April 11, 2018

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

RE: Cover Letter – Category C Environmental Services
Proposal for Minnesota Pollution Control Agency and Minnesota Department of Agriculture
Professional/Technical Master Contract

Dear Ms. Heininger:

Terracon Consultants, Inc. (Terracon) is pleased to submit this proposal in response to the February 28, 2018 "Request For Proposal" (RFP) prepared by the Minnesota Pollution Control Agency (MPCA) and the Minnesota Department of Agriculture (MDA) to perform **Category C** services under the Superfund, Petroleum and Agricultural Environmental Professional Master Contract. Terracon has reviewed and accepts the hourly rates established in Rate Schedule 1 and Rate Schedule 2 of the RFP. Terracon has also reviewed and accepts the rates listed in the Equipment and Supplies List in the RFP. We acknowledge receipt of Addendum 1 which is signed and included in Appendix A.

Mr. Eric Hesse, PE, Environmental Department Manager/Senior Associate is the designated contact for questions regarding the proposal. Our office is located at 3535 Hoffman Road East, White Bear Lake, Minnesota 55110, which is also our mailing address. Our telephone and fax numbers are (651) 770-1500 and (651) 770-1657, respectively. Additional information is available on our website www.terracon.com. Mr. Hesse's contact information is:

Phone – Direct 651-600-3502

Phone – Cell 612-718-8879

Email eric.hesse@terracon.com

Terracon's headquarters is located in Olathe, KS. Terracon has offices in White Bear Lake, Rochester, Plymouth and the Fargo-Moorhead area to service MPCA Closed Landfill projects. The White Bear Lake office will lead Terracon's efforts for this contract providing project management to complete assignments for this contract. Our technical experts from across the State and company will be consulted as appropriate to offer us practical and effective solutions for the benefit of the MPCA on an as needed basis. We can also provide field services out of our Rochester and Fargo-Moorhead office for projects in the southern and northwest part of the State.

Benefits to working with Terracon include:

- ***Responsiveness:*** Acting quickly to meet your deadlines, our employee owners are always available to you. With convenient locations across the country, we're able to quickly mobilize a workforce to respond to accelerated schedules and your changing needs.

- ***Resourcefulness:*** Applying new processes, methodologies, and techniques allows us to take a proactive approach to solving project challenges and deliver your projects better and faster. With our nationwide network of offices, we can initiate services easily on one or multiple projects simultaneously.

- ***Reliability:*** With vast experience working in local and regional conditions, Terracon is a dependable partner throughout the life of your project. We deliver practical and constructible solutions, while avoiding delays, surprises, and costly mistakes down the road.

Opening in April 1988, Terracon's White Bear Lake office has maintained consistency with the senior-level professionals, including Bill Breitzman and Paul Wiese for at least 29 years and Dave Wolfgram for 23 years, who remain as key resources for this assignment. The current office staff consists of thirteen engineers and scientists plus our support staff. The White Bear Lake office has been a partner with the MPCA and MDA under various versions of the State Contract since 1991. We believe our familiarity with Minnesota conditions and our proven track record of quality service to the MPCA and MDA underscores our commitment to the State of Minnesota. Our staff is uniquely qualified in dealing with investigation and mitigation of volatile organic compounds, metals, methane and other hazardous wastes typically generated by solid waste landfill.

Eric Hesse is the designated point of contact for all project assignments, questions, comments and project specific billing or technical concerns. Once work orders have been issued, projects will be assigned to a Terracon project manager based on the project scope, staff workload, experience and input from the MPCA. The leadership team assigned to this contract will generally consist of project managers, engineers, professional staff, technicians and draftsperson. Mr. Randall Sippel and Mr. Brett Staeden will lead and direct the hydrogeologic assignments and Mr. Eric Hesse and Ms. Cami Van Abel will lead and direct landfill gas and cover construction projects.

Terracon staff may be contacted via office telephone, personal cellular telephones, or electronic mail. All appropriate numbers will be provided to ensure the MPCA have the necessary information to contact our staff.

Please contact Eric Hesse should you have questions or require any additional information. We are excited to work with the MPCA on Closed Landfill projects for the benefit of the citizens of Minnesota.

Sincerely,

TERRACON CONSULTANTS, INC.

Eric Hesse, PE
Environmental Department Manager
Senior Associate

David Wolfgram, P.E.
Office Manager / Principal

2.0 QUALIFICATIONS AND CAPABILITIES

2.1 Overall Company Qualifications and Capabilities

Terracon is a 100 percent employee-owned consulting engineering firm that has been providing quality services to clients since 1965. From its roots in geotechnical engineering, Terracon has evolved into a successful multi-discipline firm specializing in environmental, geotechnical, construction materials, pavements, and facilities services.

Terracon's successful history within the engineering industry has resulted in exponential growth. Looking back 30 years ago, the company consisted of 330 employees and 18 offices in the Midwest. Today, Terracon has more than 4,400 employees and more than 150 offices across the United States.

In recent years, Terracon has consistently achieved growth above the industry average. This is evidenced by Terracon's current ranking of 30th in *Engineering News-Record's* 2012 listing of the "Top 500 Design Firms," as compared to a ranking of 183rd in 1991. Our growth and development can be attributed to a commitment by employees to be responsive to clients, an emphasis on providing quality services and management's ability to astutely take advantage of new opportunities and technology.

Terracon is recognized as a leader in the environmental industry, providing services from assessment to remediation to solid waste. Below is a list of the various services Terracon provides:

Solid Waste

- Planning and Permitting
- Comprehensive Subtitle D Landfill Design
- Industrial and Demolition Debris Landfill Design
- Alternative Liner and Cover System Analysis
- Closure/Post-Closure Plans
- ET Cap Feasibility Analysis and Design
- Leachate Collection and Treatment System Design
- Landfill Gas Collection and Treatment/Beneficial Use
- Groundwater Monitoring System Design and Installation
- Aquifer Characterization
- Groundwater Monitoring
- Groundwater Computer Modeling
- Construction Administration and Oversight
- Soil Suitability Testing and Analysis
- In-house Drilling Capabilities
- In-house Soil Testing Capabilities
- In-house Material Testing Services

Assessments
- Phase I Environmental Site Assessments
- Limited Site Investigations
- Soil Vapor Assessments
- Risk assessments
- Litigation support
- RI/FS and RFI activities
- EA, EIS and NEPA support
- Wetlands delineation and mitigation
- NEPA Reviews

Remediation
- Risk-based Corrective Action
- Plans and specifications
- Soil removal/disposal
- Groundwater Remediation
- Soil Vapor Mitigation
- Industrial pre-treatment design
- In-situ treatment, containment and stabilization

Field Services
- Soil Excavation Oversight
- Drilling, soil sampling and on-site testing
- On-site soil vapor analysis
- Surface water and groundwater sampling
- Remedial Oversight
- Geoprobe® Assessments including LIF and MIP

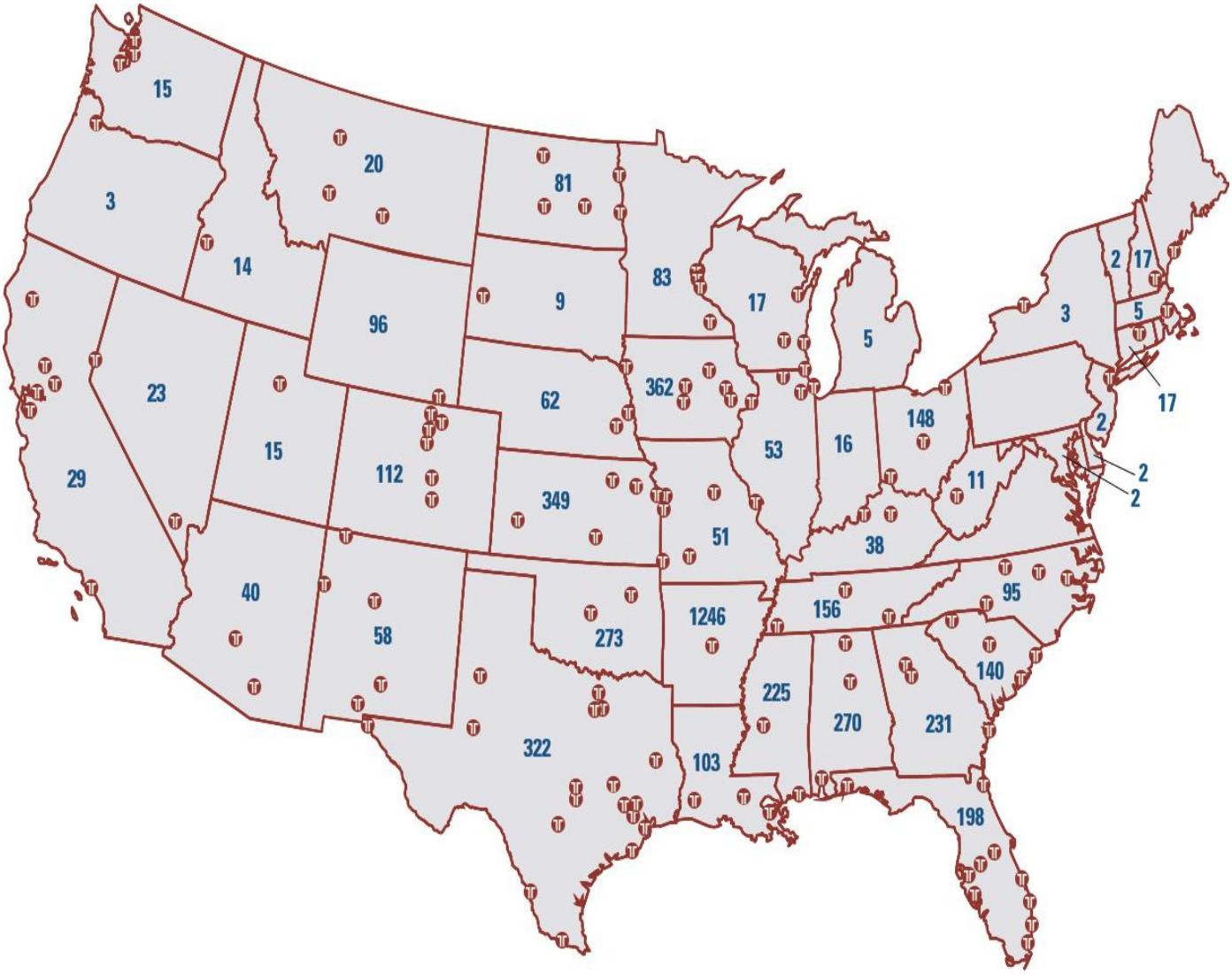
Regulatory Compliance
- Comprehensive audits
- Permitting assistance
- Compliance plans
- Environmental Management Systems

Design
- Brownfield Redevelopment
- Groundwater Modeling
- Process Design
- Closure plans
- Third party review
- Bioremediation
- Soil Vapor Extraction

Industrial Hygiene
- Exposure monitoring
- Indoor Air Quality assessments
- Noise surveys
- Health and safety planning
- Asbestos and radon surveys
- Mold assessments
- Air quality testing
- Lead-based paint surveys

Terracon develops solutions that provide a competitive advantage to our clients. Terracon's solutions, developed by experienced environmental professionals, combine proven engineering services with forward thinking and innovative technologies. The results are cost-effective and timely solutions that balance economic resources to environmental challenges.

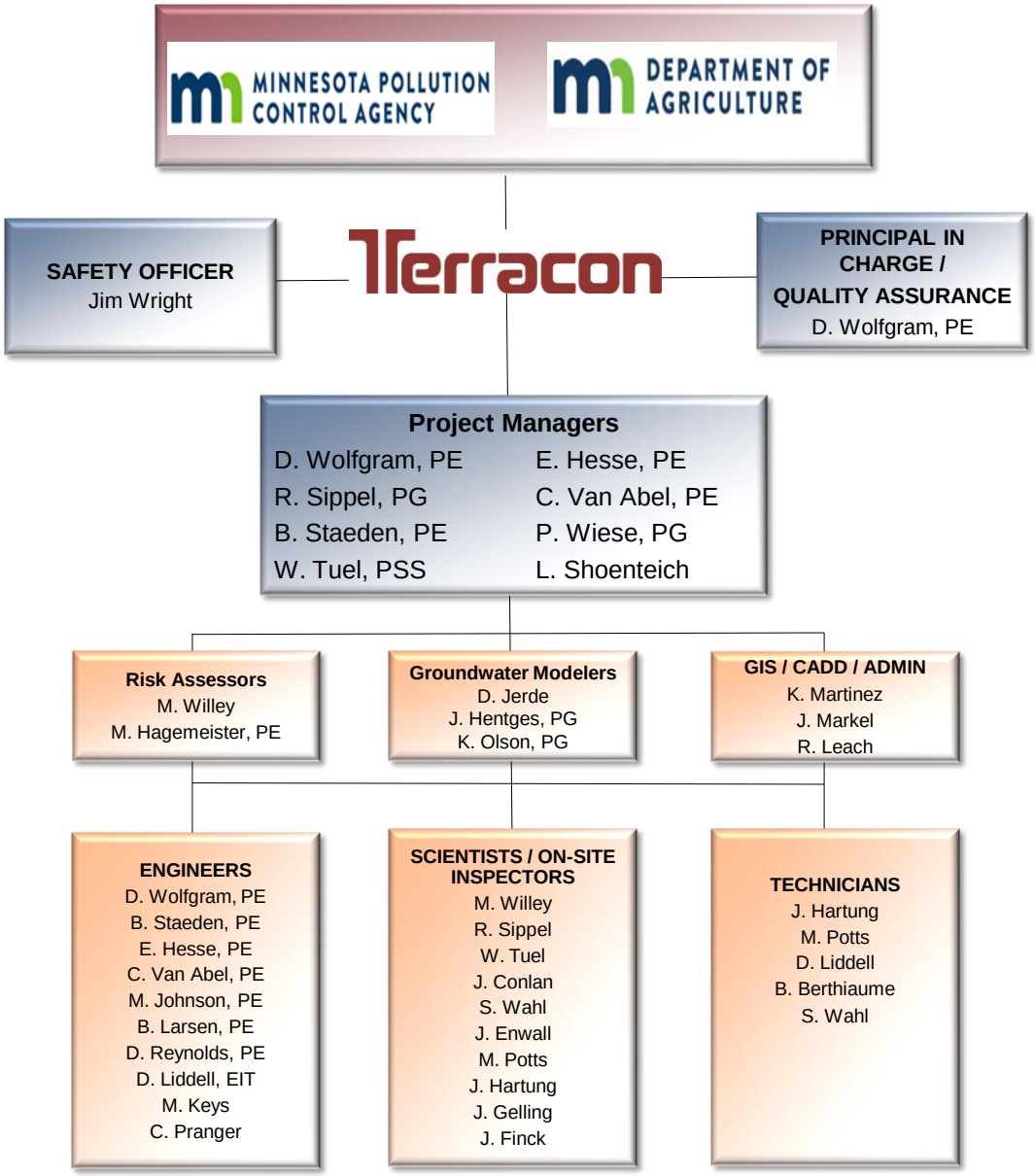
A map depicting the number of Terracon solid waste projects by State throughout the U.S. is included below. Terracon's experience on solid waste projects in Minnesota is illustrated in the Landfill Project Experience section of this proposal.



2.2 Resumes of the Key Staff

Terracon's White Bear Lake, Minnesota office is staffed with multiple senior-level professionals with almost 150 years of combined consulting experience, in addition to staff professionals, technicians, drafting, and clerical personnel. The staff in the White Bear Lake office has developed very broad experience in the area of landfill design and operations, superfund, remediation, and design and construction oversight. In addition to staff in the White Bear Lake office, Terracon personnel from offices in Plymouth, Rochester, Fargo-Moorhead and other offices will assist on project assignments for this State Contract based on their technical expertise. The following organizational chart identifies Terracon's project team that will be assigned to this State Contract.

TERRACON ORGANIZATIONAL CHART



Project Managers

Terracon will provide eleven primary project managers to the contract. The following project managers offer almost 250 years of combined experience working in the environmental field:

- Mr. Wolfgram has over 34 years of experience in investigation, remedial design, development of specifications and remedial action implementation.
- Mr. Hesse has over 29 years of experience in all aspects of solid waste planning, design and construction oversight and remedial investigation and design.
- Ms. Van Abel has over 15 years of experience in solid waste planning, design and construction oversight.
- Mr. Sippel has over 33 years of experience in remedial investigation, remediation, long term monitoring and monitoring system design at solid waste landfills.
- Mr. Staeden has over 19 years of experience in all aspects of assessments and remedial design involving both petroleum and non-petroleum contamination.
- Mr. Wiese has over 29 years of experience in all aspects of assessments and remedial design involving both petroleum and non-petroleum contamination.
- Mr. Tuel has over 32 years of experience in operations, construction management and oversight, compliance and solid waste facility design.
- Mr. Shoenteich has over 16 years of experience specializing in petroleum and non-petroleum contaminated site assessments and cleanup.

These eight project managers will work closely to coordinate activities that benefit the MPCA.

Project Specialists

Terracon has developed a list of Project Specialists to support this contract. These specialists provide expertise in the areas of hydrogeology, engineering, geology, graphical information systems (GIS), computer aided design and drafting (CADD), human health and ecological risk assessment, Quality Assurance / Quality Control (QA/QC), and field services. Project managers will provide tasks to the project specialist as needed to complete the requirements of the project.

Resumes

A matrix table of the personnel associated with the contract is included below. Resumes of several key team members for this contract are included in **Appendix B** of this technical proposal.

2.3 Matrix table listing staff, classification, OSHA certification, years of service with the company, education, work experience, licenses, certifications, and location

The following table contains a matrix of qualifications for Terracon's proposed staff. In the event that the MPCA decline to approve Terracon staff for the proposed personnel classifications, Terracon is prepared to acquire staff to meet the MPCA requirements within 12 months of executing a contract.

Category C - Staff Matrix

Name	Title	Contract Classification	40-Hr OSHA Training	8-Hr OSHA Supervisor Training	Years with Terracon	Highest Degree	Total Years of Experience	Terracon Office Location	Other Registrations, Certifications and Licenses
D. Wolfgram	Principal/Senior Engineer	PM/Eng IV/QO	X	X	23	MBA	34	WBL	PE
E. Hesse	Environmental Department Manager / Professional Engineer	PM/Eng IV	X		6	MS	29	WBL	PE
R. Sippel	Senior Project Manager	Sci II	X		4	BS	33	WBL	PG
C. Van Abel	Project Manager/Environmental Engineer	PM/Eng III	X		4	MS	15	WBL	PE
B. Staeden	Professional Engineer	PM/Eng III/QO	X		13	MS	19	WBL	PE
P. Wiese	Sr. Project Manager	PM//QO	X	X	28	BS	29	WBL	PG, CPG
W. Tuel	Environmental Scientist.	Sci II	X		6	BS	32	Minneapolis	PSS
L. Shoenteich	Environmental Department Manager	PM/Sci II	X		3	MS/MBA	16	Fargo	CSP
J. Wright	Corp. Health & Safety Manager	PM	X		1	MS	25	Corporate	
M. Hagemeister	Asst. OGM;/Environmental Engineer	Eng IV-	X		24	MS	24	Omaha	PE
M. Willey	Sr. Project Manager	PM/Sci II	X		6	BS	19	Minneapolis	AHERA, XRF
J. Hentges	Hydrogeologist	Sci IIGWM	X		24	BS	33	Des Moines	PG
K. Olson	Hydrogeologist	GWM	X		6	BS	35	Minneapolis	PG
D. Jerde	Hydrogeologist	GWM	X		6	BS	31	Minneapolis	PG
M. Johnson	Chemical Engineer	Eng IV	X		6	MS	32	Minneapolis	PE
D. Reynolds	Environmental Engineer	Eng IV	X		6	BS	25	Minneapolis	PE
B. Larsen	Geotechnical Engineer	Eng III	X		9	MS	12	Minneapolis	PE
D. Liddell	Project Engineer/Field Technician	Eng I/Tech II/OI	X		2	BS	2	WBL	EIT
M. Keys	Project Engineer/CADD	Eng I /CADD	X		6	BS	29	Minneapolis	
C. Pranger	Field Engineer	PM/Eng II /Sci II	X		8	BS	15	WBL	
J. Conlan	Project Manager/Environmental Scientist	PM/Sci II /OI	X		8	BS	11	WBL	CHMM, AHERA
J. Enwall	Project Manager/Geologist	PM/Sci II, OI	X		12	BS	12	WBL	XRF
M. Potts	Environmental Scientist / Field Technician	Sci II/ Tech II, OI	X		5	BS	7	WBL	
J. Hartung	Project Scientist/ Field Technician	Sci II/Tech II/OI	X		2	BS	5	WBL	AHERA
J. Gelling	Senior Geologist	Sci II	X		6	BS	17	Minneapolis	PG, AHERA, XRF
J. Finck	Staff Geologist	Sci II	X		2	BS	4	Fargo	GIT

Ben Berthiaume	Environmental Scientist / Field Technician	Sci II /Tech I	X		2	BS	2	WBL	AHERA
S. Wahl	Environmental Scientist / Field Technician	Sci II /Tech I	X		3	BS	3	WBL	
R. Leach	GIS Specialist / Environmental Scientist	GIS	X		3	BS	4	Minneapolis	
J. Markel	AutoCAD Technician	CADD			9	SAS	15	WBL	
K. Martinez	Drafting Technician	CADD			12	SAS	25	WBL	

Classification Key

CHMM – Certified Hazardous Materials Manager
CSP – Certified Safety Professional
CIH – Certified Industrial Hygienist
EIT – Engineer in Training
PE – Professional Engineer
PG – Professional Geologist
PSS – Professional Soil Scientist
NDG – Nuclear Density Gauge Safety Training
CPG – Certified Professional Geologist
AHERA – Asbestos Hazard Emergency Response Act
XRF – Niton XRF Spectrum Analyzer Certified

PM – Project Manager
GWM – Ground Water Modeler
HRA II – Human Health Risk Assessor II
HRA III – Human Health Risk Assessor III
ERA II – Ecological Risk Assessor II
ERA III – Ecological Risk Assessor III
Sci I – Scientist I
Sci II – Scientist II
Eng I – Engineer I
Eng II – Engineer II
Eng III – Engineer III
Eng IV – Engineer IV
CADD – CADD Specialist

I

FT – Field Technician
QO – QA/QC Officer
OI – Onsite Inspector
WBL – White Bear Lake, MN
Minneapolis - Minneapolis, MN
Fargo – Fargo, ND
Des Moines – Des Moines, IA
Omaha – Omaha, NE
BS – Bachelors of Science
MS – Masters of Science
MBA – Masters of Business Administration
BA-Bachelor of Arts
AA – Associates of Arts
SAS – Specialized Associate of Science
QO – QA/QC Officer

2.4 Number of Site Investigations/Remedial investigations/Remedial Designs

Terracon has worked on 40 solid waste/former dump sites in Minnesota involving permitting, construction, investigation, remediation and operations projects over the last 30 years. Over the past five years Terracon has worked on, or continues to work on, 4 site/remedial investigations and 2 remedial design projects at Minnesota Landfills/Closed Dump Sites within the last five years. Terracon's local experience on landfills and remediation projects over the last 30 years is further illustrated in the matrix on the following page.

TERRACON LANDFILL/REMEDIATION EXPERIENCE MATRIX

Site	Prepare Permit	Closure Construction QA/QC and Certification	Cell Costruction QA/QC and Certification	Hydrogeo Assessment	Operational Assistance	Leachate Recirc.	Leachate Land App.	Landfill Gas Mgmt	EAW/EIS	Storm Water Mgmt	NPL	State Superfund	RI	FS	RAP	RA Implement	O&M	Groundwater Modeling	Cost Recovery Litigation 3rd Party Rev
MSW Landfills																			
Burnsville Sanitary Landfill	▲	▲	▲	▲	▲	▲		▲		▲									
Crow Wing County MSW Landfill							▲												
Dickinson Sanitary Landfill	▲	▲	▲	▲	▲														
East Bethel Landfill				▲							▲	▲	▲	▲	▲	▲	▲	▲	▲
East Central Sanitary Landfill	▲	▲	▲	▲	▲				▲	▲		▲	▲	▲	▲	▲			
Elk River Landfill	▲	▲	▲		▲	▲		▲											
Freeway Sanitary Landfill		▲		▲				▲			▲	▲							
Houston County Landfill				▲								▲	▲						
Lyon County Sanitary Landfill	▲	▲	▲	▲	▲	▲		▲									▲		
Material Recovery Services	▲		▲	▲	▲			▲											
Morrison Sanitary Landfill	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▲	▲	▲	▲	▲	▲	▲	
Northwoods Sanitary Landfill				▲								▲	▲						
Ponderosa Landfill				▲								▲							
Rice County Sanitary Landfill	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲									
SRRMF	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲									
St. Louis County	▲	▲	▲		▲		▲	▲		▲									
Demolition Landfills																			
Morrison County Demo Landfill	▲	▲	▲		▲					▲									
Burnsville Demolition Landfill	▲	▲	▲		▲														
Chippewa County Demo Landfill	▲	▲	▲		▲														
Clearwater County Demo Landfill				▲															
DKV Demo Landfill	▲	▲	▲		▲														
Elk River Demo Landfill	▲	▲	▲		▲														
Hoffman Demo Landfill	▲	▲	▲		▲					▲			▲						
Hubbard Cty North TS and Demo Landfill	▲			▲	▲					▲									
Hubbard Cty South TS and Demo Landfill	▲			▲	▲					▲									
Itasca Demolition Landfill	▲	▲	▲		▲					▲									
Trout Demolition Landfill	▲		▲		▲														
Rice County Demo Landfill	▲	▲	▲		▲					▲									
SRRMF Demo Landfill	▲	▲	▲		▲					▲									
Steven's County Demo Landfill		▲								▲			▲						
Industrial Landfills																			
Duck Lake Disposal Site															▲	▲			
General Waste Disposal and Rec. Servies	▲	▲	▲		▲														
Griffin Waste Dump															▲	▲			
Midway Stadium - Old Dump								▲					▲		▲	▲			
Quarry Brownfield-Old Dump				▲				▲		▲					▲	▲	▲		
S.B. Foot Tanning				▲								▲							
Voyageur Industrial Landfill	▲	▲	▲	▲	▲			▲											
Remediation Projects																			
Fish Hatchery Dump Superfund Site													▲	▲	▲	▲	▲		
Baytown Plume Superfund Site													▲	▲	▲	▲	▲	▲	
Long Prairie Superfund Site													▲	▲	▲	▲	▲	▲	

2.5 Description of experience with other Federal and State Agencies or Departments whom the Proposer has had a contract

Terracon has 27 years of experience working with the MPCA on Petroleum Multi Site Contract projects, over 28 years of experience working on projects where the Minnesota Department of Agriculture (MDA) has provided oversight and 20 years working with the MPCA on the Superfund Multi Site Contract. Terracon's past experience working with the MPCA has enabled us to understand the agencies' requirements and to also understand their needs. We not only follow the state guidelines, we supply State Project Managers with innovative ideas and technologies to bring projects to completion sooner and less expensive than originally planned. Terracon also has experience working on hundreds of projects with other State agencies and the Federal government. Through experience, Terracon has learned how to work cooperatively with State and Federal agencies and private parties. Below is a list of other Federal and State agencies for whom Terracon has worked:

State Agencies

- Minnesota Pollution Control Agency
- Minnesota Department of Agriculture
- Minnesota Department of Natural Resources
- Minnesota Department of Commerce
- Minnesota Department of Transportation
- Wisconsin Department of Natural Resources
- Colorado Department of Public Health and Environment
- Colorado - Department of Labor and Employment – Oil and Public Safety Division
- Colorado Air National Guard
- Iowa Department of Natural Resources
- Iowa Department of Transportation
- Iowa Air National Guard
- Iowa Department of General Services
- Illinois Department of Transportation (Environmental Services)
- Wyoming, Department of Environmental Quality/Water Quality Division
- Nebraska, Department of Environmental Quality/UST
- Nebraska, Department of Environmental Quality/Superfund
- Nebraska Department of Roads
- Nebraska Department of Labor
- Nebraska Air National Guard
- Nebraska Army National Guard
- Kansas Army National Guard
- New Mexico Environmental Department
- Railroad Commission of Texas
- South Dakota Department of Environment and Natural Resources
- North Dakota Department of Health

Federal Agencies

- Red Lake Minnesota Indian Health Services
- US Environmental Protection Agency, Region 5 and 8
- GSA Finance Division 7BCP
- Corps of Engineers, Savannah District
- Directorate of Environmental Compliance
- Environmental Management Branch, US Air Force Academy
- US Department of the Army
- 10th Special Forces Group
- 651st Area Support Group (US Army Reserve)
- 96th Regional Support Command
- ABS Abatement
- Adjutant Generals Dept
- American Ordnance LLC
- Corps of Engineers District Ed G
- Directorate of Environmental Compliance & Management
- Federal Aviation Administration
- Federal Correctional Institution
- General Services Administration
- National Park Service
- Tooele Army Depot
- US Army Corps of Engineers
- US Army Engineering District Rock Island
- US Bureau of Land Management
- US Bureau of Reclamation
- US Postal Service

Representative Experience:

MacGillis and Gibbs, New Brighton, Minnesota

Terracon performed services for the MPCA on the MacGillis and Gibbs project site which is listed on the National Priority List and jointly managed by the MPCA and the USEPA. The site was a former wood treating facility now owned by the city of New Brighton. Soil and shallow groundwater were contaminated with pentachlorophenol (PCP), metals and polynuclear aromatic hydrocarbons (PAH). USEPA had installed a DNAPL recovery and treatment system which involved several recovery wells to remove free phase product and a treatment plant to process the groundwater. Terracon's services, under the direction of the MPCA included removal of contaminated soil, on-site treatment of contaminated soil, screening of debris from excavated material, installation of a RCRA cap over contaminated soil left on-site, and disposal of soil and other debris. Terracon managed two separate sub-contractors, one performing the excavation and cap installation activities and the other acting as the soil treatment contractor. Soil and debris contaminated with PCP were excavated from OU-1 and screened. The contaminated soil was placed back in the excavation and a RCRA cap was installed over the material. A total of 46,000 cubic yards were excavated from two operable units of the site. Approximately 18,500 cubic yards of PCP contaminated soil were treated on-site. All but 2,850 yards met the on-site treatment criteria and were allowed to remain on site saving the MPCA the expense of off-site disposal.

2.6 Description of Regulatory Knowledge

Minnesota Environmental Response and Liability Act/Closed Landfill Program, Land Recycling Act, CERCLA, Resource Conservation and Recovery Act, National Oil and Hazardous Substances Contingency Plan (NOHSCP), and pertinent state and federal regulations related to remediation of hazardous substances pollutants or contaminants.

Terracon has extensive experience in dealing with the Minnesota Environmental Response and Liability Act (MERLA) through project assistance provided to MPCA, MDA, and private clients. Terracon's experience includes several landfill projects where services were required to complete remedial investigations and remediation under Stipulation Agreements or Consent Orders requiring a CERCLA style investigation including the Morrison County Sanitary Landfill (completed under a Stipulation Agreement), East Bethel Landfill (completed under a Consent Order), and Isanti-Chisago Landfill (completed under a Consent Order).

Terracon staff have completed landfill projects in accordance with Minnesota Rules 7001 and 7035 and associated guidance documents/policies for decades. This work has included hydrogeologic investigation, engineering design of RCRA, Subtitle D liner and final cover systems, alternative cover systems, leachate and landfill gas management systems, development of construction documents, bid administration, construction oversight and final certification.

Facilities currently in, or proposing to be in, the Closed Landfill Program are required to execute a binding agreement with the MPCA and will be issued a Notice of Compliance by the Commissioner. Some of the

facilities currently accepted into the Closed Landfill Program have qualified under a cleanup order and some that have been accepted have not had a required cleanup. Under a Closed Landfill Agreement, the landfill will have to complete all closure obligations under its existing permit, continue implementation of post-closure care activities until notification of compliance for entry into the program and transferring all funds from its closure, post-closure and contingency action funds accumulated under its Financial Assurance Plan.

Terracon's experience also includes several projects under the current MPCA Superfund contract. Through working on these Superfund projects, Terracon has developed the knowledge and capabilities to work within the requirements of the MERLA, RCRA and NOHSCP programs. Terracon conducts our services consistent with the requirements for performing investigations provided in the MPCA Draft Guidelines of Risk Based Characterization and Sampling Guidance and the MPCA Voluntary Brownfields Program (VBP) Guidance Documents.

Terracon has experience working on VBP sites under the Land Recycling Act and has completed phases of investigation ranging from preparation of Phase I environmental site assessments (ESAs) through the preparation and implementation of voluntary response action plans. Terracon continues to perform tasks of the voluntary response action plan for the Former Midway Stadium Site in St. Paul, Minnesota (See text box below). Our services at the Former Midway Stadium Site included site assessment and implementation of a response action plan (RAP) that included oversight of excavation, staging, characterization, disposal and other soil management activities, and installation and testing of a vapor mitigation system. Terracon's services originally involved completing the tasks for the voluntary response action agreement which allowed the MPCA to generate a No Further Action letter for the site. For a detailed description see the text box below.

Representative Experience:

Saints Business Center (Former Midway Stadium) Site, St. Paul, MN

The Saints Business Center project brought together both public and private partners to facilitate environmental cleanup of the former Midway Stadium site. The site was the location of the former State Fair Dump, which covered approximately 80% of the site to depths ranging from 20-35 feet from the ground surface into the water table. The presence of the former dump required that contaminated soil/debris and subsurface vapors be remediated and/or controlled to facilitate safe redevelopment. Previously unknown special wastes such as buried drums/containers, asbestos containing soils, and hay/animal waste, were encountered throughout redevelopment activities and required proper management.

The project was the first speculative office warehouse project to obtain Leadership in Energy and Environmental Design (LEED) Core and Shell (CS) Silver Pre-certification. This required the incorporation of a substantial amount of sustainable design and construction components to the project involving the use of solar energy, materials reuse, storm water control/treatment and water use.

Terracon conducted assessment activates to determine the magnitude and extent of contamination. Since excavation of the entire waste mass was economically infeasible during redevelopment of the site, the RAP/CCP included the construction of clean soil buffers above areas where waste and contaminated materials were left in place. These clean soil buffers were required to be one-foot thick beneath the building, two feet thick beneath paved areas and four feet thick beneath green space areas. Clean buffer materials needed for the site consisted of both imported and existing soils mined from the southeast portion of the site.

Several instances of encountering previously unknown wastes occurred during redevelopment activities at the site. Unknown wastes encountered included buried drums containing paint wastes, buried containers with liquid petroleum wastes, paint stained soils, asbestos containing debris/soil and animal wastes (hay and manure). Upon encountering these wastes, work had to immediately be suspended

in this area in order to characterize the waste and determine its proper management. Most of the wastes encountered required special packaging and off-site management.

Approximately 30,000 cubic yards of soil mixed with debris was encountered during earthwork activities at the site including general grading, utility trenching and foundation work. Rather than disposing of them off-site these materials were processed into a condition that they could be reused on site.

The assessment identified elevated levels of methane and various VOCs in soil vapors being generated by the waste mass. Given the elevated levels of methane, intrusion of soil vapors into future structures and migration of soil vapors off-site were mitigated through design and installation of a duel component vapor mitigation system. This duel component vapor mitigation system consisted of a Vapor Extraction System (first line of defense of vapor intrusion) and a sub-slab depressurization system (second line of defense of vapor intrusion). The complimentary systems were designed to operate independently of each other to create a failsafe system for eliminating vapors from impacting the building.

Terracon's participation as an engineering consultant since the late 1970's in assessments, and remedial planning and implementation on hundreds of CERCLA/SARA NOHSCP national priorities list (NPL) sites in the central United States uniquely qualifies Terracon for performing similar environmental consulting services under this MPCA and MDA Master Contract. Terracon's experience with conducting Remedial Investigation/Feasibility Studies (RIFS's), Corrective Measures, Interim Response Actions, Remediat Design/Response Action Plans (RD/RAP's), and Remedial Action oversight, maintenance, monitoring and operation is highlighted by our services on such sites as Chemplex/Quantum in eastern Iowa, Behlen Manufacturing in eastern Nebraska, Imperial Inc. in southern Minnesota and MacGillis and Gibbs in New Brighton, Minnesota. We have performed an even broader range of consulting, design and remediation services for nearly a hundred projects for viable private industries under the auspices of RCRA in the central and western USA since 1980.

Our thorough knowledge of the CERCLA and RCRA regulatory and geologic environments, and the lessons learned from over 30 years of managing these types of complex and high profile projects through evaluation, remedial design and implementation, will provide time and cost savings to the MPCA and MDA.

3.0 PROJECT DESCRIPTIONS

Terracon has included the following two project descriptions for remedial investigations:

Project 1:
Project: Morrison County Sanitary Landfill

Client: Morrison County, Minnesota

Client Contact: Mr. Steve Backowski, 320.632.0120

Site Description: The site is a municipal solid waste landfill located just southeast of Little Falls, Minnesota. The facility was originally permitted to accept solid waste by the MPCA in 1970. The facility constructed its first lined cell in 1993 and has been operating as a RCRA, Subtitle D landfill since that time. Unlined portions of the landfill, filled prior to 1993, consist of approximately 30 acres. The lined area permitted in 1993 consists of approximately 20 acres. The landfill property consists of a little over 700 acres.

Project Description: Terracon staff were originally retained by Morrison County in 1989, to represent the County's interests in completing re-permitting and landfill regulatory compliance items associated with a Stipulation Agreement issued by the MPCA for the Greater Morrison Sanitary Landfill. These staff continue to provide engineering consulting services on the project today.

The site was operated from approximately 1970 through 1987, when the operation ceased upon receipt of a closure order from the MPCA. Terracon staff assisted the County with the preparation of a variance justification during negotiation of the stipulation agreement with the MPCA, under which the site was allowed to begin operations again. The site operated under the stipulation agreement from June 1989 to September 1993, at which time the facility's first RCRA, Subtitle D, liner/leachate collection system cell came on line. Since 1993, Terracon staff have been assisting the County with the following activities:

- Re-permitting including preparation of an Environmental Assessment Worksheet (EAW), increases in capacity, expansion of the leachate management system, and expansion of the landfill gas management system.
- Design and construction oversight of a leachate management system including over 3,000,000 gallons of storage in leachate treatment ponds, and leachate treatment options consisting of leachate recirculation, leachate land application, and disposal through the Metropolitan Council Environmental Services (MCES) Metropolitan Disposal System (MDS).
- Design and construction oversight of a landfill gas management system consisting of 27 landfill gas wells installed in unlined areas of the landfill and 35 shallow, medium and deep landfill gas migration monitoring probes.
- Preparation of bidding documents, bid administration, construction observation and final certification of six separate cells of the permitted liner and leachate collection system and over 20 acres of final cover system.

