPCA VIC program. Established a groundwater monitoring program and completed a remedial system pilot system study for an air sparge/soil vapor extraction system. Following successful completion of the pilot system, installed a full-scale air sparge/soil vapor extraction system at the site's downgradient property boundary to prevent off-site migration of impacted groundwater.

Federal Cartridge Corporation, Twin Cities Army Ammunition Plant - Outdoor Firing Range, Phase II Site Investigation, New Brighton, Minnesota. Managed a Phase II remedial investigation for the range, which was used for testing of small ammunition from 1943 to 1974 and comprised an area of several hundred acres. The primary constituent of concern was metals, especially lead, from bullet casings. Managed interpretation and validation of soil X-ray fluorescence (XRF) data collected during the Phase I investigation, ordnance clearance, and collection analysis and interpretation of subsurface soil and groundwater samples. The project was performed on an accelerated schedule to meet federal contract limitations.

Honeywell International, Wetland Monitoring, Plymouth, Minnesota. Project manager for NPDES monitoring program of wetlands associated with an industrial outfall. Managed chemical analysis and surveys of the biota. Designed and implemented a program to monitor the wetlands following a release of hydrogen peroxide. The study showed no long-term impacts due to the release.

US Air Force - 934 Combat Squadron, Long-Term Monitoring,

Minneapolis, Minnesota. Project manager and lead hydrogeologist responsible for the development and implementation of a long-term groundwater and surface water-monitoring program at an abandoned landfill that accepted mixed refuse and industrial wastes. Involved in the preparation of the remedial design/remedial action (RD/RA) plan for this Superfund site.

US Army Corps of Engineers, Omaha District, TERC 1 - Site Inspection, Scoping Survey and Hazardous Material Management, Sundance Radar Station, Wyoming. Task manager for a preliminary assessment and site inspection (PA/SI) for the inactive station, which was powered by a nuclear reactor that was decommissioned in the late 1960s. Portions of the reactor were entombed in place. Also managed activities associated with non-radiologic aspects of the radar station, which included disposal of hazardous waste discovered in underground tank. Designed an updated groundwater monitoring system for the reactor, which was located atop a mountain peak and required specialized well installation methods. Directed a geophysical study to locate preferred flow pathways in the bedrock to site the wells.

US Army Corps of Engineers, Omaha District, TERC 1 - CERCLA Monitoring and Remediation, Ellsworth AFB, South Dakota. Task manager responsible for several delivery orders, including the design and implementation of the long-term operations and monitoring program for nine operable units and one area of concern. Monitored the efficiency of the groundwater remediation systems and managed quarterly sampling of more than 100 groundwater wells. Task manager for the preparation and implementation of a preliminary assessment and site inspection (PA/SI) for the Badlands Bombing Range. Remediated a former water treatment building, which contained hazardous wastes.

Temrock Metals, Spill Assessment, Medina, Minnesota. Developed a sampling program to monitor the release of hydraulic press oil to the facility's septic system and drain field. The program successfully showed that the release had no long-term impact to the environment.

Renville County Sanitary Landfill, Hydrogeologic Assessment, , Minnesota. Prepared a supplemental hydrogeological evaluation report for an existing solid waste sanitary landfill. The assessment provided a detailed evaluation of a deep boring that extended through several glacial stratigraphic units to determine if there was a potential for a continuous unit to act as a migration pathway for landfill contaminants. The report concluded that there was limited potential due the low permeability of the units and the depositional environments noted in the boring were not conducive to being laterally extensive.

AECOM

B. J. LeRoy, PG
Scientist 2

Education
BS, Geology and Geophysics
University of Wisconsin

Years of Experience
With AECOM: 25
With Other Firms: 0

Registrations
Professional Geologist, WI
Professional Geologist, IL
Professional Geologist, MN (lapsed)

Professional Affiliations
National Groundwater Association
Wisconsin Groundwater Association

Awards
Chrysler Gold Award

Mr. LeRoy is a project manager and geologist responsible for landfill design, investigation and remediation projects and reports.

He has over 25 years of experience in environmental consulting primarily relating to;

- landfill development and investigation;
- environmental statistics;
- groundwater modeling and investigation;
- contaminated groundwater, surface water and sediment;
- groundwater and sediment remediation;
- data management.

Mr. LeRoy's focus is providing organization and clarity to large data sets, in order to simplify and produce solutions. His areas of expertise include landfill design, conceptual site models, site investigation, hydrogeologic data analysis, fate and transport modeling, project management, remedial design, and regulatory compliance for site remediation and development.

His experience ranges from statistics to landfill design negotiation, monitoring design, wastewater treatment plant closure to landfill remediation, groundwater modeling to database programming. He also has expertise in presentation graphics, website design and negotiation.

Select Experience

Department of the Navy, Naval Station Great Lakes, Illinois. Project manager and senior technical lead for RI/FS through risk assessment, remedial design and closure of two former waste dumps at the station. Designed, scoped and oversaw the field investigation of unknown dump sites. Followed process through remedial design, and project is on-going through the public comment and closure process.

Village of Grafton, Lime Kiln Park, Grafton, Wisconsin. Designed and managed the investigation for closure of an unregulated landfill. Demonstrated the difference between two overlapping contaminant plumes and reduced client liability to only one plume. Negotiated a natural attenuation remediation system to satisfy regulatory requirements. Awarded reimbursement through state grant package. Coordinated efforts by Village, attorneys, and PRP group. Further retained by the Village to investigate the second plume and successfully merged the two sites into one monitoring program moving toward closure.

- **Metropolitan Council, Metro Wastewater Treatment Plant.** Technical Lead for groundwater modeling project used to predict site performance during catastrophic flooding. Used Metro Model to refine a site model that used the complex underdrain and relief well system to predict groundwater levels during river flood stage.

- **Confidential Landfill Client, Illinois.** Responsible for managing geo/hydro portion of 350-acre landfill design. Designed the site investigation/monitoring plan, oversaw field work, wrote geology/hydrogeology portion of the application, managed team of a dozen professionals to complete the report submittal. Completed legal support during site location hearings, including data management,

research and simplifying complex geologic/hydrogeologic conditions. Completed similar work at various sites.

- **Confidential Landfill Client, Wisconsin.** Completed landfill expansion investigations at various sites in Eastern Wisconsin. Completed site investigation, feasibility studies, engineering support, monitoring plan design and regulatory negotiation. Completed investigations near sensitive environments (endangered species, fens, wetlands) to complete landfill and preserve habitats. Designed monitoring programs and investigated multi-layered geologic systems for representative monitoring.

- **Chrysler Corporation, Private Site, Geologic and Hydrogeologic Monitoring Model.** Created 3-dimensional model for generation of plume maps and monitoring results at a closed landfill. Completed over 100 cross sections and plan views for export to PowerPoint presentation. Determined that solvent plume was not the responsibility of the client, based on generated flow nets and groundwater statistics. Mapped 3D plumes in EVS. Prepared presentation graphics for regulatory agencies.

- **Department of the Navy, Ford Island (Pearl Harbor) Landfill, Groundwater/Surface Water Statistical Analysis.** Developed statistical analysis of groundwater/surface water interaction at the Pearl Harbor landfill. Completed analysis to be used for negotiating closure and reduced long-term monitoring plan. Investigated tidal influence, groundwater/surface water interaction, trends in water chemistry and signature of contamination. Showed that the landfill was not responsible for contamination in the harbor.

- **Confidential Steel Industry Client, Illinois.** Project Manager and Technical Lead for new and existing landfill development at an active steel production facility. Completed three dimensional groundwater flow and transport model to predict aquifer conditions for 100 years. Completed landfill development permit including long-term monitoring plan and background statistics related to existing facilities. Negotiated with regulator on permit application comments. Consulted with engineering staff to adjust landfill design to include and satisfy regulatory requirements.

- **Conoco-Phillips, Golden Eagle Refinery, San Francisco, California.** Completed one- and two-dimensional soil and groundwater models to mimic monitoring results and predict contaminant future transport at 31 closed landfills at the coastal facility. Modeled and monitored sediment, surface water, groundwater and soil contaminant migration.

AECOM

Leo B. Linnemanstons
Scientist 2

Professional History
05/2005 - Present, AECOM Senior Scientist, Project Manager
09/1994 - 03/2005, Warzyn/Montgomery Watson Hydrogeologist

Education
MS, Hydrogeology, University of Wisconsin - Milwaukee, 1994
BS, Geology, Lawrence University, 1991

Years of Experience
With AECOM: 13
With Other Firms: 11

Registrations
Professional Geologist, Wisconsin

Professional Affiliations
American Water Resources Association
Wisconsin Ground Water Association

Training
e-RAILSAFE Certified
OSHA 40-Hour HAZWOPER Training

Certifications
First Aid for Adults and CPR Certified

Mr. Linnemanstons has over 24 years of experience conducting hydrogeologic and environmental investigations relating to assessment of soil and groundwater quality and contamination problems, local and regional groundwater supplies, construction dewatering, and modeling of complicated groundwater flow systems. He is responsible for project management and specializes in hydrogeologic studies, environmental assessments, transaction due diligence, environmental restoration, and environmental management.

Project Experience

Project Manager for former municipal landfill, Hartford, Wisconsin. Directs and evaluates the long-term groundwater monitoring program performed for the landfill with a large chlorinated VOC groundwater problem. Developed and task managed investigation for the former landfill that included a soil gas survey, geophysical surveys, a hydraulic probe investigation, installation and hydraulic testing of numerous monitoring well nests, vertical groundwater profiling with an on-site laboratory. Investigation successfully characterized the magnitude and extent of soil and groundwater contamination as well as the hydrogeology of the site. Developed a three-dimensional groundwater flow model that was used to predict contaminant fate and transport and to develop remedial options. Remedies also included the installation of passive landfill gas trenches to mitigate for potential gas migration towards encroaching residential development.

Project Manager for former municipal landfill, West Bend, Wisconsin. Directs and evaluates groundwater monitoring and extraction system performance for the landfill with a large chlorinated VOC groundwater problem. Also, oversaw modifications and improvements for the landfill gas extraction system to reduce operational costs while maintaining effective landfill gas control. Task manages the monitoring program and is responsible for required reporting of results. Also, led the investigations to improve understanding of hydrogeologic conditions and for the installation of additional groundwater extraction wells to reduce the remediation time-frame.

Project Manager for former municipal landfill, Fontana, Wisconsin. Developed and task managed investigation for the former landfill that included a landfill gas study, geotechnical assessment, a landfill cover survey, installation and hydraulic testing of monitoring wells. Investigation successfully characterized the waste mass and defined the magnitude and extent of environmental impacts. Prepared application for the site to enter the State of Wisconsin's Voluntary Party Liability Exemption (VPLE) Program.

Project Hydrogeologist for a former landfill, industrial client, Cedarburg, Wisconsin. Developed work plans and directed field work for groundwater sampling and a multimedia investigation of a former landfill that had offsite impacts to numerous private wells. Evaluated contaminant migration in challenging geologic setting of heterogeneous glacial deposits overlying fractured dolomite and limestone bedrock.

AECOM

Project Hydrogeologist for hydrogeologic studies at a landfill complex, Germantown and Menomonee Falls, Wisconsin. Evaluated and provided technical guidance on the performance and operation of two separate groundwater collection/extraction systems. One extraction system controls groundwater migration through fractured dolomite bedrock that is bisected by a regional fault. The other system controls migration in discontinuous sand layers that required multiple screen intervals. These evaluations have led to system upgrades that improved performance and reduced costs.

Project Manager for agrichemical site remediation, Morrisonville, Wisconsin. Conducted a remediation of agrichemical impacted soil at an abandoned facility that formerly stored fertilizers in a leaky warehouse and was known to have caused nitrogen impacts at an adjacent municipal well. Negotiated an alternate cleanup goal for the site that reduced the volume of impacted soils to be excavated. Located and negotiated with local landowners on behalf of the client to secure the needed land use agreements for landspreading. Excavation and landspreading of approximately 2,000 cubic yards of nitrogen impacted soils was completed in just five days including the site restoration and tilling.

Agrichemical Client, Site Investigation, Germantown, Wisconsin. Conducted a site investigation to evaluate agrichemical impacts at an abandoned facility that formerly stored pesticides and mixed liquid fertilizers. Since the facility was overgrown with brush and had dilapidated buildings, demolition work and clearing of debris was required. In addition, the site was adjacent to a petroleum-contaminated site that had caused impacts to the facility property. Worked with the adjacent property owner, their consultant, and state regulators to coordinate site activities regarding the adjacent site and the agrichemical site. Resolved issues involving the discovery of various buried concrete structures containing pesticide-contaminated coal residue and a supply well with petroleum contamination.

Project Hydrogeologist for manufactured gas plant site investigations, multiple sites in Wisconsin and Iowa. Developed site investigation work plans to determine the magnitude and extent of multi-phase contaminants in complex hydrogeologic environments. Investigation elements often include unconsolidated soil and bedrock investigations as well as river sediment characterization. Technical challenges included well installations in fractured bedrock aquifers with multiple levels of nonaqueous phase liquid contaminants requiring nested casings to prevent cross-contamination. Successfully, completed site investigations that led to cost-effective remedial actions.

AECOM

James McCoy
Scientist 1/GIS & CADD Specialist/Field Technician

Professional History
06/2016 - Present, AECOM, Staff Geologist
05/2015 – 06/2016, Veolia, Environmental Specialist II

Education
BS, Geoscience, University of Wisconsin-Stevens Point

Registrations
Asbestos Inspector/MN
Asbestos Contractor Supervisor/MN DOT Hazmat

Years of Experience
With AECOM: 2
With Other Firms: 1

Training
OSHA HAZWOPER 8-Hour Refresher Training
OSHA HAZWOPER 40-Hour Training
BNSF Certification
e-Railsafe Certification

James McCoy is a Staff Geologist in AECOM's Minneapolis, Minnesota with three years of professional experience. His duties at AECOM have included environmental construction monitoring, soil, surface water, and groundwater sampling, environmental data management and analysis, and draft report preparation. Mr. McCoy also provides Geographic Information System (GIS) support for various environmental and transportation projects.

Project Experience

Subsurface Investigation and Remedial Pilot Testing and Remediation System O&M, Confidential Client, Western North Dakota (2016 – Present): Mr. McCoy has been in all facets of investigation and remediation of a large gas condensate release in western North Dakota. His duties have included drilling oversight (logging and soil sample collection), groundwater monitoring (well gauging and sampling), operation and maintenance of a light non-aqueous phase liquid (LNAPL) recovery system and remedial pilot testing to enhance LNAPL recovery efforts.

Subsurface Investigation and Construction Monitoring, Red Wing Bridge Project, Red Wing, MN (2016 - Present). Mr. McCoy was responsible for directing a subsurface investigation of the Red Wing Bridge project corridor to assess the project limits for the presence of compounds of concern prior to the start of construction. He supervised both Direct Push Technology (DPT) and sonic drilling methods during this investigation. He is also a participant in AECOM's on-going environmental construction monitoring effort during the construction season. In this capacity, he was responsible for field screening and directing segregation of non-impacted and impacted/debris soils excavated during construction. Other responsibilities included collecting soil, water and waste samples.

Construction Monitoring, TH 4 Corridor, St. James, MN (2017-Present). Mr. McCoy was one of AECOM's lead environmental field staff to provide environmental oversight during roadway reconstruction and construction of new storm water, sanitary sewer, and water main services in the TH 4 corridor. James assured that provisions of the Response Action Plan (RAP) and Construction Contingency Plan (CCP) were executed by MnDOT's contractor team. Mr. McCoy has performed traditional impacted soil monitoring, documenting soil conditions and directing the segregation of petroleum-impacted material encountered during construction-related excavation. He was also responsible for assessing and sampling suspect debris and abandoned utilities for the presence of asbestos-containing material.

Construction Monitoring, TH 149 High Bridge, St. Paul, MN (2017-Present): Mr. McCoy is leading the construction oversite activities to the construction of TH 149 High Bridge in St. Paul, MN. His primary role involved field screening impacted and non-impacted/debris soils encountered during micropile installation. Mr. McCoy also performed environmental soil sampling from the derived soil waste for disposal, conducted soil monitoring during construction-related excavations and regulated materials sampling to assess buried debris for the presence of asbestos waste-containing material.

Construction Monitoring, I-35E Corridor, St. Paul, MN (2016 to 2017). Mr. McCoy was a participant in AECOM's on-going environmental construction monitoring effort on the I-35E Cayuga project in St. Paul, Minnesota during the 2016 and 2017construction seasons. In this capacity, he was responsible for field screening and directing segregation of non-impacted and impacted/debris soils excavated during construction. Other responsibilities included collecting soil and water samples and supervising the abandonment of groundwater monitoring wells installed within the Cook/Cottonwood storm water retention pond complex.

Construction Monitoring, 29th Street Reconstruction, Minneapolis, MN (2016). Mr. McCoy assisted in construction oversite activities connected to the reconstruction of an oil-dirt road along 29th street in Minneapolis, Minnesota. In this role, James was responsible for monitoring construction-related excavation for the presence of staining and other field indicators of contamination. Other responsibilities including coordination with City of Minneapolis Public Works personnel for temporary stockpiling of impacted soil.

Soil Vapor Intrusion Assessments, Multiple Residential Households, Minneapolis and St. Paul, Minnesota (2016-Present): Working under the Minnesota Pollution Control Agency's orphaned site program, Mr. McCoy continues to serve on the AECOM team tasked with the collection of indoor and outdoor soil vapors samples throughout various sites in Minneapolis and St. Paul. Mr. McCoy interviewed home owners for information on their household and analyzed the property to determine optimal placement of soil vapor intrusion samples.

Phase II Investigation, TH 99 St. Peter Project Corridor, St. Peter, Minnesota (2016). Mr. McCoy led all Phase II ESA field activates during a subsurface investigation along a section of TH 99 in St. Peter, Minnesota. Mr. McCoy classified soil samples collected during DPT drilling activity according to U.S.C.S specifications. Mr. McCoy Collected soil samples from appropriate depths as specified by the Minnesota Department of Transportation. Contaminants of concern identified through this investigation included volatile organic compounds (VOCs), petroleum hydrocarbons, metals, and polycyclic aromatic hydrocarbons (PAH) in soil.

Phase II Investigation, I-35W MnPass North Project, Roseville to Blaine, Minnesota (2016-Present): Mr. McCoy maintains principal field data collection and database management responsibilities for an on-going hydrogeologic investigation within the I-35W/I-694 Interchange. The purpose of the study is to evaluate the distribution and magnitude of vinyl chloride (VC), pentachlorophenol (PCP) and other contaminants of concern in a proposed storm water retention improvement area. James has also served as a task manager on this project through his participation in the generation of tables, exhibits, soil boring logs during generation of Phase II ESA deliverables.

AECOM

Petros Paulos
On-Site Inspector/Scientist 1/GIS & CADD Specialist/Field Technician/Engineer 1

Professional History
06/2016 - Present, AECOM Engineer in Training
05/2014 - 09/2014, Geronimo Energy Solar Intern
05/2008 - 09/2008, University of Saint Thomas Research Assistant

Education
MS, Civil Engineering (Environmental Engineering), University of Minnesota - Minneapolis, 2015
BS, Environmental Science, University of St. Thomas, 2012

Registrations
Engineer in Training, Minnesota

Years of Experience
With AECOM: 2
With Other Firms: 0

Professional Affiliations
National Council of Examiners for Engineering and Surveying

Training
OSHA 40-Hour HAZWOPER Training

Petros is an engineer in the Environmental Division at the Minneapolis office. He provides technical support on several Minnesota Pollution Control Agency projects. Petros' experience includes but is not limited to: design/implementation of remedial systems, environmental investigation, water/wastewater design & management, storm water design & management and construction oversight.

Project Experience

Minnesota Pollution Control Agency, MacGillis and Gibbs Pump and Treat System Operations and Maintenance FY18, New Brighton, MN. Assisted in the daily operation and maintenance of the groundwater pretreatment facility as required by the EPA ROD for the site. Aided in the management of subcontractors and the available budget for routine and unique maintenance activities. Lead the field activities associated with the groundwater sampling of contaminated and potentially contaminated groundwater from the historic wood treatment facilities. Managed the current and historic groundwater analytical data within EQuIS. In addition, assisted in the sediment sampling of nearby wetlands/lakes which included potential contaminants such as pentachlorophenol, dioxins, and carcinogenic PAHs.

Minnesota Pollution Control Agency, CS Services/ Wally's Spur, Grand Marais, MN. Engineer for CS services and Wally's Spur located in the center of Grand Marais' commercial district. Reviewed and compiled decade's worth of historical laboratory analytical data.

Additionally, a conceptual corrective action design document was created for potential future remediation efforts. This included the design of various remediation systems/ options as well as the research and evaluation of a variety of different remediation options including but not limited to: In-Situ chemical oxidation, soil vapor extraction, bio-sparging, natural source zone depletion and dual phase recovery.

Minnesota Pollution Control Agency, Pigs Eye Lake Investigation & Pilot Study, Saint Paul, MN. Aided in the site review and design work for future remediation investigations. Collected various confirmatory soil and soil vapor samples. With the use of historic soil samples, various site maps were created and used to determine the extent of contamination. With the use of AUTOCAD and GIS, site maps were create to identify current site conditions and future sampling plans. . PFOS and PFOA groundwater samples were collected at various temporary and permanent wells.