Many of these staff members continue to assist with the implementation of these response actions and oversight of current system operations (See below).

After the final stipulation agreement was negotiated, Terracon staff and the County completed remedial investigation activities and associated documents to determine the extent of groundwater contamination

associated with past operations of the unlined portions of the landfill. After the need for corrective action was determined, Terracon staff prepared corrective action documents for MPCA approval. Upon approval, Terracon staff designed and prepared construction documents for the approved corrective action system.

The final corrective action system currently consists of four groundwater extraction wells. Extracted groundwater is sprayed through pressurized irrigation systems for treatment of volatile organic compounds and discharged through land application. The corrective action system has been operating for over 20 years. Over that 20-year period, approximately 1.5 billion gallons of groundwater has been treated, samples collected of the sprayed groundwater illustrates that volatile organic compounds are effectively being stripped and groundwater quality in the pumping wells has steadily improved.

Project Staff:
Terracon staff associated with the project is identified below:

Sr. Project Manager – Eric Hesse, PE
Project Professionals – Cami Van Abel, PE; Randall Sippel, PG
Field Scientist – Warren Tuel, PSS
CAD – Mike Keys

Subcontracted Tasks: Sub-contracted services for this project included drilling services, landfill liner and cover system contractors, remediation contractors and laboratory services.

Outcome Achieved: Six cells of liner constructed since 1993, approximately 30 acres of final cover (>5:1 slopes), design and implementation of a leachate management system (including over 3,000,000 gallons in storage capacity), design and installation of a landfill gas management/monitoring system (27 gas wells within the waste mass and 35 shallow, medium and deep gas monitoring probes outside the waste mass), design of the storm water management system, and design, construction oversight and operations assistance of a groundwater pump and treat system for remediation of groundwater contamination. Work is on-going at the site.

Project 2:

Project: The Fish Hatchery Dump

Clients: Minnesota Pollution Control Agency

Client Contact: Mr. Kurt Schroeder, MPCA, 651-757-2703

Site Description: The former Fish Hatchery Dump is located south of the intersection of Warner Road and Highway 61/10 in St. Paul, Minnesota. The site consists of approximately 38-acres of land that includes mostly woods, grassy areas, a stream, and a bicycle trail. The site adjoins the Little Pigs Eye Lake and railroad property to the south and the Minnesota Department of Natural Resources (DNR) Fish Hatchery to the west. Reportedly, the dump consisted of a solid waste disposal facility that operated from the mid-1930s to 1971. When the facility closed the waste was covered with a limited final cover system. The site was added to the Minnesota Permanent List of Priorities in August 2007.

Project Description: Investigation of the Fish Hatchery Dump site has been on-going since 2000. Since that time, investigation of groundwater, surface water (Willow Brook stream and the northern edge of Little Pigs Eye Lake), soil, and sediment (Willow Brook stream and the northern edge of Little Pigs Eye Lake), have been investigated.

Compounds detected in groundwater include volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs, Diesel Range Organics (DRO), Pesticides, Herbicides, Metals, Cyanide, Polychorinated byphenols (PCBs) and Perflourochlorohydrocarbons (PFCs). Several of these compounds were detected above Minnesota Department of Health (MDH) Health Risk Levels (HRLs) as well as Tier 1, Class 2B surface water standards.

Compounds detected in surface water include VOCs, SVOCs, DRO, Pesticides, Metals, and PFCs. Several of these compounds were detected above MDHHRLs as well as Tier 1, Class 2B surface water standards. Although no VOCs were detected above their respective Tier 1, Class 2B surface water standards, several SVOCs, pesticides, metals and PFCs were detected above their respective surface water standards.

Compounds detected in soils include VOCs, SVOCs, DRO, Pesticides, Metals, Cyanide, and PCBs. Several of these compounds were detected above MPCA Soil Reference Values (SRVs) and Soil Leaching Values (SLVs). Several of these compounds were detected in shallow soils (0-1').

Compounds detected in sediment include SVOCs, Pesticides, Metals, Cyanide, PCBs, and PFCs. Several of these compounds were detected above MPCA SRVs and SLVs. Several of these compounds were detected in shallow soils (0-1 foot). Several SVOCs, Pesticides and metals were detected above respective Level 2 Sediment Quality Targets (SQTs). In conjunction with the sediment sampling for the analysis of the above compounds, several sediment samples were collected to have laboratory testing conducted to determine toxicity levels and bioaccumulation of pesticides. Testing results indicated that the pesticide levels in the sediment exhibited a slight toxicity to the tested organisms.

As a result of the above remedial investigation (RI) results, Terracon has recommended additional soil sampling in the areas of shallow impacts (along with consideration of institutional controls), sediment sampling to the middle and southern portions of Little Pigs Eye Lake, and bioaccumulation testing on fish and aquatic life to determine bioaccumulation levels. It was further recommended that the results of the RI

and further testing be used to prepare a Feasibility Study (FS) to evaluate remedial options for mitigating the identified risks to Willow Brook stream and Little Pigs Eye Lake.

Project Staff:
Terracon staff associated with the project are identified below:

Sr. Project Manager – David Wolfgram, PE
Project Manager – Brett Staeden, PE
Field Scientist – Ben Berthiaume, David Liddell
CAD – Jamie Markel

Subcontracted Tasks: The contracted services included laboratory analysis and drilling services (soil and groundwater probes).

Outcome Achieved: The contaminants and concentrations relative to risk potential to receptors were assessed. A recommendation for further testing and evaluation of remedial alternatives has been made. This project is on-going.

4.0 SCOPE OF SERVICES

Terracon's experience with the scope of work items in Section 4 of the RFP are listed below:

Design remediation systems and strategies for remediation of subsurface contamination. Contaminated subsurface media includes, but is not limited to, soil, solid waste, groundwater, methane and/or other vapor.

Terracon approaches each soil, solid waste, groundwater, methane and/or other vapor corrective action design or response action plan conservatively to ensure the solution is effective and practical. Various options and alternatives are evaluated individually for their probability of success, feasibility of installation, ease of operation and overall cost. Conservative estimates of well yields, capture zones, volatilization rates, dispersion constants, etc. are used in the initial design, and are further refined after preliminary studies have been completed. Our staff of scientists, geologists, hydrogeologists, and engineers work together during the design phase to ensure that the most efficient and practical technology is chosen to address a particular site. Terracon has found that it is critical to have complete assessment and pilot test data prior to recommending a corrective action such that accurate projections regarding the design requirements, potential patent conflicts, life-cycle of the cleanup and cost can be used in the evaluation process. Terracon staff is knowledgeable in the various regulatory requirements associated with the extraction, treatment and disposal of recovered soil, vapor, groundwater and free product. We have successfully implemented a number of designs using a variety of remedial technologies or combinations of technologies.

Terracon has completed remedial designs for sites impacted with volatile organic compounds (both non-petroleum and petroleum), semi-volatile organic compounds, metals, fertilizer, pesticides, soil vapors and methane. Below is a list of remedial technologies Terracon has evaluated at various contaminated sites:

Soil, Sediment and Solid Waste Treatment Technologies

Bioventing - Bioventing is a technology that stimulates the natural in-situ biodegradation of aerobically degradable compounds in soil by providing oxygen to existing soil microorganisms. In contrast to soil vapor extraction, bioventing uses low air flow rates to provide enough oxygen to sustain microbial activity.

Enhanced Bioremediation - The process whereby the activity of naturally occurring microbes is stimulated by circulating water-based solutions through contaminated soils to enhance in-situ biological degradation of organic contaminants or immobilization of inorganic contaminants. Nutrients, oxygen, or other amendments may be used to enhance bioremediation and contaminant desorption from subsurface materials.

Natural Attenuation in Soils - Natural processes, such as dilution, dispersion, volatilization, biodegradation, adsorption, and chemical reactions with soil materials, are allowed to reduce contaminant concentrations to acceptable levels.

Soil Vapor Extraction - An in-situ unsaturated (vadose) zone soil remediation technology in which a vacuum is applied to the soil to induce the controlled flow of air and remove volatile and some semi volatile contaminants from the soil.

Composting - Contaminated soil is excavated and mixed with bulking agents and organic amendments such as wood chips, hay, manure, and vegetative (e.g., potato) materials. Proper amendment selection ensures adequate porosity and provides a balance of carbon and nitrogen to promote thermophilic, microbial activity.

Landfarming - Landfarming is a full-scale bioremediation technology, which usually incorporates liners and other methods to control leaching of contaminants, which requires excavation and placement of contaminated soil, sediment, or sludge.

Soil Vapor Extraction (Ex-Situ) - A vacuum is applied to a network of aboveground piping installed in a soil stockpile to encourage volatilization of organics from the excavated media. The process may include a system for handling off-gases

Thermal Desorption - Thermal desorption is a physical separation process and is not designed to destroy organics unless coupled with an oxidation chamber. Wastes are heated to volatilize water and organic contaminants. A carrier gas or vacuum system transports volatilized water and organics to the gas treatment system. The bed temperatures and residence times designed into these systems will volatilize selected contaminants, but will typically not oxidize them. Contaminant destruction can be accomplished in an accompanying oxidation chamber.

Excavation, Retrieval, and Off-Site Disposal - Contaminated material is removed and transported to permitted off-site treatment and disposal facilities. When excavating contaminated soils with debris/solid waste, such as in the case of relocating a waste mass, processing of the soil/waste mixture can be completed to reduce the amount of materials transported off-site for treatment and disposal. This could consist of using available equipment to separate waste from soils, screening waste/debris from surrounding soils and smaller materials, or setting up more elaborate screening, crushing and separating systems. The main goal is to reduce wastes disposed of at landfills and/or extract materials that could be beneficially reused.

Groundwater, Surface Water, and Leachate Treatment Technologies

Enhanced Bioremediation – A process where the rate of bioremediation of organic contaminants by microbes is enhanced by increasing the concentration of electron acceptors and nutrients in groundwater, surface water, and leachate. Oxygen is the main electron acceptor for aerobic bioremediation.

Natural Attenuation - Natural subsurface processes, such as dilution, volatilization, biodegradation, adsorption, and chemical reactions with subsurface materials, are allowed to reduce contaminant concentrations to acceptable levels.

Air Sparging - Air sparging is an in-situ technology in which air is injected through a contaminated aquifer. Injected air traverses horizontally and vertically in channels through the soil column, creating an underground stripper that removes contaminants by volatilization.

Bioslurping - Bioslurping combines the two remedial approaches of bioventing and vacuum-enhanced free-product recovery. Bioventing stimulates the aerobic bioremediation of hydrocarbon-contaminated soils. Vacuum-enhanced free-product recovery extracts light non aqueous phase liquids (LNAPLs) from the capillary fringe and the water table.

Directional Wells - Drilling techniques are used to position wells horizontally, or at an angle, to reach contaminants not accessible by direct vertical drilling.

Dual Phase Extraction - A vacuum system is applied to groundwater extraction wells to simultaneously remove various combinations of contaminated groundwater, separate-phase petroleum product, and hydrocarbon vapor from the subsurface. A Dual Phase Extraction system employs the use of a groundwater depression pump and a high vacuum blower connected to the well(s).

Multi Phase Extraction - Use of a high vacuum pump to extract groundwater and vapor from the subsurface. The phases are separated at the surface and treated separately then discharged according to state and local regulations. A Multi Phase Extraction system employs the use of a high vacuum blower to extract both phases of contamination from the subsurface.

Air Stripping - Volatile organics are partitioned from extracted groundwater by increasing the surface area of the contaminated water exposed to air. Aeration methods include packed towers, diffused aeration, tray aeration, and spray aeration.

Granulated Activated Carbon (GAC) - Groundwater is pumped through a series of canisters or columns containing activated carbon to which dissolved organic contaminants adsorb.

Groundwater Pumping - Groundwater pumping is a component of many Pump-and-Treat processes, which are some of the most commonly used groundwater remediation technologies at contaminated sites. The objectives of groundwater pumping include removal of dissolved contaminants from the subsurface and containment of contaminated groundwater to prevent migration.

In-Situ Chemical Oxidation – In-Situ Chemical Oxidation (ISCO) involves the treatment of dissolved phase contaminants in the groundwater using chemicals placed in the ground that react with the contaminants. The chemical reaction oxidizes the contaminants, thus destroying them, which results in benign chemical byproducts. Some common chemicals used include persulfate, permanganate, and ozone. Terracon has conducted various pilot scale and full scale ISCO treatment projects in Minnesota and throughout the region.

In-Situ Chemical Reduction – In-Situ Chemical Reduction (ISCR) involves the treatment of dissolved phase contaminants in the groundwater using materials placed in the ground to promote biotic and abiotic reactions with the contaminants. The materials either directly provide the chemicals that directly react with the

contaminants such as zero valent iron (abiotic) or provide the substances to promote biological activity which results in biologically mediated reactions that destroy the contaminant compounds. Terracon has conducted various pilot scale and full scale ISCR treatment projects in Minnesota and throughout the region.

Landfill Gas Treatment Technologies

Passive Landfill Gas Combustion – For landfills with landfill gas production levels too low to support an active extraction system, but may still pose a concern for air emissions and/or landfill gas migration to potential receptors, passive solar flares may be a suitable option. Solar panels are used to power the spark plug that flares the gas and a filter and flame arrestor is typically included for safety purposes. Passive flaring also may help alleviate odors. The efficiency of a passive collection system depends on how well the gas is contained within the landfill, therefore an adequate cover system is important. Terracon has provided assistance for Morrison County Sanitary Landfill in reporting landfill gas quantities destroyed in their passive solar flares installed in the areas of the landfill where leachate recirculation operations have occurred.

Active Landfill Gas Extraction/Combustion – An active gas collection system may be installed at landfills to comply with regulatory requirements (NSPS), to deal with landfill gas migration or odor issues or voluntarily by the facility as a proactive approach to concerns with greenhouse gas emissions. Active gas collection systems are typically comprised of a piping network (vertical wells, horizontal collectors and a piping manifold system), condensate management, a vacuum blower, and flare to combust the collected landfill gas. Terracon staff has experience in design, monitoring, operational troubleshooting, construction oversight and reporting for active landfill gas collection and control systems at several landfill sites in Minnesota.

Landfill Gas Extraction/Beneficial Reuse – The extraction of landfill gas for beneficial reuse involves the application of supplementing or replacing a fuel source with landfill gas. Conventional landfill gas beneficial reuse projects include direct use (such as a boiler or furnace operations), compressed natural gas for vehicle fueling and utilizing landfill gas in a microturbine or turbine to generate electricity. Landfill gas for beneficial uses requires that the waste mass is producing the appropriate volumes and quality of landfill gas to supply the proposed operation. Facilities where lower volumes of landfill gas are produced may be able to be used to power on-site needs. Facilities where larger volumes of landfill gas are produced can be considered to generate power for portions of the surrounding community. To determine whether or not a given facility is capable of producing the necessary volumes of landfill gas to use beneficially, a feasibility study may be necessary. This feasibility study evaluates the current and future quantity and quality of landfill gas at the facility, potential power requirements of the surrounding community, existing utility infrastructure, capital and operations/maintenance costs, etc. Terracon staff has experience in performing landfill gas-to-energy feasibility studies and providing permitting and technical assistance with the implementation of landfill gas-to-energy systems for several landfill sites in Minnesota.

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

Terracon conducts pilot testing and treatability studies to assess the viability of a specific technology(s) to remediate a contaminant. Test results generally measure the rate and extent of degradation that might be attained during remediation. Terracon has completed pilot testing and treatability studies on several large projects in Minnesota including a petroleum impact to the Buffalo Aquifer near Glyndon, Minnesota, agricultural chemical contaminated soil in Albert Lea, Minnesota, and solvent contaminated groundwater in Lake Elmo, MN. In these situations, Terracon designs and conducts the pilot test and often employs vendors to supply test equipment for the operation of the test.

Feasibility studies typically include pilot tests to evaluate the feasibility of various known remedial options based on the site specific conditions. At the site near Glyndon, conventional remedial technologies including groundwater extraction, air sparging and soil venting were pilot tested in addition to soil and groundwater biodegradation bench scale testing to provide sufficient information by which to select the most appropriate corrective action.

Representative Experience:
Lyon County Sanitary Landfill, Marshall, Minnesota

Terracon staff performed a pilot study at the Lyon County Sanitary Landfill to evaluate landfill gas quantity and quality for a potential landfill gas-to-energy project. A portable vacuum blower skid was installed on passive gas vents at various locations throughout the landfill, along with leachate recirculation laterals in the active areas of the landfill, to evaluate landfill gas production rates. The collected landfill gas was filtered through compost piles in order to minimize odors. Measurements, including vacuum, differential pressure, methane, and oxygen was collected until the monitoring point was observed to be stabilized (i.e. a consistent data trend was observed). The data was used to calibrate a landfill gas generation model in order to predict current and future landfill gas generation.

Representative Experience:
Sioux Falls Regional Sanitary Landfill, Sioux Falls, South Dakota

Terracon staff assisted with construction oversight and reporting for an evapotranspiration cover plot demonstration project at the Sioux Falls Regional Sanitary Landfill. The demonstration project included the construction of a proposed evapotranspiration cover plot, along with moisture probes installed at selected depths to monitor moisture infiltration through the proposed cover material. The demonstration project was performed in conjunction with South Dakota State University, who provided the weather monitoring station, as well as the moisture probe data compilation. The demonstration project allowed the landfill to move forward with the permitting and construction of a full scale evapotranspiration cover across the landfill.

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

Terracon approaches each corrective action design at landfill, petroleum and State Superfund sites conservatively to ensure the solution is effective and practical. Options and alternatives are evaluated

individually for probability of success, feasibility of installation, ease of operation, and cost. Conservative estimates of well yields, capture zones, volatilization rates, dispersion constants, etc., are used in the initial design, and are fine-tuned after preliminary studies have been completed. Our staff of scientists, geologists, hydrogeologists, and engineers work together during the design phase to ensure that the most efficient and practical technology is chosen to address a particular site. We have found that it is critical to have complete assessment and pilot test data prior to recommending a corrective action, so that accurate projections regarding the design requirements, potential patent conflicts, life-cycle of the cleanup and cost can be used in the evaluation process. Our staff is knowledgeable in the various regulatory requirements associated with the extraction, treatment and disposal of recovered soil, vapor/landfill gas, groundwater and LNAPL. We have successfully implemented a number of designs using a variety of remedial technologies or combinations of technologies including: groundwater extraction and treatment, groundwater extraction and product recovery, vacuum enhanced recovery (dual phase extraction), soil vapor extraction, landfill gas extraction and treatment, bio-venting, air sparging, in-situ chemical oxidation, in-situ chemical reduction, enhanced anaerobic biodegradation, natural attenuation, on- and off-site thermal treatment, bio-piles, and land application. Terracon has completed or is in the process of completing several landfill/solid waste remediation projects, petroleum remediation projects using the MPCA corrective action design (CAD) documents issued during 2011 with some updated in 2017 including conceptual corrective action design (CCADs), Focused Investigations, Pilot Test Work Plans, Pilot Test reports, Excavation Detailed Corrective Action Design reports and a Remediation System Detailed Corrective Action Design report.

Representative Experience:

Morrison County Sanitary Landfill, Little Falls, Minnesota

Unlined portions of the landfill constructed prior to Subtitle D are the source of groundwater contamination consisting of several VOCs including vinyl chloride. The main source of the contamination was determined to be from the operations of a former hazardous waste disposal area in a portion of the unlined landfill filled in the 1970s. Discharge of treated groundwater was a challenge because there was no nearby WWTP with the capacity for direct discharge and on-site treatment would require pre-treatment of naturally occurring levels of metals so treatment equipment would not become fowled. Therefore, discharge by spray application was determined to be the optimal discharge method for treated groundwater.

Treatment and discharge of groundwater by pressurized spray application presented another challenge to the design team since discharge during winter months would not be feasible. Terracon personnel designed pumping tests and performed groundwater modeling to determine the required number of pumping wells and groundwater pumping rates necessary to contain the groundwater plume from migrating off the landfill property, even if pumping ceased during the winter.

The corrective action system has been operating for over 20 years. Over that 20-year period, approximately 1.5 billion gallons of groundwater has been treated, samples collected of the sprayed groundwater illustrates that volatile organic compounds are effectively being stripped and groundwater quality in the pumping wells has steadily improved.

Prepare Health and Safety Plan (HASP).

Terracon has a 100% commitment to the safety of all its' employees. As such, and in accordance with our Incident and Injury Free® safety goals, Terracon will develop a safety plan to be used by our personnel during field services. Prior to commencement of on-site activities, Terracon will hold a brief health and safety meeting

to review health and safety needs for MPCA and MDA projects. Employee safety is a core value of Terracon, and we are committed to ensuring each employee returns home to his or her family daily. Safety will be a priority in the management of our business, and all employees are expected to perform their job assignments with safety as a primary objective. Terracon will dedicate the time, resources and equipment necessary to create and sustain an incident and injury free environment, and no employee will be required to work in unsafe conditions. Our staff are responsible for familiarizing themselves with the safety policies and procedures pertaining to their positions. Each employee in the environmental area is required to take Occupational Safety and Health Administration (OSHA) 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER), and employees involved in field work are periodically given first aid and CPR training courses. It is the responsibility of each employee to learn and abide by safety rules, which apply to their assigned duties. It is the responsibility of each Supervisor or Project Manager to ensure that safety rules are observed and enforced. Terracon's Corporate Safety Officer is Mr. Jim Wright. He may be contacted at 913-202-7525.

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

Terracon is experienced with a wide variety of drilling methods including hollow stem auger (HSA), mud rotary, air rotary, cable tool, rota-sonic, bucket augers and direct push (Geoprobe) which have been used on projects throughout Minnesota. Terracon's experience with the drilling methods and having our own drilling operations allows us to provide drilling oversight services when it comes to utilizing other drilling companies. Terracon also has a MDH license for installing monitoring wells which also allows us to provide appropriate oversight for sealing and monitoring well installation activities.

Terracon has overseen the installation of landfill gas extraction wells, utilizing bucket auger drilling methods, and landfill gas migration monitoring probes, utilizing hollow stem auger and direct push probe technologies. Terracon personnel have been present during the drilling and construction of these wells to oversee and document the construction of landfill gas extraction wells at many landfill projects including the Morrison County Sanitary Landfill, East Central Sanitary Landfill, Lyon County Sanitary Landfill and the Crow Wing County Sanitary Landfill.

Terracon has overseen several projects involving laser induced fluorescence (LIF) push-probe techniques to delineate LNAPL impacts. Many of those LIF assessment projects were conducted in Minnesota for the MPCA. In some instances, Terracon has utilized the LIF data to develop and prepare three-dimensional perspectives of the subsurface based on LIF data.

Terracon has also overseen several projects involving Membrane Interface Probe (MIP) assessments to delineate solvent related impacts such as tetrachloroethylene and trichloroethylene contamination. Some of those MIP assessment projects were conducted in Minnesota for the MPCA. Furthermore, Terracon has utilized the MIP data to develop and prepare three-dimensional perspectives of the subsurface based on the MIP data.

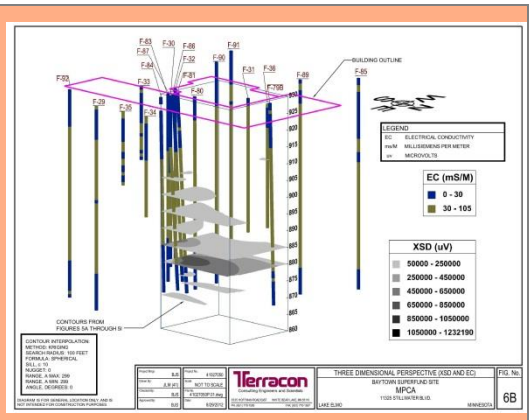
Several of these assessments have also electrical conductive (EC) probe combined with the LIF and MIP sensors that allows for the soil type to be logged during the same push. The combination of soil type along with LNAPL or contamination distribution can be a powerful tool to aid in understanding fate and transport mechanisms in the subsurface.

Terracon has a wealth of experience with soil-gas probe work at landfills as well as other soil vapor mitigation projects. Terracon has overseen the advancement of soil-gas probes via subcontract services and we have

conducted soil-gas probes ourselves. Terracon's White Bear Lake office has conducted sampling of at least 500 soil gas probes during the last three years.

Representative Experience:

Baytown Groundwater Contamination Site, Lake Elmo, MN



Terracon coordinated and oversaw additional assessment activities that involved advancing twelve MIP probes during May and June 2012. The MIP probes were advanced to further assess trichloroethylene (TCE) impacts at the site and to assess the location of dense non-aqueous phase liquid (DNAPL). The MIP probes were advanced to depths of 55 to 66 feet below ground. In addition, some of the MIP probes were advanced at angles to obtain data from below the on-site building. The MIP data provided additional information pertaining to the TCE source mass and distribution of TCE in the subsurface which was observed to coincide with the bottom of a silty soil layer located at approximately 45 feet.

In general, a test-boring program is designed to maximize the amount of data collected while minimizing the drilling budget for a given subsurface lithology. Terracon's past experience with the variable geologic conditions encountered within Minnesota is a competitive edge when preparing work plans for sites where there is limited information available. Even though Terracon has the capability to provide HSA and Geoprobe services, we will seek to identify the most cost-effective means of completing a project. Terracon will utilize drilling contractors that have a current State Contract for drilling services providing the project scope is within their capabilities.

Representative Experience:

Morrison County Sanitary Landfill Site, Little Falls, Minnesota

The Morrison County Sanitary Landfill consists of approximately 50 acres of municipal solid waste fill area. Approximately 30 acres of the fill area is unlined. Receptors near the landfill include remote residential homes and operating crop and dairy farms. As part of the landfill's permit, the County is required to manage landfill gas in an effort to minimize migration off-site towards these sensitive receptors as well as monitor on-site structures for the potential migration/intrusion of landfill gas. Terracon staff assisted the County with the design and construction oversight of a landfill gas management system consisting of 27 landfill gas wells installed in unlined areas of the landfill and 35 shallow, medium and deep landfill gas migration monitoring probes. Installation of the landfill gas wells required the use of bucket augers to construct the 36-inch diameter wells. The gas probes were installed utilizing a hollow stem auger and constructing the probes within the 3 ¼-inch diameter borings.

Conduct groundwater, soil, surface water, sediment, and air sampling and monitoring.

Groundwater Sample Collection

Terracon has experience with a wide variety of methods to collect groundwater samples for field and laboratory analysis from monitoring wells, private wells, various temporary wells, soil borings, and push-probes. Monitoring well sampling is typically completed using Teflon or disposable bottom loading bailers, stainless submersible electric sampling pumps for low flow sampling, and passive diffusion bag (PDB) samplers. Groundwater samples are collected only after a sufficient volume of water has been purged from the well, and the well is stabilized, unless PDB samplers are being used. The well purging is accomplished using a bailer, a small electric submersible pump, or dedicated purging equipment. Terracon monitors various parameters including pH, specific conductivity, temperature, dissolved oxygen, oxidation/reduction, and turbidity to ensure the groundwater in the monitoring well is stabilized with the surrounding aquifer water. More than 20 years of experience operating a Geoprobe has resulted in a number of innovative methods for collecting groundwater samples from direct push-probes. These methods include stainless steel mini-bailers, slotted rods, extractable screen points, and temporary small diameter wells.

Soil Sampling

Terracon has a vast background of experience collecting soil samples having worked on hundreds of assessments sites requiring soil sampling. Through this experience, Terracon has collected soil samples by various means including split spoon samples on conventional drill rigs, core barrels on rota-sonic drill rigs, macro-core, dual tube and discrete samples with a Geoprobe, and hand auger/Oakfield probe samples collected from quadrants, discrete point locations or soil stockpiles.

- Split spoon samples are generally collected using a 4¼-inch I.D. hollow stem auger. Soil sampling is completed in accordance with ASTM D-1584. Using this procedure, a 2-inch O.D. split barrel sampler is driven into the soil by a 140-pound weight falling 30-inches. The number of blows required to advance the split barrel sampler the last 12-inches of a normal 18-inch penetration is recorded as the standard penetration resistance value, or N value. The spoon is retrieved and opened to expose the soil sample, which is characterized. Soil samples are tested for field parameters and placed into laboratory sample jars for further analysis. The split spoon sampler is cleaned between samples using an Alconox and water wash and a water rinse. Rota-sonic drilling is slowly replacing hollow stem augers as the prefer method to collect soil sampling at deeper depths and when soil conditions make the push-probe sampling ineffective. Soil samples (or bedrock cores)) are collected during rota-sonic drilling by advancing a 3-inch diameter core barrel with carbide teeth with a vibrating drill stem. The samples are typically collected over 5- to 10-foot interval and increase in soil volume compared to other methods often provides unique insight into actual subsurface conditions.
- Macro-core samples are collected with a 2-inch diameter 4-foot sampler that is attached to the leading end of the probe rod. The sampler is comprised of a hollow, steel cylinder with an acetate liner. Samples are collected in the liner continuously in 4-or 5-foot lengths. The acetate liner and the soil core are extruded from the sampler, and the soil samples are removed and placed into laboratory prepared sample jars or other appropriate containers. Soil samples can also be collected in acetate or PVC liners using a dual tube set-up where a temporary casing is advanced to case off the borehole above the sampling interval.
- Discrete soil samples are generally collected with the Geoprobe at depths greater than 12 to 16 feet using a 2-foot long sampler that attaches to the leading end of the probe rod. The sampler consists of a hollow steel cylinder and a center piston. The sampler remains sealed until it is advanced to the desired sampling depth. The piston is retracted, and the probe is advanced approximately two feet to recover a sample. The sample is extruded and placed into laboratory prepared sample jars or other appropriate containers.

- Soil samples are generally collected using a hand auger or Oakfield probe if the sample depths are shallow, if there is limited access, inside a structure or from soil stockpiles. Terracon has hand augers with stainless steel buckets which vary from 2-inch to 4-inch in diameter. We also have larger diameter buckets which can be used to advance the borehole to the desired depth. Once the borehole is advanced to the desired depth, the hand auger with the stainless steel bucket is used to collect a discrete soil sample. The soil can be extruded from the bucket directly into a laboratory prepared sample container, into a stainless steel bowl or into a Ziploc bag.
- The Oakfield probe has a stainless steel sampling chamber which collects a soil core which is approximately ½ to 1 inch in diameter and 12 to 18 inches long. Once the borehole is advanced to the desired depth, the Oakfield probe is pushed ahead of the borehole to collect a soil core. The probe is retrieved, and the soil core is extruded as described above. The hand auger and the Oakfield probe are cleaned between each sample using an Alconox and water wash, a methanol wipe, and a deionized water rinse.

Surface Water Sampling

Terracon's experience in collecting surface water samples includes assessment activities involving monitoring plumes discharge to rivers or lakes and storm or treated water discharges to surface water. The surface water sampling methods employed at a site are typically a function of the project goal and the access limitation to the body of water. Terracon typically collects discrete surface water samples using a long handled Teflon dipper, coliwasa, or bottom loading bailer. Discrete water samples may be collected at depth using a bomb style sampler. Terracon staff also have experience using automated samplers typically used for collecting multiple samples for monitoring storm or treated water discharges.

Sediment Sampling

Terracon's experience in collecting sediment samples includes assessment activities involving the design of stream and river crossings, tracking the plume migration and discharge to rivers or lakes, and sampling of settling pond bottoms. Stream and river crossing design activities commonly involve the collection of sediment samples using split spoon samplers or shelby tube via a conventional HSA drilling rig similar to typical soil sampling, but possibly operating off a barge. The collection of sediments samples from rivers or lakes while tracking the migration and discharge of a plume or settling pond bottoms is typically accomplished utilizing conventional soil sampling equipment (hand augers, soil probes, trowels, or push-probes), although a discrete sampler such as a dredge is at times needed in deeper water.

Air Sampling

Terracon has experience collecting air samples using several types of samplers including adsorbent tubes, Tedlar bags, Summa canisters and PUF cartridges as well as various sampling media for asbestos, dust and mold. Each collection method varies in applicability and use. Adsorbent (activated carbon and other media) tubes, Tedlar bags and Summa canisters are typically used when collecting a discrete sample to evaluate air quality at a known location at a given point in time. Terracon has utilized adsorbent tubes, Tedlar bags and Summa canisters to collect discrete samples from landfill gas probes, soil vapor extraction and multi-phase extraction pilot tests and systems, soil gas surveys, exclusion zone monitoring, and homes/businesses. Adsorbent tubes, Summa canisters and PUF cartridges are often used when it is desired to collect a sample over a given period of time to compare to exposure limits. Terracon has typically used Summa canisters on

vapor intrusion projects where it is necessary to collect soil gas samples and/or monitor indoor air quality that may be affected by volatile organic compounds such as petroleum or dry cleaning solvents.

Terracon assisted the MPCA Petroleum Remediation Program with the development of the sampling procedures in Guidance Document 4-01a which included soil gas sampling techniques using push-probes units, hand driven probes, fixed soil gas monitoring points and sub-slab soil gas sampling. Terracon also was involved with evaluating sample collection methods for adsorbent tubes to be analyzed using EPA Method TO-17.

Terracon also has experience collecting soil gas samples using passive soil gas screening survey modules. Terracon has the equipment and staff experienced with the design, layout, installation/retrieval and interpretation of the passive soil gas screening survey. Terracon has completed several surveys which involved multiple stages. Passive soil gas screening survey modules are generally installed on a grid with spacing ranging from 20- to 100-feet depending upon whether the goal of the survey is to locate "hot spots" in a suspected source area or approximate the boundary of a dissolved phase solvent plume.

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

Terracon has conducted several vapor monitoring surveys of sewers, underground utilities, and residential/commercial buildings to investigate potential vapor/gas intrusion risks. Terracon's vapor monitoring equipment includes photoionization detectors, flame-ionization detectors and multi-gas meters which monitor methane, carbon monoxide, carbon dioxide, oxygen, hydrogen sulfide, and explosive levels. Terracon's inventory of equipment allows us to apply the appropriate instrument to almost any situation, whether it is monitoring vapor emanating from petroleum impacted soil consistent with the MPCA's headspace method, indoor air monitoring, collecting off-gas data from a landfill gas extraction system or soil vapor extraction system, or as part of a health and safety plan. In the past few years, Terracon has become involved with several projects involving indoor air monitoring using Summa canisters to collect air samples for air quality analysis. Furthermore, Terracon routinely conducts industrial hygiene services related to indoor air quality including conducting site testing using air monitoring equipment such as personnel air sampling pumps for sampling asbestos, vapors, or metals, and mold sampling.

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

Terracon as a company has performed more than 50,000 Phase I ESA and roughly 10,000 Phase II ESAs. Of those, staff members in the White Bear Lake, Minnesota office have completed approximately 1,250 Phase I ESAs and over 1,000 Phase II ESAs. Terracon has been involved in ESAs associated with the purchase of solid waste facilities (i.e., landfills, transfer stations, hauling companies, etc.), development or redevelopment of land ranging from small lots to sport stadiums sites to wind farms covering up to 30 square miles. Terracon routinely provides complementary services such as asbestos surveys, hazardous materials survey, wetlands delineations, and geotechnical drilling at the initial start of projects to ascertain the key physical features which are critical to evaluating whether a property is suitable for the intended use. Terracon's ESAs are performed with the utmost professionalism and quality obtained through an internal training program that ensures that ESAs performed throughout the country are conducted in accordance with ASTM standard E 1527-13. Phase II ESAs are conducted in accordance with the applicable MPCA

Voluntary Brownfield (VBP) Program, or the MDA's Guidance Documents. Terracon has completed numerous limited site investigations and remedial investigations consistent with applicable MPCA programs. Terracon's experience with performing environmental assessments in our White Bear Lake Minnesota office for almost 30 years assures our clients that their project will be completed to the current standards with the latest advances in technology and within the established guidelines by state and federal regulatory agencies.

Representative Experience:

Retail Property Redevelopment

Terracon completed a Phase I, a Phase II Investigation, a pre-demolition hazardous materials survey and soil remedial actions at a property in Madison, Minnesota which was previously a vehicle service garage and is being redeveloped as a Dollar General store. The Phase I identified a recognized environmental condition (REC) associated with the historic use of the site as a vehicle service garage. Terracon completed a remedial investigation which included 18 soil borings with the analysis of multiple soil samples for petroleum related hydrocarbons, VOCs, SVOCs, PCBs and metals and two soil gas probes for analysis of VOCs. Groundwater was not encountered, thus, groundwater samples were not collected for laboratory analysis. Laboratory analysis detected multiple compounds in the soil samples at concentrations above the regulatory standard, including PCE. Multiple VOCs were also detected in the soil gas samples. The site was enrolled in the MPCA VIC program. Terracon also worked with the MPCA to obtain a non-hazardous waste determination letter for the PCE impacted soil. Terracon prepared a RAP and ultimately coordinated the excavation and disposal of 767 tons of soil impacted with petroleum related hydrocarbons and PCE. Soil which was not impacted with PCE and which had low concentrations of the remaining analytes was reused on-site as specified in the approved RAP. A vapor mitigation system, consisting of a synthetic liner and a sub-slab venting system, was installed in the new building. The MPCA issued a Response Action Plan Implementation/Completion of Voluntary Response Action letter on January 25, 2016.

Conduct surface water, groundwater, air and vapor receptor surveys.

Terracon has completed numerous surface water, groundwater and vapor risk assessments in Minnesota associated with both petroleum and non-petroleum sites. MPCA Guidance Documents c-rem3-04 (Guidelines for Monitoring Landfill Gas at and Near Former Dumps), 4-02 and 4-18 are reviewed by our staff more frequently than any other guidance documents. We pride ourselves on having provided receptor information as a standard part of our remedial investigations prior to a number of regulatory agencies making it a requirement. Our staff is very capable in completing both the physical monitoring associated with these surveys and accessing the variety of sources of information such as municipal utility billing records, utility construction plans, county well data, and other electronic databases such as the MDH Minnesota Well Index (MWI) and source water assessments.