Provided construction oversight for the installation of a number of both temporary and permanent wells

Minnesota Pollution Control Agency, Former MN Plating Sub-slab Vapor Sampling, Minneapolis, MN. Prepared a health and safety plan for the various activities which would occur on site including the sub-slab soil vapor assessment. Aided in the sub-slab vapor sampling of various houses potentially affected by cVOC soil vapor intrusion.

State of Minnesota, Rays Truck Stop, Lakeland, MN. Performed engineering work for the MPCA on the petroleum release associated with Ray's Truck stop in Lakeland, Minnesota in which residential wells were

impacted to a point in which municipal water connections was required by the MPCA. Soil samples were collected and reviewed to better identify the extent of contamination on site. Aided in the creation of a site conceptual model and the elimination of risk receptors via various field activities which including well sealing. The release was closed by the MPCA in 2017.

Canadian Pacific, St. Paul Yard Storm water Expansion, St. Paul, MN. Aided in the design and drafting of the storm water treatment system expansion. Provided on-site construction oversight of the storm water treatment system expansion. Kept detailed notes of field activities including but not limited to: air quality, soil removal and de-watering. Collected soil and water samples from the site and the current storm water treatment system.

Canadian Pacific, St. Yard SW Flood Evaluation, St. Paul, MN. Assisted in the design of the storm water collection and retention system proposed for the site. Provided field oversight of the construction activities associated with said system. With the use of a PID, soil samples were collected to ensure safe working conditions, adequate disposal and provide a better understanding of the native soil.

Minnesota Pollution Control Agency (MPCA), Smith Avenue, St. Paul, MN. Provided engineering support for the Smith Avenue cVOC release plume in St. Paul, MN. Residential homes were impacted by vapor intrusion to a point in which several sub-slab depressurization systems (SSD) were required by the MPCA. As a field technician, assistance was provided for sub-slab soil vapor sampling.

Minnesota Pollution Control Agency (MPCA), Duluth Dump Site Conceptual Model, Duluth, MN. Provided engineering support for the MPCA on a historic dump site located in Duluth Minnesota. A site conceptual model was created to analyze risk relative to applicable receptors. Impacted groundwater, surface water, sediment, seep water and soil remain on the site and were included in the aforementioned evaluation.

Winneshiek County Area Solid Waste Agency, Solid Waste Engineering Services 2015-2017, Decorah, Iowa. Assisted the permanent field staff with construction oversight and documentation of the Winneshiek County landfill expansion and landfill leachate treatment. Oversight included the monitoring landfill liner seam testing, patching and air sealing.

AECOM

Joseph Pearson
On-Site Inspector/Scientist 1/GIS & CADD Specialist/Field Technician

Education
B.S. Geology
University of Minnesota, 2015

Years of Experience
With AECOM: 2
With Other Firms: 2

Trainings and Certifications
40-Hour HAZWOPER Certified
Construction Site Management- Erosion and Stormwater Management
Design of Construction Stormwater Pollution Prevention Plans
Geologist-in-Training (GIT)

Mr. Pearson has three years of experience in providing environmental assessment and remediation services for large and small-scale sites throughout the upper Midwest. Mr. Pearson specializes in site investigations, remedial action implementation, and monitoring program implementation. His experience also includes soil excavations, free-phase hydrocarbon investigations, geophysical surveys, geotechnical investigations, analytical/field data evaluation, ArcGIS and AutoCAD services, and technical report preparation.

Representative Project Experience

Confidential Pipeline Company, Petroleum Leak Site, Swan River, MN. Field geologist for subsurface investigation of impacted soils and groundwater associated with a former truck stop. The investigation included monitoring well installation using a hollow stem auger drilling, soil boring log preparation, soil/groundwater sample collection, groundwater flow analysis, GIS and CAD services, and report preparation.

US Steel, US Steel Duluth Works, Duluth, MN. Field geologist for geotechnical and environmental investigation throughout the US Steel Duluth Works property. The investigation included collection of geotechnical information, boring log preparation, soil sample collection, and subcontractor oversight.

Confidential Pipeline Company, Groundwater Monitoring Program, North Dakota and Minnesota. Field geologist for proactive groundwater monitoring program at crude oil pumping stations in northwestern Minnesota and North Dakota. The investigation included monitoring well installation using a hollow stem auger drilling, groundwater aquifer testing, boring log preparation, soil/groundwater sample collection, groundwater flow analysis, GIS services, report preparation, and subcontractor oversight.

Confidential Pipeline Company, Petroleum Leak Site, Deer River, MN. Field geologist for subsurface investigation of impacted soils and groundwater associated with a crude oil pumping station. The investigation included monitoring well installation, soil boring log preparation, soil/groundwater sample collection, GIS services, and report preparation.

Lot D, Former Industrial Site, Duluth, MN. Field geologist for geophysical investigation of former manufacturing site and rail yard. The geophysical investigation included combination of EM and GPR surveying. Activities included contactor oversight, technical report preparation, and remedial action design.

Previous Work Experience

US Air Force Crew Chief. Mr. Pearson has 4 years of experience working as C-5 Crew Chief and aircraft mechanic. Skills related to this time period in Mr. Pearson's career include team management, project scheduling, and subcontractor oversight.

AECOM

Terrance A. Peterson, P.E.
Engineer 4/Engineer 3

Education
BS, Civil Engineering, University of Wisconsin - Platteville

Years of Experience
With AECOM: 31
With Other Firms: 10

Registrations
PE, WI
PE, MI
PE, KY

Professional Affiliations
American Society of Civil Engineers (ASCE)
American Council of Engineering Companies (ACEC)
– Qualifications-Based Selection Committee Chair
– Design/Build Task Force Member
– Division of State Facilities Liaison Committee
Wisconsin Commercial Ports Association (WCPA)
Western Dredging Association (WDA)
American Public Works Association (APWA)

Mr. Peterson is responsible for development, and execution of ocean-front, Great Lakes and inland marine projects. He has formed and managed diverse project teams, lead project planning, performed design, client liaison, construction management, and permitting with local, state, and federal agencies.

Representative Experience

- Planning, design, and construction management of harbors, marinas, recreational and commercial docks and marine structures along Lake Michigan, Lake Superior, Lake Ontario, Lake Erie, the St. Lawrence Seaway, Chesapeake Bay, Eastern Seaboard Inter-Coastal Waterway, and numerous inland waters.
- Investigation and evaluation of coastal and river shoreline protection, including revetments, breakwaters, bulkheads and slope modification.
- Permitting and design of dredging operations and spoil disposal.
- Sampling and analysis of impacted lake and river sediments.
- Feasibility studies for marina and waterfront development.
- Boat ramp, dock design and slip layout.
- Independent Technical Review (ITR) for U.S. Army Corps of Engineers (COE) shoreline repair projects.
- Stone quality review and inspection for rubble-mound breakwaters and shoreline protection.
- Analysis of wave height, wave and ice forces, and water level fluctuation on marine structures.
- Analysis and preparation of Storm Water Management Plans for site development meeting state and local requirements.
- Hydrologic/hydraulic studies for floodplain delineation, flood routing, and flood storage.
- Impact evaluations of mining and site development on wetlands.
- Master planning and design of parks and recreational facilities.
- Grant applications through state and federal programs

Commercial Shipping

- Project Manager for investigation and design of replacement bulkhead structure at US Coast Guard Station Wilmette Harbor, Illinois. The existing bulkhead structures were over 75 years old and showed obvious signs of deterioration. Investigation included soil borings, hydrographic survey, sediment sampling, and utility location. Concept plans were developed for three alternatives, steel bulkhead replacement was selected for final design. Construction Documents included design plans, specifications, cost opinions, and construction time lines. Bulkhead design was combined with on-going dredging design for overall project permitting and contracting.

Marinas/Harbors/Launch Facilities

- Project Principal for the Olde Stone Quarry $4-million boat launch and harbor of refuge near Sturgeon Bay, Wisconsin. Project incorporated geogrid for sheetwall tie-back, construction of a 300-linear-foot rubble-mound breakwater, new dockage, and protection of a 1900s era shipwreck. Project was given awards by American General Contracting (AGC), American Council of Engineering Companies of Wisconsin (ACEC WI), and *national* ACEC.

Dredging

- Project Manager and Principal Engineer for planning and design of hydraulic dredging to remove petroleum-contaminated sediments resulting from a major oil pipeline release. US EPA and Michigan DEQ mandated removal of impacted sediments from a lake in lower Michigan as part of the clean up actions. Project involved preparation of site plan applications for approval by local governmental units, preparation of plans for hydraulic dredging, piping and conveyance of dredged sediments, and construction/operations of a dewatering site. Three separate dewatering sites were designed simultaneously. Preferred site was accepted for approval.
- Project Manager for Channel Dredging for US Coast Guard Station Stillpond near Worton, MD. Existing channel was deepened to remove shoals and deposited sediments for access to mooring area for USCG Response Boats (RBS). Project involved consideration of landfills, confined disposal facilities, and beach nourishment for disposal of dredged materials. Permits were obtained in an environmentally sensitive area of Chesapeake Bay containing nearby Submerged Aquatic Vegetation, and fisheries concerns.

Riverwalk & Trail Systems

- Project Manager/Lead Designer for Riverside Park river walk segment, along the Fox River in Oshkosh, Wisconsin. Replacement of 450 lineal feet of aging timber dockwall with new sheet pile, storm outfall penetrations, protection of critical municipal water main river crossing, new concrete walkway and lighting system. Project required close coordination to mitigate possible re-suspension of coal-tar impacted sediments.

Daniel C. Phelps
Project Manager/On-Site Inspector/Scientist 2/QAQC Officer (Scientist 2)

Education

BS, Geological Sciences, University of Minnesota, Duluth, 2003

Registrations

Professional Geologist, Minnesota

Years of Experience

With AECOM: 14

With Other Firms: 0

Training and Certifications

First Aid/CPR

OSHA HAZWOPER 40-Hour Training

OSHA HAZWOPER 8-Hour Refresher Training

Mr. Phelps has over 14 years of experience providing environmental investigation, assessment, and remediation services for large- and small-scale sites throughout the United States and in Canada. His work includes projects at former manufactured gas plants, industrial facilities, retail facilities, rail yards, refineries, and ordnance facilities. Mr. Phelps currently manages several State of Minnesota projects. Mr. Phelps specializes in site investigations, remedial action implementation, and monitoring program implementation both as a project geologist and a project manager. His experience also includes soil excavations, underground storage tank removal, in-situ soil remediation, soil vapor intrusion evaluations, free-phase hydrocarbon investigations, electromagnetic surveys, ecological risk assessments, analytical/field data evaluation, and technical report preparation.

Project Experience

Minnesota Department of Agriculture, Site Monitoring, Investigation, and Remediation, Former Wood Treatment Facility, Bemidji, Minnesota. Project manager for ongoing groundwater monitoring and investigation to evaluate pentachlorophenol contamination and determine remedial actions. The selected remedy was determined to be in-situ chemical oxidation based on a feasibility study. Completed an in-situ chemical oxidation pilot test to evaluate the remediation potential of four different in-situ chemical agents in the contamination source area and downgradient area. Currently in the process of completing the full-scale remedial design.

Minnesota Pollution Control Agency, Superfund Sites, Minnesota. Project manager at Superfund sites directed by the MPCA. Sites include Shorty's Cleaner (Stillwater), Former Arrowhead Cleaner (Grand Rapids), South Hibbing Groundwater Plume (Hibbing), Former Flame Metals (St. Louis Park), and Former EPS Printing (St. Louis Park). Environmental investigation activities were completed at each project site to evaluate soil, groundwater, and soil vapor contamination and identify potential receptors. Project activities included subsurface drilling, soil sampling, soil vapor monitoring, indoor air monitoring, and groundwater monitoring. Worked closely with MPCA project managers and hydrogeologists throughout the course of the projects. Effectively managed budgets in accordance with MPCA and Department of Administration policies.

Minnesota Pollution Control Agency, Spring Park TCE Plume, Spring Park, Minnesota. Project geologist for an investigation to evaluate trichloroethene contamination to a Municipal water supply well network. Project activities included bedrock drilling, bedrock core sample collection, discrete groundwater sampling from bedrock borehole, bedrock borehole geophysics, Municipal supply well sampling, and residential water supply sampling.

BNSF Railway Company, West Burlington Former Locomotive Repair Facility, Burlington, Iowa. Manage large-scale semiannual groundwater and surface water monitoring program and field activities for a corrective measures study at a former locomotive repair facility. Managed field staff and subcontractors during bedrock and till drilling activities, soil vapor intrusion investigation, and surficial lead investigation. Prepare technical reports associated with the groundwater monitoring program and Site investigations. Manage ongoing operation, monitoring, and maintenance activities of the two on-site groundwater extraction and treatment systems.

U.S. Navy, Soil and Groundwater Investigation, Former Naval Industrial Reserve Ordnance Plant, Fridley, Minnesota. Field manager for large-scale soil and groundwater investigation to evaluate trichloroethene contamination at a former Naval Industrial Reserve Ordnance Plant. The investigation included membrane interface probe borings, direct-push soil borings, and groundwater vertical profiling. Performed pilot test to evaluate the effectiveness of in-situ carbon injections in the contamination source area and downgradient area.

Canadian Pacific, Harvey Rail Yard, North Dakota. Field manager for remediation of chlorinated solvent impacted soil and groundwater. Remediation included excavating soil and mixing in oxidizing chemicals to reduce chlorinated solvent impacts. Mixed soil was placed back in the exaction following mixing. Managed field staff and subcontractors during the 20-day mixing event.

AECOM

Kenneth D. Pinnella
Human Health Risk Assessor 3/Ecological Risk Assessor 3

Education
MS, Environmental Toxicology, Colorado State University, 2000
BA, Social Science-Economics, Colorado State University, 1988

Years of Experience
With AECOM: 12
With Other Firms: 6

Professional Affiliations
Society of Environmental Toxicology and Analytical Chemistry

Trainings and Certifications
40-hour OSHA HAZWOPER Training 8-hour OSHA HAZWOPER Refresher Training, Annually
8-hour OSHA HAZWOPER On-Site Manager/Supervisor Training
FRA 49 CFR 214 On-Track Railroad Worker Safety Training
U.S Department of Transportation Hazardous Materials Shipping Training

Technical Specialties
Ecological Risk Assessment
Human Health Risk Assessment Pipeline Risk Assessment

Mr. Pinnella is a toxicologist and risk assessor conducting human health and ecological risk assessments, with a focus on ecological risk assessment. He has 16 years of broad-based experience in conducting risk assessments at Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), Resource Conservation and Recovery Act (RCRA), and state program and international hazardous waste facilities; water quality investigations and Use Attainability Analyses; and toxicological evaluations in water, sediment, and soil. Mr. Pinnella has experience with single focus and multidisciplinary projects involving site investigations, ecological and biological surveys and risk assessments, data management, statistical analysis, fate and transport modeling (vapor intrusion, lateral transport, and air emissions), and regulatory compliance. He has experience in most Environmental Protection Agency (EPA) regions and with many state programs, as well as international experience. Mr. Pinnella has conducted over 50 human health and ecological risk assessments in both the public and private sector.

Representative Experience

Agrium-NuWest Inactive Phosphate Mine Sites, Ecological Risk Assessment, Idaho. Prepared screening level ecological risk assessment to support contaminated site risk assessment and remediation at inactive pit mine sites (North Maybe Mine, South Maybe Mine and East Mill Dump). The evaluation identified potential adverse impacts to ecological receptors and livestock from inorganic chemical constituents in terrestrial and aquatic (pit lake) habitats. Collected and evaluated plant and invertebrate tissue data, and conducted bioaccumulation and ambient background studies. The results were used to define additional data needs to support a baseline ecological risk assessment and data collection, and to define remedial goals for the mine sites.

BNSF, Active Railyard and Maintenance Facility, Ecological Risk Assessment, Nebraska. Conducted ecological risk assessment in support of a Remedial Facility Investigation/Corrective Measures Study at an active railyard/engine maintenance facility in Lincoln. Evaluation included assessing upland and stream ecological risk from multiple sources, including evaluation of hyporheic (transition) zones in a site-associated stream. Results of the risk assessment were intended to focus remedial efforts at the site.

BNSF, Former Maintenance Facility, Ecological Risk Assessment, Iowa. Conducted ecological risk assessment in support of a Remedial Facility Investigation/Corrective Measures Study at a former engine maintenance facility in Burlington, Iowa. Issues included upland, stream, and pond ecological risk from multiple sources. Results of the risk assessment were intended to focus remedial efforts at the site.

Railroad, Tier 3 Human Health Risk Assessment, Proctor, Minnesota. Assisted in preparation and review of a Tier 3 human health risk assessment for an active railyard to evaluate the potential site-specific human health risk associated with impacted soil within Areas of Concern based on site-specific inputs and a Tier 3 risk-based approach per MPCA guidelines. The Tier 3 HHRA was conducted in accordance with the MPCA's *Risk-Based Guidance for the Soil - Human Health Pathway Volume 2,*

Technical Support Document, *Soil Reference Values and Chemical-Specific Information*, and United States Environmental Protection Agency (USEPA) risk-based guidance.

Former Tie Treatment Plant, Tier 3 Risk Assessment, Brainerd, Minnesota. Assisted in preparation, review and implementation of a Tier 3 risk assessment work plan for a former tie treating plant in Brainerd and Baxter, MN. The risk assessment work plan proposed site-specific inputs and a Tier 3 risk-based approach for review and approval by the Minnesota Pollution Control Agency (MPCA) and USEPA prior to conducting the Tier 3 risk assessment. The Tier 3 risk assessment presented an evaluation of potential site-specific human health and ecological risk associated with impacted soil at the Site.

Canadian National Railway, Operating Right of Way, Ecological Habitat Assessment, Illinois. Performed qualitative desk-top habitat assessment and prepared report in support of an Illinois Pollution Control Board (IPCB) Remediation Objectives Report (ROR). The results of the assessment were used in consideration of remedial objective for the site.

BP, Former Landfill Site, Ecological Risk Assessment, Illinois. Prepared a screening-level ecological risk assessment to support a Remedial Investigation being conducted at the site. Evaluation included assessment of groundwater expression at seeps (soil) and migration and transition of groundwater into surface water of an adjacent river. Investigation was focused on the evaluation of the adjacent river and riparian corridor potentially affected by landfill sources. The results of the assessment were intended to inform the determination of remedial goals for the site.

Dakota Gasification Company. Great Plains Synfuels Plant, Underground Pipeline Release Evaluation, North Dakota. Performed a Lateral Transport and Vapor Intrusion evaluation to address a subsurface release of volatile process chemicals. Incorporated the RBCA Toolkit and Johnson and Ettinger Model to provide risk-based action levels for groundwater constituents to be applied for interim source control measures.

US Bureau of Land Management, Bakkenline Pipeline Risk Assessment and Environmental Consequence Analysis, North Dakota. Provided technical review and support for pipeline risk assessment (PRA) and environmental consequence analysis (ECA) being developed for a proposed pipeline routed through multiple counties. Reviewed and developed incident frequency, spill volume estimation, and performed consequence analysis.

AECOM

Eric D. Poissant
On-Site Inspector/Scientist 2

Professional History
07/2000 - Present, AECOM Project Manager, Senior Geologist
06/1993 - 07/2000, West Central Environmental Consultants, Project Manager, Geologist, Emergency Response Specialist

Education
BA, Geology, University of Minnesota-Morris

Registrations
Professional Geologist, Minnesota #30242
Certified Asbestos Inspector/ #A18096 (MN), #17-8505 (IA), & #6085 (ND)
Certified Contractor Supervisor Asbestos/#AS8096

Years of Experience
With AECOM: 18
With Other Firms: 7

Training
Fundamentals of Radiological Monitoring (G320)
OSHA Hazardous Waste Operations Standard (29 CFR 190.120) (40 Hour)
OSHA 10-hour Safety Training Certification.
Hazardous Waste Operations and Emergency Response Certification Specialist Level (29 CFR 1910.120) (96 Hour)
Industrial Hazardous Materials Technician (24 Hour)
Hazardous Materials Technician (48 Hour)
First Aid/CPR
Asbestos Air Sampling (MN) (16 Hour)

Eric Poissant has 25 years environmental consulting experience. He has field expertise on a wide range of environmental projects requiring soil and ground water evaluation throughout the Midwest United States. His primary areas of expertise include, soil and ground water quality, field project supervision, spill response and cleanup. Additional areas of experience include borehole logging, storage tank investigations, asbestos and hazardous materials assessments, and environmental sampling.

Project Experience

Marathon "Park Penta Site", St. Paul Park, MN. Mr. Poissant is involved in all facets of work on the Pentachlorophenol (PCP) clean up next to the St. Paul Park, MN refinery. This included project management, scheduling fieldwork, ensuring continued operation of a duel phase recovery system, completing MCES permits, quarterly & annual reports, planning additional investigation, and regulatory interaction & negotiation.

MnDOT Rest Area Hazardous Materials Assessments. Mr. Poissant has managed the hazardous materials assessments at three MnDOT properties. This included coordinating with MnDOT to obtain site construction documents and site access, scheduling field staff, evaluation sample results, and completion of the final assessment reports. This work resulted in the awarding of the Asbestos and Regulated Materials abatement oversight project award at the Goose Creek Rest Area in Harris, MN.

St. Paul Park Refinery, St. Paul Park, MN. Mr. Poissant coordinated Field supervision for all legacy remediation at the site. Included oversight and operation of 30+ recovery wells, 90+ monitoring wells, and two vacuum enhanced product recovery systems. Additional work included preparation of permits and reports. In addition, Mr. Poissant was the company liaison between AECOM and the current facility owner in relation to the operation and maintenance of the remediation system. He also conducted Health and Safety reviews and training for AECOM personnel and AECOM contractors onsite.

U.S. Steel, Duluth, MN. Field Geologist for Investigation at 2 USS sites in Duluth, MN. Work included supervision of drilling, installation, and sampling of 21 Piezometers, 48 soil borings and preparation of detailed soil boring logs. Additional work included preparation of the health and safety plan, work plans, and investigation reports.

Marathon "Wright Products Plume", St. Paul Park, MN. Mr. Poissant is involved in all facets of work on the Trichloroethylene (TCE) clean up next to the St. Paul Park, MN refinery. This included project management, scheduling fieldwork, quarterly & annual reports and planning additional investigation.

Construction Monitoring, TH 61 Hastings Bridge Replacement, I-35E Maryland Interchange, Cayuga and MnPASS). Mr. Poissant served in an environmental construction oversight role during the construction phase of these projects; In this role, he conducted sampling and monitoring that identified the presence of debris-laden fill and VOC, petroleum, metals, PAH, and asbestos impacted soil in conflict with bridge and roadway

reconstruction areas. Based on this information, Mr. Poissant notified the appropriate parties and the materials were managed appropriately.

Four Points by Sheraton, Minneapolis, MN. Supervised the completion of an AHERA based asbestos invitation on a four-story hotel located in Minneapolis, Minnesota. Additional work included sample mapping and report preparation.

Former W.R. Grace Site, NE Minneapolis, MN. Field Geologist for the initial subsurface investigation at W.R. Grace in NE Minneapolis, MN. Work included supervision of drilling, logging, and sampling of 48 soil borings and 10 excavations for possible asbestos containing materials and minerals. Additional work included preparation of the health and safety plan, Field Heath and Safety Officer, overseeing decontamination of investigation equipment, and disposal of PPE and investigation derived waste.

West Chicago (IL) Rare Earths Facility. Field geologist for the initial outfall and stream delineation project. Work included supervision of placement and drilling of approximately 800 soil borings, that located low level radioactive materials at a rare earth's facility. As part of this project, Mr. Poissant was responsible for the down-hole gamma logging and GPS mapping activities. Additional work included database management and geologic interpretation.

AECOM

Todd Renville
Scientist 2

Professional History
01/2003 - Present, AECOM Project Director, Project Manager, Principal Environmental Scientist
1989 - 2003, EnecoTech, Inc., Project Manager and Operations Manager
1988 – 1989, Groundwater Technology, Inc., Hydrogeologist and Project Manager

Education
BS, Geology, University of Wisconsin – Eau Claire, 1987
MBA, University of St. Thomas, 2008

Registrations
Professional Geologist, Minnesota
Construction Site Management, Minnesota
Design of Construction SWPPP, Minnesota

Years of Experience
With AECOM: 15
With Other Firms: 15

Training
OSHA HAZWOPER 8-Hour Refresher Training
OSHA HAZWOPER 40-Hour Training
First Aid/CPR

Mr. Renville has over 30 years experience in environmental projects encompassing a wide array of technical disciplines. Along with extensive technical expertise, Mr. Renville also has significant management experience, including profit/loss center responsibility, technical staff management, project management, client representation, regulatory negotiation, budgetary control and litigation support. Throughout his 30-year career, Mr. Renville has had a major role in the execution of hundreds of environmental due diligence, site investigation, brownfields and contaminant remediation projects. In recognition of his experience base and vast knowledge of environmental policy, Mr. Renville was appointed in 2009 by Governor Tim Pawlenty and re-appointed in 2011 and 2015 by Governor Mark Dayton to serve on the statewide Clean Water Council.

Project Experience

St. Louis River – U. S. Steel Superfund Site, Project Manager. Project Manager for a Remedial Investigation/Feasibility Study (RI/FS) and Remedial Design (RD) Superfund project associated with a former integrated steel mill in northern Minnesota. Project elements include assessment and remedial design to mitigate PAH and metals impacts in soil and sediment, stormwater permitting and management, wetland delineation, surface water discharge evaluation and permitting, and groundwater studies/modeling.

Metro District Contaminated Materials Management Program: Mr. Renville is responsible for managing a program that provides rapid execution of site investigations and construction monitoring. The primary purpose of the program is to provide supplementary environmental consulting support to MnDOT's Contaminated Materials Management Team (CMMT) and Metro District for rapidly evolving major projects as well as for transportation corridors where contaminated materials were discovered in later stages of the project development or construction process. A partial list of Metro District project corridors covered thus far under this contract includes: I-35W North MnPass (Roseville to Blaine) Phase II Investigation and Response Action Planning; I-94 (St. Paul) Response Action Planning and construction monitoring; TH 149 High Bridge Phase II Investigation and Response Action Planning; TH 169 (Champlin) Response Action Planning; and the I-35W and Lake Street (Minneapolis) construction monitoring project.

TH 61 Hastings Bridge Reconstruction. Mr. Renville served in a primary leadership role on all phases of the Hastings Bridge project; from project development to construction implementation. Directed the planning and execution of a corridor-wide Phase I ESA and Drilling Investigation program that identified the presence of debris-laden fill and VOC, petroleum, metals and PAH impacted soil and groundwater in conflict with future bridge reconstruction areas. A RAP and various RAP addenda were executed on behalf of MnDOT's OES to manage contaminated media as it is encountered during the construction process. Mr. Renville also served as the State Design-Build teams primary environmental resource/facilitator for matters related to sediment/dredge and erosion control/SWPPP compliance, work-in-waters, construction-induced vibration, spills/hazardous materials, cultural resources, aquatic invasive species (AIS) and wetlands/wildlife impacts. Regulatory stakeholders engaged through this

process included the U.S. Fish and Wildlife Service, U.S. Coast Guard, U.S. Army Corp of Engineers, MPCA, Minnesota DNR, Minnesota Board of Soil and Water Resources (BWSR), the Minnesota State Historic Preservation Office (MnSHPO), and various environmental divisions from Dakota and Washington Counties. The project was awarded MnDOT's 2015 *Award for Construction* due to the success in delivery of environmental programs.

I-35E Corridor, St. Paul, MN. Mr. Renville has served as AECOM's project manager during the execution of linear corridor Phase I and Phase II ESAs and construction monitoring programs along the I-35E alignment from University Avenue to CSAH 96. The Phase I ESA for the Cayuga segment, one of the more complex evaluations performed on behalf of MnDOT's OES, revealed a potentially expansive contaminant foot-print within the future roadway and bridge alignment from former rail and industrial operations. Subsequent Phase II investigation confirmed a broad zone of impact from prior land-use. Mr. Renville directed implementation of response and contingency actions throughout this four year construction program.

Minnesota's Union Depot, St. Paul, MN. Site activities led by Mr. Renville included the performance of baseline Phase I and II ESAs which identified the presence of residual metals, PAHs and petroleum hydrocarbons in soil within and in close proximity to Union Depot. Under Mr. Renville's direction, broad mitigation recommendations to address these environmental concerns through the development of a RAP/CCP to guide construction operations.

Crosby Lake Industrial Park Brownfield Site, St. Paul, MN. Responsible for the overall technical direction and interaction with multiple stakeholders during the redevelopment of a former 40-acre industrial parcel as a light industrial park. The project entailed excavation and treatment/disposal of over 40,000 cubic yards of impacted soil at a former bulk petroleum storage facility. Multiple soil treatment technologies were implemented over the course of the project, including thermal desorption, on-site soil washing, bio-mounding and land farming. Mr. Renville also successfully negotiated risk-based groundwater cleanup goals based on contaminant fate and transport. Mr. Renville worked closely with the responsible parties, developers and regulatory personnel to obtain among the first Certificates of Completion conferred by the MPCA's VIC program. This project was cited for its success in several publications and presented at two national symposia.

B.F. Nelson Park Site, Minneapolis, MN. Mr. Renville served as project manager for this EPA Brownfield Grant funded park restoration project. Previous site investigation identified the presence of asphalt-impacted material, PAHs and metals from historical on-site industrial operations. Mr. Renville led a team that designed an earthen buffer over the areas of asphalt-impacted material, and assisted the Minneapolis Park and Recreation Board in competitively bidding and selecting a general contractor for buffer placement. Response Actions implemented and managed at the property under an EPA Brownfield Grant included buffer and vegetative cover placement. A property restrictive covenant was then drafted along with contingency and performance monitoring planning to assure the integrity of this protective layer.

AECOM

Paige B. Schulz, PE
On-Site Inspector/Engineer 2

Professional History
03/2016 - Present, AECOM Environmental Engineer 01/2012 - 02/2016, Arcadis U.S., Inc.,
Environmental Specialist 05/2011 – 01/2012, Arcadis U.S., Inc.
Technical Intern

Education
MS Civil Engineering, University of Minnesota, 2015
BS Geological Engineering, Michigan Technological University, 2011

Registrations
Professional Engineer,
Lic #53133, Minnesota Board of AELSLAGID, 2015

Years of Experience
With AECOM: 2
With Other Firms: 4.75

Ms. Schulz has been involved with several site evaluation and remediation projects. She has developed valuable knowledge of remedial investigation activities for soil, vapor, and groundwater treatment. Ms. Schulz has established skills for analysis and assessment of hydrogeological environments including mobility and recoverability of light nonaqueous phase liquid (LNAPL).

Project Experience

LNAPL Distribution, Mobility, and Recoverability, Multiple Sites for Railroads, Former Manufactured Gas Plants, Petroleum Storage and Fueling Sites in Alaska, Illinois, Massachusetts, Michigan, Missouri, New Jersey, New Mexico, New York, Puerto Rico, Texas, Washington, and West Virginia. Ms. Schulz provides technical analysis of LNAPL distribution within the subsurface and potential for LNAPL mobility and recoverability. Ms. Schulz serves as a lead support for incoming LNAPL assessment sites from task coordination and organization of staff to data analysis and report writing.

Ms. Schulz has further developed the American Petroleum Institute (API) LNAPL transmissivity tool to fit the needs of Arcadis and aids in completing analysis of LNAPL baildown tests or slug tests. Ms. Schulz also developed the Arcadis Standard Operating Procedure for LNAPL manual skimming tests based on the ASTM Standard Guide for Estimation of LNAPL Transmissivity published in 2012 and standard Arcadis field practices. She is proficient at analyzing LNAPL recovery data to determine an LNAPL transmissivity from the following systems: LNAPL baildown testing, LNAPL manual skimming, LNAPL pneumatic skimming, and water-enhanced / dual-phase LNAPL recovery. Final output values of transmissivity following the Interstate Technology & Regulatory Council (ITRC) lower-bound threshold indicate whether LNAPL recovery using hydraulic methods may produce sufficient LNAPL to cause beneficial reduction in overall LNAPL mass.

Groundwater Treatment System Design, Documentation, and Operations, Confidential Client, Kingsford, Michigan. Ms. Schulz was involved in the design, oversight, documentation, and operations associated with redesign start- up due to decrease in biochemical oxygen demand (BOD) loading of a groundwater treatment system in Kingsford, Michigan. Ms. Schulz manages and communicates daily with the two full time wastewater operators to evaluate on- going treatment conditions. The treatment train consists of biological activated sludge treatment followed by clarification. The plant is designed for an organic loading of 250 pounds per day of BOD. The design incorporates sludge handling and dewatering facilities, administrative and laboratory facilities, and appurtenant sewers and outfall structure for direct discharge to the Menominee River.

Residential Development, New Brighton, Minnesota Confidential Client. Ms. Schulz completed a Phase II Environmental Site Assessment of a 28-acre former industrial site for residential development. After the investigation, the Site was entered into the Minnesota Pollution Control Agency (MPCA) voluntary and brownfield remediation program in fall 2013 to begin remediation and redevelopment. Ms. Schulz lead field activities in fall 2014 for the removal and disposal of remnant shallow soil impacts (primarily diesel range organics) and debris (utilities, glass, iron pipes,

asphalts, and concrete), as well as placement confirmation of a 12- foot minimum clean fill cover across the entire footprint of the Site. Field activities also included analytical confirmation sampling of open excavation limits and clean imported fill.

Ms. Schulz oversaw installation of active vapor mitigation systems for sub-slab depressurization for eight housing layouts to prevent vapor intrusion of volatile organic compounds (VOCs) from occurring in the proposed homes. Ms. Schulz completes system operations at each house by collecting and analyzing sub-slab vapor samples and differential vacuum measurements from sampling points, as well as a U-tube manometer readings on the vent piping.

Enhanced Reductive Dechlorination (ERD) Design and Implementation, Multiple Sites in Minneapolis and Fridley, Minnesota Confidential Clients. Ms. Schulz served as task manager for design and implementation of enhanced reductive dechlorination pilot tests through injection of carbon substrate (molasses). Tasks included field- staff coordination, equipment ordering, sampling plan variances, and field-lead for unexpected issues.

Active Chemical Blending Facility, St. Paul, Minnesota Confidential Client. Responsible for the operation and maintenance sequencing batch reactor groundwater treatment system through extraction and injection of groundwater. Ms. Schulz performs maintenance work and laboratory analysis of extracted and treated groundwater (i.e. MLSS, MLVSS, COD, nutrients).

In Situ Chemical Oxidation (ISCO) Design and Implementation, Minneapolis, Minnesota Confidential Client. Ms. Schulz served as task manager for field efforts from post-injection monitoring of sodium permanganate and deuterium oxide. Tasks included field-staff coordination, equipment ordering, sampling plan variances, and field-lead for unexpected issues. Ms. Schulz additionally assisted in coordination of pre-injection tasks including equipment ordering, permitting compliance, and baseline groundwater sampling field oversight.

Former Chemical Blending Facility Roseville, Minnesota Confidential Client, Site Closure. Ms. Schulz performed monthly monitoring and quarterly air quality sampling for a soil vapor extraction (SVE) system, which consisted of a knockout tank, a venturi flow element, particulate filters, blowers, vacuum relief valves, and sampling ports.

The Minnesota Pollution Control Agency (MPCA) granted site closure to the client in December 2012 as a result of SVE operation and monitoring efforts. Ms. Schulz lead site decommissioning activities from January to May 2013. Decommissioning activities included abandoning monitoring wells, removing well vaults and well pads, removing and abandoning SVE treatment system lines.

Field Work (General), Multiple Clients, Minnesota, Wisconsin. Ms. Schulz conducts environmental field and subcontractor oversight including borehole drilling for soil lithology, soil and groundwater sampling, and monitoring well construction and development.

AECOM

Cliff Shierk, PE
Engineer 2

Professional History
05/2014 – Present, Project Manager, AECOM
05/2012 – 05/2014, Senior Environmental Engineer, URS Corporation
08/2008 – 05/2012: NSF-IGERT Fellow, University of Illinois at Chicago
03/2006 – 08/2008, Staff Environmental Engineer, URS Corporation

Education
MS, Civil Engineering, University of Illinois at Chicago, 2009
BCE, Civil Engineering, University of Minnesota - Twin Cities, 2005

Years of Experience
With AECOM: 4
With Other Firms: 4

Registrations
Professional Engineer, Florida
Professional Engineer, Minnesota
Professional Engineer, North Dakota
Professional Engineer, Wisconsin
Professional Engineer, Wyoming

Training
OSHA 40-Hour HAZWOPER Training

Areas of Expertise
Civil Site Design
Landfill Design
Wastewater System Analyses
Remediation Design
Environmental Due Diligence
Environmental Investigations
Geosynthetics
Landfill Construction Quality Assurance

Mr. Shierk is project manager and civil engineer in the Oshkosh, Wisconsin office. Mr. Shierk works in both the civil and environmental engineering disciplines, including landfill design, civil site design, environmental compliance, environmental due diligence, and construction oversight.

Project Experience

City of Oshkosh, Kienast Quarry Landfill Investigation and Gas Extraction System Design, Oshkosh, Wisconsin [2016 – Present]. Serving as project manager and technical lead for investigation of existing conditions, remedial alternatives evaluation, and design of a landfill gas extraction system for a former rock quarry that was subsequently filled with municipal waste. Investigation included extensive test pitting and gas well monitoring installation to determine limits of waste and landfill gas production characteristics for the site.

City of Oshkosh, Timmerman Farm and Quarry Park Landfill Operations and Maintenance, Oshkosh, Wisconsin [2016 – Present]. Serving as project manager and technical lead for annual maintenance and environmental sampling of two historical landfill sites. Tasks include regular sampling and reporting as required by the Wisconsin Department of Natural Resources, interface with the WDNR, and maintenance of active and passive gas management systems.

Louisville Gas and Electric, Rehabilitation of Existing Wastewater and Storm Water Ponds, Louisville, Kentucky [2016 – Present]. Serving as civil design lead for the removal of accumulated coal combustion residuals (CCR) and repurposing of four wastewater and storm water treatment ponds. Project constraints include maintaining functionality of pond and water treatment system during construction and installation of a riser and outfall structure in a regulated dam embankment.

Basin Electric Cooperative Power Cooperative, Phase 6 Permitting and Design for Leland Olds Station Solid Waste Landfill, Stanton, North Dakota [2016 – Present]. Served as project manager for multidisciplinary team providing permitting and design services for a lateral expansion of the station's CCR landfill. Design features included landfill liner and leachate collection system (including force main and lined leachate pond), storm water management features (including piping, ditches, and two storm water ponds), and site rehabilitation.

Georgia-Pacific, Tissue Paper Machine 6 Plant Expansion, Palatka, Florida [2016 – Present]. Serving as civil design lead for balance of plant construction items for large mill expansion project. Civil design features include a new 13-acre storm water pond and outfall structure, a storm water collection system, paving for perimeter access roads and parking areas, and relocation of existing utilities to accommodate new building footprint.

City of Oshkosh, Jeld-Wen Riverwalk Construction, Oshkosh, Wisconsin [2017 – Present]. Serving as project and construction manager for the construction of 1,900 feet of riverfront trail, including both concrete paths and an elevated wooden boardwalk through a wetland area. Project is redevelopment of a former industrial site and includes new storm water

outfalls, management and disposal of contaminated soils, and new electrical lighting for the length of the trail.

City of Oshkosh, Annual Environmental Support, Oshkosh, Wisconsin [2016 – Present]. Serving as project manager and technical lead for annual environmental support contract with the City of Oshkosh. Primary tasks include environmental reviews for street reconstruction projects, environmental oversight of geotechnical drilling operations, and management and disposal coordination for contaminated materials encountered during street and utility reconstruction projects.

Basin Electric Cooperative Power Cooperative, CCR Compliance for Three Power Stations in North Dakota and Wyoming [2015 – Present]. Serving as project manager for multidisciplinary team providing hazard classification assessments, hydrology studies, geotechnical analyses, and preparation of an emergency action plan to comply with the USEPA CCR Rule.

East Kentucky Power Cooperative, Landfill Expansion at H.L. Spurlock Station, Maysville, Kentucky [2015 – 2017]. Served as project manager for the expansion of the CCR landfill at Spurlock Station. Design elements included landfill design with a liner and leachate collection system to meet the USEPA CCR Rule. Additionally, the project included the design of an external haul road to provide access to the base of the new cell.

Montana Dakota Utilities, Ash Treatment and Ash Pond Closure Design, Lewis & Clark Station Unit 1, Richland County, Montana [2014 – 2016]. Served as the civil design lead for the design and construction of 1.5 million gallon in-ground concrete wastewater tank and treatment system to meet the requirements of the USEPA CCR Rule and the closure of an existing ash pond.

Minnesota Pollution Control Agency, Washington County Sanitary Landfill Final Closure, St. Paul, Minnesota [2007 – 2008]. Prepared preliminary design to move approximately two million cubic yards of waste and final cover soils from an unlined facility to a new lined landfill constructed over the footprint of the old facility.

Minnesota Pollution Control Agency, East Bethel Landfill Final Closure, East Bethel, Minnesota [2006 – 2008]. Conducted construction quality assurance monitoring for the final closure of a 34-acre landfill, including the installation of an active landfill gas management system, stormwater management system, groundwater extraction system, and 1.1 million square feet of geomembrane and geocomposite for landfill final cover and groundwater treatment pond liner.

AECOM

Andrew Tarara
Project Manager/On-Site Inspector/Scientist 2/QAQC Officer (Scientist 2)

Professional History
05/1999 - Present, AECOM Program Manager
05/1997 - 05/1999, Spectrum Laboratories Senior Lab Technician

Education
BA, Geology, Gustavus Adolphus College, 1995

Years of Experience
With AECOM: 19
With Other Firms: 2

Certifications
First Aid and CPR Certified

Training
Defensive Driving Awareness Training
OSHA 8-Hour Refresher Training
OSHA 40-Hour HAZWOPER Training
Chevron Hazard Recognition Training
Chevron Loss Prevention Systems Training
OSHA 8-Hour Site Supervisor Training
Project Management

Andrew is a geologist with the Environment business line. He has also served as the program manager for the Chevron Marketing and Business Unit East Region for the past 7 years. Andrew provides expertise/oversight for a portfolio of petroleum sites across the eastern United States.

Project Experience

Minnesota Pollution Control Agency, MacGillis and Gibbs Pump and Treat System Operations and Maintenance FY18, New Brighton, Minnesota. Project manager for O&M project at former wood treatment facility. The NPL site includes interaction with EPA. Project work includes maintaining the bioremediation system and complying with the State MCES permit.

Chevron, Program Management, Various Locations. Program manager for the Chevron MBU-East portfolio of projects. Coordination of field, technical, and management staff for sites across the eastern United States.

City of St. Louis Park Laboratory, Performance Audit and Limited Data Validation, Denver, Colorado. Assisted in laboratory audits for the city of St. Louis Park Lab located in Denver, CO. Additionally, performed limited data validation for annual reporting.