Terracon is also experienced with surface water screening using the MPCA Risk-Based Site Evaluation Guidance Document: *Surface Water Pathway Evaluation*. To conduct the surface water screening, Terracon determines whether the surface water receptor is designated as an OIRW (Lake Superior Basin), an ORVW, or the classification group of the water body. In order to determine whether there is potential or actual exposure above standards, criteria, or screening values, the most conservative of all standards for a chemical is identified in the surface water screening table. For initial screening with no dilution, this most restrictive standard is compared to the appropriate highest groundwater concentrations or potential concentrations just up gradient of groundwater discharge to the surface water body.

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

Terracon has coordinated the transportation, storage and proper disposal of a variety of wastes from remediation sites including: soil, groundwater, free product, adsorbent materials, spent carbon, demolition debris, municipal solid waste, industrial wastes, hazardous wastes and other less treatable debris.

In 2016, as part of redevelopment of a former dump site, Terracon coordinated the excavation, processing, temporary storage and proper disposal/reuse of approximately 25,000 tons of contaminated soil, construction debris, asbestos contaminated soils and several loads of special wastes (paint drums, discolored soils, petroleum containers) for proper disposal off-site or reuse on-site. Reuse involved processing clean, recovered concrete into Class V type materials for road base and reuse of screened soils for on-site grading purposes determined to not be contaminated above site cleanup levels.

Terracon has also assisted operating landfills with the evaluation of waste loads/types for acceptance for disposal in accordance with a facility's Industrial Solid Waste Management Plan. In addition, Terracon has coordinated the approvals (i.e. waste sampling, profiling, etc.) for disposal at MSW, industrial and demolition landfills.

During 1998, Terracon coordinated the loading, transportation and disposal of over 60,000 tons of petroleum contaminated soil from a former soil treatment facility in South St. Paul, Minnesota. In 2007, we managed the removal and disposal of approximately 2,500 tons of petroleum contaminated soil from a New York Mills site. In 2011/2012, we provided the oversight during the removal and disposal of approximately 22,600 tons of petroleum contaminated soil not suitable for reuse onsite from a property being redeveloped in Roseville. In one case the soil was transported to a landfarm site where the soil was thin spread and the other case the soil was loaded into trucks and transported to a nearby landfill where it was used for daily cover. The use of the contaminated soil as daily cover rather than outright disposal greatly reduced the disposal costs. During the period of 2005 through 2017 we have coordinated the excavation, transportation and disposal of approximately 24,000 tons of U051 listed hazardous soil and debris from a former wood treatment facility in Sandstone. Some of the soil was incinerated, but the majority of the soil has either been disposed of at landfills in Oklahoma or in Canada. Terracon is assisting MDA with completion of this work under the State Contract.

We have identified a number of qualified transportation and disposal contractors which provide prompt service at competitive costs. It is also a general policy to require documentation that the material was properly handled and disposed of prior to recommending payment. In instances where destruction documentation is not readily available such as the land application of soil, Terracon typically requests that the treatment facility provide an indemnification or bonding.

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

Terracon has completed a number of projects that require a temporary or permanent alternative source of drinking water for businesses and residents. It has been our experience that an evaluation of the geologic setting and water supply volume requirements is typically sufficient to determine whether to supply bottled water or install point of supply/source treatment (typically carbon). Terracon has also completed projects

where corrective actions involve the extension of a municipal water supply system, installation of a small water supply system, and the replacement of impacted potable wells. Although the evaluation of permanent solutions should be a continual process, it has been our experience that this decision is best made once the investigative phase of the project has been completed. We have seen a number of instances where an alternative water supply also became impacted because the remedial investigation had not been completed and the hydrogeologic setting was not well understood or where contaminants that were not initially of concern such as arsenic, nitrates or radon resulted in additional unanticipated costs.

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

Terracon is a team player – our roots in geotechnical consulting have instilled a firm understanding and ability to conduct business in "alliance" type settings with firms that both complement and complete the services we provide. Our past project work demonstrates that we are willing to work together with State contractors and not resort to questioning every piece of data. Terracon has also utilized laboratories, drilling firms, electricians, waste disposal firms, and water treatment firms holding State contracts as well as the MDH Laboratory. Terracon assisted a State Emergency Response contractor when water and petroleum entered a residential basement after heavy rains at a petroleum release site which we were working on. Terracon has also coordinated with the MDH to have them use their magnetometer to look for possible buried water wells at a project site. Terracon is currently working on a mulit-site project jointly with Baywest where they do research, review, and planning, and Terracon coordinates the sampling, prepares the reports, and then provides the GIS data to Baywest to include in a database.

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

Terracon has extensive experience implementing and providing oversight of investigation and corrective actions at project sites in Minnesota. For most investigation and all remediation actions, Terracon utilizes a scope of work or plans and specifications packages to obtain proposals from qualified subcontractors typically based upon low cost. Terracon typically acts as the general contractor and takes the subcontractor under contract on small projects, and commonly acts as the owner's agent on larger projects such as landfill construction projects and those we have completed for the MPCA and MDA administered through the Minnesota Department of Administration. Once the contract is signed a project schedule is developed and through a series of pre-construction meetings and telephone conversations issues such as approval of deliverables, work practices and site safety concerns are addressed prior to the work being initiated. Once site work has been initiated, Terracon staff are on-site during the critical phases of project documenting the activities performed and collecting data for construction documentation including daily field logs, meeting minutes, materials testing, air, soil or water samples. The field staff are in constant communication with the project engineer and manager to ensure the project is progressing according to the scope or specifications and the project remains on time and budget. If conditions are encountered which require a change to the work scope, our field staff confers with the design engineer and project manager to ensure that steps taken are adequate to account for the unanticipated condition and that the MPCA is aware of the situation. Changes in the work scope are documented with a change order.

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

Terracon has 27 years of experience working with the MPCA on petroleum Multi Site Contract projects, over 28 years of experience working on projects where the MDA has provided oversight and 20 years working with the MPCA on the Superfund Multi Site Contract. Terracon's past experience in preparing reports for the MPCA and MDA has enabled us to develop reporting formats that go beyond the requirements of guidance documents to deliver concise complete reports designed for easy review by agency personnel. Terracon personnel have completed reports for all phases of investigation through response action implementation reporting to include focused feasibility studies, pilot testing results, risk assessments and community relations plans. Terracon has completed, or is in the process of completing, several petroleum remediation projects using the MPCA CAD documents issued during 2011 and some of which were updated in 2017 including CCADs, Focused Investigations, Pilot Test Work Plans, Pilot Test reports, Excavation Detailed Corrective Action Design reports and a Remediation System Detailed Corrective Action Design report.

Terracon personnel have prepared numerous Construction Documentation Reports for landfill cover, landfill liner/leachate collection system and landfill gas recovery/control system construction. Per a landfill's permit, these reports are required to be submitted to and approved by the MPCA Solid Waste Department in order to achieve final certification of the construction. Our Construction Documentation Reports are all prepared by or under the supervision of a Professional Engineer licensed in the State of Minnesota.

Terracon has performed third party review on behalf of our clients on numerous projects. Typically, this entails a review of reports or other documents prepared by another consultant or regulatory agency. This may consist of reports and documents pertaining to one site or multiple sites which could be contributing to the potential problem. Terracon's project managers have years of experience which is valuable in sorting through the available technical information in a timely and cost effective manner. Our experience allows us to provide a concise interpretation and summary or review of the information.

Evaluate invoices and data reports.

Over the past 27 years working as a contractor for the MPCA, Terracon has developed cost proposals for thousands of subcontracted services that include primarily laboratory and drilling services. An important component of managing subcontractor services is the evaluation of subcontractor invoices and data reports. Terracon reviews subcontractor invoices to verify that the proposed scope was completed and appropriate rates were used compared to the initial quote. If deviations are discovered, Terracon will contact the subcontractor to obtain change order documentation and additional information required to justify the expense. This information is included in invoice review documentation that is presented to the MPCA project manager.

Terracon is also experienced in the evaluation of associated subcontractor data reports. The data reports are compared to the scope of work to verify that the proposed scope was completed and deviations are noted. If deviations are noted, a justification is obtained and incorporated into the evaluation. The data is also evaluated to determine whether complete records and reports are provided that thoroughly document the services provided, and that the data was properly collected, valid and useful.

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

Terracon was selected by the MPCA for beta testing during the roll out of the MPCA's EQuIS database where we use EarthSoft's EDGE software to collect data in the field and begin the process that allows for one of the MPCA's contract laboratories to prepare an electronic data deliverable (EDD) for uploading into the EQuIS system. Terracon is currently using the EDGE software and requesting EDD on several projects for the MPCA and assisting MDA as they transition to EQuIS. Furthermore, Terracon is currently working on a pilot study to assist the MPCA with developing an SOP for entering field data into EDGE for uploading to the MPCA's EQuIS database.

Terracon has the capability to provide submittals in a variety of electronic formats and has been doing so for several years. We routinely provide reports to the MPCA and other entities as PDF files where the text, drawings, charts, tables, boring logs, and laboratory reports have been generated as a PDF files such that they are of high quality and in color. Small files are typically submitted to the MPCA via email, but for larger files Terracon has a Sharefile website that allows for large files to rapidly be uploaded or download. Our

Sharefile website has been used by MPCA staff to transmit large files to our project managers greatly speeding the information exchange process. Terracon works with several firms where the entire project process is handled via electronic submittals and downloads for a website.

Evaluate data quality and prepare data verification reports.

Terracon routinely completes data quality evaluations and includes data verification in environmental reports to ensure the development of useable data. Data generated during projects will bear directly on the establishment of contaminant extent, compliance points, and risk assessments. In order to support these uses, and to fulfill project objectives, definitive data is required. Terracon completes data quality evaluations to ensure that definitive data is generated, field and laboratory activities are well documented, and that standardized practices and laboratory procedures are followed. Data quality evaluations include an initial evaluation of chain-of-custody documentation, adherence to required sample preservation techniques, holding times and proper shipment methods ensure sample integrity. Data is further evaluated for data quality indicators (DQIs) that include: precision, accuracy, representativeness, comparability, completeness, sensitivity (PARCCS), and the additional indicator of selectivity. PARCCS can be applied to both field and laboratory analytical measurements to ensure that data of known and appropriate quality are obtained to support specific decisions or regulatory actions. Selectivity is a data quality indicator that applies specifically to laboratory data to ensure that reported data are representative of the reported compound and not of a positive or negative artifact.

Terracon is experienced in the preparation of data verification reports that will typically include an assessment of the following: chain of custody completeness; holding time compliance; presence or absence of laboratory contamination as evidenced by method blanks; accuracy and bias as demonstrated by recovery of surrogate spikes, blank spikes and matrix spikes; precision as relative percent difference (RPD) of analyte concentration between replicate samples (i.e., lab duplicates), matrix spike and matrix spike duplicates, or laboratory control sample spikes and laboratory control sample spike duplicates; and presence or absence of field contamination as evidenced by trip and equipment blanks.

Arrange for site access.

Terracon routinely coordinates access to both public and private properties for the purpose of investigation and remediation. Terracon has obtained access to sites through the Minnesota Department of Transportation, Metropolitan Airports Commission, numerous Minnesota counties and municipalities, railroads, and hundreds of small businesses and individual residences. Terracon also has also previously obtained access to hundreds of properties using procedures and legal documents developed by the MPCA. More recently, Terracon has assisted the MPCA by preparing draft documents and drawing for projects where the MPCA is the lead in obtaining access.

Coordinate utility locates by contacting the appropriate entity and if applicable coordinate traffic control.

Prior to conducting activities at a site, Terracon requires that all overhead and buried utilities are located and marked. Terracon as well as the contractor performing the site work will file a utility location request with Gopher State One Call at least 48 hours prior to the beginning of site work. When private utilities are of concern, Terracon also contracts a private utility locating firm or requires the contractor to do so. When site work is planned for areas with complex utility configurations, Terracon organizes and attends both public and private utility locate meetings, as needed.

When significant traffic control is required, Terracon sub-contracts the duties to a reputable traffic control firm. Terracon personnel with no training or experience in traffic flagging or the placement of traffic control devices such as signs, barricades or flashers are prohibited from engaging in traffic control operations unless directed by a trained and experienced individual.

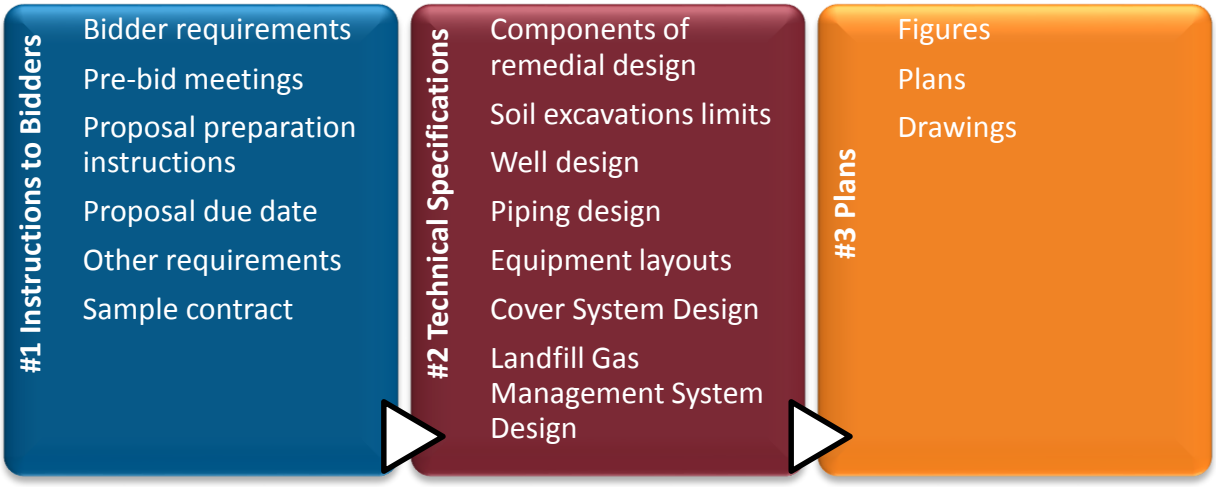
Whenever work at project sites under Terracon control will disrupt vehicle traffic or expose Terracon personnel to the hazards of vehicle traffic, (i.e., work on an active roadway, including shoulders) adequate traffic control measures must be implemented. All Terracon personnel working on projects site whether or not they are within 10 feet of an active roadway will wear reflectorized safety vests as the outermost garment. Traffic safety vests are part of Terracon standard personnel protective equipment (PPE) for all work sites. On those projects where a local traffic control firm is not available to conduct work site traffic control, Terracon may utilize personnel who have received documented, acceptable training in traffic control procedures. Such personnel must be capable of demonstrating working knowledge of local traffic safety ordinances and the Uniform Manual on Traffic Control Devices. Traffic flagging operations, when required, will be conducted only by those personnel who have received documented, acceptable training in proper flagging procedures and who possess valid flagger training certificates (where applicable). Traffic control measures will be in compliance with the Uniform Manual on Traffic Control Devices and/or state and local ordinances. Terracon personnel are instructed to consult local officials (Minnesota Department of Transportation, Highway Patrol, etc.) or local procedural requirements prior to implementing worksite traffic control measures.

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

Once the remedial design, cover system construction, and/or landfill gas management system project is approved by the MPCA, Terracon develops specifications and plans to obtain contractor bids. The specifications describe how the construction project is to be installed or implemented. They include items such as the volume of soil to be excavated, excavation limits, location and depths of groundwater or extraction wells to be installed, type and size of remedial equipment, cover system extent, landfill gas management system

extent, disposal of the waste generated from the site during construction activities, storm water management system; erosion control and construction storm water permitting requirements; and design details. The plans and specifications are utilized to solicit bids from qualified contractors and as the construction standard during the implementation of the corrective action.

Terracon's specifications generally consist of three parts:



The first section in the specifications is the instructions to bidders. In this section, bidders are informed of bidder requirements, pre-bid meetings, how the proposal should be prepared, the proposal due date and other requirements the bidder must comply with. A sample contract is also provided for review. The second section includes the technical specifications. This section details the components of the remedial design. Soil excavation limits, well design, piping design and equipment layouts are included in this section. The third section includes plans, figures and/or drawings that visually identify the items and locations described in the technical specification section.

Representative Experience:

Morrison County Sanitary Landfill, Little Falls, Minnesota

Terracon prepared bidding documents, including construction plans and specifications, for the construction of a groundwater pump and spray irrigation system, final cover construction, leachate treatment pond system construction and lined cell at the Morrison County Sanitary Landfill. Construction plans and specifications details groundwater extraction well and pump materials and construction requirements; final cover system component layers (geomembrane, drainage layer, general fill, topsoil, seeding); leachate treatment system grading, liner component layers (double composite liner); lined cell grading and liner system components (RCRA Subtitle D); and all associated details. Terracon also prepared "front end" and contract documents that included the advertisement for bids, instructions to bidders, bid form, sample contract language, methods of measurement and payment, performance and payment bond information, general conditions and supplementary conditions.

Terracon is very familiar with using the MPCA *Contractor and Subcontracting Purchasing Manual* which has been integrated into our system for preparing specifications and soliciting bids. Terracon routinely subcontracts firms with State Contracts (well drillers, laboratories, sub-slab depressurization, granular activated carbon, etc.) using a combination of bid specifications and a State Contract Order Form. For commodities and non-technical professional services for which there is not a State Contract, a boiler plate

MPCA contract, specifications and other bid forms from the MPCA *Contractor and Subcontracting Purchasing Manual* are used for subcontracts up to $50,000. Bids are tabulated on a form and submitted with our recommendation. For subcontracts of $50,000 or more, Terracon assists the MPCA and Minnesota Department of Administration with preparing the bid documents, holding pre-bid meetings, and evaluating portion of the bid submittal documents.

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

Terracon has developed and implemented QAPPs and SAPs in a variety of regulatory programs in addition to CERCLA. Terracon prepares QAPPs consistent with the requirements in MPCA *Quality Assurance Project Plan Guidance (p-eao2-13)* and EPAs EPA QA/R-5 document. In addition, Terracon has developed QAPPs and recently has used the Optimized Uniform Federal Policy (UFP) QAPP worksheets for the Baytown Groundwater Contamination Superfund site. Terracon's goal in preparing a QAPP is to document planning results for environmental data operations and to provide a project-specific strategy for obtaining the type and quality of data needed for site specific decision or use.

Consistent with recent mandates of the National Contingency Plan and CERCLA, Terracon scales the level of the QAPP to the complexity of the site. In cases where a full QAPP is not required, a SAP may be adequate to identify the samples and analytical procedures necessary. Terracon's plans include the following basic components to bring about an organized, accurate and defensible assessment:

- Project Organization and Responsibilities
- Objectives for Measurement of Data
- Custody and Control Methods
- Equipment Calibrations and Controls
- Analytical Procedures
- Internal QC Checks; Field and Laboratory
- Data Reduction and Validation
- Internal Methods Audits; Field and Laboratory

Terracon understands and anticipates that field implementation of the plans must be flexible to meet subsurface, chemical and weather effects. Terracon's plans will identify and set forth contingencies. Where these cannot be anticipated, Terracon's plans provide for a process to correct and document appropriate changes.

Representative Experience:

Baytown Groundwater Contamination Site, Lake Elmo, MN

The Baytown Groundwater Contamination Site consists of a groundwater contamination plume that measures six square miles and has impacted over three-hundred residential homes. The contaminant is TCE. Terracon recently completed an update to the Site QAPP that is in compliance with the most recent EPA requirements which required the preparation of an Optimized UFP QAPP. The QAPP addresses groundwater monitoring, remediation system monitoring, permit compliance, vapor intrusion assessment and various on-going soil and groundwater assessment activities.

Representative Experience:

Saint Paul Port Authority, Saint Paul, Minnesota

Terracon was retained by the Saint Paul Port Authority to develop a Quality Assurance Project Plan for various Brownfields site projects located throughout Saint Paul, Minnesota. The development of the QAPP was required because the Port Authority uses federal funding from the EPA to fund a number of its Brownfield projects. The QAPP was prepared in accordance with EPA QA/R-5 document. The QAPP is reviewed and approved by the EPA and the MPCA and is required to be updated on an annual basis.

Perform/oversee remedial action plans.

Terracon has extensive experience implementing and providing oversight on remedial actions conducted at petroleum, Superfund, solid waste/dump and agricultural chemical remediation sites in Minnesota. As discussed previously, Terracon utilizes the plans and specification package to obtain proposals and then provides a recommendation to the client on the low cost qualified subcontractor. Terracon has acted both as a general contractor subcontracting the remediation contractor, or overseeing the remediation contractor when they are contracted by the client. Once the contract is signed, a project schedule is developed and issues such as approval of deliverables, work practices and site safety concerns are addressed prior to the work being initiated through series of pre-construction meetings and telephone conversations. Once site work has been initiated, Terracon staff are on-site during the critical phases of project documenting the activities performed and collecting data such as daily field logs, meeting minutes, construction materials field testing, air, soil or water samples. Terracon field staff is in constant communication with the Terracon project engineer and manager to ensure the remedial activities remain on schedule and within budget. If conditions are encountered which require a change to the work scope, our field staff confer with the design engineer and project manager to ensure that steps taken are adequate to account for the unanticipated condition and that the client is made aware of changes. Changes in the work scope are documented with a change order prior to initiation of the additional work.

Terracon has been involved with over a dozen response actions on Superfund sites, including former solid waste landfills/dumps, in Minnesota over the past 30 years. The table below identifies sites where we have provided Superfund response action services:

Superfund Response Actions

Project	Remedial Investigation	Feasibility Study	Remedial Design	Response Action
MacGillis Gibbs		X	X	X
East Bethel Sanitary Landfill	X	X	X	X
Isanti-Chisago Landfill	X	X	X	X
Imperial, Inc.	X	X	X	X
Littlefork Groundwater Contamination Site	X	X	X	X
Peter Pan Dry Cleaners Site	X	X	X	X
Winona Ground Water Contamination Superfund Site	X	X	X	X
Former Kettle River Creosote Plant	X	X	X	X
Baytown Groundwater Contamination Site	X	X	X	X
Long Prairie Groundwater Contamination Site	X	X	X	X
Esko Groundwater Contamination Superfund Site	X	X		
Rochester Ground Water Plume Superfund Site	X	X	X	X
Brainerd Former Foundry	X		X	X
Dufours Cleaners	X	X	X	X
Castle Chemical			X	X
Boyer Lumber	X		X	X
Capri Beauty Shop	X	X	X	X
Cummins Power Generation (aka Boise Cascade/Onan/ Medtronics Superfund Site)	X			X
Hmong American Shopping Center / Former Pilgrim Cleaners	X		X	X
Fish Hatchery Dump	X			

Conduct surface water, groundwater, and hydrodynamic modeling.

Terracon's approach to computer modeling of groundwater flow and transport of contamination is dependent on the objective of the simulation. Modeling tasks are designed to match the expectations of the client and the reviewing regulatory agency. Terracon has completed modeling projects using techniques as simple as flow nets and analytical solutions to techniques requiring three dimensional flow and transport modeling where Visual Modflow was used. Terracon has experience with most commercially available models. Groundwater models that Terracon routinely uses include: Visual Modflow, MODFLOW, MODPATH, MOC, MT3DMS, RT3DM, and BIOCHLOR. Surface water models that Terracon routinely uses include: XPSWMM (hydrology and hydraulics), HEC-RAS (river conveyance and flooding), Detpond (wet detention basin design), National Streamflow Statistics Program, NSS (regression equations for River Peak Flows), SLAMM (pollutant loading and treatment), FLUX / BATHTUB (pollutant loading analysis and lake mixing). The surface water related modeling work conducted in Minnesota has included pipe and swale sizing, detention pond design, river analysis, and lake analysis.

Where possible, our modeling efforts are started by using a customized program developed in an Excel spreadsheet. This approach avoids the use of more complex solutions when a simpler and, at times, more realistic approach can solve the problem. Terracon also employs data handling software such as SURFER and ArcView where needed. Graphical output is typically created with GINT for boring logs, monitoring well details, and geologic cross sections. AutoCAD is used for drafting. In addition to the EPA's Tier 2 RBCA tool kit, Terracon has also used the MPCA's RBSE spread sheets to evaluate risk and establish site specific cleanup goals.

Representative Experience:

Baytown Groundwater Contamination Site, Lake Elmo, MN

Terracon designed a hydraulic barrier system to contain contamination on site at the Hagberg property in Lake Elmo, Minnesota. The system consisted of four recover wells installed along the perimeter of the property to recover groundwater. Prior to the design phase, Terracon conducted a 72-hour aquifer pumping test in order to develop aquifer characteristics and capture zone analysis needed for the design of the hydraulic barrier system.

Conduct third party review and analysis of technical information for the purpose of providing conclusions and recommendations to the State.

Terracon has performed third party review on behalf of our clients on numerous projects. Typically, this entails a review of reports or other documents prepared by another consultant or regulatory agency. This may consist of reports and documents pertaining to one site or multiple sites which could be contributing to the potential problem. Terracon's project managers have many years of experience which is valuable in sorting through the available technical information in a timely and cost effective manner. Our experience allows us to provide a concise interpretation of the information.

Terracon, on behalf of the MPCA, performed a CAD review of 16 existing petroleum remediation sites. The CAD reviews were performed to identify system design elements, such as design documentation, that were inadequate or could be improved to achieve a higher degree of efficiency and effectiveness at meeting the project's cleanup objectives. A separate report was prepared for each site reviewed with recommendations

on the efficiency of the system installed and recommendations for additional actions.

Terracon has also performed several 5-year Reviews for the MPCA on select sites. To perform the 5-year review, we have reviewed site data and annual reports from other consultants. The information collected is compared to the record of decision (ROD) for the site to determine if progress is being made and if site objectives are being met.

Perform five year reviews and site reviews.

Terracon has prepared nine Five-Year Review Reports since 2003 on behalf of the MPCA and the U. S. EPA, Region V pursuant to CERCLA Section 121 and the National Contingency Plan (NCP). The Five-Year Review Reports were completed for the following sites: FMC, NL/Tara Corp., 3M Oakdale Site, Boise/Onan/Medtronic, Waite Park Wells NPL Site, Joslyn Mfg. and Supply, Kurt Manufacturing, Lehilier Superfund Site and the Long Prairie Ground Water Contamination Superfund Site. Multiple reviews have been performed for some of these sites.

Review groundwater remediation technologies and recommend alternative and optimization options.

As mentioned previously, Terracon approaches each corrective action design or response action plan conservatively to ensure the solution is effective and practical. Various options and alternatives are evaluated individually for their probability of success, feasibility of installation, ease of operation and overall cost. Our staff of scientists, geologists, hydrogeologists, and engineers work together to ensure that the most efficient and practical technology is chosen to address a particular site. Terracon staff is knowledgeable in the various regulatory requirements associated with the extraction, treatment and disposal of recovered soil, vapor, groundwater and free product. We have successfully implemented a number of designs using a variety of remedial technologies or combinations of technologies. This experience allows Terracon to review alternative groundwater remediation technologies with a critical eye such that we can make sound recommendations of alternatives and optimization plans to the MPCA.

Below is a list of groundwater remedial technologies Terracon has evaluated at various contaminated sites illustrating the breadth of experience Terracon brings to the evaluation of a wide range of groundwater remediation technologies:

Enhanced Bioremediation – A process where the rate of bioremediation of organic contaminants by microbes is enhanced by increasing the concentration of electron acceptors and nutrients in groundwater, surface water, and leachate. Oxygen is the main electron acceptor for aerobic bioremediation.

Natural Attenuation - Natural subsurface processes, such as dilution, volatilization, biodegradation, adsorption, and chemical reactions with subsurface materials, are allowed to reduce contaminant concentrations to acceptable levels.

Air Sparging - Air sparging is an in-situ technology in which air is injected through a contaminated aquifer. Injected air traverses horizontally and vertically in channels through the soil column, creating an underground stripper that removes contaminants by volatilization.

Bioslurping - Bioslurping combines the two remedial approaches of bioventing and vacuum-enhanced free-product recovery. Bioventing stimulates the aerobic bioremediation of hydrocarbon-contaminated soils. Vacuum-enhanced free-product recovery extracts LNAPLs from the capillary fringe and the water table.

Directional Wells - Drilling techniques are used to position wells horizontally, or at an angle, to reach contaminants not accessible by direct vertical drilling.

Dual Phase Extraction - A vacuum system is applied to groundwater extraction wells to simultaneously remove various combinations of contaminated groundwater, separate-phase petroleum product, and hydrocarbon vapor from the subsurface. A Dual Phase Extraction system employs the use of a groundwater depression pump and a high vacuum blower connected to the well(s).

Multi-Phase Extraction: Use of a high vacuum pump to extract groundwater and vapor from the subsurface. The phases are separated at the surface and treated separately then discharged according to state and local regulations. A Multi-Phase Extraction system employs the use of a high vacuum blower to extract both phases of contamination from the subsurface.

Air Stripping - Volatile organics are partitioned from extracted groundwater by increasing the surface area of the contaminated water exposed to air. Aeration methods include packed towers, diffused aeration, tray aeration, and spray aeration.

Granulated Activated Carbon - Groundwater is pumped through a series of canisters or columns containing activated carbon to which dissolved organic contaminants adsorb.

Groundwater Pumping - Groundwater pumping is a component of many Pump-and-Treat processes, which are some of the most commonly used groundwater remediation technologies at contaminated sites. The objectives of groundwater pumping include removal of dissolved contaminants from the subsurface and containment of contaminated groundwater to prevent migration.

In-Situ Chemical Oxidation – In-Situ Chemical Oxidation involves the treatment of dissolved phase contaminants in the groundwater using chemicals placed in the ground that react with the contaminants. The chemical reaction oxidizes the contaminants, thus destroying them, which results in benign chemical byproducts. Some common chemicals used include persulfate, permanganate, and ozone. Terracon has conducted various pilot scale and full scale ISCO treatment projects in Minnesota and throughout the region.

In-Situ Chemical Reduction – In-Situ Chemical Reduction involves the treatment of dissolved phase contaminants in the groundwater using materials placed in the ground to promote biotic and abiotic reactions with the contaminants. The materials either directly provide the chemicals that directly react with the contaminants such as zero valent iron (abiotic) or provide the substances to promote biological activity which

results in biologically mediated reactions that destroy the contaminant compounds. Terracon has conducted various pilot scale and full scale ISCR treatment projects in Minnesota and throughout the region.

Provide evaluation and design of energy recovery system utilizing landfill gas.

Terracon's experience with landfill gas to energy recovery systems has included feasibility studies for use of landfill gas (LFG) in partnership with local energy providers and the evaluation and implementation of such systems for direct use in on-site facilities (boilers, engines). Terracon approaches each evaluation and design of landfill gas evaluation and recovery systems conservatively to ensure the solution is effective and practical. Various options and alternatives are evaluated individually for their probability of success, feasibility of installation, ease of operation and overall cost.

Evaluation involves conducting a Feasibility Study summarizing issues critical to the success of a LFG to energy system. These issues include potential landfill waste composition (% degradable), gas generation rates (consistency), landfill gas quality (corrosives and particulates), potential uses (on-site or off-site), hazard mitigation, pollution prevention, economic benefits, available funding and safety. Conservative estimates of landfill gas production, capture zones and gas quality are determined through proper field testing/pilot studies. Our staff of scientists, geologists, hydrogeologists, and engineers work together during the design phase to ensure that the most efficient and practical technology is chosen to address a particular site.

Terracon staff is knowledgeable in the various regulatory requirements associated with the extraction, treatment and reuse/combustion of landfill gas. We have successfully completed several feasibility studies and implemented a number of designs using a variety of technologies.

Terracon is aware that landfills that have been closed for an extended period of time have likely exceeded the timeframes for optimal landfill gas production from the waste mass. Therefore, potential landfill gas to energy projects at old, closed landfills are typically only successful on a smaller scale (i.e. supplementing on-site energy needs).

Representative Experience:

St. Louis County Regional Landfill, Virginia, Minnesota

Terracon staff performed a landfill gas-to-energy feasibility study for the St. Louis County Sanitary Landfill to evaluation potential options for beneficial reuse. The feasibility study included modeling landfill gas generation rates based on provided landfill records and operations, reviewing local industries for direct use options, contacting local utilities to determine requirements for generating electricity and providing costs associated with those options. Several onsite uses were also evaluated, including leachate evaporation and heating onsite buildings. Due to proposed mining operations adjacent to the Landfill, direct use partnerships were severely limited. The County elected to pursue collecting landfill gas to heat their onsite recycling building. Terracon staff has provided guidance to the County for system design and industry guidelines and practices for the application of this landfill gas-to-energy system.

Representative Experience:

East Central Solid Waste Commission, Mora, Minnesota

Terracon staff provided assistance to the East Central Solid Waste Commission in the development of a landfill gas-to-energy project with a local power municipality to generate electricity using the landfill gas generated in the landfill. An active gas collection and control system (including a flare) had been in operation at the Landfill since 2005. Terracon staff provided permitting and environmental assessment review support as well as design services for upgrading the condensate management system in the conversion to an engine destruction device. A 1.6 megawatt engine has been in operation at the landfill and provides power to meet the needs of 1,600 households.

Research, evaluate and implement innovative technologies.

Terracon has been at the forefront of evaluating and implementing innovative technologies. Over the last several years, we have implemented in-situ chemical oxidation or bioremediation on six sites in Minnesota.

Terracon designed a groundwater pump and treat system at the Morrison County Sanitary Landfill that consisted of a high pressure spray irrigation system. The corrective action system currently consists of four groundwater extraction wells. Extracted groundwater is sprayed through pressurized irrigation systems for treatment of volatile organic compounds and discharged through land application. The discharge through high pressure spray irrigation was selected for the following reasons:

- Discharge of treated water to nearby surface waters would require the treatment of naturally occurring levels of metals in order to prevent treatment systems (i.e. air stripper) from fouling. Costs associated with the additional treatment of metals and management of the sludge generated made this option difficult to manage and expensive.
- Discharge of treated groundwater through spray irrigation limited system operations to non-freezing seasons. Therefore, the pumping rates needed to be designed to maintain the defined groundwater plume on-site during the non-pumping/freezing portion of the year.

The corrective action system at the Morrison County Sanitary landfill has been operating for over 20 years. Over that 20-year period, approximately 1.5 billion gallons of groundwater has been treated, samples collected of the sprayed groundwater illustrates that volatile organic compounds are effectively being stripped and groundwater quality in the pumping wells has steadily improved.

Terracon team members have also evaluated, designed and implemented many different materials and technologies associated with landfill closure. Some of these technologies include evapotranspiration cover systems, modified RCRA cover systems, use of alternative cover materials, groundwater remediation systems (i.e., in-situ chemical oxidation, EVO), alternative LFG to energy opportunities and alternative storm water management options (underground infiltration systems, wetland treatment systems).

Another noteworthy innovative technology we have employed was discharge system installed at the Baytown Groundwater Contamination Site as described below:

Representative Experience:

Baytown Groundwater Contamination Site, Lake Elmo, Minnesota

Terracon designed a hydraulic barrier system to contain contamination on site at the Hagberg property in Lake Elmo, Minnesota. The system consisted of four recover wells installed along the perimeter of the property to recover groundwater. The well pumps were designed to pump 25 gpm each resulting in a total system flow of 100 gpm. The water is treated on site with an air stripper to remove TCE.

During the design phase, various options were evaluated for the discharge of the treated water. The site is in a rural setting and there was no sanitary or storm sewers near the site to take the discharge water. Secondary options for discharge to surface water bodies were not practical due to cost because of the distance from the site. We also evaluated the option of providing water to the City of Lake Elmo for potable use ,however, public apprehension toward the use of "treated" water was high and made this option impractical.

Ultimately, a horizontal well system was designed to discharge the groundwater beneath an adjoining baseball field owned by the City. Two horizontal wells, 500-feet long each, were designed and installed by horizontal drilling techniques. The horizontal wells are located at a depth of 25-feet below the surface to avoid the potential of mounding and flooding the field. Monitoring wells were installed along the wells and at each end to monitor potential mounding so the system can be shut down or adjusted if necessary. In addition to the horizontal wells, an irrigation system was installed for the ball field to use treated water to water the ball field during the summer months. Terracon and MPCA received an award for innovative technology for this system design from the Minnesota society of Professional Engineers.

Prepare presentations and present information at meetings.

Terracon staff that will participate in this contract have made several presentations at local conferences and meetings. Presentations we have prepared in the past have generally described project activities that we conducted or detailed innovative technologies or techniques which Terracon has employed on projects. Our staff members have provided the following presentations:

- Phalen Corridor, Saint Paul Port Authority and City of St. Paul (November 2002) – Terracon presented the investigation and remediation of West Minster Junction and Phalen Boulevard Phase I as part of the 2002 MPCA Solid Waste Conference – presented by Eric Hesse.
- City of Roseville, City Council Meeting 2016– Terracon presented its GIS database for the Twin Lakes Brownfields redevelopment area – presented by Eric Hesse.
- Multiple Presentations on Industrial Stormwater NPDES Permitting Requirements, 2004-2006 – Terracon presented current requirements to industry representatives – presented by Eric Hesse.
- City of Hastings, Housing and Redevelopment Authority Meeting 2011 – Terracon presented the investigation results of the H.D. Hudson property – presented by Eric Hesse.

- CAD Panel Discussion at MPCA Petroleum Remediation Program's Consultants' Day 2017, St. Paul, MN – Brett Staeden, panel member.
- Enhanced In-Situ Bioremediation for TCE at the Long Prairie, Minnesota Superfund Site, May 2009 In Situ and On-Site Bioremediation Symposium, Baltimore, MD – presented by Brett Staeden.
- Baytown Ground Water Contamination Site, 2007 City Council Meetings – presented by Dave Wolfgram and Brett Staeden.
- Baytown TCE Assessment, 2006 MPCA Air Water and Waste Conference - presented by Dave Wolfgram.
- Baytown Ground Water Contamination Site, 2007 Public Meeting – presented by Dave Wolfgram.
- Littlefork Ground Water Contamination Site, Regulatory Training - Dry Cleaners 2004 – presented by Dave Wolfgram.
- Landfill Gas-to-Energy Feasibility Study for the Lyon County Landfill, 15th Annual SWANA Landfill Symposium and Planning & Management Conference, April 2010 – presented by Cami Van Abel.
- East Central Sanitary Landfill Gas-to-Energy Project, 2013 Ram/SWANA Conference – presented by Cami van Abel.
- Carbon Offset Credit Hurdles for Municipal Solid Waste Projects, SWANA Wasetcon, August 2011 – presented by Cami van Abel.
- Permitting an Alternative Landfill Cap in El Paso, Texas, SWANA E-Session in 2012 – presented by Cami Van Abel.
- Better Life Through Chemistry: Leachate Treatment at the Crow Wing County Landfill, 2007 SWANA Landfill Symposium – Randall Sippel.
- Introduction to Landfill Leachate Recirculation, Minnesota Pollution Control Agency Solid Waste Operator Training in 2006 – Randall Sippel.
- Management of Hurricane Debris, Hurricane Ivan, 2006 Minnesota RAM/SWANA Conference – Randall Sippel
- Decontamination of Warehouse Impacted with Mercury, 2002 Minnesota Pollution Control Agency Air, Water and Waste Conference – Randall Sippel.
- Vapor Barrier Technology on Existing Buildings in Minnesota, 2006 MPCA Air Water and Waste Conference - presented by Paul Wiese.
- Paynesville Public Meetings and work groups – Paul Wiese.
- Laporte Public Meeting – Paul Wiese.