City of St. Louis Park, Reilly Superfund Site, St. Louis Park, Minnesota. Duties included project/task management, groundwater sampling, report writing, compliance with consent decree-remedial action plan, drilling, excavation, and land redevelopment for park use.

Chevron, Groundwater/Soil Remediation, Austin, Minnesota. Part of the Chevron portfolio reduction project. Completed a large petroleum impacted soil removal in December 2005. Received NFA from MPCA in 2008.

Domtar, Stryker Bay Sediment Sampling, Duluth, Minnesota. Assisted in collection of soil sediment samples from Stryker Bay. Samples were collected using mobile coring device from the deck of a pontoon boat, and were used to further delineate impacts in Stryker Bay from a nearby former manufactured gas plant site.

Industrial Client, Phase II Environmental Site Assessment, Little Falls, Minnesota. Duties included oversight of geoprobe investigation, trenching, sediment sampling, and hand auger soil sample collection.

Chevron, Recovery Well, Owatonna, Minnesota. Coordinated installation of a 450-foot horizontal recovery well. The well was connected to a dual phase extraction (DPE) system.

Confidential Client, Underground Storage Tank Sites, , Minnesota. Project manager for portfolio of former UST sites. Responsible for the scope, schedule, budgets, and reimbursement applications.

Various Clients, DPE/SVE Systems Operation and Maintenance, Owatonna, Austin, and Minneapolis, Minnesota. Provided troubleshooting and maintained systems for groundwater pump and treat project sites in Owatonna, Austin, and Minneapolis in Minnesota.

Chevron Corporation, Project Management, Various Locations. Primary project management duties for the Chevron Marketing and Business Unit East portfolio in Ohio, Indiana, Illinois, Minnesota, Wisconsin, Pennsylvania, Texas, Florida, and Arizona. Writing scopes, budgets, and task management. Primarily site assessment activities with some remediation technologies.

BP, Former Refinery Site, Neodesha, Kansas. Provided ongoing support to the investigation at the former refinery. Lead role for the semiannual groundwater monitoring, reports, and scheduling. Also provided support to the project manager with budget summaries and personnel.

Chevron, Chevron-Owatonna Site Management, Owatonna, Minnesota. Managed this site as part of the Unocal/Chevron petroleum portfolio. The site required soil and groundwater remediation that included the design and installation of a dual phase extraction system (DPE). The system was installed using horizontal drilling technology. The horizontal well was installed beneath two city blocks in Owatonna, MN. Maintained the remediation system utilizing a telemetry system.

Unknown Client, Phase II Environmental Site Assessment, Little Falls, Minnesota. Duties included oversight of geoprobe investigation, trenching, sediment sampling, and hand auger soil sample collection.

Various Clients, Dual-Phase Extraction/Soil Vapor Extraction Systems Operation and Maintenance, Various Locations, Wisconsin. Provided troubleshooting and maintained systems for groundwater treatment facilities.

Industrial Client, Groundwater Sampling, Cornwall, Ontario. Participated in groundwater sampling using low-flow sampling methods.

AECOM

Sarah Vavra
Scientist 1

Professional History
AECOM May 2012 - Present
Air Quality Consultant and Project Controls
Other Experience May 2011 – December 2011
Air Quality Scientist

Education
BS, Earth Sciences: Meteorology Emphasis, University of Northern Colorado, 2013
AA, Mass Media/Radio and Television, Broward College, 2000

Certifications
CPR/AED (expired)
HAZWOPER 40-Hour

Years of Experience
With AECOM: 6

Professional Affiliations
American Meteorological Society 2009 - Present

Awards
AECOM Safety Star Award
AECOM SH&E Leadership Award – Challenge Coin

Ms. Vavra is an air quality and meteorological scientist with over five years of experience in air quality monitoring and compliance. She is also experienced at data mining and data compilation and interpretation for multiple environmental and chemical projects. She has been trained in meteorology and climatology, varying areas of remediation, project controls, communications, computer technical and administration work, and is adept at client relations. Ms. Vavra has experience forecasting the weather with meteorological models and processed data, has an understanding of global and localized climatological oscillations, and has worked with climatological models such as EdGCM and CCSM/CESM.

Ms. Vavra is also adept at working within ePM as Project Controls. She is knowledgeable at setting up projects, change orders, and EACs, and enjoys working as an overall supporting member of a team.

Project Experience

Confidential Oil Refining Company – Meteorological and air quality data review and analysis, monthly validation, and quarterly report preparation for an oil refining company in Rawlins, WY.

Coal-Fired Power Plant Meteorological Operations – Meteorological and air quality data review and analysis, monthly validation, and quarterly report preparation for a power plant in Colorado Springs, Colorado.

Coal-Fired Power Plant Meteorological Operations – Meteorological and air quality data review and analysis, monthly validation, and quarterly report preparation for several coal-fired power plants and corresponding power stations throughout northern and southern Nevada.

Oil Pipeline – Meteorological and air quality data review and analysis, and monthly validation for meteorological stations along a crude oil pipeline in central Alaska.

Confidential Oil Refining Company – Chemical and groundwater quality data review, analysis, and compilation; data entry, quality assurance, data location, and SOP preparation and write-up for an oil spill.

Steel Manufacturer – Sifthand/shovelhand for a Phase I archaeological dig to search for any significant cultural signs on an island in northern Minnesota.

Government Pollution Control Agency – Various projects

Assisting in the writing and compilation of a QAPP, SAP, and SOP for an ongoing groundwater remediation project.

Performing in-depth research for potentially responsible parties of pollutants in a local harbor over the course of a 100 year time span.

Government Engineers Group – Performing in-depth research, writing, and compilation of the Cultural Resources/Affected Environment and Resource Approach Summary for the REIS for a mining project in various counties in Texas.

Nationwide Retail Outfit – Participation in quarterly carbon monoxide air quality assessments for stores' forklifts.

Paint and Coating Manufacturer – Participated in acquisition and compilation of data with regard to annual air quality compliance for SARA Tier II 312 and SARA Form-R 313 for multiple plant locations countrywide.

State DOT – Performing in-depth research, data review, report writing and compilation, and deputy management for asbestos and regulatory waste assessments in preparation for the renovation of 26 bridges and 3 rest stops.

Class I Railroad – Performing in-depth research and documentation of unmarked railroad crossings utilizing mapping databases for the Federal Railroad Administration database.

Online SDS Inventorying Company – Completed on-site inventories of chemicals for organization and categorization of Safety Data Sheets for various locations. Ms. Vavra also performs DPM tasks for this project, supporting the project manager on the behind-the-scenes work so that the project manager may be freed to work more closely with the client.

Oil Pipeline – Participated in the field verification team, which involved utilizing ESRI Collector to do address verification on compiled validation data points in varying areas of the United States. Ms. Vavra completed legs of the pipeline field verification throughout two states.

Confidential Oil Refining Company – Ms. Vavra's role in this project is to assist in project controls and support, as well as sending out a daily weather forecast and briefing to notify project managers if their sites may require extra attention.

AECOM

Seth C. Wilson
On-Site Inspector/Scientist 2/QAQC Officer (Scientist 2)/Scientist 1

Technical Specialties
Conceptual Site Model Development
NAPL Investigation - Coal Tar
LNAPL Investigation - Petroleum DNAPL Investigation – Creosote & PCP Direct Push Technologies (HPT, LIF, MIP, EC)
Groundwater Investigations
Remedial Investigations
Remedial Design
Monitoring Well Installation
Well Logging and Interpretation

Education
BS, Environmental Science, Soil Pollution and Contaminant Hydrology Track, University of Minnesota

Years of Experience
With AECOM: 12
With Other Firms: 0

Professional Accreditations
South Dakota Professional Petroleum Remediator

Training and Certifications
OSHA 40-hour HazWOPER Training
OSHA 10-hour General Industry Safety Training
OSHA 10-hour Construction Training
BNSF Contractor Orientation
Canadian Pacific Contractor Orientation
Canadian National Contractor Orientation
AECOM On-Track Safety Training
CPR Training, Annually
First Aide, Annually

Mr. Wilson has 12 years of experience providing environmental assessment and remediation services for large and small remediation projects. He specializes in subsurface investigations and remediations, and is experienced with site investigations, environmental recovery system design and installations, excavations, monitoring well installation, soil boring installations, and environmental sampling for all media. His experience includes project management, evaluating geologic and hydrogeologic data, ensuring health and safety requirements, cost estimating, and preparing and reviewing technical reports.

Project Experience

Major Railroad Company, Former Wood Treating Facility, Minnesota. Directed the installation of LIF, MIP, and HPT borings, monitoring wells and air injection points. Coordinated the collection of groundwater samples and disposal of groundwater from a former wood treating and railyard facility. Ran day to day operations of sparge system and pump and treat systems. The work included understanding regulatory requirements, special analytical procedures and field procedures.

Former Manufactured Gas Plant – Site Delineation and Thermal Desorption Remediation Oversight, Creston, Iowa. Field Lead and Task Manager for investigation and remediation of former manufactured gas plant. Led remediation activities including: well installation, hydraulic testing, groundwater monitoring, excavation, soil sample collection, on-site laboratory, on-site thermal desorption unit, excavation dewatering, water treatment, water discharge permitting, water discharge, lead author of remedial action report. Received no further action letter from the IDNR.

Former Manufactured Gas Plant – Site Cleanup and Land Transfer, Beloit, Wisconsin. Responsible for field activities associated with groundwater sampling for monitored natural attenuation. Prepared groundwater monitoring reports including interpreting groundwater data and preparing groundwater flow and contaminant distribution maps.

Major Railroad Companies, Railyard Environmental Investigations, Iowa, Illinois, Indiana, Kentucky, Louisiana, Minnesota, Mississippi, North Dakota, South Dakota, and Wisconsin. Project Manager, Field Lead, and Task Manager for investigation of petroleum impacted soils and groundwater associated with leaking underground storage tanks, above ground storage tanks, fueling facilities, pipeline leaks, and spill sites. Coordinated project activities between railroad, municipalities, and third parties. Managed the remediation sites to ultimately receive a no further action ruling from the applicable regulatory agency. Negotiated with state agencies to place institutional controls on property with residual impacts.

Oil & Gas Company - Active LNAPL Recovery System Design, Installation, and Maintenance, North Dakota. Designed and installed active LNAPL recovery system. Preformed O & M on numerous active LNAPL recovery systems. Supervise O & M staff to ensure optimal recovery is completed from LNAPL recovery locations.

Oil & Gas and Pipeline Companies – Pipeline Release Response, North Dakota & South Dakota. Project Manager and first responder for

pipeline releases for Oil & Gas Company and Pipeline Company clients. Coordinated first responders to effectively remediate pipeline releases of crude oil and salt water. Coordinated cleanup with NDDH and SDDENR project managers.

Major Railroad Company, Railroad Derailment Investigations and Clean-up, Indiana and North Dakota. Project Manager and Field Manager of impacted soil and groundwater remediations. Investigated impacts to Soil and groundwater. Supervised drilling contractor during drilling and ORC injection process.

Major Railroad Company, First Response Plan Coordination, North Dakota. Project Manager for coordination of facility response plan (FRP) implementation support for a railyard with over 2,000,000 gallons of fuel storage capacity. Coordinates subcontractor to ensure they are able meet Site specific FRP responsibilities.

Oil Production Facilities, North Dakota. Project Manager and Field Manager for soil and groundwater investigation of former oil production facilities pipeline, rupture, and leaking pipelines. Evaluated data collected during investigation and developed a remediation plan. Project Manager for numerous in-situ and ex-situ soil remediation projects.

AECOM

Paul J. Wintheiser, P.E.
Engineer 4/Engineer 3

Education

BS – Civil Engineering

Years of Experience
With AECOM: 10
With Other Firms: 31

Registrations
PE - WI

Professional Affiliations
Solid Waste Association of North America
International Solid Waste Association

Training
Hazwoper 40 Hr Certification

Mr. Wintheiser is a registered Professional Engineer with more than 40 years of civil/environmental engineering experience, including more than 30 years of solid waste experience; specializing in leachate and landfill gas collection. Relevant experience includes:

- Teaches the LFG management section of the University of Wisconsin – Madison Department of Engineering Professional Development Sanitary Landfill Design Course.
- Served as engineering lead for the Midwest Region of US EPA Landfill Methane Outreach Program (LMOP).
- Lead the site assessment and engineering design aspects of a USAID funded project to develop closure plans for seven hazardous waste sites, and implement modern municipal waste and hazardous waste disposal practices throughout the Kingdom of Jordan. Work included:
    - Design of emergency modifications to two existing municipal waste disposal sites to accommodate significant increases in waste disposal needs resulting from the influx of refugees from the Syrian war.
    - Technical presentations to the various government ministries responsible for waste management in Jordan, and on-site technical assistance to waste disposal site management and operations staff.
    - Site assessment, and closure planning and design for hazardous waste sites located in densely populated urban areas. Issues included assisting Jordanian government ministries with planning and development of strategies for relocation of indigenous families who has established homesteads on several of the sites and developing strategies directed at eliminating illegal waste dumping on vacant lands, managing radiological hazards associated with several of the sites, and incorporating detailed construction sequencing into the closure designs to minimize adverse impacts on adjacent residents and the environment, including management of wind borne particulates mobilized during closure construction.
- Managed the engineering aspects of numerous site investigations to determine waste character, gas generation potential, migration potential and groundwater impact. Site investigations included geophysics to define the limits of fill, and active pump testing to determine sustainable landfill gas character, flow rate and extraction well zone of influence. Designed passive and active gas collection systems to control landfill gas migration. Designed, constructed, operated and maintained solar powered LFG blower systems to manage LFG migration. Performed air emission evaluations for permitting. Some of these evaluations were able to justify direct atmospheric discharge of the collected landfill gas, saving the capital and O&M cost of a flare system. Started-up, operated and maintained active gas collection systems, and trained Owner's personnel to assume operations responsibilities.
- Led a site assessment to determine the source of LFG migrating in soil under a municipal government maintenance facility. The alleged source was a municipal owned landfill which had accepted a substantial amount of paper sludge and paper waste. Through systematic site

assessment, including collection of paper waste samples for bio-chemical methane potential testing and performing pump tests on existing passive LFG vents, we were able to confirm that the migrating LFG was not from the alleged source. Additional field work indicated that the LFG was coming from other areas of the site, and subsequent field investigation of those areas confirmed the existence of old unlicensed waste disposal trenches, which were proven to be the source of the migrating LFG.

- Managed the design, construction, and quality assurance program for the gas collection system at a landfill built in a coal strip mine. Unique features of the design include a segregated system to separate low quality gas from shallow wells from high quality gas from deep wells; and adapting an existing blower system to function with both high volume, low vacuum gas collection system and a low volume, high vacuum migration control system. Additional work was directed at defining gas migration pathways and differentiating between landfill gas and coal gas.
- Designed a landfill gas migration control system consisting of a deep geomembrane barrier and a geocomposite passive vent. Evaluated various construction methods and materials which would allow the owner to perform construction without assistance from specialty contractors.
- Developed a side slope riser leachate pumping system that has become the state of the practice for most landfills constructed in North America since 1985. Several aspects of this work have been patented.
- Managed the engineering aspects of a comprehensive evaluation of the leachate systems on nine separate disposal areas at a landfill site. The project addressed removal of PCBs from the leachate prior to its introduction into an on-site treatment facility. This work provided new insight into the removal of PCBs from waste streams (specifically leachate). Several aspects of the PCB removal process have subsequently been patented.
- Designed the world's first commercial LFG fueled microturbine based electric power generating facility and the world's largest microturbine based electric power generating facility.
- Provided expert engineering testimony (both proponent and opponent) for numerous landfill-siting projects.
- Has authored More than a dozen technical presentations and publications for national and international conferences, and professional journals.

AECOM

Michael G. Wolf
Scientist 2

Professional History
09/1989 - Present, AECOM Senior Hydrogeologist
01/1977 - 01/1987, Texaco, Inc.

Education
BA, Geology and Physics, Augustana College, 1975
MS, Geophysics, Northern Illinois University, 1977
MS, Hydrogeology, Western Michigan University, 1989

Years of Experience
With AECOM: 29
With Other Firms: 10

Registrations
Professional Geologist, Wisconsin
Professional Geologist, Washington
Professional Geologist, Minnesota
Professional Geologist, Illinois
Professional Geologist, Indiana

Professional Affiliations
American Institute of Professional Geologists
National Ground Water Association

Training
Trench/Excavation Safety
Safety, Health and Environment Orientation
Respiratory Protection
Reasonable Suspicion- Alcohol and Substance Abuse
OSHA HAZWOPER Biennial Medical Exam
OSHA HAZWOPER 8-Hour Refresher Training
OSHA HAZWOPER 40-Hour Training
OSHA HAZWOPER Supervisor Training
Hazard Communication (US)
General Excavation Safety
Fire Extinguisher Training
Employee Substance Abuse Training
DOT Level 1 Shipper
Defensive Driving Awareness Training

Mr. Wolf is a senior project hydrogeologist who proposes, designs, implements, and supervises geologic, hydrogeologic and geophysical investigations, aids in remediation design, interprets collected data, and prepares documentary reports. He also is a project team member on multidisciplinary projects. Mr. Wolf has designed, coordinated, and supervised a variety of field programs associated with hydrogeological investigations and remediation design including soil boring and monitoring well construction, aquifer tests, soil vapor collection, and air sparging and soil vapor extraction design. As part of his investigative and remedial design experience, he has applied, or is knowledgeable about, innovative drilling and remediation technologies. Mr. Wolf has used an applied approach to numerical and analytical groundwater models, including contaminant transport, to evaluate groundwater capture systems for remedial action plans. His project experience includes sites involving the release of petroleum products, chlorinated solvents, brines, coal tar, PFAS, PCBs, metals, cyanide, and various volatile and semi-volatile organic compounds. Mr. Wolf has prior experience as a senior geophysicist with a national oil company and as a consultant in the Gulf Coast and Indonesia. This work was primarily in seismic and well log interpretation, but also included computer-based geologic modeling, evaluation of acreage for hydrocarbon potential, and drilling location proposals.

Experience

Michigan Department of Environmental Quality, Hoskins Manufacturing, Mio, Michigan. Project hydrogeologist aided in the design, implementation and evaluation of an enhanced reductive dechlorination (ERD) pilot study as part of a feasibility study for the site.

Michigan Department of Environmental Quality, Former Kincheloe AFB, Kinross, Michigan. Project hydrogeologist provided review comments of the Kincheloe AFB remedial investigation reports and groundwater flow and transport models as part of AECOM's level of effort (LOE) contract with the MDEQ.

Michigan Department of Environmental Quality, Former Wurtsmith AFB, Oscoda, Michigan. Senior hydrogeologist aided in the development of the site conceptual site model (CSM), provided input for the design of a groundwater Remedial Investigation for PFAS, evaluated the data from the RI, evaluated historic capture of PFAS in groundwater using a groundwater flow model, designed, implemented, and evaluated data from a surface water temperature survey and a sub-bottom profile evaluation of Van Etten Lake.

Michigan Department of Environmental Quality, Air National Guard, Grayling, Michigan. Senior hydrogeologist provided input for the design of a groundwater Remedial Investigation for PFAS and evaluated the lithology from the soil borings and residential wells and the groundwater PFAS data from the RI and residential wells as part of the site conceptual site model (CSM).

Michigan Department of Environmental Quality, Air National Guard, Alpena, Michigan. Senior hydrogeologist evaluated the lithology from

residential well logs and the groundwater PFAS data collected from the residential wells.

Michigan Department of Environmental Quality, North Kent (Wolverine Worldwide), Rockford, Michigan. Senior hydrogeologist provided hydrogeology support, interpretation of the lithology from the soil borings and residential wells, and evaluation of the PFAS groundwater data from the monitoring wells and residential wells.

AECOM

Meegan L. Zimmerman
Human Health Risk Assessor 3/Human Health Risk Assessor 2

Professional History
04/2002 - Present, AECOM Scientist
09/2000 - 12/2000, Boston University - Department of Environmental Health Teaching Assistant

Education
BA, Liberal Studies, University of Pittsburgh, 1992
MPH, Environmental Health, Boston University, 2001

Years of Experience
With AECOM: 15

Professional Affiliations
American Public Health Association

Training
Project Management
OSHA HAZWOPER 8-Hour Refresher Training
OSHA HAZWOPER 40-Hour Training

Ms. Zimmerman is an environmental scientist with 15 years of experience, primarily specializing in human health risk assessment. She has evaluated the hazards of contaminant exposure to humans and the environment and prepared guidance documents on establishing site-specific screening levels and determining site-specific no-further-action criteria. Ms. Zimmerman has negotiated exposure parameters and risk methodology with clients and regulators. She has prepared or managed the publication of numerous federal and state submittals, including human health risk assessments, no further action reports, remedy completion reports, community relations plans, Phase I site assessments, environmental baseline surveys and NEPA-related environmental assessments. Ms. Zimmerman has experience in RCRA and CERCLA in most EPA regions and numerous states, including Colorado, California, Hawaii, Illinois, and Minnesota.