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

The MPCA maintains the National Pollutant Discharge and Elimination System / State Disposal System (NPDES/SDS) General Storm Water Permit for Construction Activity which is issued under the EPA Clean Water Act. Therefore, the MPCA is the local governing authority for construction work at project sites that meet the criteria for having formal Storm Water Pollution Prevention Plans (SWPPPs). Construction work conducted under this General Permit must meet the requirements of the Permit, the SWPPP and any other requirements issued by MPCA. As such, it is important to have specially trained and independent persons conduct inspections in accordance with those requirements.

As of February 1, 2010, there are training requirements that must be met under the General Permit. Terracon has staff in Minnesota that have the necessary training and hold certifications for the "Design of Construction SWPPPs" and "Qualified Compliance Inspector of Storm water". Classroom training is required to obtain these certifications in addition to continuing education courses. Having staff maintain these certifications allows Terracon to provide oversight of erosion and sediment controls at construction sites that meet MPCA storm water requirements. Terracon's experience and knowledge involving storm water controls also has aided in the proper methods that should be employed when work is taking place on a contaminated site such as how to best integrate a permanent storm water infiltration system without impacting residual soil and groundwater contamination.

Representative Experience:

St. Louis County Landfill Cell Construction Project, Lake Elmo, Minnesota

Terracon staff prepared an application to the MPCA for the above referenced project to be covered under the General Construction Storm Water NPDES Permit. Upon completion of the application, Terracon staff prepared the required Storm Water Pollution Prevention Plan required by the permit. The SWPPP provided a description of the planned construction activities, involved parties and specific responsibilities, a description of storm water pollution prevention measures, regular inspection and reporting requirements, methods used to achieve final stabilization and supporting figures and drawings. Terracon assisted the County with inspection oversight and reporting during construction.

Prepare Erosion Control Plans and oversee implementation.

Terracon is experienced in the preparation and implementation of erosion control plans. Plans are typically initiated with a discussion of the anticipated construction sequence with the contractor to assist in the selection of best management practices (BMP's) that will meet the plan goal of preventing storm water impacted with suspended solids from leaving the site. The typical design criteria include:

1) Avoidance
2) Diversion
3) Collection
4) Filtering

Avoidance is necessary to protect the existing features wherever possible by identifying areas to be left undisturbed. Diversion is necessary to channel run-on away from the construction site by means of temporary berms, swales, or pumping. Collection of storm water run-off involves retention of silty water in basins that allow fines to settle out. Filtering can include filtration systems to remove silt from site runoff. The erosion control plan is not complete without regular inspections during implementation. Weekly inspections are commonly included, at a minimum, to respond to the changing site conditions.

As mentioned previously, Terracon has staff in Minnesota that have the necessary training and hold certifications for the "Design of Construction SWPPPs" and "Qualified Compliance Inspector of Storm water". Classroom training is required to obtain these certifications in addition to continuing education courses. Having staff maintain these certifications allows Terracon to provide oversight of erosion and sediment controls at construction sites that meet MPCA storm water requirements.

Erosion Control Plans can serve both short term and long term needs. Short term plans implemented on construction projects of average size and schedule typically involve the implementation of best management practices consisting of silt fence, hay bales, erosion logs, berms for redirecting storm water flow, flow dissipation, temporary seeding and possibly temporary sedimentation basins. Long term erosion control is necessary when final site conditions and/or long term operations will involve the generation of particulates in runoff, erosion of areas during high intensity precipitation events and/or on-going soil exposure activities such as grading and stockpiling. These projects typically involve the implementation of best management practices consisting for permanent sedimentation ponds, aggregate/rip-rap stabilized drainage channels, and long term vegetation.

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

Terracon has 27 years of experience working with the MPCA on Multi Site Contract projects, over 28 years of experience working on projects where the MDA has provided oversight and 20 years working with the MPCA on the Superfund Multi Site Contract. Throughout this time, Terracon has collected and reduced volumes of data and assisted the State with the interpretation and evaluation of data for use in the development of cleanup alternatives and goals, and the documentation of the results.

Terracon, on behalf of the MPCA, performed a CAD review of 16 existing petroleum remediation sites. The CAD reviews were performed to identify system design elements, such as design documentation, that were inadequate or could be improved to achieve a higher degree of efficiency and effectiveness at meeting the project's cleanup objectives.

Terracon has also performed several 5-Year Reviews for the MPCA on select sites. To perform the 5-Year Review, we have reviewed site data and annual reports from other consultants. The information collected is compared to the ROD for the site to determine if progress is being made and if site objectives are being met.

Assist and provide training as requested by the MPCA and MDA. Training must be related to the scope of this contract.

Classroom Training

Terracon will provide training to MPCA staff as requested. In general, the activities associated with the classroom training could consist of the following as an example.

- Coordinate scheduling and agenda of training event.
- Describe, in general, the common types of mechanical remediation system(s), landfill gas management systems and/or alternative final cover systems.
- Discuss health and safety issues associated with various remedial systems.
- Describe cleanup feasibility analysis / remedial technology selection process.
- Discuss the site investigation process and how and when site investigation data should be used in conjunction with corrective actions.
- Describe existing guidance documents and new/revised guidance documents.
- Describe corrective action design process (selecting remedy, collecting design data, design of remedy, bidding, installation, monitoring, and shutdown).
- Describe engineering performance testing.
- Describe regulatory compliance testing.

- Provide mock-up or example project for demonstration purposes.

The format of the classroom training will likely include a combination of a PowerPoint presentation and hands-on practice problems relevant to the MPCA and staff.

Field Training

Terracon will provide field training event(s) to the MPCA staff as requested. In general, the activities associated with the field training could consist of the following as an example.

- Coordinate scheduling and agenda of training event.
- Prepare and/or discuss and review Health and Safety Plan requirements prior to and during training event.
- Summarize the corrective action(s) and/or construction activities associated with the training event.
- Discuss the purpose, methods and goals of field activities to be demonstrated.
- Provide mock-up or example field results for demonstration purposes, i.e., vapor sampling.
- Discuss field data in connection with corrective action design or system performance.
- Discuss experiences, challenges, and limitations of field methods.

Personnel protective equipment provided by Terracon will be limited to sampling gloves. Additional PPE such as steel toe boots, hard hats and clothing will be provided by the MPCA.

Follow MPCA Green Practices/procedures for remediation projects.

Terracon is experienced with integrating green practices into our projects as well as our work place. We attended the MPCAs Green Remediation Day Conference during 2012 and are seeking to use the ITRC *Technical/Regulatory Guidance: Green and Sustainable Remediation: A Practical Framework* in future remediation projects. Terracon also incorporates Green Practice standards into plans and specifications so that Green Practice guidance is available to general contractors and sub-contractors to follow during work conducted for the MPCA. Terracon is aware of and applies the "Green and Sustainable Remediation" practices set forth in the Petroleum Remediation Program guidance dated August 2012. https://www.pca.state.mn.us/sites/default/files/c-prp1-10.pdf

Oversee hydrogeologic investigations including fate and transport modeling.

Terracon's approach to computer modeling of groundwater flow and transport of contamination is dependent on the objective of the simulation. Modeling tasks are designed to match the expectations of the client and the reviewing regulatory agency. Terracon has completed modeling projects using techniques as simple as flow nets and analytical solutions to techniques requiring three dimensional flow and transport modeling where Visual Modflow was used. Terracon has experience with most commercially available models, but routinely uses Visual Modflow, Dream (analytical flow path analysis), and BIOCHLOR.

Where possible, our modeling efforts are started by using a customized program developed in an Excel spreadsheet. This approach avoids the use of more complex solutions when a simpler and, at times, more realistic approach can solve the problem. Terracon also employs data handling software such as SURFER and ArcView where needed. Graphical output is typically created with GINT for boring logs, monitoring well details, and geologic cross sections. AutoCAD is used for drafting. In addition to the EPA's Tier 2 RBCA tool kit, Terracon has also used the MPCA's RBSE spread sheets to evaluate risk and establish site specific cleanup goals.

Complete capture zone analyses.

Terracon's approach to capture zone analysis includes defining an appropriate target capture zone and then demonstrating that the actual capture zone includes the target capture zone through various seasons and subject to variations in nearby pumping. A three dimensional target capture zone is indicated on maps and on cross-sections of the site. If a target capture zone is not defined, then it will be uncertain if actual capture is sufficient. Terracon typically uses two to three of the capture-zone analysis methods listed below.

- Calculations of capture zone width based on aquifer flow characteristics and/or analytical models.
- Interpretation of groundwater flow lines from potentiometric surface maps that are based on measured groundwater elevations from the various subsurface stratigraphic units.
- Inward flow relative to a compliance boundary, based on measured groundwater elevations at two or more locations oriented perpendicular to the boundary.
- Concentration trends over time at sentinel wells located down-gradient of the capture zone.
- Particle tracking in conjunction with a numerical groundwater flow model calibrated/verified by actual groundwater elevations under pumping conditions.
- Implementation and analysis of data from tracer tests.

Representative Experience:

Baytown Groundwater Contamination Site, Lake Elmo, Minnesota

Terracon designed a hydraulic barrier system to contain contamination on site at the Hagberg property in Lake Elmo, Minnesota. The system consisted of four recover wells installed along the perimeter of the property to recover groundwater. Prior to the design phase, Terracon conducted a 72-hour aquifer pumping test in order to develop aquifer characteristics and capture zone analysis needed for the design of the hydraulic barrier system.

Perform/Oversee aquifer pump tests.

Terracon's approach to performing aquifer pumping tests is to first thoroughly evaluate the goals of the test, and then design a test that will provide sufficient data to meet those goals. For instance, a 72 hour pumping test is generally prudent when evaluating a new aquifer prior to installing a high capacity water supply well, but it may not be needed for a multi-phase extraction pilot test. Terracon has performed numerous aquifer pump tests in Minnesota both for evaluating and designing corrective actions and for high capacity water supply systems. Aquifer pump tests performed for corrective action evaluation have included; conventional groundwater pumping tests, multi-phase extraction pilot tests and dual phase extraction pilot tests. The conventional groundwater pumping tests have included high and low capacity wells and single and multiple well tests. Terracon's Minnesota offices have data logging transducers, water level meters, and other specialized equipment for collecting data from extraction wells and monitoring wells that are sealed to allow for monitoring vacuum.

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

Terracon's approach to evaluating the integrity of an existing cover system is to first lay out a grid of sampling point locations that will allow for a good representation of the entire cover system profile. After grid set-up, Terracon uses push probe, hand auger and shovel methods, or a combination thereof, to

evaluate the total cover thickness, individual layer thickness and individual soil types to verify existing cover system construction. Soils within each test location are logged and characterized using the Unified Soil Classification System (USCS). Representative samples of each layer type are then collected to confirm field classifications by running lab testing.

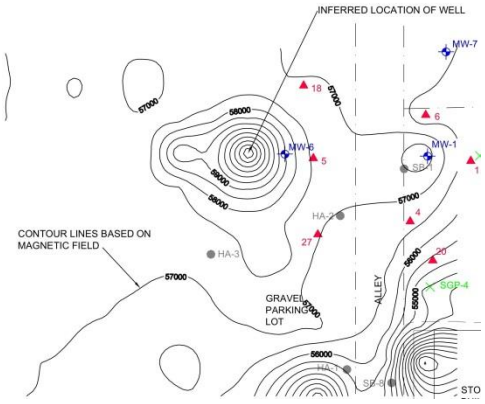
Upon characterization of the existing cover system, this data can be used to compare the construction to standard regulatory design requirements to determine the cover system is up to current standards. In addition, the information gathered from field observations and testing can be used as input into the Hydrogeologic Evaluation of Landfill Performance (HELP) Model to predict the cover system efficiency as defined by quantity of precipitation falling on the cover system that actually infiltrates through and into the waste mass below.

Terracon personnel have also been involved with the identification of soil borrow sources for cover system soil layer construction. Identifying soil borrow sources that will provide the necessary quantity and quality of soils for a given cover system component (i.e., barrier layer, sand drainage layer, buffer layer, rooting zone layer and topsoil layer) is a critical part of final cover system construction projects. Terracon's approach is to use a combination of soil borings (to help better define depth) and test pits (to provide a better visual of consistency and layering) to determine the quantity and quality of available soils. Again, soils observed are logged in the field and characterized utilizing USCS methods and select samples are submitted to a soils laboratory for testing to confirm field observations. Sampling frequencies are completed in accordance with MPCA Guidance for Soil Construction Standards and Testing Frequencies – Final Cover Construction. Testing results are compared to the standards identified in the same guidance and the MPCA Solid Waste Rules to verify the soil borrow source is adequate for use in cover construction projects.

It should be noted that Terracon has a soils testing lab in both its White Bear Lake and Plymouth offices that can conduct most, if not all, soil testing requirements for final cover construction projects.

Arrange for geophysical activities.

Terracon owns and operates ground penetrating radar (GPR) equipment used primarily for pavement delineation studies, but we have used it for subsurface explorations. Terracon also owns and operates an eight channel seismic unit to determining the bedrock contact for construction excavations. Terracon has staff expertise in performing GPR studies in our White Bear Lake and Plymouth offices. We have completed geophysical investigations in Minnesota targeting USTs, buried drums and debris, possible unsealed wells, and depth to bedrock. Terracon has conducted magnetometer surveys on MPCA projects, one in particular involved located a buried well so that the well could be uncovered and properly sealed.



Terracon has also on occasion hired sub-consultants to complete the investigations depending on the complexity of the assessment.

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

Terracon has conducted/overseen hydrogeologic, geologic and soils studies using various geophysical methods including the following:

- Ground Penetrating Radar (GPR)
- Electrical Conductivity (EC)
- Laser Induced Fluorescence (LIF)
- Membrane Interface Probe (MIP)

GPR has typically been used to identify sub-surface objects such as underground storage tanks, wells, buried drums and debris. EC is typically used to further define subsurface soil types to assist with modeling fate and transport scenarios of contaminants. LIF is implemented when trying to determine a type of free product identified at a site. MIP is typically employed to determine extent and type of contamination (i.e. chlorinated solvents, petroleum) across different media (i.e. soil, groundwater). Terracon staff in both its White Bear Lake and Plymouth offices have experience with each of these techniques.

Terracon staff in its White Bear Lake office have experience with the design and implementation of tracer studies. Groundwater tracer studies are typically conducted to obtain site specific information pertaining to groundwater velocity and flow direction using conservative tracers. The conservative tracer will consist of materials that are chemically non-reactive with the geology, relatively neutral buoyancy and have good resistance to chemical and biological degradation. Furthermore, the tracer(s) should allow for efficient and effective field and/or laboratory testing for detecting the tracer above natural aquifer background concentrations. Lastly, the tracer(s) should be safe for shipping, handling and have minimal health risk once it is injected into the aquifer.

Prepare construction cost estimates using standard engineering practices.

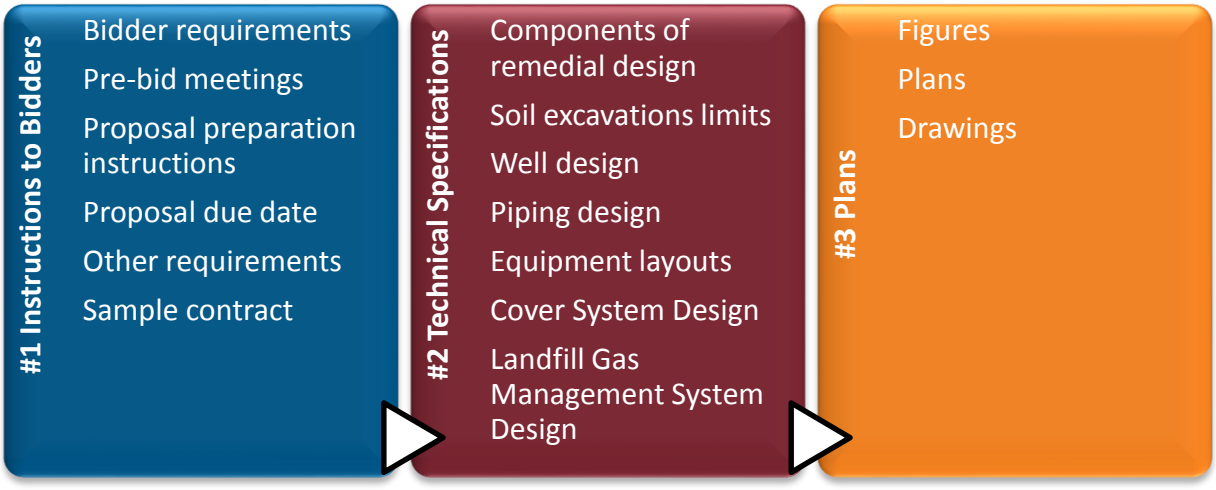
Terracon has nearly 30 years of experience designing and implementing remedial actions at Superfund, petroleum and landfill sites. This extensive experience with remedial actions provides Terracon with the understanding of the level of effort and associated costs required to construct and operate remedial systems or implement an in-situ response action.

Terracon has been providing cost estimates for construction of remediation projects for decades. This includes Engineer's Estimates on all construction projects as well as cost estimates to develop overall project budgets. Terracon's long term relationships with contractors enable us to obtain current pricing for equipment and installation requirements. Over the years Terracon has also been involved in numerous competitive bidding processes. As a result of this experience, Terracon has been able to develop an extensive library of contractor bid tabulations for reference when preparing cost estimates.

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

Once the remedial design, cover system construction, and/or landfill gas management system project is approved by the MPCA, Terracon assists the MPCA with the development specifications and plans to obtain contractor bids. The specifications describe how the construction project is to be installed or implemented. They include items such as the volume of soil to be excavated, excavation limits, location and depths of groundwater or extraction wells to be installed, type and size of remedial equipment, cover system extent, landfill gas management system extent, disposal of the waste generated from the site during construction activities, storm water management system; erosion control and construction storm water permitting requirements; and design details. The plans and specifications are utilized to solicit bids from qualified contractors and as the construction standard during the implementation of the corrective action.

Terracon's specifications generally consist of three parts:



The first section in the specifications is the instructions to bidders. In this section, bidders are informed of bidder requirements, advertisement for bids, pre-bid meetings, how the proposal should be prepared, the proposal due date and other requirements the bidder must comply with. A sample contract is also provided for review. The second section includes the technical specifications. This section details the components of the remedial design. Soil excavation limits, well design, piping design and equipment layouts are included in this section. The third section includes plans, figures and/or drawings that visually identify the items and locations described in the technical specification section.

During the bidding process Terracon has assisted with developing and posting the advertisement for bids, distribution of construction documents to interested contractors, responding to contractor questions and issuing addenda as deemed necessary. Terracon is very familiar with using the MPCA *Contractor and Subcontracting Purchasing Manual* which has been integrated into our system for preparing specifications and soliciting bids. Terracon routinely subcontracts firms with State Contracts (well drillers, laboratories, sub-slab depressurization, granular activated carbon, etc.) using a combination of bid specifications and a State Contract Order Form. For commodities and non-technical professional services for which there is not a State Contract, a boiler plate MPCA contract, specifications and other bid forms from the MPCA *Contractor and Subcontracting Purchasing Manual* are used for subcontracts up to $50,000. Bids are

tabulated on a form and submitted with our recommendation. For subcontracts of $50,000 or more, Terracon assists the MPCA and Minnesota Department of Administration with preparing the bid documents, holding pre-bid meetings, and evaluating portion of the bid submittal documents.

Provide project management and construction oversight.

Project Coordination

Efficiency and high technical standards are the foundations of the Terracon approach to project management. Upon project initiation, a senior project manager designated as the Authorized Project Reviewer (APR) will discuss the project with the assigned project manager. The APR and project manager will discuss the project goals to ensure we meet MPCAs needs and the appropriate scope of work is developed and followed. The APR and project manager will go over potential safety considerations for the field work and overall project approach including schedule and deliverables. The Terracon APR will stay involved throughout the project to answer questions, provide guidance, and perform review of data and reports.

Terracon's communication system starts with direct communication between the project manager and the client and is designed to facilitate project tracking. This system is propelled by a networked communication system both interoffice network and cross office WAN, computerized financial information, and project specific data which are immediately available to all staff. Each proposal/work plan includes a work scope of specific tasks, a project schedule, and detailed cost breakdowns for each task. It is the responsibility of the project manager to see that the project objectives are met and that the client understands what, how, when, and why tasks are to be completed. To monitor progress, we use our computerized job cost system to track how projects are progressing. As fees are incurred to a project, the project manager monitors the costs to assure they are consistent with the work plan scope and budget. Project costs are updated weekly so the project manager can monitor project expenses compared to the budget. The program manager also can oversee the progress on projects and financial standing weekly.

One or more qualified representatives at the project site at all times when the construction contractor is conducting significant work or when otherwise directed by the MPCA Site Team

Terracon commits to at least one qualified field technician (project dependent) to be present at all times during construction projects to prepare daily field activity logs, act as liaison between the contractor and project manager, perform and record results of required field testing, collect required samples for laboratory analysis, perform photo-documentation and be present at regular construction progress meetings. On occasion, there is enough construction activity taking place that more than one on-site representative will be necessary to properly monitor construction activities. Terracon understands that situations like this can occur and, therefore, is prepared to commit the proper resources to properly oversee construction activities.

Ensuring that all specifications are met, by reviewing tests including, but not limited to, equipment and material submittals, liner testing, soil compaction, soil gradation, materials placement, elevation grades, and concrete testing.

During construction projects, Terracon’s responsibilities include making sure the contractor is performing construction in strict conformance with the construction plans and specifications. This will require review and approval of contract shop drawings, review and approval of material submittals, collection of the required field and laboratory tests, verifying the field testing and laboratory testing meet the requirements of the construction plans and specifications, and performance of photo-documentation requirements.

Conducting weekly progress meetings, preparing a weekly construction agenda, and distributing a summary of the weekly construction meeting minutes.

Terracon encourages regular meetings throughout construction projects. Terracon's standard meeting frequency for projects that would be typical of closed landfills are weekly. Required attendees at these meetings include the owner's representative(s), the Terracon project manager, the Terracon field technician(s), the contractor(s) site supervisor/foreman, and any subcontractors performing critical work at the time of the meeting(s). A standard agenda will be prepared prior to the first construction meeting with the same format for all subsequent meetings. Meeting minutes will be recorded by the Terracon project manager or field technician and will be maintained in cumulative format throughout the project. Meeting minutes will be distributed to meeting attendees within 48 hours of each meeting. Terracon conducted routine weekly meetings as described above for the 4th Street reconstruction project for the City of Minneapolis during 2017.

Reviewing and approving of contractor invoices.

Procedures for pay requests will be detailed in the construction specifications. Typically, contractors will submit monthly requests for payment. Terracon's project manager will review each pay request for accuracy, relying on Terracon's field technician for input on work completed to date. Upon determination that the pay request includes only work that has been completed to date, Terracon's project manager will make a recommendation to the MPCA for payment. Upon concurrence by the MPCA that the pay request is complete and accurate, Terracon's project manager will sign the pay request and forward it to the MPCA for processing.

Erosion control measures inspections.

Terracon's project manager and field technician(s) will be intimately familiar with the projects Construction SWPPP requirements. Terracon will designate a "Qualified Compliance Inspector of Storm Water" for each project. This person will act as the MPCA's representative for maintaining compliance with the Construction Storm Water Permit and the associated SWPPP throughout the project. It is anticipated, since the Construction Storm Water permit requires both the owner and contractor to adhere to the requirements of the SWPPP, Terracon's storm water inspector will work closely with the contractor's designated representative and the MPCA.

Oversee equipment/system start-up and trouble shoot problems with the Contractor/Vendor for repair and newly installed remediation systems.

Construction plans and specifications will present requirements for start-up and trouble-shooting procedures for installed equipment that will need to be met prior to full payment to the contractor. Terracon's project manager/designer and field technician will be present during start-up of system equipment to verify that equipment is operating properly. If problems occur during initial start-up, Terracon will work with the contractor and/or its vendor to correct any malfunctions. Terracon requires 1-2 year warranties from equipment suppliers or the general contractor on system equipment and operations in our construction specifications so that the contractor and/or vendor is required to respond to problems within that timeframe at no cost to the owner.

Participation in or conduct other public and project management meetings.

Terracon's project manager is always available to assist the MPCA with addressing concerns from the general public about a specific project. Terracon will attend these meetings either in support of MPCA representatives or to conduct the meetings themselves. In the event special project meetings are necessary to solve unforeseen problems, Terracon's project manager, along with any necessary specialists, will be in attendance in support of MPCA representatives or to conduct the meeting themselves.

Prepare Construction Documentation Reports.

Terracon will prepare construction documentation reports in accordance with MPCA Solid Waste Rules 7001.1450 and the facility permit. Construction Documentation Reports will be prepared as part of all construction projects to document that construction was performed in accordance with the project plans and specifications, documenting all modifications to the plans and specification made throughout the construction of the project. Construction Documentation Reports will include a detailed discussion of construction activities that occurred during the construction project, all material testing results indicating materials were installed per specifications, copies of approved equipment and material submittals and photo-documentation of critical construction activities. The Construction Documentation Report will be prepared by or under the supervision of a Professional Engineer and/or a professional knowledgeable in the field of hydrogeology per MPCA Solid Waste Rules 7001.0070 and 7001.3150.

Prepare Operations and Maintenance Manuals.

Operations and Maintenance (O&M) Manuals are prepared to make sure that all systems remain operating as intended and that potential problems are discovered before they can be corrected. In addition, implementation of an O&M Manual is also intended to determine when site maintenance (i.e., grass cutting, erosion repairs, leachate seep repairs, etc.) are addressed properly and as soon as possible.

Terracon has extensive experience implementing and operating corrective action remedial systems at petroleum and Superfund remediation sites and preparing Operations and Maintenance Manuals for landfills in Minnesota. Terracon project managers develop a O&M form for remediation sites that details the activities and data to be collected during each site visit. Typical data collected includes:

- Pumping flow rates.
- Total volume pumped.
- Line and manifold pressure.
- Product recovered if applicable.
- Air flow rates from soil vapor extraction (SVE) lines.
- SVE line vacuum.
- SVE Discharge flow rate and pressure.
- Air Stripper pressure
- Air Stripper air discharge flow rate.
- Air temperature (to calculate standard flow rates).
- Carbon vessel influent and effluent pressure.
- Groundwater and product levels in recovery and monitoring wells.

Minnesota Rules Chapter 7035.2815, Subpart 13 lays out operations and maintenance requirements for landfills. Terracon project managers develop an O&M Manual for each site in accordance with the applicable portions of this Subpart. Additional subparts included in an O&M Manual might be Subpart 11 “Gas Monitoring, Collection and Treatment System,” Subpart 14 “Sampling and Analysis,” (typically included in the QAPP/SAP) and Subpart 16 “Post-Closure Care.” A copy of the O&M plan will be stored at the if possible.

Terracon utilizes information gathered during the implementation of the O&M Manual to evaluate the need to address system is operating efficiently and/or damage to site conditions. If the data indicate that remediation system efficiency is decreasing or damage to final cover system has been incurred, changes or maintenance is recommended. An example of this is the bi-weekly O&M visits to the Long Prairie Ground Water Contamination site. The influent pressure is monitored on the lead carbon vessel and when the pressure exceeds 18 pounds per square inch (psi), a backwash is performed on the lead carbon vessel to remove

particulate matter that inhibits flow and reduces treatability. When groundwater recovery flow rates decrease, this is another example of a drop if operating efficiency. In these cases, the pumps are usually pulled to be cleaned or repaired. This ensures that the system continues to operate as intended. Another example would be if evidence of erosion is observed during regular inspections, repairs can be made before the problem is magnified.

The data gathered during implementation of a facility's O&M Manual is summarized in annual reports which track system operation which detail the total amount of groundwater treated and total amount of contaminants removed by the system.

APPENDIX A

ADDENDUMS

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

REQUEST FOR PROPOSAL (RFP) ADDENDUM

Addendum No.: 1 Date of Addendum: March 19, 2018

Due Date, Time: April 11, 2018, 2:00 PM

Title: MPCA PT RFP – REMEDIATION MASTER

SCOPE OF ADDENDUM

The Request For Proposal (RFP) is revised as follows with additions underlined, and deletions are ~~struck out~~:

Revision 1. RFP Section 2: Project Goals, Page 3, is amended as follows:

The total amount of money available for work under this Master Contract is approximately ~~$120,000,000.00 (One Hundred Twenty Million Dollars)~~ $420,000,000.00 (Four Hundred Twenty Million Dollars) for five years between all Master Contracts issued under this RFP. No payments will be made except for work authorized by a Work Order that is issued from the State. No minimum payment is guaranteed by the State.

Revision 2. RFP Attachment C. Sample Contract, Page 2, Clause 4.1 Consideration. is amended as follows:

4.1 Consideration. The State will pay for all services satisfactorily performed by the Contractor for all Work Order Contracts issued under this Master Contract. The total compensation of all Work Orders may not exceed ~~$120,000,000.00 (One Hundred Twenty Million Dollars)~~ **$420,000,000.00 (Four Hundred Twenty Million Dollars)** for five (5) years between all Master Contracts

Revision 3. RFP Section 7. Proposal Content, Category A: Petroleum, Superfund, MDA, and Closed Landfill Program Environmental Services, A.3, Page 31, is amended as follows:

Provide a detailed description of the company's experience as it relates to the scope of services outlined in this RFP; specifically, describe the company's experience with each of the bullets listed in **Section 4 3** of this RFP. The Proposal shall contain the following additional details specific to Category A services:

- A summary of Proposer's experience with agricultural chemical investigation and cleanups.
- A list of remediation technologies with which the Proposer has experience.
- Provide a detailed description of the company's experience as it relates to the scope of services outlined in this RFP for Category A.

Revision 4. RFP Section 3: Scope of Services, Page 3, is amended as follows:

The Contractor shall submit a separate proposal for each Category of Service for which the Contactor would like to be considered. Proposals will be evaluated individually for each Category of Service for which they were submitted. Category B is a subset of Category A. If the Contractor submits Proposals for both Category A and Category B, Category A will be evaluated first for qualification. If the Contractor is not approved for Category A, they will then be evaluated for Category B. Category C will be evaluated individually. Contractors can submit Proposals for all three Categories if desired.

Should a Contractor be approved and selected for more than one Categories, the Contractor will receive only one Master Contract containing all the approved and selected Categories.

Joint ventures and teaming among groups of Contractors is not allowed.

Revision 5. RFP, Attachment C Sample Contract, Clause 38. C. Additional Insurance Conditions, Bullet #5, Page 21, is amended as follows:

- Contractor's policy(ies) shall include legal defense fees in addition to its liability policy limits, with the exception of ~~B.4~~ Professional/Technical, Errors and Omissions, and/or Miscellaneous Liability Insurance above;

Revision 6. RFP, Section 4. Personnel Classifications and Qualifications, Category C: Closed Landfill Program, Project Manager Qualifications,Second Bullet, Page 23, is amended as follows:

- Minimum of three years experience working with landfill, investigation and closure. ~~Minnesota Guidance and Policy with the Superfund/ Petroleum programs. https://www.pca.state.mn.us/waste/cleanup-guidance~~

Revision 7. RFP, Section 6. Supplies and Equipment Pricing, EQUIPMENT RATES, Pages 28 and 29, and RFP, Attachment C, Sample Contract, EQUIPMENT RATES, Pages 5,6,7, is amended as follows:

Equipment	Cost (per day)
Turbidity Meter	$52.00
Oxidation-reduction potential (ORP) Meter	$39.00
~~Hydrolab Quanta~~	~~$80.00~~
Dissolved Oxygen Meter	$46.00
Temperature, pH, conductivity, ORP meter	$68.00
Temperature, pH, conductivity	$35.00
~~YSI Multi Meter w/ Flow Cell~~	~~$117.00~~
Flow Cell	$77.00
Water Quality Meter (6 parameters)	$102.00
2" Trash Pump	$~~189~~75..00
Bladder pump	$118.00
Submersible Pump	$52.00
Peristaltic Pump	$43.00
Diaphram Pump	$53.00
Mechanical Pump Puller	$44.00
Water Level Indicator	$27.00
Hydrocarbon/Water Interface Probe	$55.00
Pump/Slug Testing Equipment	$110.00
Manual direct-push probe equip.	$165.00
X-ray Fluorescent (XRF) for Soil and Lead Paint	$468.00

Nuclear Density Gauge	$69.00
Multi Gas Meter (02/CO/LEL/Methane)	$123.00
O2/Combustible Gas Detector	$110.00
LEL/O2/CO2 Gas Meter	$66.00
LEL/O2Gas Meter	$55.00
Explosimeter	$52.00
Photoionization Detector (PID) 10.6	$99.00
Photoionization Detector (PID) 11.7	$138.00
Flame Ionization Detector (OVA)	$135.00
Velometer / Anemometer	$34.00
Micro Manometer	$64.00
Sound Level Meter	$53.00
Dust Meter	$70.00
Air Compressor	$54.00
Metal/Cable Detector	$47.00
Generator	$65.00
Sump Pump	$33.00
Pressure Washer	$69.00
Magnetometer	$151.00
Coreing Machine with Drill Bits	$110.00
Surveying Equipment - Rotary Laser	$104.00
GPS (Submeter)	$122.00
Laser Level/Lenker Rod	$127.00
Ground Penetrating Radar (GPR)	$426.00
EM-31 Ground Conductivity Meter	$440.00
EM-61 Ground Conductivity Meter	$688.00
55 gal Drums	$70.00
Sub-Slab Soil Gas Sampling Point Insert	$88.00
Screen for Soil Gas Monitoring Points	$51.00
Vapor Pin Installation Kit (per point)	$60.00
Lumex Mercury Monitoring	$187.00
Mercury Analyzer	$179.00
Canoe	$15.68
Boat (includes motor and trailer)	$58.24
ATV **(Hourly Rate)**	$16.80

Revision 8. RFP, Section 7. Proposal Content, Category B. Petroleum Only Remdiation Environmental Services B.5., Scenario 1: Petroleum Only Environmental Services, Page 39, is amended as follows:

5. **Scenario ~~1~~ B: Petroleum Only Environmental Services**

Scenario ~~1~~B:

Revision 9. RFP, Section 6. Supplies and Equipment Pricing, Item cc., Page 27 and RFP, Attachment C, Sample Contract, Clause 8, Page 5, is amended as follows:

cc. Tubing less than $100.00

Revision 10. RFP, Section 7. Proposal Content, 5. Scenario A., Page 33, is amended as follows:

The property owner conducted a limited investigation consisting of several push probes throughout the facility and adjacent property. This investigation identified chlorinated ethenes (most notably trichloroethylene [TCE]) and agricultural chemicals (nitrogen, dicamba, metolachlor, metribuzin, pendimethalin, and triclopyr) in soils and groundwater above agency-regulated cleanup goals. General geology was noted to generally consist of coarse grained sands with thin lenses of silt and clay. The investigation encountered shallow groundwater approximately 6-10 feet bgs, with an assumed flow direction heading into town. All groundwater samples (blue GW samples) were collected at 30 feet for domestic wells, and 15 feet for investigation borings. The investigation did not evaluate the stream.

A single round of vapor points were also advanced off-site as part of the property owner's investigation, with some of the detections exceeding the 33X ISV for TCE (Figure 1). Vapor samples (orange vapor samples) were collected above the water table. MPCA is aware there is a pregnant person at the property with the sub-slab point. A passive soil-gas sample collected in the vehicle/equipment maintenance garage was several orders of magnitude above screening criteria; however, additional characterization nor remediation occurred in the building by the property owner.

Revision 11. RFP, Section 7., Proposal Content, Category A..; Scenario A, 2nd Paragraph, Page 32, is amended as follows:

The site topography is mostly flat, however the elevation does dip downward toward a small stream running through the northern portion of the property. This stream continues into the town which is located in the west adjoining property (see Figure 1). Older portions of the town (situated closer to the former ag-chem plant) are on private well drinking water (blocks 3, 5, and 7) that are 30 feet deep. Newer portions of the town (farther from the former plant) are on community water from the local municipality (blocks 1, 2, 4, and 6).

Revision 12. RFP, Section 7., Proposal Content, Category B. #5. Scenario 1: Petroleum Only Environmental Sercices, 5th Paragraph , Page 39, is amended as follows:

Municipal services are available in the area; however, the lakeside homes are all on private wells. The wells are 80 feet deep. The fueling station is hooked up to municipal water and other utilities at the site include storm sewer, sanitary sewer, and water that run along main street.

This addendum shall become part of the RFP and MUST be returned with the RFP Response.

RESPONDER NAME: David Wolfe

TITLE: Principal

DATE: 4/11/18

APPENDIX B

STAFF RESUMES

David J. Wolfgram, P.E.

PRINCIPAL

PROFESSIONAL EXPERIENCE

Mr. Wolfgram is a Principal and Office Manager in the Terracon's White Bear Lake, Minnesota office with over 30 years' experience. He provides project management, technical review, direction and management of major projects involving the assessment and remediation of environmental contaminants. Mr. Wolfgram is responsible for the overall management of Terracon's White Bear Lake, Minnesota office, including business development, resource allocation and a wide range of environmental engineering, geotechnical engineering and construction materials engineering services.

Prior to becoming the office manager, Mr. Wolfgram gained considerable experience directly managing numerous environmental projects. Those projects dealt with assessments, feassibility studies, evaluating remedial alternatives, remedial design and implementing remedial solutions to remove contaminates from the groundwater and soil. Mr. Wolfgram also has experience working on landfill leachate treatment and methane control projects. He has developed, managed, and overseen complete system designs and managed several large superfund remediation projects involving chlorinated solvents and petroleum hydrocarbons including steam injection, vapor extraction, free product removal, air sparging ex-situ and in-situ bioremediation systems.