Project Experience

Bureau of Reclamation, Navajo Generating Station and Kayenta Mine Complex (NGS-KMC) Permit Renewal Environmental Impact Statement, Coconino and Navajo Counties, Arizona. Author of the human health risk assessment resource section for the Draft EIS. Reviewed the human health risk assessments performed for the Navajo Generating Station and the Kayenta Mine Complex to address air emission and metal deposition and summarized their methodologies and results into the Draft EIS. AECOM was selected as the third party contractor to develop an EIS on behalf of the Bureau of Reclamation (lead agency) and the Salt River Project and Peabody Western Coal Company (Applicants), who were seeking to continue operation of an existing coal mine and coal-fired generating station in northern Arizona. The Office of Surface Mining (OSM) and Bureau of Indian Affairs (BIA) were key federal cooperating agencies. The Draft EIS analyzed potential impacts associated with various federal actions required for continued operation of the NGS-KMC from 2019-2044, including decommissioning and reclamation activities. Participated in public scoping meetings and other community meetings throughout the Navajo Nation and Hopi Tribal areas to present findings of the draft EIS and discuss community health concerns with tribal members.

US Army Corps of Engineers - Omaha District, Risk Assessment, Pueblo Chemical Depot, Colorado. Lead risk assessor for a complex site that is approximately 35 square acres in size and includes 55 solid waste management units. Responsible for the preparation of no further action justification documents for numerous solid waste management units. Responsible for annually updating the no further action methodology document which provides site-specific, risk based screening criteria. Participated in ongoing negotiations with regulators over toxicity values and risk assessment methodology. Participated in the preparation of presumptive remedy work plans and remedy completion reports.

BNSF Railway Company, Burlington Northern Railroad Tie Treatment Facility Superfund Site, Brainerd and Baxter, Minnesota. Prepared a human health risk assessment as part of the Remedial Feasibility Investigation for the tie treatment facility to address potential health risks from human exposure to soil and groundwater. The risk assessment was conducted in accordance with EPA Risk Assessment Guidance for Superfund and in consultation with Minnesota Pollution Control Agency.

Chemicals of concern include polycyclic aromatic hydrocarbons and petroleum-related VOCs. Soil and groundwater direct contact exposure pathways as well as leaching and vapor intrusion pathways were included in the evaluation. Conclusions of the risk assessment supported the objectives of the Remedial Feasibility Investigation and assisted in further remedial decisions at the site.

US Air Force Civil Engineer Center, Air Force Plant 44 - Risk Assessment, Tucson, Arizona. Lead risk assessor for a complex site involving numerous potentially responsible parties and contaminants of concern that are on the Department of Defense emerging contaminants list such as 1,4-dioxane and TCE. Participated in negotiations with regulators over toxicity values, exposure factors, and risk assessment methodology while producing the risk assessment work plan. Prepared a baseline human health risk assessment using historical data obtained from multiple agencies and data obtained from groundwater modeling. Participated in the preparation of a chromium background statistical evaluation.

US Army Corps of Engineers - Omaha District, Fort Carson Military Reservation, Fort Carson, Colorado. Lead risk assessor responsible for developing soil, groundwater, surface water and sediment risk-based concentrations for screening solid waste management units and for updating accompanying guidance document. Participated in negotiations with regulators over exposure factors, toxicity values, and risk assessment methodology. Prepared numerous no further action documents, leading to the closure of 20 solid waste management units. Primary contaminants of concern encountered included polycyclic aromatic hydrocarbons, volatile organic compounds, and metals.

US Air Force Center for Engineering and the Environment, Operable Units Applicable or Relevant and Appropriate Requirements Analysis, Edwards AFB, California. Participated in the development of a list of federal, state, and local ARARs and to be considered criteria to individual sites within 10 operable units at this Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) National Priorities List base.

US Air Force Center for Engineering and the Environment, Community Relations Plan, Andrews AFB, Maryland. Updated the community relations plans and survey questionnaire under US Environmental Protection Agency Superfund guidance. Conducted approximately 40 interviews and attended public meetings in the Prince George’s County community surrounding the base. Provided advice on Access database development, analyzed survey results, and prepared community action items for future community requirements.

AECOM Imagine it. Delivered.

AECOM Per- and Poly-Fluoroalkyl Substances (PFAS)

Capabilities and Experience

photo credit: www.af.mil

AECOM has PFAS experience at over 165 sites globally

photo credit: www.af.mil

Providing PFAS and Other Environmental Services to the DOD

Why Choose AECOM?

Our fundamental approach to PFAS program management includes:

- **STRATEGIC PROGRAMMING.** Use of our programmatic experience supported by over a decade of working at commercial and DoD sites including program management of the Australian DoD PFC program. We bring a cadre of technical and program professionals to the Armed Forces' drivers, challenges, and stressors with up-front, well-developed tools, meaning overall greater efficiency, less reactivity and award-winning environmental stewardship.
- **INNOVATIVE STUDIES.** A regulatory and scientifically defensible investigative approach that is optimized through a CSM based on Environmental Sequence Stratigraphy (ESS). We streamline the investigative process, minimizing rework and maximizing the results per dollar spent.
- **REGULATORY EXPERTISE.** Decades of regulatory experience with USEPA and in every state that is built on partnering and trust. We bring instant credibility with all state regulatory agencies to find the best solutions in the least amount of time.
- **FOCUSED TECHNOLOGICAL SOLUTIONS.** Thorough understanding of the remedial technologies available including their applications by media, limitations, effectiveness, and cost. We begin with the end in mind by leveraging our insight and unmatched knowledge of remedial technologies and provide the best, most cost-effective options available.

Overall, AECOM provides an overall approach that minimizes expenditures, maximizes schedule efficiencies, and diminishes the risk to the Armed Forces mission.

Specialized Experience and Technical Competence

AECOM provides direct experience successfully executing environmental contamination investigation projects spanning multiple installations across the US and internationally. AECOM initiated its first Per- and Poly-Fluoroalkyl Substances (PFAS) project in 2001, and has since become a recognized PFAS industry leader. Our teams have presented and authored dozens of PFAS-related conference presentations and publications, and have worked at PFAS sites at various installations for the Air Force and other Department of Defense (DoD) agencies. We are currently working on more than 182 PFAS projects throughout the world.

As the Engineering News Record (ENR) #1 Environmental Firm, our team qualifications, size, and diversity is unmatched. We bring veteran professionals with over 15 years of experience conducting all aspects of PFAS site characterization, risk assessment, remediation, and response/mitigation measures. AECOM's PFAS Technical Practice Group (TPG) allows technical staff to share knowledge, lessons learned, and best practices from projects executed worldwide. AECOM is also a leader in treatment of PFAS-impacted drinking water, wastewater, and groundwater, partnering with academic and industry experts to develop and deliver cost-effective technologies that generate less waste.

Past Performance

With nearly 25 years executing environmental restoration work, AECOM (including the former URS Corporation) presents AFCEC with a reliable, low-risk partner that consistently delivers up to and beyond expectations. We have executed over $2B in work for AFCEC in the last 10 years alone. We have helped the Air Force solve some of their most challenging environmental issues, while performing the full array of environmental restoration activities, including multi-base, multi-media Site Inspections (SIs).

Now as a cohesive, united team, we are able to provide even more resources and expertise to AFCEC and other Federal clients. For our DoD contracts, 78% of our final Contractor Performance Assessment Reports System (CPARS) ratings received during the past 5 years have been either Exceptional or Very Good. These ratings are a testament to our Project Managers' ability to deliver top-quality results while serving as responsible stewards of client funds and adhering to established performance schedules.

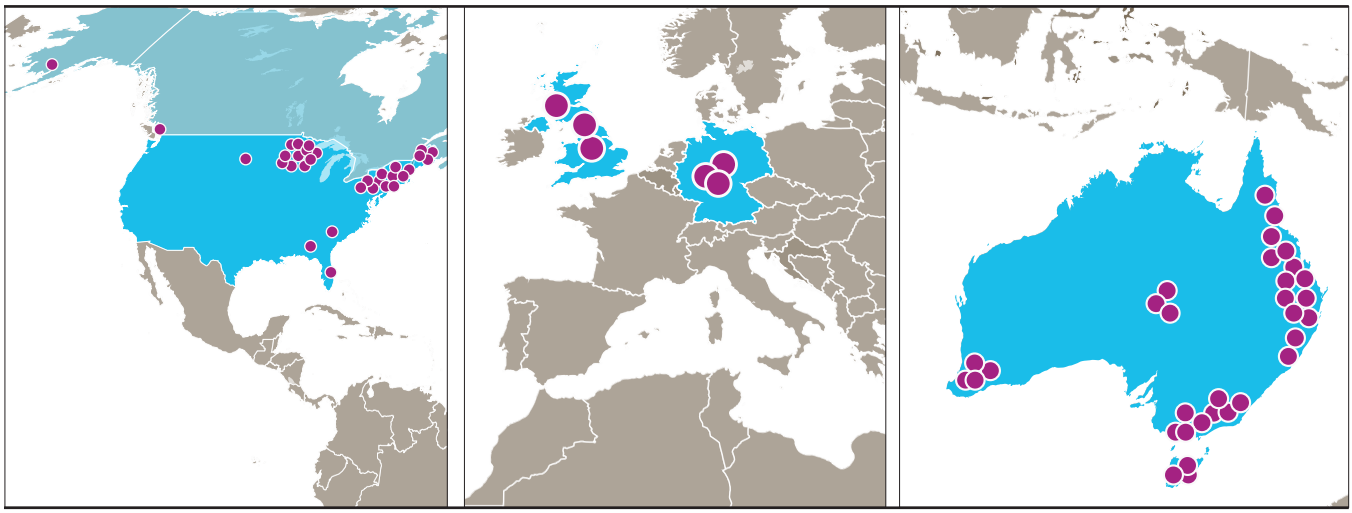
Capacity

AECOM is the largest environmental restoration company in the US with thousands of environmental professionals in close proximity to Air Force installations. We employ more than 1,900 project managers, including hundreds who have managed projects for US military clients. Our project managers include architects, engineers, scientists and planners in various disciplines. AECOM and URS have executed more than 2,000 Task Orders (TOs) for AFCEC in the last 10 years through the 4P AE-08 and prior contracts. With access to 85,000 employees worldwide including over 20,000 in our US-based Environmental Services organization (the primary provider of A-E environmental services for the US government), AECOM can respond rapidly with staff at any site.

Location

AECOM has executed A-E services at more than 75 active and all BRAC installations in the US plus at 23 OCONUS locations. To sustain the Federal Government's mission, AECOM can draw resources from over 500 offices worldwide (including 190 OCONUS offices), combining experienced project managers with local technical expertise in the general geographical area of the project and knowledge of the locality of the project.

AECOM Global Perfluorinated Compounds Project Sites



CONTRACTS HELD BY AECOM

- AFCEC A-E13 ES Contract, URS Group, Inc. (now part of AECOM), FA8903-16-D-0029
- AETC A-E Environmental Services Contract, AECOM, FA3002-07-D-0015
- AFCEC A-E13 ES Contract, CTI-URS Environmental Services, LLC. (now part of AECOM), FA8903-16-D-0053
- AFCEC A-E13 ES Contract, Prudent-AECOM 8(A) JV, LLC, FA8903-16-D-0037

In addition, AECOM also holds a wide range of other DoD (including USACE) contracts:

- USACE Baltimore A-E HTRW (AECOM Tidewater JV)
- USACE Kansas City A-E HTRW NWD & USEPA Region 2
- USACE Louisville A-E Environmental Services (URS and URS-CTI JV)
- USACE Mobile REAT-C-HTRW
- USACE Tulsa A-E SWD

AECOM

Technical Capabilities

AECOM Capability Overview — PFAS Management

Areas of Expertise

- PFAS Sampling
- Toxicity/Risk Assessment
- Feasibility Studies/Remediation/Development of Treatment Technologies
- Regulatory Navigation/Negotiation
- Off-Site Release Mitigation
- PFAS Waste Management

More Information

Katherine Davis, Ph.D.
North America PFAS Technical Lead
+1.302.781.5890
katherine.l.davis@aecom.com

Dora Chiang, Ph.D., P.E.
Vice President, Director of
Emerging Contaminants
+1.404.405.1214
dora.chiang@aecom.com

Rachael Casson
Director of International PFAS Program
+61.2.8934.0142
rachael.casson@aecom.com

AECOM has been conducting PFAS investigations since 2001, has worked on many of the world's most significant PFAS problems, and is currently working on over 165 PFAS sites around the globe including >50 DOD and 15 R&D projects.

What Are PFAS?

Per- and Poly-fluoroalkyl Substances (PFAS) comprise a diverse group of synthetic chemicals used for over 50 years in various military and industrial applications and consumer products. PFAS are detected in aqueous film forming foams (AFFF) used for fire fighting and fire suppression starting in the 1960s. Sources of PFAS used by military and commercial airports can include: fire training areas, nozzle test areas, hangars and other buildings equipped with fire suppression equipment, fire stations, AFFF loading, handling and storage areas, aircraft and vehicle crash response areas, and AFFF ponds, sumps, and tanks. The U.S. Air Force estimates PFAS-containing AFFF may have been used at approximately 200 active and former Air Force bases, including Air National Guard and Air Force Reserve facilities.

Properties of PFAS

- Limited sorption to soil and sediments
- Highly water soluble, non-volatile and extremely mobile in water
- Exceptional stability
- Persistent with very little attenuation
- Widely present in the environment, bioaccumulative and detected in plants, many animals, and humans

Potential Health Effects

Toxicological data is generally limited for most PFAS with the exception of a few more highly studied compounds. The C8 Science Panel identified the following probable links to Perfluorooctanoic Acid (PFOA) exposures:

- Ulcerative colitis
- Thyroid disease
- Testicular and kidney cancer
- Pregnancy-induced hypertension
- Diagnosed high cholesterol

Increased Regulatory Attention

Concerns associated with PFAS prompted the US EPA to include six PFAS compounds on its Unregulated Contaminant Monitoring Rule – 3 List (UCMR-3) that required sampling/analyzing the compounds in large public water systems. This sampling resulted in the discovery of impacted drinking water supplies, several linked to joint DoD and commercial airport sites. The US EPA also recently finalized its Lifetime Health Advisory Levels (HALs) for perfluorooctanesulfonic acid (PFOS) and PFOA in drinking water at 0.070 µg/l (70 parts per trillion) with a recommendation for combined PFOS/PFOA concentrations <70 ppt. Given these impacts to drinking water sources and the establishment of US EPA HALs, a higher level of environmental regulatory scrutiny is occurring and is expected to continue.

Areas of Expertise

PFAS Sampling. PFAS sampling requires careful consideration and use of unique procedures and materials to obtain high-quality data because of the high potential for introducing contaminants during sampling. AECOM has developed internal training for PFAS sampling, and all field teams are required to complete this training before conducting PFAS sampling. AECOM has also worked closely with analytical laboratories certified to conduct PFAS analysis, has audited them, and has even influenced their procedures.

Toxicity/Risk Assessment. AECOM has conducted over 15 years of research on PFAS toxicity, maintains a current collection of human health/ecotoxicological information, and tracks this literature to allow us to select toxicity values that are appropriate for the receptors for different types of habitats. This allows risk assessments to be targeted to the site and to reduce unnecessary remediation needs and costs by avoiding the use of default values. Our risk assessors globally have performed precedent setting human health and ecological PFAS-specific risk assessments which assist our clients in managing PFAS impacts using state-of-the science information.

Feasibility Studies/Remediation/Development of Treatment Technologies. PFAS remediation is challenging, with a limited number of commercially available effective technologies. Demonstrated options for soil include: Excavation and off-site disposal or incineration; isolation in place. Demonstrated options for groundwater include: Pump and treat with granular activated carbon or thermal oxidation. Testing of stabilization (soil/groundwater) and ion exchange resins are showing promise. AECOM is currently conducting PFAS treatment R&D on behalf of the U.S. Air Force, Australian Defence, and Canadian Government.

Regulatory Navigation/Negotiation. AECOM has been actively involved in negotiating with regulators to ensure that pragmatic management measures are put in place. AECOM has the capabilities to address Applicable or Relevant and Appropriate Requirements (ARARs) for various sites and contaminants regulated by USEPA and State/Local regulators. AECOM brings its regulatory expertise in solving complex waste management thereby minimizing environmental liabilities.

Off-Site Release Mitigation. Numerous AECOM personnel with PFAS experience can respond quickly to off-site releases and potential human exposures. In addition to residential or private drinking water sampling, AECOM performs community relations activities including development of communications plans, hosting community engagement meetings, and establishing call centers.

AECOM has implemented active solutions to mitigate human exposure including design, installation, operation, and maintenance of hundreds of off-site residential point of entry treatment water systems and 10 public water supply treatment systems treating over 13 billion gallons of water to date.

Waste Management. AECOM provides a wide range of capabilities to manage PFAS-contaminated wastes. Our teams utilize off-the-shelf technologies ranging from incineration for solid wastes to granular activated carbon systems for water wastes. We are also looking to newer, innovative ways to manage wastes with the goal of destroying PFAS molecules, focusing on sustainable and affordable technologies that emphasize total destruction through electrochemical oxidation, ultrasonic or enzymatic oxidative destruction. We have also evaluated the feasibility of stabilizing and reducing PFAS in soil and solid waste using commercial products such as RemBind® and innovative enzymatic oxidation destruction. Our waste management experience includes support to clients for compliance with permitted waste requirements when other chemicals of concern are also contained in the impacted media. AECOM also has extensive experience in managing wastes containing Resource Conservation Recovery Act (RCRA) listed wastes, Toxic Substances Control Act (TSCA) wastes, and other wastes regulated as solid and hazardous wastes.

Our Approach

AECOM was awarded our first PFAS project in 2001, and has since become a recognized industry leader on PFAS around the globe. We've established global and regional leaders that support PFAS projects and understand how to work closely with local teams. AECOM's PFAS Technical Practice Group (TPG) tracks regulatory and treatment technology developments and meets monthly to exchange recommendations. AECOM participates in research forums and works with leading academics globally. For example, AECOM and University of Georgia currently have an Air Force Broad Agency Announcement (BAA) grant for conducting a pilot study to evaluate treatment technologies at Wurtsmith AFB.

Key AECOM Attributes

- Conducted PFAS activities at >50 U.S. DOD facilities and is currently conducting PFAS PA/SIs, RI/FSs, Conceptual Site Models (CSMs), and R&D for DOD.
- Worldwide, multi-country experience in all aspects of PFAS investigation, risk assessment and remediation in consulting, research, and regulatory developments.
- Conducting the largest PFAS investigation ever performed; collecting >15,000 samples, investigating several entire counties, and collecting samples along an 80 mile segment of a large river.
- Designed, installed, operated, monitored and maintained dozens of full scale PFAS groundwater remediation systems, hundreds of residential and 10 commercial supply well PFAS treatment systems.
- Conducting innovative on-site soil and groundwater remediation bench and pilot scale testing on behalf of the Australian and U.S. DOD.

Risk Assessment Services for Per- and Poly-Fluoroalkyl Substances (PFAS)

Areas of Expertise

- **Design of sampling and analysis plans** for PFAS in multiple environmental media (water, soil, sediment, tissues), and data collection for ultimate use in risk assessment
- **Human health risk assessment** for PFAS in accordance with guidelines from USEPA, US Navy and Australia.
- **Ecological risk assessment** for PFAS in accordance with guidelines from agencies in USA, Canada, United Kingdom, European Union and Australia
- **Development of ecological screening benchmarks** for water, sediment and soils and toxicity reference values for invertebrates, fish, birds and mammals
- **Tracking continuing research and development** in the ecotoxicity of PFAS
- **Innovative evaluations of ecological impacts** related to accidental and chronic releases of PFAS into aquatic and terrestrial environments using field data collection, toxicity testing and other methods
- **Regulatory tracking and client alerts** on PFAS
- **Critical reviews** of human health-based toxicity studies and regulatory thresholds

More Information

Usha Vedagiri
Regional PFAS Market Sector Lead
+1.510.873.3123
usha.vedagiri@aecom.com

Overview

Per- and Poly-Fluoroalkyl Substances (PFAS) are perfluorinated compounds that are widely used by a number of industries. Some of the most commonly used PFAS, including perfluorooctane sulfonate (PFOS) and perfluorooctanoic acids (PFOA) are now known to be persistent, toxic at relatively low concentrations and bioaccumulative. The behaviour of PFAS in the environment provide unique challenges when assessing contaminated soil, groundwater and surface water.

Our Approach

AECOM is well-placed to guide clients through the identification, management and, if warranted, remediation of PFAS. We have worked with multinational oil clients and the Department of Defence, and are providing informed advice to a wide range of clients around the impact of state, federal and international legislation associated with the use, storage and disposal of these products.

Examples of PFAS sources include:

- Aqueous Film Forming Foams (AFFFs), which are used on flammable liquid (Class B) fires
- Industrial surfactants, including hydraulic fluids and photolithographic coatings
- In Scotch-Guard, Gore-Tex and a number of textile products
- In Teflon 'non-stick' products

Some of these chemicals are now listed as 'persistent organic pollutants' under the Stockholm Convention of Persistent Organic Pollutants.

The regulatory landscape around the storage, use and remediation of PFAS is changing rapidly. Environmental regulators may require an overly conservative approach to investigations and PFAS management on-site, despite evidence that in some instances, fluorinated products

are the most 'fit-for-purpose' currently available. Some jurisdictions have also indicated that in the future, PFAS should completely be removed from use on industrial sites. In some instances, this is not practical and the use of replacement compounds may introduce other potential human health or environmental issues. AECOM has been actively involved in negotiating with regulators to ensure that pragmatic management measures are put in place that do not compromise human health or the environment.