Mr. Wolfgram also assists clients in the preparation of remedial action plans and specifications for site remediation, developing QAPPs for EPA superfund sites and preparing focused feasibility studies to supply state and federal agencies with the necessary information to obtain "closure" and "no action" assurances".

PROJECT EXPERIENCE

Superfund Site Remediation – New Brighton, Minnesota

Senior Project Manager with responsibility for the design and implementation of soil remediation actions at a federally listed superfund site. The site was a former pole treating facility that contained soil and groundwater contamination by pentachlorophenol and carcinogenic polyromantic hydrocarbons. The project involved the development of design specifications for the excavation of contaminated soil, contractor oversight, soil screening to remove debris, off-site disposal of impacted debris, on-site soil biological treatment by chemical oxidation and construction of a modified RCRA cap. The remediation work was completed and met the remediation goals.

Littlefork Groundwater Contamination Site – Littlefork, Minnesota

Conducted remedial investigation activities to assess potential source areas and plume extents of tetrachloroethylene groundwater contamination. Forty-two push probe holes were advanced to assess six potential source areas, with 37 additional push probe holes advanced to evaluate the groundwater plume extents. Investigation activities also included the installation of 18 monitoring wells to augment nine existing monitoring wells, installation of test pits, conducting a soil vapor screening survey with GoreSorbers, performance of a natural attenuation study, an evaluation of contaminant loading to a river next to the site, performing a feasibility study, conducting a pilot test for in-situ treatment, and conducting a full scale in-situ bio treatment event. Activities also include design and installation of a Soil Vapor Extraction system and quarterly groundwater monitoring.

Superfund Site Assessment – Lake Elmo, Minnesota

Responsible for conducting assessment activities to delineate a trichloroethylene plume that extends 6,000 feet. The assessment involved over 200 push probe holes, several deep soil borings into bedrock and monitoring well installations over a four year period. The plume was tracked back to a former metal shop that had been converted to a gas station / grocery store. A hydraulic barrier groundwater recovery system consisting of four recovery wells was

EDUCATION

Master of Business Administration
Southern Illinois University
Edwardsville
1985

Bachelor of Science
Mining Engineering
University of Wisconsin-Platteville
1980

REGISTRATIONS

Registered Professional Engineer:
Minnesota and Wisconsin

CERTIFICATIONS

40 Hour OSHA Hazardous Waste Operations Training

AFFILIATIONS

American Council of Engineering Companies of Minnesota

National Society of Professional Engineers

Minnesota Society of Professional Engineers

Sensible Land Use Coalition

Economic Development Association of Minnesota

WORK HISTORY

Terracon Consultants, Inc.
Principal
1997 - Present

Delta Environmental Consultants,Inc.
Senior Engineer
1994 - 1997

Terracon Environmental, Inc.
Environmental Engineer
1991 - 1994

Zeigler Coal Company/Old Ben Coal Company
Senior Development Engineer
1980 - 1990

designed and installed in 2008 which includes a groundwater treatment system involving an air stripper and discharge of treated water to 2-500 foot horizontal wells. Additionally, a pilot test of in-site treatment of the source zone by chemical or biological means has been conducted and evaluated.

Honeywell Facility Remediation – St. Louis Park, Minnesota
Responsible for the demolition of a 560,000-square-foot Honeywell facility impacted with PCBs. Prior to the demolition, conducted assessment activities beneath the facility floor to delineate potential PCB contamination. Coordinated excavation and disposal activities to remove over 33,000 tons of impacted PCB soil and concrete. Responsible for the preparation and implementation of TSCA required soil sampling plans and remedial investigation reports. Impacted soil was disposed at a TSCA approved landfill in Alabama and the Buffalo, Minnesota landfill. Remediation goals were met and the site received a "No Further Action" and "Certificate of Completion" from the Minnesota Pollution Control Agency Voluntary Investigation and Clean-up program.

Long Prairie Groundwater Contamination Site – Long Prairie, Minnesota
A remediation project involving six recover wells recovering 250 gpm of groundwater contaminated with tetrachloroethylene. The groundwater plume under lays the City of Long Prairie and has impacted municipal wells. The remediation system was designed to control plume migration preventing further contamination of municipal wells. Treated water is discharged to the Long Prairie River. The recovered groundwater is treated by two 14,000 pound carbon vessels before discharge to the River.

BNSF Northtown Yard Remediation System Operation and Maintenance
Project Manager of a large remediation system including three total fluid pumping wells and six product skimmers to recover product from the subsurface. The remediation system is installed at a large railroad yard, which has been in use for over 50 years. Several areas of the yard are impacted with diesel fuel from past practices. The remediation system combines capture zone technologies with active product recovery to provide the client with the most cost-effective solution for their situation. The system includes three submersible depression pumps to depress the water table and pneumatic product skimmers placed in the recovery wells and other monitoring wells.

BNSF Railroad La Crosse Yard Remediation – La Crosse, Wisconsin
Managed the operation of an in-situ bioremediation system to address diesel fuel impacted groundwater. Groundwater at 350 gpm was extracted for the subsurface from six recovery wells, the water was amended with nutrients and passed through an oxygen contactor to add dissolved oxygen, then discharged to a surface pond for infiltration. The infiltrated water created a closed loop passing through the source area and enhancing bioremediation of the contaminants in the sub-surface. The system operated for five years and met cleanup goals then was shut down.

Multi-Site Phase I and Phase II Investigation
Managed the Phase I and Phase II investigations of 45 convenience stores for an acquisition project. Services included historical research into the past activities at the sites; an evaluation of current activities at the sites and adjacent sites; the completion of six to eight direct push probes per site; the collection of soil and groundwater samples for analytical tests and the preparation of a report for each site. The reports were completed and supplied to the client in eight weeks from project initiation so that environmental information was available prior to closing of the sale.

Eric C. Hesse, P.E.

SENIOR ASSOCIATE/ENVIRONMENTAL CIVIL ENGINEER

PROFESSIONAL EXPERIENCE

Mr. Hesse is an Environmental/Civil Engineer in Terracon's White Bear Lake office. Mr. Hesse has managed a wide variety of environmental projects for the past 29 years. Areas of expertise include environmental due diligence, Brownfield investigation and remediation, solid and hazardous waste management, landfill design and re-permitting, construction oversight and documentation, storm water management/modeling, National Environmental Policy Act (NEPA) compliance, stormwater management, and general environmental compliance.

Mr. Hesse has conducted and managed Phase I and II Environmental Site Assessments, prepared Phase II Investigation Work Plans and Phase II Investigation Reports, prepared Response Action Plans and Construction Contingency Plans, overseen Response Action Plans and Construction Contingency Plan implementation, and prepared final Response Action Plans and Construction Contingency Plan Implementation Reports in accordance with Minnesota Pollution Control Agency Voluntary Brownfield Programs on a wide variety of small, medium and large residential/commercial/industrial Brownfields sites. Mr. Hesse has also managed pre-demolition surveys, abatement planning and abatement oversight for buidling demolition projects ranging from small, single story structures to multi-floor office/retail buidlings.

Mr. Hesse has prepared, and managed the preparation, of solid waste permit applications for municipal solid waste, industrial solid waste and construction demolition debris landfills. Mr. Hesse has also prepared, and managed the preparation, of permit applications for solid waste transfer stations. Specifically, Mr. Hesse's work has included landfill liner design, landfill cover design, leachate management system design and operations, landfill gas management system design and operations, industrial waste management plans, financial assurance plans, stormwater management system and erosion control design, preparation of construction documents, construction management and construction certification. Mr. Hesse has also assisted landfill operators with the evaluation of waste types for compliance with facility industrial waste management plans.

Mr. Hesse has prepared, or managed the preparation of Environmental Assessments in accordance with NEPA. Facilities Mr. Hesse has prepared Environmental Assessments for include solid waste management facilities, gravel mining operations and large, mixed use developments.

GENERAL ENVIRONMENTAL COMPLIANCE

Mr. Hesse has worked with many clients in the commercial, industrial and public sectors on a wide variety of environmental compliance issues. Compliance issues Mr. Hesse has primarily been involved with include management of solid and hazardous wastes, storm water NPDES compliance, spill prevention, control and countermeasure planning, and UST/AST compliance.

PROJECT EXPERIENCE

BROWNFIELDS

Saints Business Center, St. Paul, MN (2011 – 2017)

The Saints Business Center Site is located on the land previously occupied by the former Saint Paul Saints baseball stadium. The site is the location of the former State Fair Dump. Wastes historically disposed of at the site included demolition debris and animal waste generated during operations of the Minnesota State Fair from approximately 1950 to 1972. Mr. Hesse managed the investigation and cleanup of the site from 2011 – 2017 during the construction of a 200,000 square foot office warehouse. Environmental work involved the demolition of the former stadium structure, management of contaminated soils and debris encountered during construction, design and installation oversight of a sub-surface vapor extraction system, and the design and installation oversight of a sub-slab depressurization system. Mr. Hesse was

EDUCATION

Bachelor of Civil Engineering
University of Minnesota
Institute of Technology
1989

Bachelor of Arts
Core in Mathematics
Macalester College
1989

REGISTRATIONS

Professional Engineer:
Minnesota No. 29743
Wisconsin No. 29888
North Dakota No. PE 4386
Nebraska No. E-7832
Arizona No. 29936

CERTIFICATIONS

40-Hour OSHA HAZWOPER

AFFILIATIONS

Great River Greening
Past Board Member (2008 – 2017)
Minnesota Brownfields Board
Member (2018 -)

WORK HISTORY

Terracon Consultants, Inc.
Environmental/Civil Engineer
Senior Associate
2013 - Present

Liesch Associates, Inc.
Environmental/Civil Engineer
Shareholder
1989 - 2013

Eric Hesse (continued)

the primary contact and worked closely with MPCA Voluntary Brownfields staff and eventually secured a Certificate of Completion for the site.

Treasure Island Center (Former Macy's Building), St. Paul, MN (2014 – 2017)
The former Macy's Department Store is located in downtown St. Paul and was recently renovated into the Treasure Island Center. Mr. Hesse managed the investigation and cleanup of the site from 2014 – 2017. Environmental work included the investigation of sub-slab soils, and the investigation of sub-surface and sub-slab soil vapors. In addition, environmental work included the completion of an Asbestos and Hazardous Materials Survey of the approximate 600,000 sf structure and oversight and documentation of asbestos and hazardous materials abatement services during renovation of the building. Mr. Hesse was the primary contact with the MPCA and worked closely with the MPCA VBP staff during this work.

HmongTown Market Place, St. Paul, MN (2017 – Present)
HmongTown Market Place is located at the corner of Como Avenue and West Pennsylvania Avenue in St. Paul. The current Market Place is located on property formerly owned by Stewart Lumber, an historic bulk petroleum storage facility, a former gas station and rail road spurs. Mr. Hesse is managing the investigation and cleanup of the site in an effort to demolish the current structures and construct new facilities to house the current operations. To date, work has included the preparation of a Phase I ESA and Phase II Work Plan. On-going work will include the completion of the Phase II Investigation work, preparation of a Response Action Plan/Construction Contingency Plan (RAP/CCP) and implementation of the RAP/CCP. Mr. Hesse is the primary contact with the MPCA and has been working closely with the MPCA VBP staff.

Former Buon Giorno/Metals Recovery Company Site, St. Paul, MN (2016 – Present)
Regions Hospital purchased the former Buon Giorno and Metals Recovery Company site in 2016. Current plans are to develop the site into a surface parking lot with future plans involving redevelopment of the site into medical offices and associated parking ramp. Mr. Hesse is managing the investigation and cleanup of the site not only to accommodate the current parking lot plans but also to accommodate future redevelopment plans for the site. To date, work has included the completion of a Phase I ESA, Phase II Work Plan, Phase II Investigation and the preparation of a Response Action Plan/Construction Contingency Plan. Work has also included the completion of an Asbestos and Hazardous Materials Survey and oversight/documentation of the abatement activities prior to demolition of the former structures. Mr. Hesse is the primary contact with the MPCA and has been working closely with the MPCA VBP staff.

Former Zephyr Dry Cleaners Site, Hastings, MN (2013 – Present)
The former Zephyr Dry Cleaners site is located in downtown Hastings. As part of property transaction environmental due diligence work, elevated concentrations of tetrachloroethylene (PCE) were detected beneath the property and surrounding area. Mr. Hesse is managing the investigation and mitigation of soil vapors for this project. To date, work has included the completion of a Phase I ESA, preparation of a Phase II Investigation Work Plan, completion of a Phase II Investigation, design and installation oversight of a sub-slab vapor mitigation system for the Former Zephyr Dry Cleaners Building, and supplemental investigation of the surrounding properties. Mr. Hesse has been the primary contact with the MPCA and has been working closely with the MPCA VBP staff.

Phalen Corridor Redevelopment, St. Paul, MN (2000 – present)
Mr. Hesse completed the preparation of a Quality Assurance Project Plan (QAPP), Phase II Investigation Work Plans, Phase II Investigation Reports, Response Action Plan/Construction Contingency Plans (RAP/CCPs), oversaw implementation of RAP/CCPs and prepared the final RAP/CCP Implementation Reports associated with the construction of Phases I – III of Phalen Boulevard and adjacent properties along the 3.5 mile corridor including Westminster Junction, Former Stroh's Brewery Site, Former Whirlpool Site, Former Griffen Wheelworks Site, Former Budget Towing Site and portions of the Former 3M Campus. The site has received a No Action Letter and/or Certificate of Completion on the Phalen Boulevard right-of-way portion of the site as well as the adjacent properties. Mr. Hesse has served as the primary contact with the MPCA and has worked closely with MPCA VBP staff throughout this project. The Phalen Corridor Project was awarded the Regional, National and People's Choice Phoenix Award for the top Brownfield in the Country.

Other Brownfields Experience

270-284 Snelling Avenue South, St. Paul, MN (2016 – present)
Pelham Business Center Site, St. Paul, MN (2011 - 2013)
Amherst H. Wilder Foundation – Wilder Square, St. Paul, MN (2011 – 2013)

Former Diamond Products Site, St. Paul, MN (2011 – 2012)
Chatsworth and Pierce Butler Site, St. Paul, MN (2008 – 2011)
Arlington/Jackson Site, St. Paul, MN (2007 – 2008)
Globe Building Materials, St. Paul, MN (2005 – 2007)
Ryland Homes – Columbia Heights, MN (2005 – 2006)
Twin Lakes Redevelopment – Roseville, MN (1990 – 1995)

SOLID WASTE

St. Louis County Regional Landfill - Virginia, Minnesota (2000 – Present)

Mr. Hesse has worked as St. Louis County's solid waste lead engineering consultant since 2000. Mr. Hesse's responsibilities have included the design and construction oversight of four lined landfill cell expansions, two final cover projects, expansion of the landfill's leachate land application system and a demonstration project utilizing landfill gas to heat the County's Materials Recycling Facility. Mr. Hesse has also been responsible for the preparation and submittal of 3 solid waste permit applications and associated design documents since 2000. Permit application work included facility design, leachate management planning, financial assurance planning, industrial waste management planning and landfill gas management planning. As part of this work, Mr. Hesse has been responsible for overseeing both design and field project engineers, QA/QC on all deliverables, maintaining overall project schedules and managing overall project budgets. Mr. Hesse's work has required regular communication with the Minnesota Pollution Control Agency project managers and project engineers to ensure work in completed in accordance with the state's solid waste regulations.

General Waste Disposal and Recovery Services Industrial Waste Landfill – Keewatin, MN (2013 – 2014)

Mr. Hesse served as GWDRS lead design engineer during the permitting of its lined industrial waste landfill in 2013. The industrial landfill was designed to be constructed adjacent to an existing demolition landfill and included a RCRA liner/cover design and leachate collection system. Permit documents prepared included an Engineering Design Plan, Leachate Management Plan, Industrial Solid Waste Management Plan and Closure/Post-Closure/Contingency Action and Financial Assurance Plan. Mr. Hesse also oversaw the preparation of construction documents, provided oversight of bid administration, oversight of construction and final construction certification for the the first lined cell and head end of the leachate collection system. As part of this work, Mr. Hesse was responsible for overseeing both design and field project engineers, QA/QC on all deliverables, maintaining overall project schedules and managing overall project budgets. Mr. Hesse's work required regular communication with the Minnesota Pollution Control Agency project managers and project engineers to ensure work was completed in accordance with the state's solid waste regulations.

Morrison County Sanitary Landfill - Little Falls, Minnesota (1989 – 2011)

Mr. Hesse was Morrison County's lead consulting engineer from 1993 - 2011. Mr. Hesse's responsibilities included the design and construction of 5 lined cell expansions, three final cover projects, three leachate land application system expansions, one major landfill gas well installation project, and two groundwater remediation system projects. Mr. Hesse has also been responsible for re-permitting the landfill (and associated demolition landfill) on 5 occassions since 1993 including the design of the Landfill's first lined cell in 1993. Permit application work included facility design (both MSW and Demolition), leachate management planning, financial assurance planning, industrial waste management planning and landfill gas management planning. As part of this work, Mr. Hesse has been responsible for overseeing both design and field project engineers, QA/QC on all deliverables, maintaining overall project schedules and managing overall project budgets. Mr. Hesse's work has required regular communication with the Minnesota Pollution Control Agency project managers and project engineers to ensure work in completed in accordance with the state's solid waste regulations.

Voyageur Industrial Landfill – Canyon, MN (2007 – 2012)

Mr. Hesse served as lead consulting engineer from 2007 – 2012. Mr. Hesse's responsibilities included the design and construction of two lined cell expansions and one final cover projects. Mr. Hesse was also responsible for repermitting the landfill on two occasions including alternative liner and cover design systems. Permitting included the facility design, leachate management planning, financial assurance planning, and industrial solid waste management planning. As part of this work, Mr. Hesse was responsible for overseeing both design and field project engineers, QA/QC on all deliverables, maintaining overall project schedules and managing overall project budgets. Mr. Hesse's work required regular communication with the Minnesota Pollution Control Agency project managers and project engineers to ensure work was completed in accordance with the state's solid waste regulations.

Other Landfill Experience

Trout Demolition Landfill Permitting (2008 – 2014)
Itasca County Demolition Landfill - Grand Rapids, MN: 2006
Northwoods Sanitary Landfill – Rice Lake, WI (2006)
Milleacs Band of Ojibwe Transfer Station Permitting (2006)
Onyx Waste Services Rochester Transfer Station Permitting – Rochester, MN (2005)

Waste Management Rochester Transfer Station Permit – Rochester, MN (2004)
Elk River Sanitary Landfill - Elk River, MN: (2002)
Material Recovery Services Construction and Demolition Landfill – Wheaton, WI (2000-2001)
East Central Sanitary Landfill - Mora, MN: 1993-1995
Red Wing Sanitary Landfill - Red Wing, MN: 1989-1990
Ponderosa Landfill - Blue Earth, MN: 1989
Isanti-Chisago County Sanitary Landfill - Cambridge, MN: 1989

NATIONAL ENVIRONMENTAL PROTECTION ACT (NEPA)

United Health Group Site – Emergency Generator Noise Analysis (2010)
Rational Energies – EAW (2009)
Maple Grove Wetland Delineation and Mitigation (2009)
First Park Lakeville – Mobile Source Air and Noise Analysis (2007)
Morrison County Sanitary Landfill – EAW (2006)
Rice County – Mobile Source Noise Evalution (2006)
Opus Hopkins Office Development – Mobile Source Air and Noise Evaluation (2006)
Target North Campus – Mobile Source Air and Noise Analysis (2005)
Sakuma Property - Wetland Delineation (2005)

GENERAL ENVIRONMENTAL COMPLIANCE

Starkey Hearing Technologies – SPCC (2017)
Kraft Foods – SWPPP, SPCC, ERP (2010 – present)
ALTA Gas Limited Compliance Assessment – Graying, MI Site (2011)
ALTA Gas Limited Compliance Assessment – New Bern, NC Site (2011)
ALTA Gas Limited Compliance Assessment – Fitzgerald, GA Site (2011)
Up North Plastics – SPCC, SWPPP, Tier II Filing (2009 – 2010)
Little Falls Public Works – SPCC, SWPPP (2004 – update 2010)
Central Bi-Products (Redwood Falls, Long Prairie) - SWPPP (2004-2006)
Veolia – Rochester Transfer Station SWPPP and SPCC (2005)
Park Midwest Auto Malls - Grit Trap Waste Management Planning (2004)

Paul J. Wiese, P.G., C.P.G.

SENIOR PROJECT MANAGER/HYDROGEOLOGIST

PROFESSIONAL EXPERIENCE

Mr. Wiese is a Senior Project Manager/Hydrogeologist in Terracon's White Bear Lake, Minnesota, office. Specializing in assessments and clean-ups at industrial properties. Project responsibilities for the past 29 years have involved all facets of project management, preparation of proposals, work plans, reports, as well as regulatory and client contacts. Mr. Wiese is also responsible for the review of work prepared by other staff members. Mr. Wiese provides geologic and hydrogeologic analysis, including the evaluation of subsurface conditions, aquifer characterizations, vapor intrusion assessments, groundwater surface water interaction and natural attenuation. Other responsibilities include the design and implementation of a variety of different active and passive vapor, soil and groundwater remediation plans.

Mr. Wiese has supervised drilling crews during remedial assessments, remedial well installations and push-probe soil, groundwater and soil-gas assessment. Mr. Wiese has conducted environmental field tasks such as well development and stabilization, soil/groundwater/soil-gas sampling, vapor monitoring, observation of monitoring well construction, remediation system monitoring and documentation of subcontractor operations. Mr. Wiese has completed pilot testing and remedial actions involving groundwater extraction, soil vapor extraction, air sparging, multi-phase extraction, in-situ chemical oxidation, vapor mitiation,and large scale soil excavation and treatment. Mr. Wiese has also been responsible for writing sampling and analysis plans, quality assurance project plans and reports.

PROJECT EXPERIENCE

Phase I and II Environmental Site Assessments – Minnesota
Managed the completion of 70 Phase I Environmental Site Assessments for the telecommunications industry, 50 of which also included Phase II assessments or geotechnical assessments.

Phase I Environmental Site Assessments – Minnesota, Wisconsin, and the Dakotas
Coordinated the completion of more than 100 Phase I Environmental Site Assessments for manufacturing, food service and financial firms. The properties involved varied in complexity from greenfield developments or multi-unit residences to equipment manufacturing and paint formulation plants.

Phase I and II Environmental Site Assessments – Minnesota and South Dakota
Managed the completion of 45 Phase I and II Environmental Site Assessments at active and closed petroleum retail facilities during a 45-day period for a multi-site acquisition.

Brownfields Development – Mahtomedi, Minnesota
Completed Phase II Environmental Site Assessments, response action plan, and reports, obtained various assurance letters from state regulatory agencies to limit the environmental liability after various wastes from a former truck maninteance facility was found in a geotechncial boring for a planned communication tower. Assisted with selecting a design for the tower foundation and coordinated the removal and disposal of impacted soil or debris generated during construction activities.

Brownfields Redevopment at former Dry Cleaners – Blaine, Minnesota
Completed Phase II Environmental Site Assessments, soil-gas assessment of an apartment building, response action plan for soil exavavation, reponse action plan for vapor mitigation of new grocery store, response action plan implementation report, obtained various assurance letters from state regulatory agencies to limit the environmental liability after a release of dry cleaning solvents was encounterd during a soil gas investigaton. Assisted with the coordination of a geotechnical investigation and assessment of asbestos materials prior to bulidng demolish. Coordinate the disposal of varioius waste generated during building demolish and site preparaton activities.

EDUCATION

Bachelor of Science, Geology
Winona State University
1985

Graduate Studies, Geology
Northern Illinois University
1985-1987

REGISTRATIONS

Professional *Geologist:*

Minnesota No. 30152
Wisconsin No. 562013

CERTIFICATIONS

Certified Professional Geologist:
GPC-09477
40 Hour HAZWOPER Training

AFFILIATIONS

American Institute of Professional Geologist

Minnesota Ground Water Association

WORK HISTORY

Terracon Consultants, Inc.
Senior Project Manager/
Hydrogeologist
1989 - Present

Twin City Testing Corporation
Geologist
1988 - 1989

Northern Illinois University
Graduate Research Assistant
1985 - 1987

Paul J. Wiese, P.G., C.P.G.(continued)

Agricultural Chemical Facility – Lewiston, Minnesota
Directed site assessment and remedial activities at a pesticide and fertilizer distribution facility, resulting in project closure. Site activities included the installation of over 30 soil borings, excavation of more than 1,000 cubic yards of impacted soil and coordination of land application of the impacted soil.

State Superfund Site – Winona, Minnesota
Managed the completion of a remedial investigation and prepared a feasibility study. Operated an interim plume containment system, developed and implemented a response action plan involving the demolish of buildings and excavation of impacted soil. Oversaw the installation of a soil vapor collection system and monitor groundwater quality in the impacted aquifer including an evaluation of natural attenuation of the dissolved phase solvent plume.

Dry Cleaning Solvent Site – Duluth, Minnesota
Completed a remedial investigation, prepared a focused feasibility study, developed and implemented a response action plan involving the excavation of impacted soil. Oversaw the installation of a combination sub-slab and perimeter soil vapor collection system, installation of a sump and granular activated carbon treatment system to collect and treat impacted foundation water, and monitored system operation and indoor air quality.

State Superfund Site – Rochester, Minnesota
Managed the initial site assessment investigation identifying the source of chlorinated solvents in a nearby monitoring well. Oversaw the completion of a remedial investigation, prepared a feasibility study, implemented a response action plan involving the installation of a soil vapor extraction system to mitigate solvent vapors intruding into buildings and reduce the source mass in the unsaturated zone.

State Superfund Site – Northfield, Minnesota
Managed the completion of a remedial investigation, prepared a feasibility study, implemented a response action plan involving the removal of two underground storage tanks, excavation of a limited amount of soil and installation of a soil vapor extraction system, vapor intrusion assessment monitor groundwater quality in the impacted aquifer including an evaluation of natural attenuation of the dissolved phase solvent plume and project closure.

LUST Vapor Intrusion Pilot Study Sites in Minnesota
Manage vapaor intrusion pilot study projects as approximately 75 petroleum release site that were collected with elevated levels of petroleum to assess whether the residual impacts posed a vapor intrusion threat.

LUST Site – Glyndon, Minnesota
Directed site assessment and remedial activities at a state funded clean-up of a sole source aquifer impacted with petroleum, resulting in project closure. Assessment activities included installation of over 20 monitoring and test wells, completion of a feasibility study for evaluation of various remedial options and pilot testing potentially effective options. Remedial actions included coordinating the on-site thermal treatment of more than 16,000 cubic yards of soil.

LUST Site – New Richmond, Wisconsin
Completed site response, assessment and remedial activities at a petroleum release site, which resulted in the recovery of more than 20,000 gallons of free phase product during a three-month period. Site response and assessment activities included coordinating the installation of an exhaust fan to reduce vapor levels in storm sewer, maintaining product booms in a nearby wetland, overseeing installation of over 20 test pits, soil boring and monitoring, as well as overseeing the design and construction of an interceptor trench.

LUST Sites – Hastings, Minnesota
Completed underground storage tank removal oversight, site assessment and remedial activities at a petroleum service station where free product was present on the water table in a bedrock aquifer. Assessment activities included the installation of borings and monitoring wells, completion of soil vapor and groundwater extraction pilot testing and design of a corrective action plan. Remedial actions included coordinating the installation of a vacuum enhanced groundwater extraction system. Project closure was obtained after successfully negotiating less restrictive site clean-up goals. Completed similar remedial activities at two additional LUST sites in Hastings.

Paul J. Wiese, P.G., C.P.G. (continued)

LUST Site Investigation – Plummer, Minnesota
Managed the completion of a remedial investigation, prepared annual reports summarizing the results of groundwater monitoring and vapor intrusion assessment activities, and prepared a project closure report.

LUST Site – Flensburg, Minnesota
Managed the completion of annual monitoring reports summarizing the result of groundwater monitoring, additional assessment and vapor intrusion assessment activities and prepare a conceptual corrective action design.

Petroleum Spill Site – Fridley, Minnesota
Managed the preparaton of annual monitoring reports summarizing the results of additional assessment and vapor intrusion assessment activities and prepared a conceptual corrective action design for a sub-slab depressurization system and lining of a sanitary sewer, prepared an updated conceptual corrective action design following flooding of the basement by water and petroluem, and the prepare an excavation detailed corrective action design for building demolition, excavation of petroleum saturated soil and lining of a sanitary sewer. Completed follow up sub-slab soil gas and crawl space monitoring to document the corrective actions had addressed potential vapor intrusion concerned and the project was closed.

LUST Site – Sobieski, Minnesota
Managed the completion of annual monitoring reports summarizing the result of groundwater monitoring and additional assessment including soil probes, laser induced fluorescence electrical conductivity probes, and vapor intrusion assessment activities. Prepared a pilot test work plan for an air spargings soil vapor extraction pilot test, prepared a pilot test report for an air sparging/soil vapor extraction pilot test, and assisted with the preparation of a remediation system detailed corrective action design.

Groundwater Resources – Wisconsin
Assisted in water supply and wastewater treatment activities in a remote area of northeast Wisconsin. Activities included assisting with the design of the supply well and monitoring well network, evaluating the hydrogeologic setting based upon soil boring logs and fluid level data, performing a groundwater pumping test and data analysis. Data collected during drilling and pilot testing activities were used to model the influence of the planned groundwater pumping and wastewater infiltration on the hydrogeologic setting. This information was used to locate the water supply and wastewater treatment systems.

Brett J. Staeden, P.E.

ENVIRONMENTAL ENGINEER

PROFESSIONAL EXPERIENCE

Mr. Staeden is an Environmental Engineer in Terracon's White Bear Lake, Minnesota office. Mr. Staeden conducts project management, engineering design, and oversight for implementation and monitoring of environmental remediation projects including brownfields redevelopments, petroleum releases and Superfund sites. Responsibilities have included planning, coordinating and implementing small and large environmental projects that involve various remediation and assessment methods (i.e. vapor intrusion / vapor mitigation, excavation clean-ups, ex-situ treatment and in-situ treatment), Phase I and II Environmental Site Assessments, release investigations (i.e. petroleum and solvents), and asbestos surveys.

Mr. Staeden has conducted Phase I and II Environmental Site Assessments, natural attenuation evaluations, focused feasibility studies, pre-demolition asbestos surveys, hazardous material building surveys, underground storage tank removal oversight, prepared bid specifications, and oversaw contamination management activities (i.e. excavation work, vapor mitigation system installation, and in-situ remedial system installations).

Merit Award and a Honor Award in 2009, were received from the American Council of Engineering Companies and the Minnesota Society of Professional Engineers, respectively, for the design of an innovative water infiltration system used to re-infiltrate treated groundwater to the aquifer.

Merit Award and a Honor Award in 2012, were received from the American Council of Engineering Companies and the Minnesota Society of Professional Engineers, respectively, for the design of an innovative geocomposite vent system used for remediating clay soil.

PROJECT EXPERIENCE

Hydraulic Barrier and In-Situ Treatment – Baytown, Minnesota

Designed an innovative water infiltration system including a pump and treat system for containing a trichloroethylene plume. The infiltration system consisted of two, 500-foot long horizontal infiltration pipes installed 24-feet below ground using horizontal directional drilling techniques. Prepared bid documents, oversaw construction and conducted operation and maintenance work for the treatment system. Project tasks included modeling air emissions, conducting aquifer tests, specifying water treatment units, managing contractors, managing schedules and managing budgets. Other related project activities included conducting natural attenuation evaluations, feasibility studies and preparation of annual reports. Also designed and oversaw the implementation of an in-situ chemical oxidation and an enhanced biological treatment using sodium permanganate and emulsified vegetable oil.

In-Situ Treatment and Soil Vapor Extraction System – Long Prairie, Minnesota

Conducted performance evaluation and monitoring of a tetrachloroethylene plume in which a vegetable oil and sodium lactate solution was injected into the groundwater for enhancing natural degradation. Also designed and oversaw the installation of a soil vapor extraction system for source area vapor mitigation. Prepared sampling plans, coordinated monitoring events, evaluated field and laboratory analytical data, and provided performance results. Other related project activities include oversight of a pump and treat system, oversight of an soil vapor extraction system, conducting groundwater pumping tests, and preparation of annual reports.

Groundwater Monitoring and Corrective Action Evaluation – Red Lake, Minnesota

Oversaw project at a petroleum release site involving free product and groundwater contamination near a lake. This project included conducting quarterly groundwater sampling and reporting for nineteen monitoring wells and two test wells, many containing free product.

EDUCATION

Master of Science
Environmental Engineering
Worcester Polytechnic Institute
2012

Bachelor of Science
Environmental Engineering
Northern Arizona University
1998

REGISTRATIONS

Professional Engineer
Minnesota, No. 43902

CERTIFICATIONS

40-Hour HAZWOPER
Minnesota Department of Health
Certified Asbestos Inspector
Design of Storm water Pollution Prevention Plans
Minnesota
National Radon Proficiency Program

AFFILIATIONS

American Society of Civil Engineers
Chair of the Environmental Engineering and Water Resources committee
2012 - 2017

National Society of Professional Engineers

WORK HISTORY

Terracon Consultants, Inc.
Environmental Engineer
2005 - Present

American Engineering Testing, Inc.
Environmental Engineer/Technician
1999 - 2005

GME Consultants, Inc.
Engineer Technician
1999

Brett J. Staeden, P.E. (continued)

In addition, a corrective action evaluation was conducted to implement removal of the remaining free product.

Soil Vapor Extraction, Geocomposite Venting – Rochester, Minnesota
Design and oversight of an innovative soil remediation technique involving a traditional soil vapor extraction system and an innovative utilization of geocomposite materials to treat low permeable clay soils contaminated with tetrachloroethylene and related chemicals. The geocomposite system allowed for in-situ treatment of the contaminated soils. The project is currently on-going and positive results have been obtained regarding significant contaminant reductions in groundwater, vapor and soil.

Vapor Intrusion Investigation – Brooklyn Center, Minnesota
Coordinated activities for a dry cleaning solvent contaminant plume extending under four city blocks of a residential neighborhood. This project has included an extensive investigation including the use of membrane interface probes, soil borings, monitoring wells and soil-gas sampling. Oversaw the installation and monitoring of a soil vapor extraction system and the implementation of in-situ treatment using sodium permanganate. Currently, the site is focused on investigating potential vapor intrusion into the houses which has involved the installation of 29 fixed monitoring points in boulevard areas and sampling sub-slab points which has identified a vapor plume that is attributed to the groundwater plume.

Multi-Phase Extraction System Design – Minneapolis, Minnesota
Prepared design specifications of a multi-phase extraction system to be used to extract subsurface petroleum contaminants, treat the contaminants on-site to regulatory limits, and safely discharge off-gas and water. The multi-phase extraction system design was based on multi-phase extraction pilot test results completed by Terracon staff.

Excavation Cleanup – New York Mills, Minnesota
Prepared design specifications for excavation clean-up to remove petroleum contaminated soil. Also coordinated bid solicitation, bid review, contractor oversight, and excavation oversight. Groundwater dewatering was also conducted to access soil contamination at depths below the groundwater table. Contaminated groundwater recovered during dewatering was pumped through an on-site treatment system that treated the water to regulatory limits followed by discharging the water to a drainage ditch. The treatment system included weir tanks, sand filters and granulated activated carbon vessels.

Transportation Corridor Environmental Assessment – Alexandria, Minnesota
Performed environmental assessment work that included 2.5-mile long roadway that extended through the downtown district of the city. Initial assessment included historical research, database records, and site reconnaissance conducted in general accordance with the ASTM Phase I Environmental Site Assessment methods. The results of the initial assessment identified more than 20 sites within 200 feet of the roadway that had environmental conditions of concern to the project area. Subsequently, 18 sites were assessed using drilling techniques to determine if potential contamination originating from the sites had impacted the road area where road improvements were planned. Soil and groundwater impacts were identified, delineated and documented so that the road improvement project could be planned and coordinated regarding proper management of the contaminated media.

Brownfield Redevelopment – Minneapolis, Minnesota
Coordinated environmental assessment work to assess petroleum and heavy metal chemical contaminants and develop soil management methods and costs associated with a redevelopment project. The site qualified and received financial resources from the State for costs associated with managing the impacted soil. During site redevelopment work, monitoring of the excavation work was conducted including sampling soil and documenting the excavation clean-up. A final “Response Action Implementation Report” was prepared for submittal to the Minnesota Pollution Control Agency.

Cami A. Van Abel, P.E.
ENVIRONMENTAL ENGINEER

PROFESSIONAL EXPERIENCE
Ms. Van Abel is an environmental engineer in the solid waste industry. She has over 15 years' experience providing environmental consulting services. Her responsibilities have included permitting and environmental review assessment, construction design and oversight and alternative technology analysis for landfills. She has experience with local, state and federal regulatory compliance and reporting for MSW and C&D landfills.

Prior employment experience includes environmental remediation design and construction oversight, brownfield redevelopment investigation activities and regulatory documentation.

BROWNFIELDS PROJECT EXPERIENCE
Former Midway Stadium Redevelopment – St. Paul, MN
Project engineer for the redevelopment of the 13-acre site previously used as a minor league baseball stadium. The site's historical use was as a Minnesota State Fair dump. Provided design work for installation of vapor mitigation system for 189,000 square foot commercial building. Performed construction oversight and documentation for preparation of the Response Action Plan Implementation Report.

New Brighton Exchange TUV SUD – New Brighton, MN
Lead design engineer for design of vapor mitigation system for redevelopment site located adjacent to the Old Miller Dump site. Redevelopment included 37,000 square foot commerical building and associated parking and stormwater management features.

Former Red and White Service Station – Brook Park, MN
Lead engineer for petroleum impacted soil excavation cleanup for former service station. Work included excavation grading design, volume estimates associated with contaminated soil removal, contractor management, and local government (city and county) coordination.

HmongTown Market Place – St Paul, MN
Project engineer for development of environmental investigation work plan for redevelopment activities associated with the HmongTown Market Place.

University Avenue and Mississippi Street Redevelopment – St Paul, MN
Project engineer for proposed redevelopment activities for the northwest corner of the intersection of University Avenue and Mississippi Street. Site formerly housed Metals Reduction Company and Buon Giorno Restaurant. Work included development of Phase II environmental site investigation work plan, investigation oversight and reporting and development of a Response Action Plan and Construction Contingency Plan for proposed redevelopment activities.

SOLID WASTE PROJECT EXPERIENCE
St. Louis County Sanitary Landfill Phase 1 and 1a Partial Closure – Virginia, MN
Lead engineer for preparation of closure plans and landfill gas venting well installation for a 11-acre closure.

Lyon County Sanitary Landfill Phase 10A Design and Construction – Marshall, MN
Lead engineer for design and construction oversight for 8-acre MSW landfill cell. Design included an inward gradient liner system and a stormwater separation berm within the 8-acre cell for delayed waste placement.

EDUCATION
Bachelor of Science, Environmental Engineering, Michigan Technological University, 2001

REGISTRATIONS
Professional Engineer: Minnesota, No. 46187; South Dakota, No. 11249; Texas No. 113723, Iowa No. 22694

CERTIFICATIONS
40-Hour Hazardous Waste Operations Training

AFFILIATIONS
Solid Waste Association of North America

Society of Women Engineers

WORK HISTORY
Terracon Consultants, Inc., Senior Environmental Engineer, 2014-Present

Leidos Engineering, LLC. (Formerly R. W. Beck), Environmental Engineer IV, 2005 – 2014

Peer Engineering,Inc. Environmental Engineer, 2002 - 2005

PRESENTATIONS/PUBLISHED ARTICLES
"Innovative Technologies for Landfill Expansion" 13th Annual SWANA Landfill Symposium and Planning & Management Conference, June 11, 2008.*

"East Central Landfill Gas-to-Energy Project", Minnesota RAM/SWANA Conference, November 20, 2013.*

"Permitting an Alternative Landfill Cap in El Paso, Texas" SWANA E-Session, December 5, 2012.*

"Carbon Offset Credit Hurdles for Municipal Solid Waste Projects" SWANA Wastecon, August 23, 2011.*

"Landfill Gas-to-Energy Feasibility Study for the Lyon County Landfill" 15th Annual SWANA Landfill Symposium and Planning & Management Conference, April 13, 2010.*

"EPA Mandatory Greenhouse Gas Reporting Rule" South Dakota Solid

Cami A. Van Abel, P.E. (continued)

Lyon County Sanitary Landfill Leachate Recirculation System Expansions – Marshall, MN
Lead engineer for design and construction documentation for several expansions of leachate recirculation system.

Lyon County Sanitary Landfill Phase 6 through 8 Final Cover Design and Construction – Marshall, MN*
Lead engineer and project manager for design and construction oversight for 8-acre MSW landfill closure project. Final design included accommodations for continued leachate recirculation activities in the closed area.

East Central Sanitary Landfill Gas Collection and Control System Expansions – Mora, MN*
Lead engineer for design and construction documentation for several expansions of landfill gas collection and control system, including installation of a landfill gas fueled generator.

East Central Sanitary Landfill Phase 6A Cell Design and Construction – Mora, MN*
Lead engineer and project manager for design and construction oversight for 4-acre MSW landfill cell.

St. Louis County Sanitary Landfill Permit Modification – Virginia, MN
Lead engineer and project manager for permit modification to expand leachate land application area.

Twin City Refuse Transfer Station – St. Paul, MN
Lead engineer and project manager for permit modification to increase material throughput for facility.

Stevens County Demolition Landifll Permit Renewal – Morris, MN
Lead engineer for permit renewal application to continue solid wast operations. Permit application included expansion and design modifications.

Double "D" Demolition Landfill Permit Renewal – Pipestone, MN
Lead engineer for permit renewal application to continue solid wast operations.

Lyon County MSW and Demolition Landfill Permit Application Renewals – Marshall, MN
Lead engineer for solid waste operating permit reissuance for the MSW and C&D landfills for Lyon County, Minnesota. The MSW landfill permit included expansion for an additional 10 years of operation, including a piggyback landfill design overlying the existing closed landfill. The C&D landfill permit included continued operation under a Type I C&D landfill.

Clearwater County Demolition Landfill Permit Renewal – Bagley, MN
Lead engineer for permit renewal application to continue solid wast operations. The permit renewal application requests additional disposal capacity to the facility's ultimate disposal design.

Hubbard County North and South Demolition Landfill Permit Application Renewals – Park Rapids, MN*
Lead engineer for solid waste operating permit reissuance for the north and south locations of C&D landfills for Hubbard County, Minnesota. Permit reissuance included modification of the landfills from a Type II to a Type I C&D landfill and for continued operation and expansion.

Crow Wing County Landfill Gas Collection and Control System Design – Brainerd, MN*
Lead engineer for design of an active landfill gas collection and control system (GCCS). Design included destruction of landfill gas through a flare and an onsite boiler. Project awarded EPA Landfill Methane Outreach Program (LMOP) 2010 Project of the Year.

East Central Sanitary Landfill Permit Application Renewal – Mora, MN*
Lead engineer and project manager for solid waste operating permit reissuance for the MSW and C&D landfills for the East Central Sanitary Landfill located in Mora, Minnesota. The MSW landfill permit included expansion of the existing footprint, including an ultimate development design for MSW liner piggybacking C&D landfill.

PRESENTATIONS/PUBLISHED ARTICLES CONTINUED

"Head Start: How MSW Landfills can Prepare for Upcoming Monitoring and Reporting Requirements" Waste Age Magazine, February 1, 2010.*

"Innovative Technologies for Landfill Expansion" 13th Annual SWANA Landfill Symposium and Planning & Management Conference, June 11, 2008.*

* *Work performed prior to joining Terracon.*

Cami A. Van Abel, P.E. (continued)

East Central Sanitary Landfill Environmental Assessment Worksheet – Mora, MN*
Lead engineer for Environmental Assessment Worksheet (EAW) for expansion of the East Central Sanitary MSW Landfill. EAW scope included assistance with Title V air permit application and air emissions analysis for the landfill expansion and the installation of a landfill gas fueled engine.

Lyon County Sanitary Landfill Environmental Assessment Worksheet – Marshall, MN*
Lead engineer for EAW for expansion of Lyon County MSW Landfill. Project scope encompassed ultimate design of the facility.

St. Louis County Sanitary Landfill Gas-to-Energy Pilot Projet – Virginia, Minnesota
Assisted county in the development of a pilot landfill gas-to-energy project at the landfill site.

Landfill Gas Management Evaluation*
Aerobic and Anaerobic Bioreactor Project Protocol Issue Paper – Climate Action Reserve
Provided technical assistance for the development of a protocol issue paper evaluating greenhouse gas emissions for MSW landfills operated under aerobic and anaerobic conditions.

St. Louis County Landfill Gas Management Evaluation Study – Virginia, MN*
Lead engineer and project manager for a landfill gas management evaluation for the St. Louis County MSW Landfill. The evaluation included potential impacts to landfill gas production for implementing leachate recirculation, addition of C&D waste stream and future landfill expansion. The study researched several options for landfill gas management, including landfill gas-to-energy and onsite re-use.

Landfill Performance Standard Climate Leaders Protocol Research Paper – United States EPA*
Provided technical assistance for review of US EPA Climate Leaders protocol for MSW landfills. The review included evaluation of emission projection calculations, default values used for calculations and current industry standards. Recommendations made for document updates were incorporated into protocol.

Lyon County Sanitary Landfill Gas-to-Energy Feasibility Study – Marshall, MN*
Lead engineer and project manager for landfill gas-to-energy feasibility study performed for the Lyon County MSW Landfill. Project partially funded through Minnesota Pollution Control Agency grant. Evaluation included model projections for landfill gas generation and collection, which included a pilot field study. Feasibility study included potential landfill gas-to-energy options, including electricity generation and off-site distribution. Report included financial modeling for end use options.

Title V Air Emissions Annual Compliance Reporting – Mora, MN*
Lead engineer for annual Title V air emissions reporting required for East Central MSW Landfill.

United States EPA Mandatory Greenhouse Gas Reporting for MSW Landfills – MN, SD*
Lead engineer for annual greenhouse gas emissions reporting through the electronic greenhouse gas reporting software, e-GGRT, for compliance with the Mandatory Greenhouse Gas Reporting Rule (MRR) established by the US EPA. Reporting done for several regional MSW landfills.

Randall J. Sippel, P.G.

PROJECT MANAGER/GEOLOGIST/HYDROGEOLOGIST

PROFESSIONAL EXPERIENCE

Mr. Sippel is a Progect Manager and Hydrogeologist with more than 30 years of environmental experience working for engineering/consulting firms and government agencies. He has experience with petroleum and chemical spills sites, and brownfields redevelopment programs including site assessment and investigations to characterize soil and groundwater contamination, design of sampling programs for groundwater, surface water and soils, risk based assessment for site remediation, and design and implementation of corrective action plans. Mr. Sippel has managed and directed projects throughout the United States. In addition he has expertise in solid waste permitting and facility operations.

PROJECT EXPERIENCE

LANDFILL PERMITTING, COMPLIANCE AND OPERATIONS

Lyon County MMSW Landfill – Minnesota

Permited renewal and EAW for continued operation and expansion. This expansion included the evaluation of the site hydrogeologic characteristics that facilitated a zone of saturation landfill design. Prepared the MPCA Annual Reports pertaining to the Landfill's waste disposal, financial assurance, and environmental monitoring.

Crow Wing County MMSW Landfill – Minnesota

Developed various leachate treatment methods including the reduction of nitrogen in leachate to allow land treatment via spray application. Conducted a pilot study involving the precipitation of metals in leachate to evaluate the potential for metals reduction. Completed a pilot study evaluating a reverse osmosis process call Vibratory Shear Enhanced Process (VSEP) for removal of contaminant in landfill leachate to allow unrestricted discharge.

City of Sioux Falls Landfill – South Dakota

Provided technical support for the design of leachate extraction wells and pumps for the current dual phase extraction system. Prepared Closure/ Post-Closure Plan for the facility and provided technical support and review for the recent landfill permit renewal. Drafted a permit application and system design for the land application of leachate using treatment with poplar tree (phytoremediation).

Hubbard County North and South Demolition Landfills – Minnesota

Completed a hydrogeologic evaluation that included the design and installation of a groundwater monitoring networks to define the characteristics and quality of the aquifers beneath each site. Prepared permit applications for the demolition debris landfills to fulfill the requirements for a MPCA solid waste permit.

CONTAMINANT INVESTIGATIONS AND HYDROGEOLOGIC STUDIES

Mr. Sippel has managed or been the senior technical professional for number of site investigations and hydrogeologic studies to evaluate the extent of soil and groundwater contamination, interaction of surface water and groundwater, define aquifer characteristics, and assess water quality, and the fate and transport of contaminants in groundwater.

CMC Lite Yard – Minneapolis, Minnesota

Project Manager and lead scientist charged with defining the extent and magnitude of arsenic impacts to soil and groundwater associated with the historical operation of an arsenic-based pesticide manufacturer in Minneapolis, Minnesota. The site was approximately seven acres in size and had detectible arsenic soil impacts both on- and off-site. A groundwater plume approximately six city block in length was impacted by arsenic associated with the site. This project included site evaluation, risk assessment, computer groundwater modeling, response action plan (RAP) and RAP implementation. Site Investigation, cleanup and redevelopment were completed under the Minnesota Deparment of Agriculture (MDA) Ag-Chem Program.

Education
Bachelor of Science, Geology,
Indiana University - Bloomington,
1984

Registrations
Professional Geologist:
Minnesota, No. 30519
Wisconsin, No. 951-13

Certifications
40-Hour HAZWOPER

Affiliations
Solid Waste Association of North America (SWANA)

Minnesota Ground Water Association (MGWA)

Work History
Terracon Consultants, Inc.
Project Manager / Hydrogeologist,
2014 - Present

Liedos Engineering, LLC
(formerly R.W. Beck)
Project Manager/Hydrogeologist
2003 - 2014

Peer Engineering, Inc.
Project Manager/Hydrogeologist
1996 - 2003

Foth Infrastructure
Geologist/Hydrogeologist
1989 - 1996

Dakota County Environmental Services
1988 - 1989

GME Consultants
1986 - 1988

Indiana Geological Survey
1984 - 1985

Randall Sippel (continued)

University of Minnesota – St. Paul Campus, Minnesota

Led the hydrologic study of the St. Paul Campus and adjacent State Fair Grounds to evaluate the continued expansion of the St. Paul Campus and its effect on groundwater and surface water flow. The study included the installation of a groundwater monitoring network, surface water flow measurements and construction of a computer surface water/groundwater model. Recommendations were made for the design of surface water drainage and infiltration basins on the campus to control runoff.

University of Minnesota, Minnesota Library Archives Center – Minneapolis Campus, Minnesota

Project Hydrogeologist for an investigation conducted to define the characteristic of the bedrock aquifers and the magnitude of the contaminants in groundwater. The Minnesota Library Archive Center is a climate controlled library constructed in the St. Peter Sandstone formation beneath the East Bank Campus at the University of Minnesota, Minneapolis. The library was designed to preserve the State's most precious documents. Contaminated groundwater was seeping into the library causing odor, vapor and moisture problems that posed a potential health risk. A 200-foot long horizontal interceptor well was designed and installed to collect and control groundwater infiltration into the library. This was the first horizontal well constructed in Minnesota for this purpose. Installation and operation of the system reduced infiltration into the library by over 85 percent.

Dakota Gasification Company – Beulah, North Dakota

Carried out all field work completed for this study including the installation of groundwater monitoring wells, defining site geology, and collecting data of aquifer characteristics to evaluate the potential impacts of the coal gasification activities on the sole source aquifer beneath the site.

Warren S. Tuel, P.S.S.

ENVIRONMENTAL SCIENTIST / SOIL SCIENTIST

PROFESSIONAL EXPERIENCE

Mr. Tuel has over 17 years' experience performing wetland delineations in Minnesota and permitting and designing wetland mitigation projects for various wetland types and vegetation communities. He has thorough knowledge of Section 404 and WCA regulations. Warren prepares and implements designs for wetland mitigation projects and post construction monitoring of wetland mitigation projects.

Mr. Tuel serves as a quality control/quality assurance manager for landfill construction projects and is actively involved in quality assurance/quality control for landfill final cover and lined facility projects totaling greater than eight million square feet. Involved in evaluation of existing liners and closure covers and evaluating potential soil borrow areas. He prepares "as-built" documentation reports for landfill construction certification.

PROJECT EXPERIENCE

Central Bi-Products Rendering Facilities – Redwood Falls, Minnesota
Mr. Tuel has assisted in providing consulting engineering services to Central Bi-Products at both the Redwood Falls plant and the Long Prairie plant. The wastewater design services of this project have included the design of anaerobic treatment systems for both facilities and lined final holding ponds for both facilities. Warren assisted in the provision of the following services; leakage evaluations of seven existing treatment ponds at the two facilities, waste load studies for both facilities, emergency irrigation permitting, sludge disposal permitting, biogas recovery evaluation, pond aeration system design, and permit compliance negotiations with MPCA. Mr. Tuel also performed a wetland delineation at the Redwood Falls plant and wetland permitting for the addition of wastewater ponds at the facility. Mr. Tuel also performed the post-construction monitoring of the completed wetland mitigation site.

Red Oak – Oakdale, Minnesota
Liesch Associates, Inc. was retained by LSA Design to conduct wetland mitigation permitting, design, site mitigation planning and monitoring for a residential development in Oakdale, MN. Warren and Liesch staff worked closely with the Valley Branch Water District (VBWD) performing wetland mitigation design and permitting for 17,000 square feet of impacts to Type 2 wetlands. Liesch also provided construction oversight for replacement, wetland construction and performed mitigation monitoring throughout the development process. Warren prepared the mitigation plan in accordance with local unit of government (LGU) and applicable State and Federal requirements. Mr. Tuel and Liesch developed a comprehensive site visit and monitoring schedule in accordance with the Wetland Mitigation Monitoring and Maintenance section of the Wetland Permit Application which involved monitoring vegetative establishments and hydrogeology for a minimum period of 5 years.

Grain Storage Facility – Savage, Minnesota
Liesch Associates, Inc. was retained by a major agricultural products distributor to delineate wetlands at a site where expansion of a railroad siding was proposed. Mr. Tuel performed the wetland delineation and also assisted the client and project designers with wetland impact avoidance. This project also involved expansion of a flood control levee and Liesch performed the hydrologic modelling necessary to determine any potential floodplain impacts and produced a "no-rise certification" for the project allowing development of the railroad siding and other site improvements. Mr. Tuel worked closely with the City of Savage, US Army Corps of Engineers and the Minnesota Department of Natural Resources on this project.

EDUCATION

1985, University of Minnesota, Minneapolis/St. Paul, Minnesota

B.S./ Soil and Water Resource Management

Water Resources Conferences, University of Minnesota Continuing Education Program

Air, Water and Waste Conferences, Minnesota Pollution Control Agency

Construction with Geosynthetics and Material Properties Conferences,

Geosynthetic Research Institute

REGISTRATIONS/CERTIFICATIONS

P.S.S.: Professional Soil Scientist: Minnesota and Wisconsin

Minnesota Certified Wetland Delineator

Trained Radiation Safety Officer, Troxler Certified Soil Moisture/Density Gauge Operation

Erosion and Sediment Control Certification, University of Minnesota

PROFESSIONAL MEMBERSHIPS

Wetland Professionals Association

Minnesota Association of Professional Soil Scientists

National Society of Consulting Soil

Scientists (NSCSS) and Soil

WORK HISTORY

Liesch Associates, Inc.,
a Terracon Company
2013 - Present
Liesch Associates, Inc.,
1990-2013

GME Consultants
1986-1990

Warren S. Tuel, P.S.S. (continued)

City of Askov Wastewater Storage Ponds – Askov, Minnesota

Liesch Associates, Inc. was retained by the City of Askov to conduct wetland delineation at the proposed wastewater storage pond site located outside the City of Askov, Minnesota. Mr. Tuel assisted the project engineers during the design stage to avoid and minimize impacts to wetlands present at the site. Warren and Liesch staff worked closely with the Pine County Soil and Water Conservation District and the US Army Corps of Engineers performing wetland mitigation design and permitting for over 45,000 square feet of impacts to Type 2 and 3 wetlands. Liesch also provided construction oversight for replacement, wetland construction and performed mitigation monitoring throughout the development process. Warren prepared the mitigation plan in accordance with local unit of government (LGU) and applicable State and Federal requirements. Mr. Tuel and Liesch developed a comprehensive site visit and monitoring schedule in accordance with the Wetland Mitigation Monitoring and Maintenance section of the Wetland Permit Application which involved monitoring vegetative establishments and hydrogeology for a minimum period of 5 years. Liesch also performed hydrologic modeling to assess the feasibility of constructing replacement wetlands adjacent to existing wetlands at the site.

Leif H. Schonteich, CSP, CHMM ENVIRONMENTAL DEPARTMENT MANAGER

PROFESSIONAL EXPERIENCE

Mr. Schonteich is the Environmental Department Manager in Terracon's West Fargo, North Dakota office. He is responsible for managing and growing the Environmental Services within North Dakota and the surrounding regions. He is responsible for management and mentoring of staff, developing scopes of work for various projects, preparing cost proposals, scheduling, reviewing technical reports, and managing department financials.

Mr. Schonteich has more than 19 years of experience consulting, designing, and managing safety and environmentally sensitive projects. Experience ranges from management and design of remediation of agricultural and petroleum contamination to commercial projects requiring emergency and disaster recovery services from large loss events such as hurricanes, tornadoes, flooding, and fire across the United States and Canada. He has conducted design and oversight of asbestos abatement, microbial remediation, hazardous materials abatement, environmental remediation, reclamation, multi-disciplinary reconstruction, and disaster recovery mitigation and restoration projects. He has provided environmental, safety, industrial hygiene, restoration, insurance liaison, claims review, litigation support, and owner's representative consulting services to a variety of facilities including agriculture, healthcare, government, retail and property management, distribution, power generation, oil and gas, education, and industrial manufacturing.

Additional experience includes hazardous materials surveys, sub-surface investigations, spill prevention, control, and countermeasure (SPCC) planning, stormwater pollution prevention planning (SWPPP), pre-construction infection control risk assessments (ICRA), interim life safety planning, job hazard analyses (JHA), health and safety planning (HASP), site safety/environmental compliance auditing, indoor air quality investigations, training, moisture intrusion assessments, tank removal and disposal oversight, environmental site assessments (ESAs), and baseline environmental assessments (BEAs).

PROJECT EXPERIENCE

STATE

North Dakota Industrial Commission (NDIC) – Brine Remediation Technology Study
Serving as a Senior Project Manager in support of the NDIC to identify technologies to remediate brine pond pits associated with legacy exploration and production in effort to reduce remediation costs. Work includes providing site assessment to determine extent and magnitude of contamination, designing and constructing test plots using in situ remediation techniques, and monitoring vegetation growth in treated soils.

NDIC – Environmental and Spill Response/Reclamation
Serving as a Senior Project Manager in support of the NDIC to remediate and reclaim legacy sites damaged by exploration and production activities and unclaimed hydrocarbon and brine releases associated with former well pads, pits, and seismic boreholes under the Abandoned Oil and Gas Well Plugging and Site Reclamation Fund (AWPSRF). Work includes providing site assessments to determine extent and magnitude of contamination, prioritizing and designing corrective action based on environmental risk, and corrective action planning to provide remediation and reclamation.

California Department of Water Resources (DWR) – Oroville, CA*
Served as Health and Safety Officer and a Project Manager to provide recovery and restoration services to a 115 MW hydro power facility damaged by fire. Conducted the project hazard analysis, developed the health and safety plan, designed the restoration scope of works,

EDUCATION

Bachelor of Science, Occupational Safety and Environmental Health, University of North Dakota, 1999

Master of Science, Industrial Technology, University of North Dakota, 2001

Master of Business Administration, University of Phoenix, 2009

CERTIFICATIONS

Certified Safety Professional (CSP), Board of Certified Safety Professionals

Certified Hazardous Materials Manager (CHMM), Institute of Hazardous Materials Managers

Certified Asbestos Inspector/Project Designer: MN, ND, SD

OSHA 40-Hour Hazardous Waste Operation and 8-Hour Supervisor Certification (HAZWOPER)

OSHA 30-Hour Certification: Construction Safety and General Industry

Petroleum Release Assessor: SD Registration No. 12567

Erosion and Sediment Control Construction, ND DOT

Part 107 Remote Pilot Certificate with a Small Unmanned Aircraft Systems (sUAS) rating, FAA

AFFILIATIONS

American Society of Safety Engineers (ASSE) – Northern Plains Section, Section Operating Committee Officer, Member-at-Large

North Region Association of Safety Professionals (NRASP)

University of North Dakota, Department of Technology, Advisory Council

Sigma Alpha Epsilon - ND Alpha

WORK HISTORY

Terracon Consultants, Inc., Environmental Department Manager, 2014-Present

BMS CAT, Inc., Project Manager/Safety & Health, 2006-2014

Risk Tech, LLC, Project Manager/Industrial Hygienist, 2005-2006

Legend Technical Services, Inc., Industrial Hygienist II, 2003-2005

Traer Manufacturing, Environmental Health and Safety Coordinator, 2001-2003

* *Work performed prior to joining Terracon.*

developed and maintained medical surveillance for employees, and administered the training program. Designed the isolation of the building through the creation of a controlled climate using dehumidification, air filtration, air pressure relationships, and controlled temperature under Hazardous Waste Operations and Emergency Response (HAZWOPER) and a high level of Personal Protective Equipment (PPE) requirements. Assisted with the design of establishing building services to remove and transport internal components to an off-site facility for restoration and inventory. Provided job and safety training, directed crews, oversaw restoration quality, and coordinated the restoration schedule with the DWR and general contractor.

FEDERAL

US Army Medical Research Institute of Infectious Diseases Replacement Project – Fort Detrick, MD*
Served as Health and Safety Officer and a Project Manager during the restoration of Biosafety Level (BSL) 3 and BSL 4 laboratory suites, structural components, and mechanical and electrical systems damaged by fire. Conducted the project hazard analysis, developed the health and safety plan, designed restoration scope of works, and administered the training program. Provided job and safety training, directed crews, oversaw restoration quality, and coordinated the restoration schedule with the United States Army Corps of Engineers (USACE) and general contractor.

COMMERCIAL

Confidential Client – Petroleum Brownfields Program – MN
Conducted the Phase I Environmental Site Assessment (ESA), hazardous material survey, and a Limited Site Investigation (LSI) for a proposed retail store to determine impacts to soil, groundwater, and soil vapor. Submitted application to the Minnesota Pollution Control Agency (MPCA) Petroleum Brownfields Program and oversaw the development and implementation of the Response Action Plan (RAP) during construction phase. Oversaw the site investigation to determine extent and magnitude of petroleum contamination including groundwater and surface water receptor surveys. Served as the Project Manager during site remediation and submittal of the RAP implementation report to receive MPCA closure.

Prologis – Meadowlands, NJ*
Served as Project Manager to provide recovery and restoration services for the majority of the Prologis portfolio damaged by Hurricane Sandy consisting of over one million square feet (17 buildings, 26 tenants). Conducted damage assessments, developed restoration scope of works, and coordinated remediation with contractors, consultants, tenant, and owner to establish near normal business operations.

Cavendish Farms – Jamestown, ND*
Served as Health and Safety Officer and a Project Manager during the restoration of a food processing facility damaged by fire. Conducted the project hazard analysis to develop the health and safety plan, restoration scope of works, and training program. Provided job and safety training and oversaw restoration quality.

ISO 14001 Implementation – Magna International/Traer Manufacturing*
Responsible for the implementation and oversight of all elements of the ISO 14001:1996 standard for an automotive manufacturing facility. The installation of the Environmental Management System (EMS) included the identification and prioritization of environmental issues, developing written procedures to address those issues, training of employees, and leading/participating in internal and third party audits. The EMS was merged with QS9000 Quality Management System which succeeded in obtaining ISO 14001 registration, with no adverse findings, within one year from start.

HEALTHCARE

Tulane Medical Center & Tulane-Lakeside Hospital – New Orleans, LA*
Served as Project Manager to provide remediation services to maintain occupancy of healthcare facilities damaged by Hurricane Isaac. Coordinated damage assessments, remediation and replacement of damaged building materials, hazardous materials removal, scheduling, and environmental clearance testing. Designed, implemented, and maintained engineering controls to maintain infection control and life safety requirements.

Delray Medical Center – Delray, FL*
Served as Project Manager to provide remediation services to maintain occupancy of a healthcare facility damaged by severe flooding. Coordinated remediation and replacement of damaged building materials, hazardous materials removal, scheduling, and environmental clearance testing. Designed, implemented, and maintained engineering controls to maintain infection control and life safety requirements.

Leif H. Schonteich, CSP, CHMM (continued)

The Mount Sinai Medical Center – New York, NY*
Served as Project Manager to provide remediation services to maintain occupancy of a healthcare facility damaged by fires and Hurricane Irene. Coordinated remediation and replacement of damaged building materials, scheduling, and environmental clearance testing. Designed, implemented, and maintained engineering controls to maintain infection control and life safety requirements.

Women's Centennial Hospital – Nashville, TN*
Served as Project Manager to provide remediation services to maintain occupancy of a healthcare facility damaged by severe flooding. Coordinated remediation and replacement of damaged building materials, hazardous materials removal, document recovery, contents disposition, scheduling, and environmental clearance testing. Designed, implemented, and maintained engineering controls to maintain infection control and life safety requirements.

Hurricane Recovery – Houston, TX*
Served as Project Manager to provide remediation services to a number of healthcare facilities damaged by Hurricane Ike. Coordinated remediation and replacement of damaged building materials, scheduling, and environmental clearance testing. Designed, implemented, and maintained engineering controls to maintain infection control requirements during remediation.

Columbus Regional Hospital – Columbus, IN*
Served as Health and Safety Officer and a Project Manager to provide remediation services of a healthcare facility damaged by severe flooding. Conducted the project hazard analysis, developed the health and safety plan, restoration scope of works, and training program. Coordinated the removal and disposal of damaged building materials and contents, hazardous materials and biohazard removal, scheduling, and microbial clearance testing. Designed, implemented, and maintained engineering controls to maintain infection control requirements.

Hurricane Recovery – Gulf Coast/South Florida*
Served as Project Manager to a number of healthcare facilities damaged by Hurricanes Katrina and Wilma to coordinate remediation and construction contractors. Conducted damage assessments and scope of work development for the removal and replacement of damaged building materials and contents. Maintained remediation scheduling, project documentation, and contractor auditing services. Directed environmental testing and interpreted results for recommendations. Designed, implemented, and maintained engineering controls to maintain infection control and life safety requirements during remediation and construction.

UNIVERSITY

University of Illinois at Urbana-Champaign – Champaign, IL*
Served as Project Manager to provide restoration services of the rare books collection, vault housing the collection, and heating, ventilation, and air-conditioning (HVAC) system impacted by microbial contamination. Designed, implemented, and maintained engineering controls to prevent cross-contamination during operations. Assisted the library conservators with preservation and cataloging over 400,000 manuscripts and books for the duration of the project.

University of Washington Medical Center – Seattle, WA*
Served as Project Manager and to provide to provide remediation services of a laboratory damaged by flooding. Conducted the project hazard analysis, developed the health and safety plan, restoration scope of works, and training program. Coordinated the removal and disposal of damaged building materials and contents, scheduling, and microbial clearance testing. Designed, implemented, and maintained engineering controls to maintain infection control requirements. Also served as insurance liaison to maintain construction scheduling, project documentation, and contractor auditing services. Directed environmental testing and interpreted results for recommendations.

DUE DILLIGENCE

Phase I Environmental Site Assessments: ND, MN
Project manager and Environmental Professional for ESAs of agricultural, healthcare, retail, commercial, and telecommunication sites. Responsibilities included conducting site reconnaissance, interviews, reviewing and interpreting historical research and regulatory records, report preparation, and final recommendations.

Phase II Environmental Site Assessments / Limited Site Investigations: ND, MN
Responsibilities have included developing scope of work documents, health and safety planning, obtaining historical information, contacting various government entities, field work oversight, and report preparation and recommendations. Field activities included conducting soil, groundwater, and soil gas/vapor investigations using push probe and hollow stem auger drilling techniques. Additional responsibilities include multimedia sampling, soil logging and classification, and installation and sampling of groundwater monitoring wells.

INDUSTRIAL HYGIENE

Indoor Air/Environmental Quality Assessments/Investigations: FL, LA, ND, NM, MA, MN, PA, SC, SD, TX
Performed investigations to identify indoor air contaminants in a wide variety of facilities including residential, healthcare, education, commercial, and industrial settings. Field activities have included performing visual inspections, infrared (IR) thermal imaging moisture surveys, and air and surface sampling. Responsibilities also have included evaluation and interpretation of data, remediation design and oversight, and post-remediation clearance and re-occupancy evaluations.

REGULATED MATERIALS

Asbestos, Lead-Based Paint, and Hazardous Materials Surveys: LA, ND, MN, SD
Conducted surveys in facilities including healthcare, commercial, telecommunications sites, public and private schools, and various military installations to identify asbestos containing material (ACM), lead-based paint, and other hazardous materials. Project activities included identifying potential ACM and collecting bulk samples for laboratory analysis, using an x-ray fluorescence (XRF) analyzer for lead paint testing, as well as collecting paint chip and soil samples for laboratory analysis, final report preparation and recommendations.

Asbestos Abatement Consulting Services: ND, MN
Conducted asbestos project design to prepare abatement plans, comprehensive specifications, and bid management services. Other project activities include on-site air monitoring, asbestos air sample analysis by phase contrast microscopy (PCM), contractor oversight, and abatement project management services. Facilities include residential, commercial, industrial, state, federal, K-12, and university campus facilities.

LEGAL SUPPORT

Confidential Client – Petroleum Impacted Property: MN
Served as the Project Manager for the file review of existing environmental documentation of a historical petroleum spill associated with a retail gas station and dispute of property ownership due to contamination on an adjoining parcel of land. Project activities associated with the site included a site investigation to determine extent and magnitude of petroleum contamination including groundwater and surface water receptor surveys; UST removal and associated soil management oversight, submission of applicable documents to the MPCA for regulatory closure, and submission of eligible costs for reimbursement to the Minnesota Department of Commerce Petrofund Division. The file review and data obtained from the site investigation and UST removal were used to obtain an opinion regarding historical contamination associated with the site.

Jim Wright, Director of Safety and Health

PROFESSIONAL EXPERIENCE

Jim is the director of Safety and Health based in Terracon's corporate office in Olathe, Kansas. Jim has over 25 years of safety experience in drilling and construction operations. He is a certified MSHA surface and underground mining instructor, approved OSHA Construction Safety instructor, and extremely knowledgeable in defensive driving and DOT regulations.

Jim oversees Terracon's corporate safety staff in the implementation of all employee health and safety programs across our national footprint of 150 offices in 40 states and over 3,600 people. Jim supports and executes Terracon's *Incident and Injury Free* program, including the implementation and accountability associated with our Rules to Live By, Terracon's set of 13 core rules and 9 core practices employees are required to comply with daily. Jim is also responsible for implementing necessary improvements to Terracon safety protocols in response to lessons learned and company initiatives, managing workers compensation insurance claims and accident investigation, overseeing safety training and safe operating procedures. This includes OSHA, DOT, EPA and MSHA legislative compliance. Duties also include evaluating client safety requirements and ensuring Terracon operations exceed client safety expectations with regards to environmental, health and safety.

EXPERIENCE

Compliance Manager, National Exploration, Wells and Pumps – Woodland, CA

Write and oversee implementation of all compliance aspects of the EH&S program for National's mining, geotechnical, environmental and water service operations. Ensure all OSHA, DOT, EPA and MSHA mandated training compliance, including HAZWOPER, surface and underground miner, DOT, defensive driving, and first aid. Create JSA's, CBT's and industrial hygiene monitoring. DOT and fleet safety responsibilities including vehicle operation, hazmat, logbook auditing, and maintenance program management for over 500 vehicles and 300 drivers. EPA responsibilities include waste stream analysis and disposal, compliance auditing, SPCC and RCRA. Work with Federal and state environmental and safety regulatory agencies. Implement and Management Representative for company ISO program and ensure compliance for 9001, 14001 and 18001 certification / recertifications.

Safety Director, WDC Exploration & Wells – Woodland, CA

Implement all aspects of the EH&S program for WDC's mining, geotechnical, environmental and water service operations. Ensure all OSHA, DOT, EPA and MSHA mandated training compliance, including HAZWOPER, surface and underground miner, DOT, defensive driving, and first aid. Conduct job site safety inspections, JSA's, CBT's and industrial hygiene monitoring. Responsible for worker's compensation, vehicle and general liability insurance claims and accident investigation. DOT and fleet safety responsibilities including vehicle operation, hazmat, logbook auditing, and maintenance program management for over 500 vehicles and 200 drivers. EPA responsibilities include waste stream analysis and disposal, compliance auditing, SPCC and RCRA. Work with Federal and state environmental and safety regulatory agencies.

Environmental, Health and Safety Manager, Layne Christensen Company – Kansas City, KS

Manage a twelve employee staff and $1 million budget for Layne Christensen's worldwide environmental, safety and health program for mining, geotechnical, environmental and water service drilling. Responsible for EH&S operations in United States, Mexico, Canada, Australia, Africa and Mexico. Familiar with EH&S legislative requirements in these countries and all US states.

Regional Environmental, Health and Safety Coordinator, Layne Christensen Company – Fontana, CA

Assisted in implementing all aspects of the employee health and safety program for Layne's operations in the United States. Conducted inspections of shop, jobsite, DOT, and environmental compliance to continue working relation with Layne's policies, procedures and programs. Provide all mandated employee training including, OSHA, MSHA, DOT and EPA; PPE including respirator usage, confined space, forklift, backhoe, crane, HAZCOM, HAZWOPER, defensive driver and new hire safety orientation. Determine safe operating procedures (JSA/JHA) for tools and equipment in compliance with appropriate safety standards. Performed and documented industrial hygiene testing including respiratory and noise dosimetry. Conducted onsite safety meetings to ensure employee safety and safety needs. Evaluated current policies, procedures, and programs to ensure compliance with federal, state, and local legislation. DOT and fleet safety responsibilities including vehicle operation, hazmat, logbook auditing, and maintenance program auditing for over 2,500 vehicles and 1,000 drivers.

EDUCATION

Bachelor of Arts, Chemistry, Minor in Biology Central Methodist University, 1989

Masters Degree, Industrial Hygiene, University of Central Missouri, 1991

CERTIFICATIONS

American Red Cross Certified Standard First Aid and CPR Instructor, 1992 - present

Smith System Certified Driving Instructor, 2004 - present

Mine Safety and Health Administration Certified Instructor Surface / Underground, 1994 - present

Occupational Safety and Health Administration Approved Instructor 10 & 30 hour Construction Safety, 2014 - present

Loss Prevention System (LPS) Approved Instructor, 2006 – 2014

ISO 9001/14001/18001 Certified Auditor

AFFILIATIONS

National Ground Water Association, 2002 – present; Safety Subcommittee Chairman 2008 – 2011; Safety Advocate Awardee 2012

WORK HISTORY

Terracon Consultants, Inc., Corporate Director of Safety and Health, 2016 - Present

National Exploration Wells and Pumps, Compliance Manager, 2012 - 2016

WDC Exploration & Wells, Safety Director, 2004 - 2012

Layne Christensen Company, Environmental, Health and Safety Manager, 2002 - 2004

Layne Christensen Company, Regional Environmental, Health and Safety Coordinator, 1992 - 2002

Jim Wright, Director of Safety and Health

Professional Biography

Jim Wright is the Corporate Safety Director for Terracon Consultants, Inc.. He holds a Bachelor's degree in Chemistry and a Master's degree in Industrial Hygiene. Jim began a career in the drilling industry in 1991 as a project safety officer for safety and environmental monitoring on Superfund sites for an international drilling contractor. This work took him to some of the most highly contaminated sites in the United States. Jim's position then evolved into managing all aspects of safety, health, environmental and fleet management for worldwide drilling operations. Jim has designed and implemented world class safety systems for geotechnical, mining, environmental and water service drilling and construction operations in the US, Africa, Australia, Mexico, Canada and South America. From remote mineral exploration to complex geotechnical infrastructure to high-tech radiation contaminated soil sampling, Jim has made a career of providing industry leading safety programs and a zero accident goal to field crews. Jim is an MSHA certified underground and surface mining instructor; American Red Cross certified infant, child and adult first aid / CPR instructor; OSHA approved 10 and 30 hour construction safety trainer; performance, off-road and Smith System® driving instructor; and LPS® certified instructor. Jim currently sits on the National Groundwater Association's Professional Development, Safety Subcommittee, and was the past Chairperson. He was awarded the 2012 Safety Advocate Award by the National Groundwater Association.