Key AECOM Attributes

- **Interpretation of Multi-media sampling and PFAS data.** Because PFAS chemicals have unique properties and are distributed throughout the world, data collection for risk assessment use requires particular attention to avoid cross-contamination and selection of the correct tissues for analysis. AECOM is practiced in designing and executing large-scale multi-media sampling, including many types of tissue (vegetation, invertebrates, fish, blood, milk, etc), working directly with analytical laboratories to generate data of the risk assessment quality and educating regulators and clients who may be unfamiliar with PFAS. This assists with project efficiency and success.
- **PFAS Ecotoxicity database.** AECOM maintains a current collection of ecotoxicological information for PFAS. There is a vast amount of emerging literature on ecotoxicity of PFAS with respect to numerous biological groups. AECOM tracks this literature and is able to select toxicity values that are appropriate for the receptors for different types of habitats. This allows ecological risk assessments to be targeted to the site and avoids default values, and minimizes the potential for overestimation of risks, reducing unnecessary remediation needs and costs.
- **Major Clients and Projects.** Human health and ecological risk assessments on multiple large scale projects for US Navy, US Army Corps of Engineers, Oil and Gas clients, Chemical industry, Australian Air Force and other clients, involving PFAS in soil, sediment, groundwater, surface water, vegetation, fish and other biological tissues.

Key Reference Material

- Draft Toxicological Profile for Perfluoroalkyls. Agency for Toxic Substances and Disease Registry (ATSDR). August 2015. http://www.atsdr.cdc.gov/toxprofiles/tp.asp?id=1117&tid=237
- Toxicity values for PFOS, PFOA and other PFAS. Texas Commission on Environmental Quality. August 2014. http://www.tceq.texas.gov/assets/public/remediation/trrp/pcls2014.pdf.
- Provisional Peer-Reviewed Toxicity Values (PPRTVs) for some perfluorobutane sulfonate. 2014. http://rais.ornl.gov/home/whatnew.html
- Aquatic Toxicology of Perfluorinated Chemicals. J.P. Giesy, J.E.Naile, J.S.Kim, P.D.Jones, J.L.Newsted. 2010. Reviews of Environmental Contamination and Toxicology.

World-wide, multi-country experience in all aspects of PFAS investigation, risk assessment and remediation in consulting, research, and regulatory developments

AECOM PFAS Sampling Guidance

Per- and Poly-Fluoroalkyl Substances (PFAS), including PFOA and PFOS, comprise a diverse group of synthetic chemicals used for over 50 years in various military and industrial applications and consumer products. In May 2016, USEPA established the life-time health advisory levels of 70 parts per trillion (ppt) for PFOA and PFOS. When both are present in drinking water, the combined concentrations of PFOA and PFOS should be compared with the 70 ppt advisory level. Public scrutiny and the low USEPA advisory levels rapidly raised concerns about the extent of PFAS in the environment. Since 2001, AECOM has been contracted by a confidential manufacturing client to manage a PFOA site-related environmental assessment program that included multi-media monitoring of PFOA on and around their fluoropolymer manufacturing facility located in West Virginia. AECOM has also been contracted by the Australian and U.S. Departments of Defense to sample and assess PFAS impact to the environment due to Aqueous Film Forming Foam (AFFF) releases at their most challenging sites.

FOR MORE INFORMATION

Katherine L. Davis, PhD
North America PFAS Lead
+1-302-781-5890
katherine.l.davis@aecom.com

Rachael Casson
International PFAS Lead
+61 2 8934 0142
rachael.casson@aecom.com

aecom.com

As of December 2016, AECOM has conducted PFAS sampling at over 165 sites globally. Recently reduced PFAS health advisory levels and analytical reporting limits in the 2 to 20 ppt range increased the need for collection of reliable data for risk reduction decision making. With over a decade of PFAS sampling experience, as well as interactions with regulatory agencies, AECOM took an important step in developing an internal PFAS sampling guidance document and field staff training program. **Because of the significant potential for cross-contamination during sampling, AECOM implemented strict PFAS multimedia sampling procedures to obtain high-quality data and requires certification of all field personnel involved in PFAS sampling.** These measures will ensure that standardized sampling procedures and materials are utilized and followed across all PFAS sites. Concurrently, AECOM has also worked closely with analytical laboratories and academic communities to update the sampling guidance when new scientific data become available, further improving the quality of PFAS data collected.

AECOM's PFAS Sampling Guidance is designed to:

- Provide, in a single document, guidance on avoiding PFAS cross contamination during sampling of various types of environmental media (a total of 12 different sampling media are included).
- Provide procedures, tracking and decision making tools to improve sampling consistency and data quality.
- Provide recommended management guidance on supervising AECOM field sampling staff and AECOM subcontractors.
- Provide updates on the PFAS sampling procedures meeting federal and state requirements.

It includes the following sections:

- Safety
- Training and qualifications
- General PFAS sampling guidance
- Media-specific sampling guidance
- Managing PFAS Investigation Derived Wastes (IDW)
- Guidance for subsurface investigation activities at PFAS sites, such as well installation, hydraulic testing and well abandonment

Our sampling guidance also features an awareness identification system that differentiates the field sampling materials that:

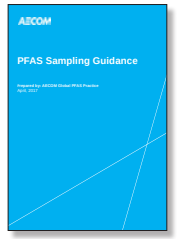
- Cannot be used
- Use with caution
- Are safe and can be used

This second category is used for materials where no scientific data is available to prove cross contamination potential, but was thought to be a problem at some point, so use only after careful evaluation or after equipment blanks verify that the item is not a cross contamination source.

We advise our practitioners that AECOM PFAS Sampling Guidance supplements the AECOM-required training necessary prior to performing PFAS sampling, but should NOT be used to replace PFAS sampling Standard Operative Procedures (SOP) required by regulatory entities or clients' organizations.

AECOM's PFAS practice is committed to investing in efforts that build trust and bring quality that our clients expect. For more information about our PFAS sampling protocol, please contact Dr. Katherine Davis or Rachael Casson.

AECOM Sampling Guidance was developed:



- ☑ To improve data quality and reduce cross contamination
- ☑ Based on sampling at more than 165 PFAS impacted sites.
- ☑ To include 12+ environmental media.
- ☑ To cover best practice for all field activities encountered during PFAS investigation.
- ☑ For site investigation and remediation system monitoring, globally.
- ☑ To include a sampling equipment/material awareness identification system.
- ☑ To be used during PFAS sampling training program.

AECOM Per- and Poly-Fluoroalkyl Substances Treatment

Where We Are and What's Next

Technology Update

September 2017

More Information

Dora Chiang, Ph.D., P.E.
Vice President, Director of Emerging Contaminants
+1.404.405.1214
dora.chiang@aecom.com

About AECOM

AECOM is built to deliver a better world. We design, build, finance and operate infrastructure assets for governments, businesses and organizations in more than 150 countries. As a fully integrated firm, we connect knowledge and experience across our global network of experts to help clients solve their most complex challenges. From high-performance buildings and infrastructure, to resilient communities and environments, to stable and secure nations, our work is transformative, differentiated and vital. A Fortune 500 firm, AECOM had revenue of approximately $17.4 billion during fiscal year 2016.

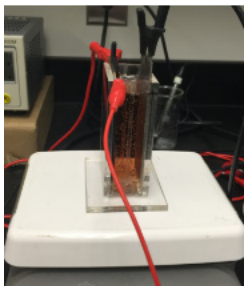
See how we deliver what others can only imagine at aecom.com and @AECOM.

AECOM is a global leader in providing cutting-edge and innovative client-focused solutions to reduce social, economic and environmental risks associated with the releases of emerging contaminants into the environment.

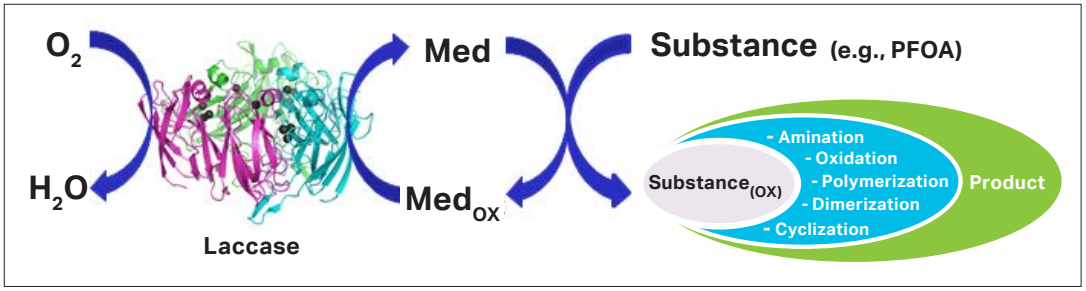
In recent years, Per- and Poly-Fluoroalkyl Substances (PFAS), including perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS), have been classified as emerging contaminants that have been found to occur globally and are the subject of increasing regulatory focus and concerns. PFOA and PFOS have been detected in air, soil, sediment, groundwater, surface water, plants and animals, infrastructure, garments and drinking water due to their physicochemical characteristics, which make them easily transported and persistent in the environment.

PFAS have been extensively used as fluorosurfactants for a large number of applications, including for aqueous film foaming foams (AFFFs). The chemical composition of AFFF has changed a number of times over the last 40 years and research has identified over 300 different PFAS in AFFF formulations used by the US Department of Defense. More tools are needed to characterize them properly. Some PFAS (e.g., perfluoroalkyl acids [PFAAs]) are resistant to microbial biodegradation or chemical oxidation processes. Furthermore, the US EPA's recently established Lifetime Health Advisory Levels for PFOS and PFOA were established at 70 ppt resulting in the need to suspend the use of, or treat, many public and private groundwater drinking wells.

Excavation and off-site landfilling of PFAS-impacted soils has been the preferred remedy for PFAS-impacted soil in the US. However, landfilling of impacted soil to industrial or municipal landfills may not be allowed soon. Granular activated carbon (GAC) treatment for PFOA and PFOS impacted water has been demonstrated at full-scale treatment plants in the US and is the preferred technology in recent years. Although AECOM's 11-year GAC system operation told us PFOA can be successfully treated to meet the remedial goal at parts per trillion levels, our practical experience suggests GAC's effectiveness on treating AFFF impacted groundwater (mix of PFAS compounds) remains uncertain and unproven. GAC has been proven repeatedly



Electrochemical Oxidation Study



Enzyme Catalyzed Oxidative Humification Reaction

ineffective for short-chain PFAS or fluorotelomers. More frequent GAC changeouts are likely needed and increase the operation costs. In addition, the spent carbon has to be incinerated safely for regeneration, increasing costs.

Several other technologies have been developed that transfer PFAS in water onto sorbents, such as ion exchange resin, RemBind™, chemical and electro-coagulation, reverse osmosis (RO), etc. However, these mass transfer technologies have no track records of full-scale operations and will require a regeneration process for sorbent reuse, and further treatment of a PFAS-concentrated brine in the case of RO. This regeneration process will produce spent regenerants containing very high concentrations of PFAS for disposal. Destructive technologies (e.g., electrochemical oxidation, sonochemistry) are under bench-scale development, but they consume large quantities of energy, are presently not cost effective, are sustainable to treat a large and low-concentration PFAS plume.

AECOM Supports PFAS Technology Development

While the challenges of treating PFAS exist, AECOM strives to select the most appropriate management and treatment technology to meet the client's requirements. Presently, AECOM does not favor one remedial technology, and in some instances, we recommend a multifaceted approach between management and treatment (administration controls, mitigation of exposure, water treatment and/or source control). Other overarching philosophical approaches AECOM considers when prioritizing our technology development efforts include:

- **MASS TRANSFER IS NOT THE FINAL SOLUTION.** We encourage the development of low-cost and regenerable sorbents for high-volume and low-concentration PFAS plume treatment. However, the mass transfer technology is an intermediate process that should be followed by mass destruction processes for sorbent reuse and destruction of PFAS.
- **ZERO PFAS WASTE STREAM FOR OFF-SITE DISPOSAL.** AECOM supports technologies that destroy PFAS waste on-site, so that the PFAS legacy will not be transferred from on-site to off-site.
- **GREEN AND SUSTAINABLE.** We support green technologies including phytoremediation and fungal degradation opportunities as sole or part of plume management strategy to reduce economic, social and environmental risks.

AECOM is currently researching the following treatment technologies:

- Plant-assisted uptake of PFAS
- New low-cost and regenerable sorbents
- Cost-effective destructive technologies for treatment of PFAS-laden spent regenerants and high PFAS concentration waste
- Coupling sorption (low-cost, high-volume) with destruction (high-cost, low-volume) treatment technologies for PFAS plume remediation and management
- Field demonstration of optimizing GAC treatment performance by coupling GAC and fungal-produced enzyme to "trap and treat" and reduce the PFAS mass
- Soil immobilization treatment and *in situ* stabilization/solidification

Closing

AECOM leverages our practical PFAS project experience and our collaboration with our clients, technology vendors and academia to support good science. We evaluate treatment technologies to reduce short-term and long-term risks for our clients, while leading innovative technology development to manage complex PFAS sites in a sound, cost-effective manner.

AECOM Treatability Studies Laboratory

Areas of Expertise

- Bioremediation (aerobic and anaerobic)
- *In situ* chemical oxidation
- Chemical reduction
- Solidification/stabilization
- Surfactants treatment
- Metals fixation
- Batch and column tests
- Flocculation and settling tests
- Cell culture of beneficial microbial strains

The contaminants of concern that can be evaluated with these tests include:

- Chlorinated ethanes/ethenes: PCE, TCE, 1,1,1-TCA, cis-DCE, etc.
- Benzene, toluene, ethylbenzene, and xylene (BTEX)
- Chloroform
- Nitrosodimethylamine (NDMA)
- 1,4-Dioxane
- Toxic metals: mercury, arsenic, hexavalent chromium
- PFAS

More Information

Francisco Barajas, Ph.D.
Treatability Study Lab Manager
+1.512.419.5447
francisco.barajas@aecom.com

Overview

The AECOM Treatability Study Laboratory provides a cost-competitive option for performing batch and column treatability studies to evaluate chemical, biological, and physical treatment approaches for a wide range of chemicals in various environmental media, at projects across the US. Bench-scale treatability studies can be used to compare treatment alternatives, evaluate reagent types, dosages and application methods, shed light on site biogeochemical conditions, and provide proof-of-concept evidence that a selected remedial technology will attain performance objectives. The treatability study results can be used to support all aspects of remedy selection, design, and implementation.

Our Approach

Analytical Capabilities

On-site analytical capability is critical to measure the real-time contaminant degradation kinetic data and determine the time points for off-site quantitative analyses, if needed.

Our facility offers the following analytical capabilities:

- Ion chromatography: Nitrate, sulfate, chloride, organic acids
- Gas chromatography (FID and TCD detection): VOCs and gases
- Atomic absorption (metals)
- Mercury analysis
- UV-VIS spectrophotometry: reduced iron, reduced anthraquinone disulfonic acid (AQDS), protein, hexavalent chromium
- Soil oxidant demand test
- Total organic carbon (TOC)
- pH, ORP, DO, specific conductivity, temperature, and turbidity

Community/Stakeholder Relations

Areas of Expertise

- Communications Strategy Plan
- Printed Information Materials
- Preparation of News Releases, Media Briefs, and Presentation Materials
- Website Development and Management
- Q&As
- "Behind the Scenes" Briefings
- Risk Communications
- Public Information Forums
- Mailing Lists
- Information Repositories

More Information

Shannon Gleason
Community and Stakeholder Relations
+1.802.989.1164
shannon.gleason@aecom.com

Overview

Regulatory agencies, stakeholders and the public are often concerned about the potential threats and impact of environmental projects — actual and perceived — to public health and the environment. When a project is complicated by political, environmental, or site conditions, these complications are difficult to understand. No matter how sound the proposal or technical solution is, the project can be delayed, if the community distrusts the source of the technical analyses. This will impact the schedule and, usually, the cost of an otherwise successful project.

AECOM's experience and literature confirm that the best approach to community relations is to keep stakeholders and the public informed throughout project planning process, so that no one feels the need to take dramatic action to be heard or considered. Research has shown that regular communications lead to familiarity; familiarity can lead to understanding, which can increase one's comfort and decrease one's perception of risk.

AECOM's community relations experts have implemented successful, cost-effective public involvement programs to support complex environmental projects for many private and public sector clients, including:

- Major government agencies
- Multinational manufacturers
- Global oil and gas firms
- Integrated power companies

Our Approach

Our approach to community relations projects is to work as a team with our clients' environmental and communications professionals to develop effective strategies and implement successful programs. AECOM's Community Relations Specialists work side-by-side with our project and site managers, technical staff, and scientific risk assessors to help identify key community issues, and articulate a realistic and understandable view of the work being done and the potential risks or exposures involved. Aware of important issues potentially affecting a site, we communicate the facts in a non-threatening manner to enhance understanding and trust.

Our experience has shown that focused planning facilitates effective community relations – and successful projects. AECOM focuses on:

- Minimizing project costs and delays
- Identifying, anticipating, and addressing public concerns
- Establishing and improving our clients' credibility
- Improving the quality of decisions through consensus-building

Areas of Expertise

AECOM has extensive experience in developing strategies, and sharing information through community communications, public education, and outreach programs. Nearly all of our projects involve communicating technical information in a manner easily understood by both technical and non-technical audiences. Our work has included communications tools for a wide range of environmental projects, including:

- **COMMUNICATIONS STRATEGY PLAN**. A Communications Strategy Plan is a key element in creating and maintaining effective communications with stakeholders and the community. An effective Plan should outline the essential components of a Community Relations Program, including rationale for conducting the program; events that will require communications; messages to convey; potential audience for communications; vehicles to convey message(s); participants in communications process and their roles; and timing of events/schedule.
- **PRINTED INFORMATION MATERIALS.** Printed information materials include Fact Sheets, Newsletters, Brochures, and Issue Papers, which are useful tools for providing information to the community about a project. We are adept at dispelling public fears of misunderstood projects, which often boil down to fear of the unknown or fear of unforeseen consequences.
- **PREPARATION OF NEWS RELEASES, MEDIA BRIEFS, AND PRESENTATION MATERIALS.** We assist our client in distributing accurate, scientifically-sound information to media outlets and other information providers.
- **WEBSITE DEVELOPMENT AND MANAGEMENT.** AECOM's project websites for its clients are an integral tool for providing accurate information to the community on multiple issues surrounding a project.
- **Q&AS.** Developed for internal project team use, Q&As "brainstorm" questions or concerns the public may have regarding the site, and develop answers to these questions. By having the questions and answers formalized, all project team members can provide consistent responses to public or media inquiries.
- **INTERNAL TEAM BRIEFINGS.** Often, our clients' public relations professionals or media contact person(s) are the focus of inquiries from the public or press. We work "behind the scenes" with these persons to ensure they are adequately briefed on the site, the issues, and the action plan. Often, AECOM develops answers to the "tough questions" the public or media may ask, documents these answers in an internal briefing document, and distributes this to all team members.
- **RISK COMMUNICATIONS.** AECOM specializes in preparing and implementing effective risk communications programs by working with the scientific risk assessors to articulate a realistic view of the risk for the public.
- **PUBLIC MEETINGS AND INFORMATION FORUMS.** These forums, which include stakeholder/community advisory groups, restoration advisory boards, and open houses, are managed, developed and coordinated by AECOM to ensure maximum participation, and rational, science-based communication among all parties.
- **MAILING LISTS.** An essential element of each Community Relations Program, a mailing list is typically generated by reviewing potential stakeholders in the cleanup of the site (e.g., local, county, state officials) and potential impacted citizens (e.g., residents or businesses in a certain radius of the site).
- **DOCUMENT REPOSITORIES.** Typically housed in public libraries or town offices, a document repository provides a central location for the community to access important site information.

AECOM

Department of Defense Experience

PFAS Projects for the Air National Guard

Fiscal Year (FY) 16 Phase 2 Regional Site Inspections (SIs) for PFAS at Multiple Air National Guard (ANG) Installations

AECOM is under contract to complete PFAS SI activities for 78 areas of concern (AOC) at seven ANG installations in five different states, with an optional 125 AOCs at 12 ANG installations in seven additional different states. Our team is delivering defensible, regulatory approved No Further Action (NFA) decision documents. AECOM is also providing data quality objectives specific to AOCs not meeting NFA criteria to provide clear direction for follow-on Remedial Investigations. To ensure a consistent approach across all ANG installations, AECOM's project management office developed a consistent and repeatable field sampling process that is used by all AECOM local offices to supplement the SI Work Plan. This process includes standardized field sampling forms, chain-of-custody, database-generated pre-printed sample labels, etc., in order for the local office to complete the field work and provide high-quality, consistent project documentation. We are analyzing for the six Third Unregulated Contaminant Monitoring Rule (UCMR-3) PFAS (PFOS, PFOA, PFBS, PFNA, PFHXS and PFHPA) and providing minimum reporting limits of 4 nanograms per liter (ng/L) for groundwater and surface water and 3 nanograms per gram (ng/g) for soil and sediment, which are well below any current applicable Federal, State, or local action and notification levels. Additionally, to help ANG respond consistently to public concerns, AECOM is providing community relations planning, consisting of first level planning involving a Decision Tree and Communication Plan. When sampling results confirm off-base migration, AECOM is providing pre-established protocols for each of a number of scenarios outlined in the Decision Tree and Communication Plan. Each scenario can result in a different set of responses that range from simply communicating no impact/detections, to immediately implementing mitigation measures.