Justin M. Enwall

PROJECT GEOLOGIST

PROFESSIONAL EXPERIENCE

Mr. Enwall is a Project Geologist in Terracon's White Bear Lake, Minnesota office. Mr. Enwall's responsibilities include environmental assessment, reporting, and sampling services. Mr. Enwall's field project involvement includes; drilling oversight using various techniques; oversight of remedial actions including soil excavation, remediation system installation, vapor mitigation system installation, and pilot testing; monitoring well installation oversight; groundwater elevation collection; collection of representative groundwater, soil, soil-gas, and indoor air samples; elevation surveying; and performance of remediation system operation and maintenance activities for various remedial systems. Project duties include analysis of data and the preparation of reports including Phase I and Phase II Environmental Site Assessments, Limited Site Investigations, Focused Investigations, Remedial Investigations, Remedial Actions, Annual Monitoring Reports, and construction specifications. His duties also include project management involving the preparation of proposals, work plans, reports, as well as regulatory and client contacts.

Mr. Enwall previously served as a Materials Services Technician in Terracon's White Bear Lake, Minnesota office. His responsibilities included fieldwork provided by the materials engineering and testing service line. Project involvement included field and laboratory testing of materials and field observation of shallow foundations, deep foundations, soil fill, concrete placement, asphalt pavement, reinforcing steel, and masonry.

PROJECT EXPERIENCE

Former Ness Property – Shafer, Minnesota (2012)

Conducted a Limited Site Investigation to delineate the extent and magnitude of petroleum impacts and for the presence of underground storage tanks identified during historical environmental assessment activities conducted at the site. Tasks completed included the preparation of a work plan and cost estimates, preparation of specifications, subcontractor solicitation and contracting, on-site filed assessment activities, data analysis, preparation of a Limited Site Investigation report, and invoicing.

Former Kettle River Company Creosote Plant – Sandstone, Minnesota (2014 to present)

Coordinated and conducted additional sampling and site investigation activities related to further defining the extent of impacted groundwater, soil, sediment, soil-gas, and ambient air associated with the former creosote plant, properties located adjacent to the former plant site, and at properties along a creek down-gradient of the former plant site. Developed plans and specifications, solicitied bids from contractors, and coordinated final removal and disposal of impacted soil and residual creosote for remedial excavation phases completed since 2015. The project site is a State of Minnesota superfund site and the client is the Minnesota Department of Agriculture. Due to limited state funding, the project has been completed using a phased approach with 12 phases completed through 2016 involving the removal of approximately 22,000 tons of contaminated soil and debris for disposal. The project also involved routine groundwater monitoring at 22 monitorings wells, 10 potable wells, and along an adjacent creek. The project is currently on-going.

Winona Groundwater Contamination Superfund Site – Winona, Minnesota (2007-2015)

Performed operations and maintenance site visits for a combined air stripper / granular activated carbon groundwater treatment system. Conducted groundwater monitoring, vapor intrusion assessment, and source area assessment activities. Source area assessment activities included the completion of a passive soil gas assessment using diffusion samplers, the advancement of membrane interference / electrical conductivity probes to delineate chlorinated solvent impacted soil and groundwater within the source area, the advancement of soil and groundwater borings, and installation of monitoring wells using roto-sonic drilling techniques. Provided field oversight and subsequent monitoring of an in-situ chemical oxidation pilot test utilizing sodium permanganate to evaluate the effectiveness of the treatment in reduction of source area impacts.

EDUCATION

Bachelor of Arts
Geology
Macalester College
2006

CERTIFICATIONS

HAZWOPER – 40 hour Training
HAZWOPER – 8 hour Refresher
Nuclear Density Gauge Safety Training
CPR/First Aid/AED Certification
Thermo Fisher Scientific Radiation Safety and Monitoring Certification

WORK HISTORY

Terracon Consultants, Inc.
Project Geologist
2016 - Present
Staff Geologist
2011 - 2016
Environmental Field Scientist
2009 - 2011
Environmental Field Technician / Field Scientist
2006 - 2011
Materials Technician
2006

Justin M. Enwall (continued)

Able Property Management – Fridley, MInnesota (2009-2014)
Perfomed site assessment, site investigation, and vapor intrusion activities including delineating the extent and magnitude of fuel oil impacts to soil, groundwater, soil-gas, and indoor air. Coordinated with drilling contractors to complete soil probes, soil-gas probes, laser induced fluorescence probes. Fulfilled duties as the Resident Project Representative during remedial actions involving field coordination and oversight of structure demolitions, vacuum dewatering and on-site water treatment, excavation of petroleum impacted soil, water main replacement, sanitary sewer replacement, sanitary sewer lining, excavation backfilling, road reconstruction, and site restoration.

Lafayette and University Soil Gas Investigation – Saint Paul, Minnesota (2010-2013)
Conducted vapor intrusion investigations on numerous properties within the study area. Vapor intrusion investigation activities included the installation of sub-slab soil gas monitoring points, collection of sub-slab soil-gas samples, and collection of indoor air quality samples. Provided subcontractor oversight during the advancement of soil probes, advancement of soil-gas probes, and installation of monitoring wells. Performed data reduction activities and prepared a Compendium Report documenting the results of the vapor intrusion investigation activities and the cumulative historic environmental assessment and remedial actions that had been performed on properties located within the study area.

Baytown Township Contamination Site – Lake Elmo, Minnesota (2007-2016)
Conducted routine groundwater monitoring of the 40+ monitoring well network, source area assessment, and system operation and maintenance. Fulfilled duties as the Resident Project Representative during the construction of the hydraulic barrier remediation system which included field coordination and oversight of contractors performing trenching, remediation building/system construction, horizontal infiltration well installation, and remediation system startup activities. Performed quality assurance review of work completed by contractors during project to assure project specifications were achieved.

Rochester Groundwater Contamination Superfund Site – Rochester, Minnesota (2008-2014)
Fulfilled duties as the Resident Project Representative during remedial actions involving installation of a geocomposite soil-gas venting system. Task completed included field coordination and oversight of the excavation of chlorinated solvent impacted soils, segregation of the excavated soils based on field screening data, construction of the geocomposite soil-gas vent system and associated equipment, system piping trenching, and site restoration.

KR Mart – Kettle River, Minnesota (2008-2014)
Conducted source area assessment, site investigation, and groundwater monitoring activities to delineate the petroleum impacted soil and groundwater plume. As the Resident Project Representative, provided contractor oversight during remedial soil excavation activities including the removal of three underground storage tanks and associated piping, installation and operation of a dewatering system consisting of rock sumps connected to an onsite water treatment system, and excavation and segregation of non-impacted and petroleum impacted soils for re-use at the site or for off-site disposal.

Former Wood Treatment Facility / Active Industrial Facility – Fridley, Minnesota (2010-2016)
Provided subcontractor oversight during implementation of a Interim Response Action Plan to address creosote and polycyclic aromatic hydrocarbon impacted soil in an undeveloped area outside of the known cresote impacted portion of the property. The Interim Reponse Action Plan was performed as part of redevelopment activities conducted by the current site owner involving the construction of a new industrial facility. As part of the Interim Response Action Plan implementation activities, documentented the excavation, staging, characterization, disposal, and other soil management activities of impacted soils at the site. Conducted field site investigation activities in various locations of the facility including the advancement of soil probes, hand augers, geotechnical borings, and water infiltration testing.

Former Agronomy Center – Hector, Minnesota (2010-2012)
Performed assessment activities including the advancement of soil probes to delineate the extent and magnitude of fertilizer / pesticide impacted soils located at the site to assist in the completion of a corrective action plan. As part of corrective action plan implementation, provided oversight of subcontractors during the excavations of impacted soils. Oversight activities included the documentation of the excavations and compaction testing of backfill material using a nuclear density gauge to assure construction and corrective action plan specifications were achieved.

Joseph J. Conlan, CHMM

PROJECT SCIENTIST

PROFESSIONAL EXPERIENCE

Mr. Conlan is a Project Scientist in Terracon's White Bear Lake, Minnesota office. Mr. Conlan's responsibilities include project management and field oversight for a variety of projects including Phase I and Phase II Environmental Site Assessments, Limited Site Investigations, Remedial Investigations and Response Action Plan Implementation, Annual Monitoring Reports, Underground Storage Tank removals, Excavation Oversight, Asbestos Surveys, Lead Based Paint Inspections and Hazardous Material Assessments. Mr. Conlan's project management activities include proposal preparation and project scoping, subcontractor bid specification preparation and selection, subcontractor oversight, report preparation, data analysis, client relations and regulatory authority interaction. Mr. Conlan's field oversight includes drilling using push probe, hollow stem auger, and rota-sonic rigs, monitoring well installation, groundwater elevation monitoring, surveying, soil gas, indoor air, soil, groundwater sampling, remediation system operation and maintenance, excavation oversight, asbestos, lead-based paint and hazardous material sampling, potable well sampling, Phase I Environmental Site Assessments interviews and site reconnaissance.

PROJECT EXPERIENCE

Convenience Store Redevelopment – Vadnais Heights, Minnesota (2015 – 2016)
Coordinated Phase I ESA, Subsurface Investigations, Pre-Demolition Inspection, Abatement and Remediation at a petroleum and hazardous substance impacted property. Several RECs were identified in the Phase I ESA to develop a scope to be completed in subsequent subsurface investigations. Numerous soil borings were advanced at the site to analyze samples for associated chemicals of concern in soil and groundwater. The site was enrolled in the MPCA VIC program and a Response Action Plan was completed to detail how the identified 1,500 cubic yards of petroleum and chlorinated solvent impacted soil would be managed during redevelopment. During redevelopment an unidentified 1,000 cubic yards of asbestos containing debris was encountered which resulted in an emergency notification to MDH and MPCA officials. Pre-demolition inspections of site buildings identified asbestos containing materials requiring abatement prior to building demolition. Project management activities included coordinating with abatement contractors, landfills, developers, general contractors, property owners, tenants and regulatory officials to successfully keep the construction timeline on track.

Agricultural Chemical Facility Remediation – Welcome, Minnesota (2014 – 2016)
Assessment of soil and groundwater impacts and completion of soil remedial actions at a bulk fertilizer and pesticide storage facility. Terracon completed the assessment, prepared a corrective action plan and coordinated completion of the remedial actions under the Minnesota Department of Agriculture AgVIC Program. Remedial actions included the excavation of 5,000 cubic yards of soil impacted with fertilizer and pesticides and the subsequent land spreading on agricultural fields at agronomic rates.

Seed Treatment Facility – Shakopee, Minnesota (2010)
Conducted a Phase I Environmental Site Assessment in accordance with ASTM 1527. The site was a former industrial property that consisted of two connecting parcels of land totaling approximately 5.8 acres and had reportedly been utilized as a seed treatment facility and an automobile storage facility. Several RECs were identified in connection with the assessment. Additionally, a former incineration facility was located on an adjacent property with identified groundwater contamination. Based upon the identified RECs a scope was developed for completion of a Phase II assessment to assist in quantifying petroleum and pesticide contamination, industrial well abandonment and identifying building effluent locations. The building contained various hazardous substances which required proper disposal and obtaining a hazardous waste generator identification number.

Commercial Redevelopment – Detroit Lakes, Minnesota (2010)
Conducted a Phase I ESA in general accordance with ASTM E 1527. The site was occupied by several businesses including an operational gas station with residual petroleum contamination.

EDUCATION

Bachelor of Science
Environmental Science
University of Wisconsin
River Falls, Wisconsin
2005

CERTIFICATIONS

Certified Hazardous Material Manager
40-Hour HAZWOPER
CPR/First Aid
Asbestos Inspector
Asbestos Site Supervisor
Asbestos Air Sample Technician
Lead Risk Assessor
Lead Inspector
Thermo Fischer Scientific Radiation

WORK HISTORY

Terracon Consultants Inc.
White Bear Lake, Minnesota
Project Scientist
2015 – Present

Vieau Associates, Inc.
Edina, Minnesota
Project Manager
2013 - 2015

Terracon Consultants Inc.
White Bear Lake, Minnesota
Environmental Scientist
2007 - 2013

Clean Harbors Environmental Services Inc.
Cannon Falls, Minnesota
Senior Lead Chemist
2006 - 2007

Joseph Conlan (continued)

RECs identified underground storage tanks and leaking underground storage tanks and former underground storage tanks on site and on adjacent up-gradient properties. Given the building was constructed in approximately 1930 an asbestos survey was completed on the building as client plans included the demolition and redevelopment of the property. Additionally an unknown underground storage tank was identified through use of a magnetometer survey. A Phase II ESA was completed to assess and quantify on-site contamination in the soil, groundwater and soil gas, with documentation being sent to the proper governmental officials to assist the client in entering the VIC and Brownfields program.

Multi-Family Housing Redevelopment – Lakeville, Minnesota (2012)
Assisted with redevelopment at a site located near a former landfill to determine boundaries of potential contamination areas. Numerous test pits were advanced and soil samples collected and analyzed for parameters associated with potential landfill contaminants. During the excavation provided oversight to identify soil considered to be regualted fill material based upon field observations. An excavation report was completed and submitted to the client.

***State Highway Reconstruction Project - Adams, Minnesota (2015)**
Completed a corridor Phase I ESA in general accordance with ASTM E 1527 to assist with proposed highway reconstruction. Several areas of historical petroleum impacts were identified in addition to other areas of potential concern. These areas were later assessed during subsequent subsurface investigations after determining a sampling scope with MNDOT representatives. Traffic control measures were implemented during subsurface investigation activities. During sample collection copies of completed boring logs and photographs were immediately sent to MNDOT representatives to provide real-time data to better determine sampling strategies. Following completion of each boring a discussion was had with MNDOT to cooperatively determine necessary sample locations dependant upon the proposed redevelopment.

***Roadway Reconstruction Project – Minneapolis, Minnesota (2016)**
Completed a corridor Phase I ESA in general accordance with ASTM E 1527 to assist with proposed roadway reconstruction. Several areas of historical impacts were identified in addition to potential areas of impacts. A subsurface investigation was completed and several areas of impacts were identified. A Response Action Plan was prepared and submitted to the MPCA to outline how impacted soil would be managed during reconstruction activities. Terracon provided oversight during the reconstruction activities to identify impacted soils which may be reused on site and those requiring off-site disposal. During reconstruction Terracon responded quickly to help characterize soil viewed by contractors to have a potential to be impacted. These soils were segregated accordingly and reused or disposed off-site as necessary.

UST Removal – Winona, Minnesota (2014)
Oversaw the removal of a diesel underground storage tank associated with emergency telecommunication tower. Contamination was identified during the underground storage tank removal and a leaking underground storage tank number assigned. Assisted client in obtaining documentation from the respective governmental authorities to get the leaking underground storage tank site complete site closure in a minimal amount of time through functional communication with the client and governing authorities.

UST Removal/LUST Site Investigation – Minneapolis, Minnesota (2012)
Coordinated the removal of a diesel and gasoline underground storage tank associated with a former hospital. During tank removal contamination was identified and reported to the state duty officer. Soil was managed and segregated based upon observed field photoionization detector readings and soil was returned to the excavation tank basin. Confirmation analytical samples indicated high levels of diesel related compounds and a limited site investigation was performed at the site to delineate contamination boundaries.

Phase I Environmental Site Assessment / Limited Site Investigation – La Crosse, Wisconsin (2010)
Identified numerous recognized environmental conditions associated with a large parcel of a railroad switch yard, in a heavily industrial area. Site operations included the maintenance of locomotives with a documented petroleum release and remediation system installation, in addition to filling in receptor basements with concrete to mitigate free-product and vapor intrusion. Additionally, adjacent industrial properties used hazardous materials and also had documented contamination and groundwater use restrictions. Site buildings were proposed to be demolished and resulted in the identification of numerous asbestos containing materials. Additional proposed construction resulting in wetland disturbances requiring discussions with the United States Army Corps of Engineers. Buried debris items encountered during development reportedly consisted of rail car debris and buried drums. Encountered contaminated soil was properly disposed of with local, state and federal regulations.

Michael J. Willey
SENIOR PROJECT MANAGER

PROFESSIONAL EXPERIENCE
Mr. Willey is an asbestos, lead-based paint and hazardous/regulated materials Senior Project Manager with Liesch Associates, Inc., a Terracon Company, in Minneapolis, Minnesota. Mr. Willey has over 23 years of experience as a Project Manager with significant experience with large site re-developments including both renovation and demolition projects. Areas of expertise include pre-renovation and pre-demolition services conducting and preparing surveys, preparing management plans / abatement plans / cost estimates / bid management and on-site compliance sampling for asbestos / lead-based paint / mercury / polychlorinated biphenyl and other regulated materials.

Additional experience includes; moisture and mold assessments, design plan development and oversight during mold remediation; industrial hygiene monitoring, sampling and safety compliance related projects; environmental grant application preparation; Housing and Urban Development funded projects specifically lead hazard compliance during repurposing commercial properties into target housing; preparing demolition specifications and deconstruction documentation; and other acquisitions investigations.

PROJECT EXPERIENCE
ASBESTOS / HAZARDOUS MATERIALS
Foshay Tower (32-Story) – Minneapolis, Minnesota

Mr. Willey served as the Senior Project Manager to design and coordinate abatement of environmental hazards during the redevelopment of the thirty-two story Foshay Tower (listed on the National Historical Registry) in the heart of downtown Minneapolis, Minnesota. Mr. Willey assisted in conducting asbestos, lead-based paint and hazardous/special waste survey to supplement the previous inspection information. The bidding tasks for this project included plan distribution, project walkthrough, response to questions, addendum development, and bid review and award recommendation. The site work Mr. Willey was responsible for included specification oversight, regulatory compliance, air monitoring, and documentation during abatement and disposal activities.

Rayette Redevelopment (7-Story) – Minneapolis, Minnesota

Mr. Willey served as the Senior Project Manager to design and coordinate abatement of environmental hazards during the redevelopment, into residential housing, of the seven-story Rayette redevelopment which was also seeking historic tax credits in downtown Saint Paul, Minnesota. Mr. Willey assisted in conducting asbestos, lead-based paint, and hazardous/special waste survey. The bidding tasks for this project included plan distribution, project walkthrough, response to questions, addendum development, and bid review and award recommendation. The site work Mr. Willey was responsible for included specification oversight, regulatory compliance, air monitoring, and documentation during abatement and disposal activities.

Soo Line Building (19-Story) – Minneapolis, Minnesota

Mr. Willey served as the Senior Project Manager to design and coordinate abatement of environmental hazards during the redevelopment of the nineteen-story Soo Line building (listed on the National Historical Registry) in the heart of downtown Minneapolis, Minnesota. Mr. Willey assisted in conducting asbestos, lead-based paint, and hazardous/special waste survey including obtaining grant funding for the project. The bidding tasks for this project included plan distribution, project walkthrough, response to questions, addendum development, and bid review and award recommendation. The site work Mr. Willey was responsible for included specification oversight, regulatory compliance, air monitoring, and documentation during abatement and disposal activities.

EDUCATION
Bachelor of Science: Geology, St. Cloud State University, 1994

SPECIALIZED TRAINING
NIOSH #582 "Sampling & Evaluating Airborne Asbestos Dust"

Mechanical Hygiene and Indoor Air Quality

Advanced Asbestos Identification, McCrone Research Institute

Recognition & Mitigation of Indoor Air Quality, Midwest Center Occupational Health & Safety

Train-The-Trainer

CERTIFICATIONS
40-Hour OSHA HAZWOPER

Asbestos Building Inspector

Asbestos Management Planner

Asbestos Contractor / Supervisor

Asbestos Project Designer

Lead Supervisor: Minnesota

Lead Project Designer

Lead Risk Assessor

Lead-Safe Renovator

Radiation Safety Certified

WORK HISTORY
Liesch Associates, Inc. a Terracon Company, Senior Project Manager, 2013-Present

Liesch Associates, Inc., Senior Project Manager, 2000-2012

Nova Consulting Group, Project Manager, 1994-2000

* *Work performed prior to joining Terracon.*

Michael J. Willey (continued)

TCF Tower (17-Story) – Minneapolis, Minnesota
Mr. Willey served as the Senior Project Manager to design and coordinate abatement of environmental hazards during the tenant improvement of the seventeen-story building in the heart of downtown Minneapolis, Minnesota. Mr. Willey conducted asbestos, lead-based paint, and hazardous/special waste survey of the property. The bidding tasks for this project included plan distribution, project walkthrough(s), response to questions, addendum development, and bid review and award recommendation. The site work Mr. Willey was responsible for included specification oversight, regulatory compliance, air monitoring, and documentation during abatement and disposal activities.

Federal Aviation Administration – Farmington, Minnesota
Mr. Willey served as the Senior Project Manager during primarily a fireproofing removal project at the Federal Aviation Administration's Air Route Surveillance Center, which was operational throughout the project, in Farmington, MN. Mr. Willey provided abatement plan review; regulatory assistance and in-house staff to collect and read air samples twenty-four hours a day seven days a week for during asbestos removal work. The project required staff for approximately two years and the collection and analysis of over 20,000 air samples. The project required careful planning as the site was an operational facility.

Brainerd Regional Treatment Center – Brainerd, Minnesota
Mr. Willey acted as the lead Project Designer to assist with the demolition of thirteen buildings at the Brainerd Regional Treatment Center for the State of Minnesota Real Estate and Construction Services Department. Mr. Willey assisted in the review of previously completed asbestos surveys, conducted supplemental sampling, provided cost estimates and compilation of an Asbestos, Lead and Regulated Materials Abatement Design for the facility. Mr. Willey and the Liesch team helped generate specification for bidding, participated in the bidding and selection process, and provided oversight of abatement and contract compliance with the specification requirements. Mr. Willey led weekly project meetings while also completing a tank removal at the site in order to obtain regulatory closure of the tank issues.

MGK Building, University of Minnesota – Minneapolis, Minnesota
Mr. Willey acted as the project manager to assist with the project oversight during the demolition of the former pesticide processing plant acquired by the U of M on the University of Minnesota Twin Cities Easy Bank Campus. His primary duties were to assess the building for environmental hazards and develop a specification for demolition. Mike also assisted in the creation of a Development Response Action Plan for the overall site cleanup. Mr. Willey aided in the development of the site clean-up plan, acted as the interface between the regulatory agency and the owner, and implemented the cleanup, which included both impacted soil removal and impacted soil in-place management.

Poucher-Holman-U Press Buildings, University of Minnesota – Minneapolis, Minnesota
Mr. Willey acted as the Senior Project Manager to produce a project demolition specification, perform bid management activities, and project oversight during the demolition of three former buildings on the University of Minnesota Minneapolis campus. Liesch was responsible for; compilation of all information pertaining to asbestos, and other hazardous and special wastes, assisting with modifications to the steam tunnel system connected to the buildings, addressing subsurface environmental hazards identified during demolition, and monitoring adjacent structures and overseeing the demolition of the buildings. During the demolition, a previously unknown process tank was identified beneath one of the buildings. Mr. Willey was involved in coordinating testing and assisted with disposal of that tank, while completing the building demolition on schedule with no impact to the neighboring historic building.

David A. Jerde

SENIOR HYDROGEOLOGIST / PROJECT MANAGER

PROFESSIONAL EXPERIENCE

Mr. Jerde is a senior hydrogeologist and project manager for the Minneapolis, MN office of Terracon Consultants, Inc. Mr. Jerde has over 30 years of experience in the environmental industry. His areas of expertise include hydrogeologic investigations, site remediation, remote sensing geophysical/groundwater exploration, and groundwater modeling.

HYDROGEOLOGIC INVESTIGATION

Develops plans for remedial investigation, and supervises implementation of the field exploration activities. Experience includes waste sites contaminated with dense and/or light non-aqueous phase liquids. Involved with the protection of municipal and industrial water supplies through the definition of potential contaminant-migration pathways and the development of plans to manage risk.

Prepares and directs implementation of monitoring systems to evaluate environmental contamination and the effectiveness of remedial actions. Develops plans and supervises the evaluation of hydrogeological characteristics of the vadose-zone and aquifer systems.

SITE REMEDIATION

Mr. Jerde is a team leader responsible for developing and implementing pilot-scale testing to evaluate technical and economic feasibility of active and passive remedial alternatives. He evaluates site conditions to develop cleanup goals for soil and ground water. Mr. Jerde compiles and reviews data generated during testing to develop response plans that will attain the specified cleanup goals.

Mr. Jerde has experience with evaluation, design, and implementation of many remedial technologies including but not limited to electrical resistive heating, soil vapor extraction, in situ chemical oxidation, in situ chemical reduction, aquifer air sparging, pump-and-treat, and natural attenuation. He is familiar with implementing technologies to remediate non-aqueous phase liquids and dissolved-, vapor-, and adsorbed-phase impacts.

REMOTE SENSING GEOPHYSICAL/GROUNDWATER EXPLORATION

Develops and conducts remote sensing investigations to identify subsurface conditions. Experience includes seismic reflection mapping of buried bedrock valleys; electrical resistivity soundings and traverses to delineate potential groundwater supply aquifers; seismic refraction profiling to identify the depth-to / friability-of bedrock and depth-to water; gravimetric methods to identify anomalies resulting from changes in sub-surface conditions, and electromagnetic sensing techniques to identify buried ferrous materials.

GROUNDWATER MONITORING

Proficient in numerical and analytical groundwater modeling of hydrogeologic environments, including the United States Geological Survey's three-dimensional flow model (MODFLOW), EPA's wellhead protection model (WHPA), and numerous analytical models.

EDUCATION

Evening MBA Program
Opus College of Business
University of St. Thomas
2012-Present

Bachelor of Science, Geophysics
University of Minnesota
1987

Undergraduate Studies, Computer Science, Hardware and Software Design/Implementation
Augustana College
Sioux Falls, South Dakota

REGISTRATIONS

Professional Geologist
Minnesota, #30560

Professional Geologist
Wisconsin, #768

CERTIFICATIONS

40-Hour HAZWOPER

AFFILIATIONS

Minnesota Groundwater Association

WORK HISTORY

Terracon Consultants, Inc.
Hydrogeologist/Project Manager
2013-Present

Liesch Associates, Inc.
Hydrogeologist/Project Manager
1987-2013

* *Work performed prior to joining Terracon.*

David A. Jerde (continued)

HYDROGEOLOGIC INVESTIGATION

PROJECT EXPERIENCE

INDUSTRIAL

Claire Manufacturing Company – Addison, Illinois

Senior Hydrogeologist / Project Manager. As project manager, Mr. Jerde enlisted a team of engineers and scientists in providing a full range of environmental services, guiding our client in pursuit of a Comprehensive No Further Remediation determination for the former aerosol manufacturing facility. In his role as the senior hydrogeologist, Mr. Jerde directed site investigation efforts, teamed to develop and implement pilot testing, and aided with both design and implementation of the final remedial action for the site. Terracon collaborated with TRS to implement electrical resistive heating, an innovative remedial technology, to drop concentrations of volatile organic compounds to below their applicable, regulatory standards. Mr. Jerde was also intimately involved in the design/installation of sub-slab depressurization to mitigate potential vapor intrusion concerns.

Professional Services Completed: *Final closure 2014*.

Remedial Action Implementation: 2012 & 2013

Tubelite, Inc. – Reed City, Michigan

Senior Hydrogeologist / Project Manager. Mr. Jerde leads a team of professionals who are assisting our client in pursuit of non-residential closure for legacy, chlorinated-solvent impacts related to former degreasing operations. Mr. Jerde was part of the team that evaluated the adequacy of prior investigation efforts, spearheaded supplemental site characterization/pilot testing, and designed a remedial action plan (RAP) to accomplish the closure objectives. Mr. Jerde is responsible for overseeing implementation of the RAP, which incorporates constructed hydraulic barriers to control groundwater flow, *in situ* chemical oxidation using permanganate injections, soil vapor extraction, and long term groundwater monitoring.

Professional Services Completed: *Final closure anticipated in 2018*.

Remedial Action Implementation: 2013 through 2018

STATE/LOCAL GOVERNMENT

West Fargo Aquifer Study – West Fargo, North Dakota

Senior Hydrogeologist/Groundwater Modeler. Mr. Jerde was responsible for overseeing development of a conceptual site model (CSM) of the aquifer system and performing numerical, groundwater modeling based on the CSM. Terracon completed the project for the City of West Fargo as they evaluate medium- to longer-term alternatives for municipal water supply. Mr. Jerde used MODFLOW, supported through the Groundwater Vistas program, to develop and calibrate a model of groundwater flow; he then used the model to project the 50-year, forward-looking aquifer response based on the estimated municipal demand.

Professional Services Completed: 2012 through 2013

Kenneth P. Olson, P.G.

SENIOR PROJECT MANAGER/PROFESSIONAL GEOLOGIST

PROFESSIONAL EXPERIENCE

Mr. Olson is a Principal and Senior Hydrogeologist at Terracon's Minneapolis, MN office. Mr. Olson has over 36 years of experience in the environmental consulting field. He has managed or supervised hundreds of projects, including environmental review (EA, EAW, EIS), Phase I and Phase II environmental site assessments (ESAs), hydrogeological evaluations, CERCLA RI/FS/RA, and groundwater monitor network plans. Mr. Olson has also provided senior project management for several multi-site contracts with large public and private clients.

Mr. Olson is Office Manager, responsible for coordinating and managing Terracon's services in the Minneapolis office which provides services around the country. Mr. Olson has responsibility for overseeing the quality and timeliness of Terracon's services.
Mr. Olson's extensive experience has provided him a strong knowledge of environmental review, RCRA, CERCLA and other environmental regulatory requirements. He has dealt with a wide variety of contaminants including volatile and semi-volatile organics, wood treating chemicals, agrichemicals, heavy metals, and petroleum products.

PROJECT EXPERIENCE

ENVIRONMENTAL REVIEW

Merriam Junction Silica Sand Mining Project EIS, Scott County, MN
Currently providing consulting services to Scott County who is the RGU for generation of an EIS for a proposed Silica Sand mining project. Mr. Olson is the Project Manager and Senior Hydrogeologist on the project. He is coordinating the efforts of others on the team to assess dewatering effects, transportation issues, air quality issues, natural resources effects. The applicant is preparing technical documents in support of the project, which will be independently assessed by the Terracon team and the County and included in the Scoping EAW and the EIS.

Hancock Pro-Pork EIS, Minnesota Pollution Control Agency
The Hancock Pro-Pork (HPP) Project is a multi-site hog, farrow-to-finish feedlot project consisting of one farrowing/nursery facility (five total confinement barns) and nine finishing facilities individually owned by HPP member located in West Central Minnesota. We were one of three consultants retained by the Minnesota Pollution Control Agency to complete the Hancock Pro Pork EIS by investigating the potential for impacts on ground water, surface water, air, human health, wildlife, and habitat, as well as manure management practices, appropriate alternatives, and mitigation. Air emissions and socioeconomic impacts were assessed by other consultants.

Light Rail Transit Federal Environmental Assessment-Airport Portals
Part of a team completing an Environmental Assessment of the portals at the Minneapolis-St. Paul International Airport that were part of the Light Rail Transit Line from Minneapolis to Bloomington, MN. Mr. Olson was the Project Manager and senior technical resource on the team. Our role included assessment of surface water and groundwater affects including those associated with construction dewatering to construct the portals.

I Expansion EAWs
Prepared EAW documents for multiple landfill expansion projects in Minnesota. The MPCA was the RGU on these projects. Primary issues included facility design, leachate management design and operations, potential for groundwater impacts, and surface water control issues. Prepared comment responses to comments made on the public. Mr. Olson's role ranged from project manager and primary author to technical resource on the projects.

EDUCATION
Bachelor of Science
Geology
University of Minnesota
1980

REGISTRATIONS
Certified Professional Geologist:

AIPG-7053

Registered Professional Geologist
Minnesota (30102), Wisconsin (144), Wyoming (2995), Missouri (0721)

North Carolina Registered Site Manager

AFFILIATIONS
Minnesota Ground Water Association

WORK HISTORY
Liesch Associates, Inc.
A Terracon Company
Principal/Office Manager
2013-present

Liesch Associates, Inc.
Principal
1986-2012

Senior Hydrogeologist/Project Manager
1990-2012

Hydrogeologist/Project Manager
1986-1990

Field Geologist/Hydrogeologist
1980-1986

University of Minnesota
Undergraduate Research Assistant
1979-1980

Kenneth P. Olson, P.G. (continued)

Landfill Expansion EAWs
Prepared EAW documents for multiple landfill expansion projects in Minnesota. The MPCA was the RGU on these projects. Primary issues included facility design, leachate management design and operations, potential for groundwater impacts, and surface water control issues. Prepared comment responses to comments made on the public. Mr. Olson's role ranged from project manager and primary author to technical resource on the projects.

HYDROGEOLOGY/REMEDIATION

MLAC Groundwater Collection and Treatment, Minneapolis, MN
University of Minnesota, Minneapolis, MN
Senior Project Manager. Project included designing the groundwater treatment & discharging system to address impacts to groundwater collected from a horizontal dewatering well that was in place providing protection to the underground library archives at the University of Minnesota. Operated & monitored H2S levels in the library, monitoring the library drainage system, weekly inspections and monitoring of the groundwater treatment system.

Metropolitan Airport Commission (MAC)- Minneapolis-St. Paul International Airport
Continuing consultant for the MAC. Mr. Olson served as Project Manager on vehicular tunnel installation including construction dewatering design, permitting and monitoring. He has overseen assessments of tank releases and removals and coordinated environmental activities with the A/E and Engineering firms on the MAC team. Mr. Olson serves as a Senior Hydrogeologist on projects including dredge projects, release assessments and remediation and area groundwater monitoring.

Union Metal Corporation (UMC), Canton, OH
Technical consultant to UMC, completing an assessment of the extent and magnitude of releases at the site and the impacts caused by neighboring sites. Mr. Olson was the Certified Professional overseeing and approving activities at the site. The site has a No Further Action Letter accepted by the state and is in an Operations and Maintenance mode for product recovery.

Education Sciences Building Cleanup
University of Minnesota, Minneapolis, MN
Senior Project Manager for development of a corrective action/building cleaning plan for addressing environmental impacts (asbestos, mercury, LBP, heavy metals, electronics) that required screening and cleaning prior to removal and recycling. Integrated work with the A/E and CM at Risk for the Project.

Moorhead HRA Cost Recovery Litigation
Retained to complete an assessment and cleanup of a large fuel oil release at the site of a proposed Convention Center. After completion of the cleanup, a cost recovery action was initiated by the City against the responsible party for the fuel oil release. Mr. Olson was retained as an expert witness to render opinion on the extent of impact associated with the fuel oil release, the reasonableness of costs incurred to clean up the release, allocation of costs between parties at the site, and regulatory requirements for the cleanup.

Superfund
Minnesota Landfill RI/FS and Cleanups Pursuant to Administrative Orders
Was retained by a number of cities and counties to complete CERCLA compliant Remedial Investigation/Feasibility Study/Response Actions (RI/FS/RA) at their sanitary landfills to fulfill their assessment and cleanup obligations under administrative orders from the Minnesota Pollution Control Agency. Mr. Olson was the Project Manager and Senior Hydrogeologist on the projects, directing the work of his staff, authoring the various RI/FS/RA documents in accordance with USEPA requirements, and representing clients before regulatory bodies and the public.

Feasibility Study following CERCLA Guidance to Assess Remedial Options for a Chlorinated Solvent Release
Was retained by an industrial client to complete a CERCLA compliance FS to assess remedial options associated with a chlorinated solvent release to soil and groundwater at an operating facility. The FS was developed to identify the optimal response actions for regulatory agency review and approval, and to provide a framework for cost recovery discussions with former owners. Mr. Olson was the Senior Project Manager and one of the primary authors of the report on the project.

Expert Witness for Superfund Cost Recovery Actions

Mr. Olson has been retained on numerous occasions by legal counsel to represent their clients in cost recovery actions associated with the release of hazardous substances to the environment and the associated response costs to address the releases. Mr. Olson has rendered opinion and generated expert reports on NCP compliance issues associated with the cost recovery actions and the overall implementation of CERCLA compliance RI/FS/RA's. Mr. Olson has been deposed as an expert on numerous occasions and had testified at trial.

DEVELOPMENT

Cobalt Portfolio-Multi Site Due-Diligence Assessment

Terracon was retained to complete Phase I ESA's and Property Condition Assessments for 256 warehouse buildings across the US. The assessments were completed within the 45 day schedule for the project. Mr. Olson's role was to provide detailed QA/QC review of the projects completed in the Minnesota offices and to provide PM assistance and QA/QC consistency review for all 256 project sites. The project was completed on time and budget and the acquisition was completed.

Westminster Junction/Phalen Corridor Redevelopment, St. Paul, MN

Terracon was retained by the St. Paul Port Authority to assist with the redevelopment of a commercial/industrial/rail corridor in St. Paul. Mr. Olson was the QA/QC manager and completed the preparation of a Quality Assurance Project Plan (QAPP) and completed QA/QC on the Phase II Investigation Work Plans, Phase II Investigation Reports, Response Action/Construction Contingency Plans, implementation of RAP/CCPs and preparation of the final RAP/CCP Implementation Reports associated with the construction of Phases I – III of Phalen Boulevard and adjacent properties along the 3.5 mile corridor. The Westminster Junction/Phalen Boulevard project received a No Action Letter and Certificate of Completion on several of the adjacent properties. The project was awarded the Regional, National and People's Choice Phoenix Award for the top Brownfield redevelopment in the Country.

Gerald T. Hentges, P.G.

SENIOR HYDROLOGIST/SENIOR ASSOCIATE

PROFESSIONAL EXPERIENCE

Mr. Hentges is a senior project manager in the Des Moines, Iowa, office. His duties include managing projects for water supply, wetland mitigation, sanitary landfills, agricultural facilities and hazardous waste facilities. Mr. Hentges is a registered professional hydrogeologist with over 30 years of experience in the hydrological, hydrogeological and environmental engineering fields. He has been involved in all phases of hydrological and enivronmental engineering projects from preparation of proposals, project management, coordination of field and laboratory programs, data analysis and evaluation of subsurface conditions. He is also involved in the quality control of the services provided across the company by reviewing natural and cultural resources reports.

Mr. Hentges's technical expertise includes analyses skills for groundwater occurance and movement, surface and groundwater quality, surface water modeling for discharge and sediement transport and groundwater water modeling for flow and chemical fate and transport.