PFOS/PFOA SI, Delaware ANG Base, New Castle, Delaware, Contract: W9133L-14-D-0001

AECOM has been advising the ANG on management of PFOS/PFOA at the Delaware ANG facility since 2014 and began conducting groundwater monitoring for PFOS/PFOA at the base in 2016. AECOM's involvement has consisted of:

- Briefing ANG personnel on the current state of the industry with regard to PFOS/PFOA investigation and regulation.
- Providing technical support to the ANG in their discussions of PFOS/PFOA at the Delaware ANG facility with the Delaware Department of Natural Resources and Environmental Control and EPA. During these meetings, AECOM has been a strong advocate for the ANG, identifying potential sources of PFAS contamination outside the base boundary.
- Completed a basewide groundwater monitoring event for PFOS/PFOA in April 2016 and October 2016.

PFAS Projects for the Navy

PFOS/PFOA RI, Findings of Suitability to Transfer (FOST)/Findings of Suitability to Lease (FOSL) Support, Naval Air Station (NAS) Joint Reserve Base (JRB) Willow Grove, NJ, and Naval Air Warfare Center (NAWC) Warminster, PA, NAVFAC Atlantic Contract N62470-11-D-8013, Task Order (TO) WE28.

AECOM performed an RI of groundwater, soil, surface water and sediments; source study; Community Environmental Response Facilitation Act investigations, and is managing FOST preparation. Our team responded rapidly to the discovery of PFOS/PFOA in nearby municipal supply wells by developing a work plan sampling over 30 base-wide monitoring and potable supply wells and surface water pathways. We conducted a study to identify potential on- and off-base sources of PFOS/PFOA contamination in groundwater and initiated a private potable well search within 1.5-miles of the base to identify potential drinking water receptors. AECOM prepared and implemented a RI Sampling and Analysis Plan to delineate the nature and extent of PFOS/PFOA contamination at the base. Field work included the installation of over 90 nested monitoring wells up to 400 feet (ft) deep. Downhole geophysics were performed on each borehole and meetings held with the Navy, EPA, Pennsylvania Department of Environmental Protection, and U.S. Geological Survey (USGS) to determine well construction specifications. The RI also included the sampling of approximately 200 monitoring wells, surface and subsurface soil sampling, and surface water and sediment sampling in multiple waterways. The RI included calculation of human health project-specific screening levels for soil, groundwater sediment, and surface water. Project-specific ecological screening values were developed for surface soil, sediment, and surface water based on review of available literature. Surface water mass loading calculations were used to show the Navy was not the only PFAS contributor.

PFAS Preliminary Assessments, SIs, RIs, and Long Term Monitoring, Naval Facilities Engineering Command (NAVFAC) Atlantic Comprehensive Long-term Environmental Action Navy (CLEAN) Contract Number N62470-11-D-8013, Multiple TOs.

AECOM, in a joint venture with EnSafe, is performing Preliminary Assessments, SIs, RIs, and Long Term Monitoring of PFAS at 15 US Navy installations. We have been able to respond rapidly to these multi-site emerging requirements due to our worldwide presence, use of multiple offices to provide a consistent approach, experience with local regulatory requirements, and high-quality service. Recent projects include:

- **Naval Station Great Lakes/Site 4 Former Firefighting Training Area (FFTA), Lake County, IL.** AECOM is performing long-term groundwater monitoring for PFAS and other contaminants of concern.
- **Former Naval Air Station South Weymouth, Weymouth, MA.** AECOM is monitoring and assessing the extent of PFOS/PFOA contamination in a groundwater plume at a Former FTA, Operable Unit (OU) 04. Our team is performing an on-site groundwater and soil RI for the six UCMR-3 PFAS, including development of a Human Health Risk Assessment (HHRA) at Hangar 1, OU25. We are also performing a preliminary assessment of groundwater, surface water, and sediment at multiple basewide sites for the six UCMR-3 PFAS.
- **Former BHRA, Annapolis, MD.** AECOM is providing SI, RI, Feasibility Study, Proposed Plan, and Record of Decision support for potential PFOS/PFOA groundwater contamination at this Base Realignment and Closure (BRAC) site.

- **Naval Computer and Telecommunications Area Master Station Atlantic - Site 1, Fire Training Area, Cutler, ME.** AECOM is performing a SI to determine if PFOS/PFOA are migrating to a drinking water well one mile away.
- **Portsmouth Naval Shipyard, Basewide, OU3, Kittery, ME.** AECOM performed a basewide assessment to identify potential sources for PFOS/PFOA to groundwater based on historic and current installation activities. Groundwater sampling is being completed as part of a Five Year Review process to determine presence/absence of PFOS/PFOA at a former landfill.
- **Former Naval Air Station Brunswick, Brunswick, ME.** AECOM is conducting a basewide investigation to assess absence/presence of PFOS/PFOA primarily in groundwater. However, surface water and sediment have been added in limited locations. The surface water and sediment study encompasses a storm water retention pond system that received the majority of the base's runoff/discharge. The groundwater investigation includes impacts to private drinking water wells. Additionally, AECOM is assessing the treatability of two different granulated activated carbon systems in an existing treatment plant for the treatment of 16 PFAS.
- **Naval Station Newport, Newport, RI.** AECOM prepared a Basewide Preliminary Assessment to identify potential sources of PFOS/PFOA in groundwater. Groundwater sampling has been conducted in two areas to expedite a solar array proposal and a property transfer.
- **Former Naval Construction Battalion Center Davisville, North Kingstown, RI.** AECOM is preparing a preliminary site assessment for potential PFOS/PFOA impacts to groundwater from historical base operations.

PFAS Projects for the Air Force

The AECOM Team is currently supporting Air Force efforts to address PFAS at many of their installations. It is estimated that PFAS-containing Aqueous Film Forming Foams (AFFF) may have been used at approximately 200 active and former Air Force bases, including Air National Guard and Air Force Reserve facilities.

FY14 Spangdahlem Air Base (SAB), Germany, PFAS Site Investigation, Contract/Task Order (TO) Number: W912GB-09-D-0029/0006

AECOM was contracted to assess the presence, extent, and degree of PFAS in soil at a number of potential PFAS source areas throughout the SAB, Germany. Investigations by the communities neighboring the SAB found that the effluent water from the SAB contributes to PFAS contamination of surface water and groundwater. In addition, PFAS impacts cause a cost increase for sewage treatment. A work group was established between the US and the German stakeholders to investigate the PFAS sources and transport pathways. AECOM was contracted to perform a first set of on-base soil investigations. The SAB pre-defined six AOCs where PFAS-containing AFFF was released in the past. Under this TO, AECOM provided:

- Drilling services;
- Soil and water sampling services;
- Laboratory analysis; and
- A comprehensive investigation report, including the assessment of the transport mechanism for PFASs that apply at the site, recommendations for further investigations, and a German translation of the investigation report for the German authorities.

The investigation found that soil impacted with PFAS led to an adverse alteration of storm water, seepage water, and/or perched groundwater. The investigation also showed that the storm water discharge system plays a relevant role for the distribution of PFAS from the original source areas. The storm water discharge system is able to transport PFAS dissolved in water as well as "solid" substance in the form of foam. At locations where PFAS foam could have accumulated in the past, secondary sources of PFAS may potentially have formed.

Calumet Air Force Station (AFS), PFAS Preliminary Assessment

AECOM is conducting a preliminary assessment for PFAS to identify any potential AOCs at the former Calumet AFS, Michigan. The preliminary assessment will be performed to locate, evaluate, and assess the potential for environmental risk associated with past use and storage of AFFF at Calumet AFS. The preliminary assessment will include a history of ownership of the parcels that made up Calumet AFS, and a description of uses and operations of the AFS during its history.

Chanute AFB, IL, PFOS/PFOA Leachate Treatment System O&M

AECOM is providing operations and maintenance support to a landfill leachate treatment system designed and implemented to remove PFAS before discharge to a publicly-owned treatment works (POTW). O&M activities include monitoring of system parameters including flow, pressure, temperature, etc. to ensure the proper treatment of leachate water before discharge to a POTW that is not equipped to remove PFAS. Influent and effluent will be monitored to measure the performance of the carbon treatment vessels and anticipate when replacement will be required. Reports are prepared periodically to demonstrate system performance and absence of PFAS in effluent.

Peterson AFB, CSM

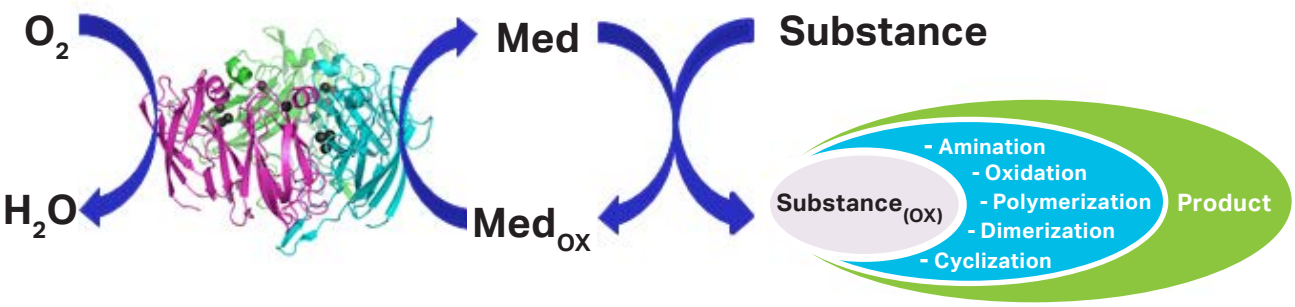
AECOM is using Environmental Sequence Stratigraphy at Peterson AFB to develop geologic cross-sections and water table maps in support of the PFAS assessment efforts at Peterson AFB. Initial regional geologic cross-sections were developed by our team prior to the SI kickoff meeting, and AECOM attended the kickoff meeting and provided geologic and hydrogeologic expertise in support of decisions regarding placement of PFAS SI wells. Subsequent to the SI, we further refined the geologic cross-sections utilizing boring logs from the SI, conducted a synoptic gauging event of all existing wells on Peterson AFB and Colorado Springs Airport, generated a groundwater water table map to predict groundwater flow and potential PFAS migration in the area of Peterson AFB, and briefed the results of the CSM to Peterson AFB and the Air Force. The CSM will allow the Air Force to streamline RI activities by accurately predicting PFAS contaminant migration pathways and will define potential liability.

PFAS Projects for Australian Ministry of Defense

The AECOM PFAS team collaborates globally to apply innovative approaches and practices needed to address this emerging contaminant. AECOM has undertaken PFAS related environmental work at a number of Australian Ministry of Defense (MoD) facilities since late 2013, in particular the Army Aviation Centre Oakey (AACO) and the Royal Australian Air Force (RAAF) Base Williamtown. The original scopes had to be modified rapidly to innovatively and cost effectively assess two of the largest PFAS groundwater contamination plumes in Australia. AECOM has been undertaking the projects simultaneously and in a severely compressed schedule to meet client reporting obligations. AECOM also rapidly responded to client requests for 'adhoc' technical information required for senate inquiry meetings. Our team developed an expanding risk-based response to assess water contamination and risks, engage with community and stakeholders, and address potential health risks. Projects undertaken did not impact DoD's operational capacity. AECOM subsequently developed the precedent-setting impact and risk-based approach to the Strategic Management Plan (to cost-effectively guide future work for a 10+ year period. This plan presented a strategic road map prioritizing actions, not only related to contamination but also provided consistent messaging internally and externally on community, legal matters, socioeconomic issues, regulatory compliance, etc. AECOM provided advice to the DoD regarding the requirement to implement risk mitigation measures (e.g., 'Do Not Drink Water' advice). In addition, AECOM has achieved effective community and stakeholder engagement, produced high quality deliverables that have been accepted by the Technical Advisor and Auditor and regulating agencies, and have provided technical and strategic leadership that has leveraged off international expertise. For these projects AECOM provided the following broad ranging services:

- Residential water sampling (households and water tanks)
- Groundwater sampling program (private and public wells)
- Soil, groundwater, surface water, sediment, porewater, concrete sampling program
- Management of alternative water supply for affected community
- Sampling and cleaning of water tanks and swimming pools
- Chemical characterization of AFFF concentrate
- Stakeholder communications and management (project website, email address, 1800 telephone, mailing address, community engagement meetings, letterdrops, stakeholder briefings, minister inquiries)
- Development of protocols and advice documents (water use surveys, qualification assessment decision trees, feasibility study for alternate water supplies)
- Ecological assessment
- Human health and ecological risk assessment
- Hydrogeological modelling (including solute fate and transport)
- Horse and livestock watering advice
- Remedial/Treatment research
- Soil stabilisation trials
- Fate and transport research (transformation of PFAS precursors)
- Plant uptake research
- Chicken/egg translocation study
- Seafood study
- Management of a Sharepoint and Geographic Information System (GIS) database

Enzymatic Oxidative Treatment Technology for Perfluorinated Compounds



AECOM collaborating with University of Georgia in developing novel technologies for treatment of persistent perfluorinated compounds commonly found in aqueous film-forming foam (AFFF) of air force fire training areas.

Client

AFCEC

Location

Multiple Locations, USA

Contract Value

USD 632K

Years

2012—2016

More Information

1.978.905.2100
AskEnvironment@aecom.com

Project Overview

Per- and Poly-Fluoroalkyl Substances (PFAS) make up a group of compounds that have extreme thermal and chemical stability. Due to their unusual characteristics, PFAS are found in hundreds of articles used in nearly every aspect of daily lives. Although the excellent chemical inertness is a huge advantage in the use of PFAS, it also causes considerable environmental concerns because of the ubiquitous presence in the environment and toxicity to animals and potentially humans. Contaminated water treated with granular activated carbon (GAC) has been the most common treatment to remove PFAS, although several studies reported using electrochemical, photolytic, or sonochemical oxidation and catalyzed hydrogen peroxide propagation to break down PFAS. These approaches require large energy inputs, and special devices, thus limit their full-scale applications. This project identified an approach that can decompose PFAS under naturally relevant conditions.

Client Benefits

A novel PFAS treatment technology was developed to replace or combine with the existing pump and treatment that commonly uses GAC as the PFAS treatment system. The novel enzymatic treatment system uses bulk enzyme to sustainably treat PFAS and can be used for both *in situ* and *ex situ* applications.

Work Performed

Enzymatic oxidative treatment refers to an important class of reactions that are facilitated by fungal extracellular enzymes to mediate the polymerization of small molecule humic precursors into humic substances in the environment. These enzymes oxidize phenolic or anilinic substrates into radical and quinone intermediates that are further covalently bound with each other via coupling. The active intermediates formed during reactions can also attack other persistent organic compounds such as polychlorinated biphenyls (PCBs) and polycyclic aromatic hydrocarbons (PAHs), thus incorporating them into humification and leading to their decomposition and detoxification. AECOM collaborated with UGA to investigate the possibility and mechanisms of PFAS (with use of PFOA to model PFAS) degradation by enzymatic oxidation.

AECOM's scope includes this technology development project management, selects air force sites for bench-scale study, two *in situ* pilot studies and one *ex situ* treatment systemfor comparison with the GAC treatment systems. AECOM will conduct engineering design, treatment system installation, operation and monitoring of treatment performance. The performance results will be used as guidance for future scale-up full treatment systems. Currently, AECOM and UGA had published this enzymatic treatment technology on the Environmental Science and Technology Letter in 2015 to document the success of bench-sale treatment success.

AECOM

Private Sector Experience

PFAS Projects for the Private Sector

PFOS/PFOA SI (Confidential Client)
AECOM performed extensive site assessments in Decatur, Alabama where biosolids from a Waste Water Treatment Plant that contained PFAS were used as fertilizer over a multi-county area. The resulting impacts to soil, groundwater, surface water, sediments, agricultural crops, and cattle caused concerns from the community and stakeholders. Our team worked closely with the stakeholders, including the Centers for Disease Control and Prevention, to reach consensus on the scope of investigations and data quality objectives. The multi-disciplinary project team worked extensively with the client, regulatory community, and other key stakeholders to successfully scope the SI, including the overall sampling strategy, to reach consensus on the DQOs and desired outcomes of the project. The project team successfully satisfied all stakeholder concerns and the site was ultimately closed without any remediation.

Enhanced Groundwater Remediation System Design for PFOA

URS successfully removed PFOA to a level below regulatory standards at this complex site.

Client

Manufacturing Company

Location

New Jersey, USA

Contract Value

USD 2.6MM

Years

2008—2012

More Information

1.978.905.2100
AskEnvironment@aecom.com

This project was completed by URS, which became a part of the AECOM family of companies in October 2014.

Project Overview

At this former manufacturing facility, URS assisted in assessing the remediation needs necessary to extract and treat volatile organic compounds (VOCs) and perfluorooctanoic acid (PFOA) that were identified in the groundwater below the site.

Client Benefits

- URS provided a multi-disciplined team of water treatment and remediation technical resources to complete this project with complex treatment and regulatory issues.
- The team worked with the regulatory agency to obtain a permit by rule for treatment and discharge systems.
- The URS treatment system design met industry and stricter client standards
- The treatment system successfully removed contaminants below regulatory levels.
- Reinjection of groundwater is returning valuable resources and minimized the impact to water allocation permit application.

Work Performed

URS' complete remediation system for VOCs and PFOA included the design, permitting, and construction of the following components:

- Six groundwater extraction wells with an expected pumping capacity of 405 gpm
- Four extraction well houses and well transmission mains totaling 10,000 ft
- Iron removal by pH adjustment, oxidation, flocculation/ settling to prevent fouling of the GAC filters

- Continuous backwash sand filters for polishing removal of manganese, arsenic, and aluminum.
- Low profile coarse bubble air stripping and granular activated carbon (GAC) filters to treat extracted groundwater
- 69,000 gallon equalization reservoir to accommodate all recycle flows
- Residuals solids management including 100,000 gallon dual compartment residuals holding tank and nine separate covered sand drying beds totaling 14,700 ft2
- A Rapid Infiltration Basin (RIB) system of 1.2 acres to recharge treated groundwater back into the source aquifer

Six extraction wells captured potentially impacted groundwater throughout the site and pumped water via four separate transmission water mains to the new Groundwater Treatment Plant (GWTP) building. Additionally, the existing pump and treat wells were re-routed to the new GWTP and can be operated for additional capture if necessary.

The transmission mains join to form a common header pipe at the GWTP. The combined water will be pH adjusted with sodium hydroxide before flowing through a cascade aerator. The cascade aerator at the elevated groundwater pH facilitates oxidation of the reduced iron in the groundwater. The groundwater then flows by gravity into a rapid mix, coagulation, flocculation, and settling unit. Plate settlers are used to minimize the required footprint necessary for settling. Sodium hypochlorite and polymer is then added to the groundwater prior to entry into the plate settlers. The unit process clarifies the groundwater of the precipitated iron and other metal hydroxide species. This unit process, because of the groundwater quality, generates a significant volume of residuals, which will settle out of solution.

The clarified water in the plate settlers then flows to the continuous backwash filters. Potassium permanganate may be added prior to the backwash filters, if necessary, for manganese removal. The continuous backwash filters also removes other colloidal precipitates not removed upstream in the plate settlers.

Water then flows into a low profile coarse bubble air stripper for removal of VOCs. The air is then discharged to the atmosphere through a stack located on top of the GWTP building roof. The treated water from this unit operation then flows into a 16,800-gallon equalization tank. This tank serves as a hydraulic "break" for the treatment system. High service pumps then convey water through the GAC vessels for further organic polishing and PFOA removal. Following GAC treatment, the groundwater is then discharged into the RIBs for final disposal by aquifer recharge.

The residuals from the plate settlers are periodically drained into one of two 50,000 gal settling tanks to thicken under quiescent conditions. The residuals in the settling tanks are dosed with polymer and mixed for further thickening during an additional settling and supernatant decant phase before ultimate application on the sand drying beds. Upon further solids concentration on the sand drying beds, the dried solid "cake" is then physically removed and hauled off-site for ultimate disposal. The filtrate water that passes through the sand is then pumped at a continuous rate back to the headworks of the GWTP.

Design/Installation of Granular Activated Carbon Systems/O&M for Seven Public Water Treatment Facilities

All systems achieved (and continue to achieve) the remedial objective for reducing PFOA in drinking water.

Client

Confidential Manufacturing Company

Location

Ohio, West Virginia, USA

Contract Value

USD 3.3MM

Years

2005—present

More Information

1.978.905.2100
AskEnvironment@aecom.com

This project was completed by URS, which became a part of the AECOM family of companies in October 2014.

Project Overview

As part of a legal settlement, the client was required to initiate a program to upgrade existing potable water works in the region around the company's manufacturing facility to remove perfluorooctanoic acid (PFOA) from the raw water. URS provided planning, design, permitting, health and safety and construction management, and operation and maintenance (O&M) phase services for the installation of eight granular activated carbon (GAC) units for seven public water treatment facilities. The team assisted through all phases of the project from pilot testing through start-up and O&M.

Client Benefits

- URS was able to implement the systems to meet a very tight regulatory deadline. Client had requested the most rapid implementation possible to meet legal agreements and water utility project objectives. The first 3 systems were completed within 16 months of initiating design and permitting activities. The remaining 4 facilities were completed within 48 months of design initiation.
- URS provided a consistent, dedicated team of experts throughout all phases of the project. A unique blend of water treatment and remedial design resources were used to meet complex regulatory and end user issues. Dedicated staff continues to be used during the monitoring and O&M phases of work. URS was very responsive to the client's and agency's needs during this fluid and challenging project.
- URS accommodated the client's need to provide them with monthly cost updates and forecasts that were used for setting account reserves for project execution.
- URS expertly provided construction management for all client vendors and subcontractors ($12 million vendor and subcontract value). Project was completed on time and under budget. Total change orders approved were less than 5 percent of contract bid price.

- URS achieved design and construction of this technically challenging remedial project. Consistent removal of PFOA from low ppb to non-detect levels had only been demonstrated at the pilot level. Development and execution of responsive monitoring programs were key to successful implementation.

Work Performed

The client had initiated a program to upgrade existing potable water works in the region around its manufacturing facility in West Virginia. The program included the installation of state-of-art treatment systems for seven facilities operated by local water utilities to remove PFOA from the raw water as part of a legal settlement.

Following URS' detailed evaluation and pilot testing of treatment technologies, GAC was selected as the preferred technology. The particular carbon media selected for this application excels at trace level contaminant removal found in the groundwater at these locations. The systems consistently and reliably reduce the PFOA content to low part-per-trillion (ppt) levels.

All seven facilities are presently operating with the new equipment, and each offered unique challenges for the incorporation of the additional treatment into their overall process. At one location, an intricate pump and control strategy was required to boost the water through the pressure filters while not overloading the geologic formation at any individual supply well. A finished water equalization tank was provided at another site to ease operations of the facility by "decoupling" the wells and distribution pumps. Other sites containing iron/manganese removal and softening systems required detailed analysis to optimize the retrofit. Nearly every facility required additional and/or relocation of chemical application points for chlorine, fluorosilicic acid, potassium permanganate, caustic soda, and corrosion inhibitors as chemical dosing was altered with the addition of GAC treatment. The most extensive project included the construction of an entirely new treatment system since construction of the carbon filtration unit could not occur in the existing well field located in the Ohio River floodplain.

Each installation also presented a unique set of permitting and regulatory requirements that were addressed by working closely with the utilities, state, and local authorities to obtain the necessary health and operating permits.

The GAC layout allows for series operation so a polishing bed of carbon follows the first bed to add redundancy and avoid release of PFOA into the system. In some locations, multiple trains of vessels are run in parallel to increase hydraulic capacity. Design considerations also included carbon backwash handling, carbon change-out access, pressure relief, high pressure installations, and flow balancing between vessels.

The treatment concept was also implemented for leachate treatment at two landfills containing the compound to protect receiving waters.

The project goals for expedient installation were achieved by accelerating the design/construction schedules while meeting safety and cost expectations. Five separate facilities were designed, permitted, and constructed within 32 months. The remaining two sites were constructed the following year.

Dry Run Landfill Pond/Leachate Treatment System for PFOA-Contaminated Industrial Landfill

URS provided a rapid response and expedited design, permitting and construction, successfully removing the contaminant to bring the site into compliance.

Client

Industrial Landfill

Location

West Virginia, USA

Contract Value

USD 250K

Years

2005-2007 (Design & Construction)
2007-present (Operations & Maintenance)

More Information

1.978.905.2100
AskEnvironment@aecom.com

This project was completed by URS, which became a part of the AECOM family of companies in October 2014.

Project Overview

At this 26 acre industrial landfill site, URS designed a remediation system to treat NPDES outfall discharge that failed to meet metal parameters for a 25-year storm event.

Client Benefits

- URS provided a rapid response to the emerging contaminant issue in the landfill leachate. The team expedited design, permitting and construction to meet regulatory permit requirements.
- The team successfully removed the contaminant below regulatory levels. We are also currently evaluating BMPS for stormwater control and contaminant reduction at other outfall locations.
- URS provided a full range of services for this project – including regulatory assistance, permitting, conceptual and final design, bid preparation and contractor selection, construction oversight, start-up, and long-term monitoring and O&M.
- Provided a consistent, dedicated team of experts throughout all phases of the project. Dedicated staff continues to be used during the monitoring and O&M phases of work. URS was very responsive to the client's and agency's needs during this project.

Work Performed

Surface water and some seeps from a 26 acre industrial landfill are collected in a surface pond that discharges to a receiving stream. Discharge from the pond exceeded metal parameters for the NPDES outfall and there was also a need to remove perfluorooctanoic acid (PFOA). A design was needed to treat water up to a 25-yr storm event from the landfill. Design and construction of the leachate treatment system is complete. AECOM continues to perform monitoring, reporting, and O&M activities.

The existing lined pond acts as an equalization basin for the treatment system and provides primary treatment (aeration and settlement). URS designed and constructed a leachate pump station adjacent to the existing pond discharge pipe to collect water and pump it at 150 gpm to the treatment building. A ductile iron pipe connected to the existing pond discharge pipe directs flow into the precast concrete pump station. Following treatment, the effluent is discharged back into the same stream channel at the same location of the present Outfall 001.

Using the URS treatment system, leachate is initially filtered for iron and manganese removal. The first cartridge filter (5 micron) reduces discharge of metals/solids into the environment and reduces the clogging potential in the subsequent organic removal Granular Activated Carbon (GAC) treatment unit.

The URS GAC system consists of two units in series to maintain a lead and polishing bed. The primary adsorption of PFOA occurs in the first carbon bed (lead bed) in a series operation. The second bed provides a polishing step (polishing bed) so that any breakthrough of PFOA from the lead bed adsorbs prior to discharge. When breakthrough is measured after the lead bed, the carbon will be replaced with a fresh bed. Effluent from the GAC unit flows into a mixed open neutralization tank to adjust the pH for further treatment. Hydrochloric acid is added to lower the pH to 6.5 and optimize the insolubility of aluminum. Multiple pH probes measure the pH of the water to adjust the chemical feed rates to maintain the target operating point. A slowly mixed flocculation tank following the neutralization tank provides the residence time for aluminum floc development. A feed pump delivers the flocculated leachate to a 1 micron cartridge filter for aluminum removal.

A 4,500 gallon effluent holding tank receives the filter effluent and discharges by gravity to the existing Outfall 001. The effluent holding tank also provides a volume of treated water that can be used for back flushing activities for the GAC units. Backwash water overflow is discharged to a recycle manhole that drains into the holding pond.

Sample taps are provided at the inlet and outlet of each treatment unit in the system for monitoring purposes.

URS conducts operations, maintenance and monitoring of the treatment system on an ongoing basis.

Investigation and Remediation of PFOA in Environmental Media and Drinking Water at Former Manufacturing Site

URS's assessment gave the client a clear idea of the extent of PFOA contamination, transport and migration pathways and exposure risks.

Client

Confidential Manufacturing Company

Location

Ohio and West Virginia, USA

Contract Value

USD 3.7MM

Years

2001—present

More Information

1.978.905.2100
AskEnvironment@aecom.com

This project was completed by URS, which became a part of the AECOM family of companies in October 2014.

Project Overview

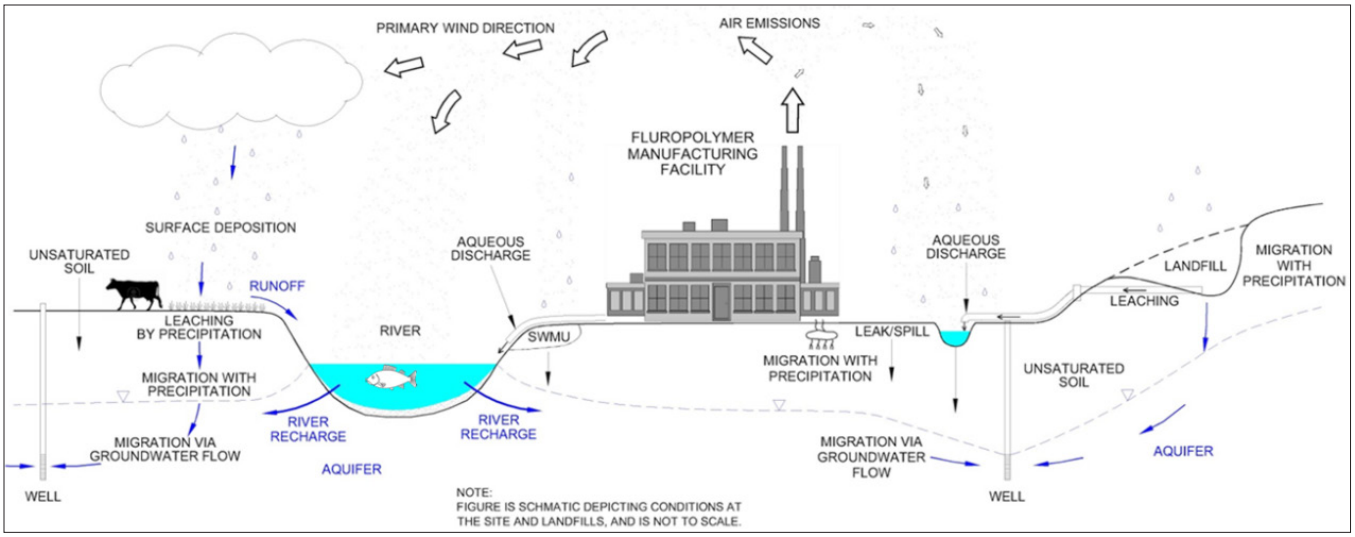
In 2001, URS was contracted to manage a screening level Perfluorooctanoic Acid (PFOA) site-related environmental assessment program that included multi-media monitoring of PFOA on and around a fluoropolymer manufacturing facility in West Virginia. The objectives of this investigation were to develop a Site Conceptual Model (SCM) that described the PFOA sources, pathways of migration and the presence of PFOA in environmental media on and around the site and to assess exposure on a screening level basis. The client committed to three phases of investigation (Phase I through III) to meet the objectives of this investigation, in addition to a previous commitment to conduct a Resource Conservation Recovery Act Facility Investigation at the facility.

Client Benefits

- URS's thorough environmental assessment of the site left the client well informed of the transport and migration pathways of PFOA in environmental media and potential exposure pathways.
- URS's drinking water remediation systems have operated successfully for the past 11 years, significantly reducing human exposure to PFOA.

Work Performed

Conceptual Site Model. URS generated a CSM that identified releases from solid waste management units and historical air emissions as the primary PFOA sources at the site. The primary transport mechanism to environmental media both on and off site is leaching of air deposits via precipitation into soil and groundwater, which is utilized as a drinking water source. In support of the CSM, URS also developed a groundwater flow model (1999) focused on the site and later developed a revised groundwater flow model (2003) that included a much larger area surrounding the site.



Multi-Media Sampling. URS developed multi-media sampling plans designed to understand the sources of PFOA at the site and the pathways of migration from those sources to on- and off-site environmental media, as required by the West Virginia Department of Environmental protection. URS also provided support for multi-media PFOA sample analysis method development and validation, and maintained a database of all results associated with the project. The aerial extent of the investigation included within six Public Water Supply (PWS) districts around the facility and as far as 26 miles upstream and 80 miles downstream. Environmental media sampled by URS on site and nearby included:

- Surface and subsurface soil (on and off site)
- Groundwater (on and off site)
- Local surface water (on and off site)
- Hay, beef fodder, grass and roots (on and off site)
- Air sampling (on and off site)
- Residential drinking wells (within the six PWS districts)
- Public Service District (PSD) well fields (off site)
- River water (off site)
- Fish, small mammals and beef tissue (off site)
- Home-grown produce (off site)

Drinking Water Remediation. Because groundwater is utilized as a drinking water source, URS designed and installed, and continues to perform operation and maintenance on granular activated carbon (GAC) treatment systems at the site, at 10 well fields at eight public water supplies upstream and downstream of the site, and at over 100 private residences.

Reporting Requirements and Other Activities. URS also generated numerous project-required reporting deliverables including two Quality Assurance Project Plans, monthly, quarterly and annual public water supply reports to PWSs, quarterly residential result letters to residents, quarterly update reports to EPA, Ohio Environmental Protection Agency and West Virginia Department of Environmental Protection, and two Data Assessment Reports, which summarized all activities performed related to the project from 2001 through 2008 and from 2008 through 2012. In 2007, URS and the client collaborated on a joint peer-reviewed publication titled "Transport of Ammonium Perfluorooctanoate in Environmental Media near a Fluoropolymer Manufacturing Facility".

Project Outcomes. Transport and migration pathways from the site to on- and off-site environmental media and the presence of PFOA in environmental media are well understood and exposure to PFOA associated with the facility was adequately characterized and assessed on a screening level basis. Drinking water remediation has operated successfully for the past 11 years, significantly reducing human exposure to PFOA. Now AECOM, our team continues to provide O&M for the GAC treatment systems, conducts additional sampling and generates reporting documents as required by other commitments made by the client. In addition, AECOM is providing similar services for the client at several other sites where PFOA is found in environmental media.

Bench and Pilot Scale Testing for Foaming Agent Removal from Wastewater

AECOM was able to identify methods to reduce foaming of wastewater prior to discharge to the municipal sewer system.

Client

Confidential Firefighting Equipment Manufacturer

Location

Confidential, USA

Contract Value

USD 190K

Years

2014—present

More Information

1.978.905.2100
AskEnvironment@aecom.com

Challenges

Many wastewater treatment technologies can induce foaming during use. Minimizing foaming during treatment, while removing chemicals that cause foam, was especially challenging.

Project Overview

At this firefighting equipment manufacturing site, AECOM was contracted to help the client identify potential treatment technologies to remove foaming materials from wastewater prior to discharge to the city's sewer system. AECOM is also under contract to provide design services for the full-scale wastewater pretreatment facility.

Client Benefits

AECOM identified several technologies and combinations of technologies that are effective in removing high concentrations of foam-causing chemicals from wastewater. Very little data exists for this unique treatment application. Therefore, the effectiveness of these technologies was demonstrated through bench and pilot scale testing.

Work Performed

A confidential manufacturer of fire-fighting equipment and chemicals operates a test facility to evaluate the effectiveness of their products, and discharges the resulting wastewater to a sanitary sewer. The sewer authority limited the volume of the manufacturer's discharge due to the foaming properties of the wastewater, which limited the test activities that could be conducted. The manufacturer needed a method to pretreat the wastewater to significantly reduce foaming prior to discharge.

AECOM identified potential treatment technologies and coordinated bench and pilot studies for pretreatment of the manufacturer's wastewater, with the objective to remove foaming materials from the wastewater prior to discharge to the municipal sewer system. Technologies included air-sparged hydrocyclone, electrocoagulation, membranes (ultrafiltration, nanofiltration and reverse osmosis), anaerobic biological treatment and evaporation technologies using bench-scale treatability testing, and upflow anaerobic sludge blanket and evaporation technologies through on-site pilot testing. Anaerobic biological treatment, membranes, and evaporation technologies proved effective to varying degrees in reducing the foaming properties of the wastewater, and in removing the specific chemicals which contribute to foaming.

PFAS Remediation at a Former Fire Extinguisher Factory

Impacted soils have been successfully removed from the site and properly disposed of off site. This process prevented direct contact between contaminated soil/surface water and humans and eliminated the possibility of future re-contamination with potentially impacted groundwater. In addition, the ongoing groundwater monitoring show significantly decreased PFAS results in local groundwater and in the site's discharge water.

Client

Fire Extinguisher Manufacturer

Location

Northern Germany

Contract Value

~ 800,000 EUR

Years

1995—present

More Information

1.978.905.2100
AskEnvironment@aecom.com

Project Overview

At this former fire extinguisher manufacturing facility, AECOM was contracted to provide site assessment and prepare a remedial concept to clean up Per- and Poly-Fluoroalkyl Substances (PFAS). Upon regulator's approval, the site has been remediated by soil excavation and surface restoration. Groundwater Monitoring is ongoing.

Client Benefits

- Former sources of contamination, including the onsite Fire Training Area and a downgradient surface water body were successfully removed
- Remediation measures also eliminated the possibility of future re-contamination
- Mitigation of client's liability issues and cost savings for long term clean up at the site
- AECOM provided a full range of services for the site – from authority management to assessment, design, permitting, cleanup, and reconstruction
- Good planning and transparent communication with all involved project stakeholders provided sustainable and long lasting excellent relationships with the relevant regulators, the site owners, and the site neighbors
- Maintenance of cooperative relationship with all involved parties facilitated project execution during its entire duration

Work Performed

The site was used as agricultural land until 1945, and in 1953, was developed into a fire extinguisher factory, which operated until 2007, producing and testing fire extinguishers on site.

In 2008, PFAS was detected in the sewage sludge. Extensive site investigations found elevated PFAS concentrations in soil, groundwater, surface water, and discharge water on site and on two neighboring properties.

AECOM prepared a remedial concept in 2012 in response to the PFAS detections. The team planned excavation and the remedial target values, and also defined the two main remediation zones:

- The former on-site Fire Training Area (FTA)
- A pond on a downgradient neighboring property

The former on-site FTA acted as the main source area for PFAS in soil. Discharge occurred via shallow groundwater influenced by a very shallow drainage system present in the neighboring grassland, leading to PFAS accumulation in the downgradient pond located on the neighboring property. In addition, PFAS was discharged via the on-site sewer lines into the public sewer system.

FTA Remediation. Following the removal of all above ground structures and surface sealing, the impacted soil was excavated. This process included confirmation sampling, analyses, and further excavation as needed. The base of the excavation was sealed with a geomembrane, then backfilled with clean soil and a drainage system was installed and connected to the separator present on site. Finally, the surface sealing was re-established to include storm water drainage into the on-site sewer line.

Pond Remediation. Following the property clearance and the preparation of the access road, loading area, etc., the pond sediments were excavated and separated based on pre-investigation results and organic residuals. The pit base was then backfilled with clean soil above the groundwater fluctuation and also sealed with a geomembrane. After the installation of a circumferential drainage and the connection to the existing water treatment plant for the drainage water from the meadow, the landscaping was installed. This process prevented direct contact between contaminated soil and humans and eliminated the possibility of future re-contamination with potentially impacted groundwater.

Sewer Line Remediation. The on-site sewer line section between the former FTA and the transfer point to the public sewer system was flushed with high pressure water. The flushing water was collected, sampled, analyzed, and properly disposed of. Using these remedial measures, the PFAS-concentrations in the discharge water of the site were significantly reduced.

Groundwater Remediation. AECOM has been conducting groundwater remediation by pump & treat at the site since 1995 due to elevated chlorinated hydrocarbon concentrations in the groundwater. Since 2008, groundwater samples have also been collected and analyzed for PFAS during a semi-annual routine groundwater monitoring of more than 30 wells located on-site and on downgradient private properties. A general decrease of the PFAS in groundwater can be observed over time. Since the main PFAS source (former on-site FTA) has been remediated by soil exchange, there is presently no known PFAS input and a future decrease of PFAS concentrations in groundwater is anticipated.

AECOM

Key Staff

Experience Matrix

AECOM PFAS Team	Contact Information	Region/Role	Regional Market Sector Lead	Environmental Business Lead	Federal Business Lead for Emerging Contaminants
Dora Chiang	dora.chiang@aecom.com +1.404.405.1214	Director of Emerging Contaminants		■	
Rachael Casson	rachael.casson@aecom.com +61.2.893.40142	ANZ and EMIA		■	
Katherine Davis	katherine.l.davis@aecom.com +1.302.530.2687	North America		■	
Usha Vedagiri	usha.vedagiri@aecom.com +1.510.874.3123	Pacific/LA Metro	■		
Rich Sturn	richard.sturn@aecom.com +1.714.973.3367	Pacific/LA Metro	■		
Kamalesh Pinisetti	kamalesh.pinisetti@aecom.com +1.602.861.7434	Gulf/Southwest	■		
Matt Zenker	matthew.zenker@aecom.com +1.919.461.1390	Southeast	■		
Rosa Gwinn	rosa.gwinn@aecom.com +1.301.820.3131	DC Metro	■		
John Santacroce	john.santacroce@aecom.com +1.518.951.2200	NYC Metro	■		
Jim Fenstermacher	jim.fenstermacher@aecom.com +1.610.832.3530	Northeast	■		
John Cuthbertson	john.cuthbertson@aecom.com +1.616.574.8480	Midwest	■		
Joel Nolin	joel.nolin@aecom.com +1.403.270.4870	Canada			
Rick Parkman	rick.parkman@aecom.com +441612376078	EMIA		■	■
Daniel Medina	daniel.medina1@aecom.com +1.210.253.7515	US Federal			■
Steve Paznokas	steve.paznokas@aecom.com +1.303.823.5130	Army			■
Ken Vinson	ken.vinson@aecom.com +1.757.306.6793	Navy			■
Kurt Kaisler	kurt.kaisler@aecom.com +1.303.694.2770	Air Force			■

AECOM

About AECOM

AECOM is built to deliver a better world. We design, build, finance and operate infrastructure assets for governments, businesses and organizations in more than 150 countries. As a fully integrated firm, we connect knowledge and experience across our global network of experts to help clients solve their most complex challenges. From high-performance buildings and infrastructure, to resilient communities and environments, to stable and secure nations, our work is transformative, differentiated and vital. A Fortune 500 firm, AECOM had revenue of approximately $17.4 billion during fiscal year 2016. See how we deliver what others can only imagine at aecom.com and @AECOM.

ABOUT AECOM

AECOM is built to deliver a better world. We design, build, finance and operate infrastructure assets for governments, businesses and organizations in more than 150 countries. As a fully integrated firm, we connect knowledge and experience across our global network of experts to help clients solve their most complex challenges. From high-performance buildings and infrastructure, to resilient communities and environments, to stable and secure nations, our work is transformative, differentiated and vital. A Fortune 500 firm, AECOM had revenue of approximately $18.2 billion during fiscal year 2017. See how we deliver what others can only imagine at aecom.com and @AECOM.

DARYL BECK, PE

Senior Project Engineer/Project Manager
800 LaSalle Avenue, Suite 500
Minneapolis, MN 55402
T: 612.376.2000
F: 612.376.2271
E: daryl.beck@aecom.com