PROJECT EXPERIENCE

Environmental Assessments

His experience with environmental assessment projects includes primary management of major contracts for culture resources, wetland delineation, and mitigation, flood plain and stream channel restoration. His experience includes primary management of the Annual Wetland Monitoring Reports for the Iowa Department of transportation, Highway 63 wetland delineation and stream channel impact mitigation, Highway 71/Interstate 80 Interchange and 22 Bridge replacement projects. Mr. Hentges was responsible for conducting an environmental assessment on a major asphalt batch plant and quarry along the Avenue of the Saints in Mason City, Iowa. He conducted an environmental assessment on a major airport runway extension in Belle Plain, Iowa. He was senior project manager for the environmental assessment of the 480-acre Ames facility that houses the National Animal Disease Laboratory. The site is proposed to undergo extensive renovation and modernization. He manages NEPA projects on a nationwide basis for Terracon. His 30 years of environmental assessment and permitting experience has included roadway and bridge construction, commercial developments, manufacturing and distribution facilities, residential developments, utility structures, solid wastes disposal facilities, and communication towers.

WATER RESOURCES

Mr. Hentges was the senior hydrologist on the Hughes/Phillips and Rempe Reclamation abandoned strip mine projects, where groundwater flow from underground mines contributed significant amounts of acid mine drainage to the receiving surface water streams. His work included geophysical studies to determine the sources of groundwater flows from underground mine works. He developed a reclamation plan to create a 50-acre wetland to reduce impacts on local streams from spoils and underground mines in the area. Mr. Hentges has conducted several flood plain delineation, erosion and sediment transport control studies by modeling runoff and peak flows for major streams and drainage ways.

WETLAND MITIGATION

Mr. Hentges is responsible for managing wetland delineation and mitigation projects on a nationwide basis for Terracon. Mr. Hentges acts as primary coordinator for Terracon's statewide 404 Permitting for Wetland Delineation and Mitigation contract with the Iowa Department of Transportation. His wetland permitting experience has included large and small commercial developments and retail buildings, manufacturing and distribution facilities, roadway and bridge construction, residential developments, utility structures, solid wastes disposal facilities, and communication towers. His expertise in groundwater hydraulics and surface and groundwater modeling have led to effective programs for wetland management and design at many sites. Mr. Hentges' experience includes delineation and mitigation of wetland areas impacted by highway alignments, developments and recreational facilities in Kansas, Nebraska, Missouri, Texas, Georgia, Minnesota, Nebraska and Iowa. Mr. Hentges experience includes mitigation of wetland areas impacted by developments and agricultural practices in Minnesota, Nebraska and Iowa. He has written several wetland enhancement, creation and mitigation plans

EDUCATION

Post Graduate Work, Hydrology, 1983, University of Arizona

Bachelor of Science, Hydrology, 1983, University of Arizona

REGISTRATIONS

Professional Hydrogeologist: Arkansas

CERTIFICATIONS

40-Hour OSHA Hazardous Waste Operations Training

Wetland Delineation

CPR/First Aid Training

AFFILIATIONS

American Institute of Professional Geologists

National Water Well Association

Association of Groundwater Scientists and Engineers

American Water Works Association Iowa Groundwater

Iowa Groundwater Association

American Society Wetland Scientists and Engineers

WORK HISTORY

Terracon Consultants, Inc., Senior Associate, 2012-present

Terracon Consultants, Inc., Senior Project Manager, 1995-2012

Terracon Consultants, Inc., Project Manager, 1989-1995

James M. Montgomery Consulting Engineers, Inc., Project Hydrogeologist, 1983-1989

University of Arizona, Research Assistant, 1980-1983

WATER SUPPLY

Mr. Hentges was the senior hydrologist responsible for evaluation and assessment for well field expansion and water quality at Boone, Sergeant Bluff, Greenfield, Logan, Carlisle, Carroll and the Wappello Rural Water Districts South Skunk River well field in Iowa; Kahoka, Missouri; Eden Prairie, Bloomington and Mankato, Minnesota. Pesticide spill studies and the impact on public water supplies in Hospers, Iowa and Oxford Junction, Iowa. He conducted a study of the effects of logging and pulp mill effluent on the city well field in Marshfield, Wisconsin. Mr. Hentges has managed well field investigation projects including aquifer pumping test analyses and groundwater modeling to evaluate zone of influence, gradient control, and time of travel at over ten municipal and twenty industrial sites throughout Iowa and at ten municipal well fields in Missouri, Minnesota and Wisconsin. He has written several well field management plans as well as preparing vulnerability assessments at many of the sites. Mr. Hentges completed a wellhead protection area study under contract with the USEPA for the City of Eldora, Iowa.

GROUNDWATER ASSESSMENTS

Mr. Hentges' environmental experience includes Project manager for assessment and remediation plan for pesticide impact on public water supplies for the Farmers Coop elevator in Hospers and Oxford Junction, Iowa. He has investigated grain fumigant, fertilizer and pesticide spills and the impact on local water supplies.

He developed a regional groundwater flow and fate and transport model and designed a gradient control system to protect a municipal well field for the Minnesota Pollution Control Agency at the Long Prairie, Minnesota Super Fund site. Mr. Hentges' developed regional groundwater models used to design dewatering and flood protection drains and relief well fields along the Iowa River for the City of Coralville, Iowa and the University of Iowa in Iowa City. He has performed groundwater modeling as required using MODFLOW, MODPATH, MOC, MT3DMS and RT3D simulation programs to model groundwater flow and contaminant transport during assessments and remedial well design and operations. He has designed and managed several remedial cleanup projects that included aquifer pumping test analyses to evaluate zone of influence, gradient control and contaminant transport. His efforts in surface and groundwater modeling have led to effective programs for long term monitoring and management of remedial design implementation.

Mr. Hentges has successfully used aquifer pumping test data and MODFLOW to evaluate and design geothermal pumping and injection systems for the city of Marion, Iowa School district and the City of Cedar Rapids Library and Fire Station. He used the same regional model to conduct a well field evaluation and redesign in an alluvial and deep bedrock aquifer for the Cargill Corning Milling facility in Cedar Rapids, Iowa.

DEWATERING ASSESSMENTS

Mr. Hentges has been involved with all aspects of surface and groundwater control from assessment to system design. He is responsible for planning and conducting assessments and dewatering system designs at private and publicly owned facilities throughout Iowa, Nebraska, Minnesota and Wisconsin. He was involved with assessment, modeling and engineering design at many of the sites. Some of these sites include; the University of Iowa Power Plant, the University of Iowa Recreation and Wellness Center, the City of Coralville River Landing Development, the City of Coralville Theater, Mercy Hospital in Cedar Rapids, Iowa, Faith Regional Health Services in Norfolk, Nebraska, Novozymes Biotech Facility in Blair, Nebraska and Allen Hospital in Waterloo, Iowa. Mr. Hentges has developed groundwater modeling studies with MODFLOW to assess the impact of shallow and deep drains and extraction wells for several clients including the University of Iowa Children's Hospital Iowa City. These plans included extraction system design and component specifications. He has conducted long-term, site-specific field assessments with groundwater modeling to evaluate the extractable volume of groundwater under normal and flooding conditions for relief well systems along levees for the city of Des Moines, Coralville and Iowa City, Iowa. Mr. Hentges provided a MODFLOW dewatering design for a half mile section of a deep interceptor sewer line constructed with tunneling machine 120 feet below the ground surface in Davenport, Iowa.

MANUFACTURED GAS PLANTS

He was the project manager for an assessment of impacted groundwater from buried gasometer/residues and light non-aqueous phase liquid impacts at two coal tar sites. Mr. Hentges subsequently provided remedial investigation and mitigation services to the Cities of Newton and Davenport, Iowa during remedial activities at former manufactured gas plant sites. He represented the client in on-site observation/documentation of gasometer remedial activities, groundwater treatment design, evaluation and consultation relative to a removal action (RA) of the gasometer and cost estimation relative to negotiating joint technical and financial responsibility for the project.

INDUSTRIAL SITES

Mr. Hentges has been the project manager for several industrial sites where he planned and implemented investigations, assessments and remedial designs including the Naval Ordinance Facility and Whitaker Solvent cleanups in Fridley, Minnesota; the John Deere Moline Plow Works in Rock Island, Illinois; the J.I. Case Plant in Burlington, Iowa; Firestone Tire and Rubber Company, Parr Manufacturing and Gates Rubber Company in Des Moines, Iowa and several others. Mr. Hentges managed a multi-year lead assessment and remediation at the former Des Moines Ordinance Plant (DMOP) in Ankeny, Iowa. Several lead and PAH disposal areas were evaluated and cleaned up using innovative techniques that treated hazardous lead levels in place in the site soil and groundwater.

PUBLIC HEARINGS AND EXPERT TESTIMONY

Mr. Hentges has assisted several sanitary landfills and agricultural clients with local zoning approval and the technical submittals required by the regulatory agencies. He has successfully represented clients at several public meetings and informational hearings regarding permit issues, livestock facility siting and asphalt batch plant operations. He has performed expert witness services on ten litigation projects covering livestock facilities, landfills, chemical plants and water resource issues.

SOLID WASTE OPERATIONS

Mr. Hentges has been involved with all aspects of solid waste operations from permit application through hydrogeological assessment to site closure. He is responsible for planning and conducting hydrogeological assessments at over 20 private and publicly owned solid waste facilities throughout Iowa, and at 16 sites in Nebraska, Minnesota and Wisconsin. He was involved with engineering design, expansion design, permit renewals, groundwater monitoring plans, soils waste comprehensive planning, and has prepared closure and post-closure plans at many of the sites. Some of these sites include; Fayette County, Buchanan County, Hamilton County, North Dallas, Wright County, Montgomery County, Mills County, Polk County, Mahaska County, Story County, Madison County, ADM (Clinton, Iowa) and Hamilton County sanitary landfills. Mr. Hentges has developed leachate control plans for several Iowa sanitary landfills. These plans included chemical characterization, extraction system design, treatment and disposal. He has conducted long-term, site-specific field assessments to evaluate the extractable volume of leachate. Mr. Hentges was formerly on the technical advisory and legislative rules committee for the Iowa Society of Solid Waste Operations for the Solid Waste Association of North America (SWANA).

PUBLICATIONS

Hentges, Gerald T., F. Thies, T.S. Lemar, A Case History: The Use of an Uncovered Windrow Compost Facility as a Bioreactor for Municipal Solid Waste Landfill Leachate (17th Annual International Madison Waste Conference, Municipal and Industrial Waste, University of Wisconsin, Madison, Wis., Sept. 21-22, 1994).

Hentges, Gerald T., F. Thies, T.S. Lemar, Leachate Extraction Well Assessments, Des Moines Metropolitan Park East and Hamilton County Sanitary Landfill (16th Annual International Madison Waste Conference, Municipal and Industrial Waste, University of Wisconsin, Madison, Wis., Sept. 22-23, 1993).

Hentges, Gerald T., F. Thies, T.S. Lemar, Leachate Extraction Well Assessment, Des Moines Metropolitan Solid Waste Agency, Des Moines Metro Park East Sanitary Landfill, Des Moines, Iowa (12th Annual Conference of The Solid Waste Association of North America/Iowa Society of Solid Waste Operations Chapter, Sept. 16-18, 1992).

Benjamin J. Berthiaume

ENVIRONMENTAL FIELD SCIENTIST

PROFESSIONAL EXPERIENCE

Benjamin Berthiaume is an Environmental Field Scientist in Terracon's White Bear Lake, Minnesota office. Mr. Berthiaume responsibilities include field assignments, sampling, data collection and reporting. His principle assignments include collection and monitoring of ground water, soil and air samples, drilling oversight, operation of remedial systems, and data evaluation.

Mr. Berthiaume assisted in the collection of soil samples, rock coring, installation of monitoring wells, piezometers, grounting and abandonment of borings. This involved communicating with engineers, clients, utility locators and property managers to carry out jobs in their appropriate and requested manner.

PROJECT EXPERIENCE

Midway Stadium – St. Paul, Minnesota

Participated in construction oversight at the former Midway Stadium site in St. Paul, Minnesota. Oversaw soil excavation and the installation of a vapor extraction system (VES) and sub-slab depressurization (SSD) system. Coordinated off-site soil disposal and on-site reuse. Performed post-excavation monitoring of the VES and SSD systems.

Former Red & White Service Station – Brook Park, Minnesota

Performed pre-demolition asbestos sampling of an apartment structure and participated in construction oversight including demolition and soil excavation. Coordinated off-site soil disposal and on-site reuse. Collected post-excavation soil and groundwater samples to assess residual subsurface contamination and oversaw boring abandonment.

Minneapolis Corridor Sites – Minneapolis, Minnesota

Completed Phase I and Phase II Environmental Site Assessments for several corridor sites in Minneapolis, Minnesota. Conducted file reviews for adjoining sites of environmental concern, assisted in determining boring locations for Phase II assessment, and assisted in preparing response action plans. Provided oversight and collected soil samples for over 40 soil borings at various corridor sites. Assisted in coordinating scheduling and utility clearance.

Long Prairie Groundwater Contamination Site – Long Prairie, Minnesota

Performed monitoring and maintenance on the granular activated carbon groundwater treatment system and the soil vapor extraction system including collecting water and soil vapor samples. Installed and sampled several sub-slab vapor points.

Minneapolis International Airport – Minneapolis, Minnesota*

Assisted in drilling soils using both solid-stem and hollow-stem augers as well as mud rotary. Collected soil samples using split spoon sampling techniques and logged soil types, inclusions, moisture content, color, blow counts and noted fill. Assisted in limestone, sandstone and shale rock coring activities including collecting rock samples and logging rock types, bit and water pressure, rate of advancement and water return. Coordinated day-to-day activities with airport personnel, utility locators and engineers.

Northern Tier Energy Refinery – St. Paul Park, Minnesota*

Assisted in the subsurface exploration of areas near a sludge pond in the NTE St. Paul Park Refinery. Noted contaminated soils and groundwater and complied with Minnesota Polution Controll Agency and refinery standards to avoid cross-contamination of drilling equipment and proper sealing techniques, including proper grouting of boreholes.

Hwy 35W – Roseville and Lino Lakes, Minnesota*

Assisted in drilling and collecting soils from over 200 boreholes along the inside and outside shoulders as well as enter and exit ramps on Hwy 35W. Coordinated with engineers and Safety Signs personnel to ensure safe working conditions.

EDUCATION

Bachelor of Science
Environmental Studies
Saint John's University
2014

CERTIFICATIONS

40-Hour HAZWOPER
Minnesota and Wisconsin Certified Asbestos Inspector

WORK HISTORY

Terracon Consultants, Inc.
Environmental Field Scientist
2016 - Present

Braun Intertec Corporation
St. Paul, Minnesota
Drilling Assistant
2014 - 2016

Minnesota Department of Natural Resources
St. Paul, Minnesota
Watercraft Inspection Intern
2012

* Work performed prior to joining Terracon

Josephine Hartung

FIELD ENVIRONMENTAL SCIENTIST

PROFESSIONAL EXPERIENCE

Ms. Hartung is a Field Environmental Scientist at Terracon's White Bear Lake, Minnesota office. Ms. Hartung has a bachelor's degree in Environmental Science with five years of professional environmental consulting experience. She has conducted Phase I Environmental Site Assessments in the Upper-Midwest. She has assisted in the preparation of National Environmental Policy Act (NEPA), the completion of Phase II Environmental Site Assessments, and field remediation oversight. She has diverse experience in conducting field surveys including wetland delineations, cultural resource, avian, bat, vegetation and baseline noise surveys.

PROJECT EXPERIENCE

Mississippi and University – St. Paul, Minnesota (February 2016 – Present)

Assisted in conducting an asbestos and hazardous materials survey on two buildings; a former restaurant and a former metal recovery facility. Work tasks included the collection of samples from potential asbestos containing materials, potential lead based paint and taking inventory of other regulated wastes (i.e. fluorescent light bulbs, ballasts, mercury switches, caulking, refrigerant, etc.).

Former Kettle River Company Creosote Plant – Sandstone, Minnesota (October 2015 – Present)

The project site is a State of Minnesota superfund site and the client is the Minnesota Department of Agriculture. Ms. Hartung has conducted additional sampling and site investigation activities since 2015 related to further defining the extent of impacted groundwater, soil, sediment, soil-gas and ambient air associated with the former creosote plant. The project involves routine groundwater monitoring at 22 monitoring wells, 10 potable wells, and along an adjacent creek. Soil sampling and investigation activities were conducted at the former plant site, properties located adjacent to the former plant site, and at properties along a creek down-gradient of the former plant site.

Red Wing Mall – Red Wing, Minnesota (March 2017)

Assisted in conducting an asbestos and hazardous materials survey on two tenant spaces within an existing strip mall; a former office max and existing dance studio. Work tasks included the collection of samples from potential asbestos containing materials, and taking inventory of other regulated wastes (i.e. fluorescent light bulbs, ballasts, mercury switches, caulking, refrigerant, etc.).

Midway Stadium – St. Paul, Minnesota (May 2016 – January 2017)

Performed oversight and documentation of response actions performed during the redevelopment of the former Midway Stadium site in St. Paul, Minnesota, the former State Fair Dump. Oversaw soil excavation, processing and overall management (i.e. off-site disposal and on-site reuse) along with overseeing and documenting the installation of a soil venting system and an active sub-slab vapor mitigation system. Contamination consisted of buried debris (i.e. wood, concrete, metal, bricks, animal waste, etc.), petroleum contaminated soils, soils contaminated with non-petroleum compounds, VOC vapors and methane.

Minnesota DOT Trunk Highway 48 – Hinckley, Minnesota (September – October 2016)

Responsibilities included the field oversight of boring installation and soil sampling performed in an effort to identify soil contamination that may be present and require management during the completion pavement rehabilitation, guardrail replacement and traffic signal upgrades near the intersection of Trunk Highway 48 and Interstate 35 in Hinckley, Minnesota. Responsibilities also included the organization of data and preparation of a final report summarizing the investigation results.

EDUCATION

Bachelor of Science
Environmental Science
Mankato State University
2011

CERTIFICATIONS

40-Hour HAZWOPER
Minnesota and Wisconsin Certified Asbestos Inspector

WORK HISTORY

Terracon Consultants, Inc.
Field Environmental Scientist
2015 - Present

Tetra Tech, Inc.
Environmental Scientist
2013 - 2015

Mankato State University
Wildlife Technician
Fall 2012

United States Geological Survey
Biological Science Technician
Spring – Summer 2012

Josephine Hartung (continued)

Former Automotive Service Center – White Bear Lake, Minnesota (December 2015 – August 2016)
Provided oversight of response actions completed during redevelopment of the site. Response actions included oversight and documentation of the excavation and removal of petroleum contaminated soils, asbestos contaminated soils, petroleum product and miscellaneous debris. Responsibilities included on-site oversight/documentation, confirmation soil sample collection, communication and coordination with the contractor performing the work and reporting back to the project manager.

PRIOR EXPERIENCE

Natural Resources – Stutsman County, North Dakota (2013 – 2015)
Ms. Hartung conducted desktop analysis, spring avian point county surveys, aerial raptor nest surveys, raptor habitat and nest surveys, eagle use surveys, bat acoustic surveys, wetland surveys, tree surveys and cultural resource surveys. Ms. Hartung was responsible for the direction and data collection for all avian surveys of the project. Ms. Hartung has exceptional experience utilizing field equipment including: binoculars, hand held GPS units, range finder, wind gauges, and acoustic equipment.

Cultural Resources – Stark County, North Dakota (2014 – 2015)
Ms. Hartung served as a field crew member for the Phase II Archaeological Investigation for the proposed Dickinson Wind Farm in western North Dakota. The total area surveyed for the project was 3,047 acres. During this investigation, Ms. Hartung documented archaeological resources ranging from Euro-American artifact scatters to Native American lithic sites.

Wetland Delineations – Holt County, Nebraska (2014 – 2015)
Ms. Hartung acted as field scientist on the wetland survey team for the proposed 400 MW Wind Park in northeastern Nebraska. The total area surveyed for the project was 5,334 acres (8.3 square miles). Tasks included wetland delineations using the United States Army Corps of Engineers 1987 Wetlands Delineation Manual and regional supplements, using hand-held GPS, completing field data sheets, soil probing and analysis for hydric conditions.

Samuel C. Wahl

FIELD ENVIRONMENTAL SCIENTIST

PROFESSIONAL EXPERIENCE

Mr. Wahl is currently employed as an Environmental Field Scientist in Terracon's White Bear Lake, Minnesota office. His responsibilities include environmental assessment, sampling, data reduction, and reporting services. His project involvement includes various field activities such as soil gas monitoring and sampling, groundwater monitoring and sampling, indoor, outdoor air sampling, drilling oversight, remediation system operation and maintenance (O&M), data evaluation for reports, and report writing.

Mr. Wahl previously served as a Construction Services Technician in Terracon's White Bear Lake, Minnesota office. His responsibilities included fieldwork for the construction materials engineering and testing service line. Project involvement included field and laboratory testing of construction materials and field observation of shallow foundations; deep foundations; soil fill; concrete placement; asphalt pavement; reinforcing steel and masonry

EDUCATION

Bachelor of Science
University of Wisconsin – Stout
Wisconsin, 2014

CERTIFICATIONS

40-Hour HAZWOPER
8 Hour Refresher

DOT Radiation
CPR/First Aid/AED Certification

WORK HISTORY

Terracon Consultants, Inc.
Environmental Field Scientist
2015 - Present

Terracon Consultants, Inc.
Construction Materials Technician
2014 - 2015

Hayden's Ridge Tree Service
Arborist
2013 - 2014

University of WI – Stout
Research Assistant
2012 - 2013

PROJECT EXPERIENCE

Multi-Site Petroleum Vapor Investigations

Coordinated Site access for drilling and vapor sampling activities for petroleum leak sites. Site activites includeded soil and groundwater sampling to investigate present day Site conditions, and post-run tubing vapor sample collection for assessment of nearby vapor receptors. Vapor receptors in nearby exposure areas were assessed for building construction methods and further vapor pathway exposures. Data collected from the sampling was used to provide reports to the MPCA.

Chlorinated Solvent Vapor Remediation Sites

Completed site visits where active soil vapor extraction systems were present (Littlefork, Long Prairie, and Rochester Minnesota). The site visits included pressure and vaccum data collection to monitor the system effectiveness, analytical sampling to determine compliance with NPDES permit requirements, and system maintenance. Data was entered into long term monitoring tables to analyze the systems effectiveness for it's designed pressure field extension.

Groundwater Treatment System Remediation Sites

Completed site visits where active groundwater treatment systems were present (Long Prairie, Lake Elmo, Rochester, and Winona Minnesota). The site visits included system condition monitoring (pH, ORP, DO) in various stages of the treatment propcess to monitor the system effectiveness. Analytical samples were collected to determine compliance with NPDES permit requirements. System maintenance was completed regularly during these visits to keep the systems operating efficiently. Data was entered into long term monitoring tables to analyze the systems effectiveness for it's designed treatment plan.

State Superfund Site – Long Prairie Groundwater Contamination Site – Long Prairie, Minnesota

As an environmental field scientist, coordinated O&M site visits to collect data from a granular activated carbon (GAC) groundwater treatment system and SVE system located at the site. Performed subcontractor oversight of push-probe advancement, oversight of remedial well rehabilitation to clean well screens of scale and bio-growth, collecting groundwater samples from the various monitoring wells located onsite, and collecting sub-slab vapor samples from surrounding area for vapor intrusion assessment (VIA). Analyze and evaluate data for report preparation.

Paynesville Municipal Water Supply – MPCA, Paynesville, Minnesota

Collected fluid levels and calculate groundwater elevations, collect groundwater samples, preform O&M activites on a pump and treat system, and recover free phase petroluem from monitoring wells that contain light non-aqueous phase liquid (LNAPL). Input data into an excel speadsheet for report preparation.

State Superfund Site – Esko Groundwater Contamination Site – Esko, Minnesota

Collected fluid levels and calculated groundwater elevations, collected groundwater samples, surveyed ground elevation, installed monitoring wells near the midway river to assess the extent of the contamination plume, and collected potable well samples from the communtity to monitor the status of their drinking water.

Sameul Wahl (continued)

State Superfund Site – Baytown Township Contamination Site - Lake Elmo, Minnesota
Collected fluid levels and calculate groundwater elevations, collect groundwater samples with multiple parameters, and collect soil-gas samples in the Bayport area for VIA. Compile data into to Equis Edge database as well as analyze and evaluate data for report preparation.

State Superfund Site – Littlefork Groundwater Contamination Site –Littlefork, Minnesota
Collected fluid levels and calculate groundwater elevations, collect groundwater samples and collect soil-gas samples, preformed oversight on sub-slab depressurization systems, and conducted O&M on soil vapor extraction systems. Analyze and evaluate data for report preparation.

Former Kettle River Company Creosote Plant - Sandstone, Minnesota
Collect***ed*** fluid levels and calculate groundwater elevations, collect groundwater samples from monitoring wells, collect surface water samples from Skunk Creek, and input data collected from the lab into an excel spreadsheet for report preparation.

David E. Liddell

FIELD ENVIRONMENTAL ENGINEER

PROFESSIONAL EXPERIENCE

David Liddell is a Field Environmental Engineer in Terracon's White Bear Lake, Minnesota, office. Mr. Liddell's responsibilities include field assignments, sampling, data collection and reporting. His principle assignments include collection and monitoring of ground water, soil and air samples, drilling oversight, operation of remedial systems, and data evaluation. Data collected and analyzed by Mr. Liddell will be used to create project reports.

Mr. Liddell has also worked at Saint Anthony Falls Laboratory on the University of Minnesota campus as a laboratory and field technician. There he helped in the research of removal techniques of phosphorus in stormwater runoff as well as other urban hydrologic and environmental projects.

PROJECT EXPERIENCE

Stormwater Runoff Filter – Prior Lake, Minnesota*

Mr. Liddell was responsible for collecting, processing and analyzing water samples taken from ISCO water samplers. His other responsibilities included observation and maintenance of the site and other sites located throughout the greater metro area, data analysis and future project advice. Water samples were analyzed for dissolved reactive phosphorus and total phosphorus using spectrophotometry.

Roadside Swale Infiltration – Twin Cities, Minnesota*

As a field technician, Mr. Liddell estimated the amount of water that a swale or roadside ditch is able to infiltrate during a rainfall event. He helped run experiments consisting of simulating surface runoff from the road into a swale and determining total runoff versus total infiltration. The model included measured variables such as side slope of swale, initial moisture content of soil, soil type and composition, vegetation coverage and intensity of flow.

Chlorinated Solvent Vapor Remediation Sites - (Long Prairie and Littlefork Minnesota)

Performed vapor sampling activities and operation and maintenance activities on multiple soil vapor extraction systems. Completed soil gas monitoring point instillation and sampling events around the areas of concern. Assisted in data collection and entry, documentation and preparation of reports. Oversaw the instillation of a soil vapor extraction system containing eight vapor extraction points (Littlefork).

Groundwater Treatment System Remediation Sites – (Long Prairie Minnesota and Baytown Supefund Site)

Conducted operation and maintenance activities on groundwater treatment systems. Operation and maintenance activities included: collection of water parameters, recording of systems readings, cleaning of system and equipment. Performed groundwater sampling events. Water levels and water parameters were collected with each sampling event. Aided in data collection and entry, documentation and preparation of reports.

In-Situ Groundwater Remediation Oversight - (Baytown Superfund Site)

Oversaw the in-situ groundwater treatment injection of emulsified vegetable oil into various depths of the soil profile. Provided on-site calculations for solution mix design concentrations and volume totals based on remediation design plans.

Excavation Oversight – (Minneapolis)

Provided oversight for the removal of contaminated soils during roadway reconstruction. Took analytical samples and screened soils that were removed from the site. Characteristics, depths and volumes were recorded during oversight.

EDUCATION

Bachelor of Science
Civil Engineering
University of Minnesota Twin Cities
2015

CERTIFICATIONS

40-Hour HAZWOPER

REGISTRATIONS

Fundamentals of Engineering – Civil
NCEES ID 16-884-52

WORK HISTORY

Terracon Consultants, Inc.
Field Environmental Engineer
2016 - Present

Saint Anthony Falls Laboratory
University of Minnesota Twin Cities
Laboratory and Field Technician
2013 - 2016

David Liddell (continued)

Soil Vapor Mitigation Systems – (Long Prairie and Minneapolis, Minnesota)
Oversaw the instillation of a soil vapor extraction system at a residential and commercial properties. Performed checks to assure system followed Minnesota Pollution Control Agency standard's. Collected vacuum, pressure and ambient air readings before, during and after instillation.

Spill Prevention, Control and Countermeasure Plan – (Eden Prairie, Minnesota)
Assisted in writing a Spill Prevention, Control and Countermeasure plan for a business in Eden Prairie, Minnesota. The plan included details on discharge prevention measures, potential discharge volumes, direction of flow, containment or diversionary structures, inspections, training, security, response actions and requirements.

EDUCATIONAL EXPERIENCE

Stormwater Treatment
Assisted in collecting, processing and analyzing of phosphorus in stormwater runoff samples at the University of Minnesota, Twin Cities. Studied effects of oxygen concentration in water correlating to phosphorus release. Responsible for cleaning and maintaining a safe chemical laboratory and equipment.

Filter Design
Aided in the design of hydraulics of a stormwater filter using HydroCAD at the University of Minnesota. The filter was designed to both reach peak flow and drain quickly so that water did not overflow the filter, accumulate, or become stagnant at the end of a rainfall event.

* Work performed prior to joining Terracon

Michael D. Potts

ENVIRONMENTAL FIELD SCIENTIST

PROFESSIONAL EXPERIENCE

Mr. Potts is an Environmental Field Scientist in Terracon's White Bear Lake, Minnesota office. His responsibilities include field assignments, data collection and reporting, and environmental assessments. His primary duties include collection and anlaysis of groundwater, soil and subsurface air samples; completion of site assessments including soil boring and monitoring well installation oversight; data entry and quality review; and report preparation.

Mr. Potts has completed analytical sample collections for soil, groundwater, surface water, soil vapor, indoor air, and sub-slab vapor. Mr. Potts has conducted environmental field oversight tasks such as monitoring well construction, soil excavation, soil injection treatment, and vapor barrier installation.

PROJECT EXPERIENCE

Multi-Site Petroleum Vapor Investigations

Coordinated Site access for drilling and vapor sampling activities for over 70 petroleum leak sites beginning in 2015. Site activites includeded soil and groundwater sampling to investigate present day Site conditions, and post-run tubing vapor sample collection for assessment of nearby vapor receptors. Vapor receptors in nearby exposure areas were assessed for building construction methods and further vapor pathway exposures. Data collected from the sampling was used to provide reports to the MPCA.

Chlorinated Solvent Vapor Remediation Sites

Completed site visits where active soil vapor extraction systems were present (Littlefork, Long Prairie, and Rochester Minnesota). The site visits included pressure and vaccum data collection to monitor the system effectiveness, analytical sampling to determine compliance with NPDES permit requirements, and system maintenance. Data was entered into long term monitoring tables to analyze the systems effectiveness for it's designed pressure field extension.

Groundwater Treatment System Remediation Sites

Completed site visits where active groundwater treatment systems were present (Long Prairie, Lake Elmo, Rochester, and Winona Minnesota). The site visits included system condition monitoring (pH, ORP, DO) in various stages of the treatment propcess to monitor the system effectiveness. Analytical samples were collected to determine compliance with NPDES permit requirements. System maintenance was completed regularly during these visits to keep the systems operating efficiently. Data was entered into long term monitoring tables to analyze the systems effectiveness for it's designed treatment plan.

In-Situ Groundwater Remediation Oversight- (Baytown Superfund Site)

Provided contractor oversight during the in-situ groundwater treatment injection of emulsified vegetable oil into various depths of the soil profile. Provided on-site calculations for solution mix design concentrations and volume totals based on remediation design plans.

Excavation Oversight- (Brainerd Foundry, Kettle River Creosote, Keewatin Petroleum)

Provided contractor oversight during the removal of contaminated soils. Soil samples removed from the excavation areas was screened and separated depending on the removal parameters. Locations and depths of soils removed was documented during the excavation activities. Analytical samples were collected during excavation activities to verify removed soil contents or document remaining soil conditions.

Nitrogen Impacted Soil Screening (Hallock, Welcome, MN Fertilizer Plants)

Submitted soil samples for Nitrogen content analysis at two active fertilizer plants (Hallock, MN and Welcome, MN). The samples were collected from various depths and near areas with potential soil disturbance for infrastructure improvements. A soil management plan was drafted based off of the sampling results.

Fish Hatchery Dump Site- St. Paul, MN

EDUCATION

Bachelor of Science, Biology
Minnesota State University-Mankato
2008

CERTIFICATIONS

40-Hour OSHA HAZWOPER

WORK HISTORY

Terracon Consultants, Inc.
Environmental Field Scientist
2012 - Present

Pace Analytical/3M Physical Properties Technician
2011 – 2012
Drug Manufacturing Technician
2010 – 2011

Minnesota State University-Mankato
Lab Assistant
2008

Michael Potts (continued)

Collected groundwater, surface water, and sediment samples from the Site known as the Fish Hatchery Dump Site. Samples collected were analyzed for VOC's, PAH's, Pesticides, TSS, TDS, RCRA Metals, and Sulfates. Other field parameters analyzed during field activities included turbidity, ORP, pH, DO, and methane monitoring.

Hmong American Shopping Center - Brooklyn Park, MN

Involved in multiple field sampling and observation events since 2012. Field activities have included; vapor monitoring point installation and sampling, monitoring well sampling, monitoring well installation, residential building sub-slab sampling and building survey completion, groundwater elevation surveying, and roto-sonic drilling oversight.

Long Prairie Superfund Site – Long Prairie, MN

Involved in multiple field sampling, observation and report writing events since 2012. Activities have included; vapor monitoring point installation and sampling, monitoring well sampling, monitoring well installation, sub-slab sampling and building survey completion, groundwater elevation surveying, soil vapor extraction system monitoring, and groundwater treatment system monitoring.

Littlfork Superfund Site – Littlefork, MN

Involved in multiple field sampling, observation and report writing events since 2013. Activities have included; vapor monitoring point installation and sampling, monitoring well sampling, monitoring well installation, sub-slab sampling and building survey completion, groundwater elevation surveying, soil vapor extraction system monitoring, and pilot testing residential vapor mitigation systems.

Curtis L. Pranger

PROJECT ENVIRONMENTAL ENGINEER

PROFESSIONAL EXPERIENCE

Mr. Pranger is a Project Environmental Engineer in Terracon's White Bear Lake, Minnesota office. His responsibilities include environmental assessment, sampling, and reporting services. His project involvement includes drilling oversight using push probe, hollow stem auger, rotosonic, etc., remedial action including excavation oversight, utility replacement, remedial system installation, monitoring well installation oversight, groundwater elevation monitoring, surveying, soil gas, indoor air, soil, groundwater sampling, and remediation system operation and maintenance for various environmental systems. His duties also include analyzing data and the preparation of reports such as Phase I and Phase II Environmental Site Assessments, Limited Site Investigations, Focused Investigations, Remedial Investigations, Remedial Action, Construction Specification, Corrective Action Design, and Annual Monitoring Reports for environmental projects. His duties also include project management involving the preparation of proposals, work plans, reports. He regularly contacts state regulatory agents, county officials, city officials, public entities and privately owned client contacts.

Mr. Pranger was previously employed as a Field Technician and Environmental Analyst at DPRA Inc. in St Paul, Minnesota. Responsibilities included hazardous material surveys, asbestos containing material surveys, remedial and investigative services, excavation oversight, underground storage tank removal oversight, ASTM and AAI compliant Phase I Environmental Site Assessments, reviewing financial assurance cost estimates prepared by RCRA on behalf of the Environmental Protection Agency. He also assisted in regulatory impact analysis for USEPA's 2008 final rule amendments to the industrial recycling exclusions of the RCRA definition of solid waste, compliance inspections of underground storage tank systems throughout the southwest United States, and calculating air emissions for air permits.

PROJECT EXPERIENCE

Former Foley Bulk Site – Foley, Minnesota (2013 – 2014)
Conduct Subsurface Investigations, Pre-Demolition Inspection, Abatement and Remediation at a petroleum and hazardous substance impacted property. Numerous soil borings were advanced at the site to analyze samples for associated chemicals of concern in soil and groundwater. A Corrective Action Design Plan was completed to detail how the identified petroleum impacted soil would be managed. Pre-demolition inspections of site building identified asbestos containing materials requiring abatement prior to building demolition. Project management activities included coordinating with abatement contractors, landfills, general contractors, property owners, city officials and regulatory officials.

Able Property Management – Fridley, MInnesota (2013 – 2014)
Perfomed site assessment, site investigation, and vapor intrusion activities. Fulfilled duties as the Resident Project Representative during remedial actions involving field observation of vacuum dewatering, on-site water treatment, excavation of petroleum impacted soil, took continuous air samples to protect public health, water main replacement, sanitary sewer replacement, and site restoration.

Rochester Superfund Site – Rochester, Minnesota (2010 – Present)
Performed operation and maintenance site visits for a Soil Vapor Extraction System. Conducted groundwater monitoring, vapor intrusion assessment, and source area assessment activities including coordination with property owners and tenants in conjunction with indoor air sampling.

Winona Superfund Site – Winona, Minnesota (2010 – Present)
Performed operation and maintenance site visits for a combined air stripper / granular activated carbon groundwater treatment system. Conduct groundwater monitoring, vapor intrusion assessment, and source area assessment activities. Source area assessment activities

EDUCATION

Bachelor of Science
Environmental Engineering
2005

Michigan Technological
University-Houghton, Michigan

CERTIFICATIONS

40-Hour HAZWOPER
Asbestos Inspector
Minnesota
Wisconsin

WORK HISTORY

Terracon Consultants Inc.
Project Environmental Engineer
2010 - Present

DPRA, Inc.
Field Technician/Environmental Analyst
2006 - 2010

included the completion of a passive soil gas assessment using diffusion samplers, the advancement of soil and groundwater borings, and installation of sub-slab soil-gas monitoring points. Initiation of a soil vapor extraction venting system with coordination of subcontractors to install electrical lines and timer on the extraction system.

Littlefork Groundwater Contamination Site – Littlefork, Minnesota (2010 – 2014)
Conducted remedial investigation activities to assess potential source areas and plume extents of tetrachloroethylene groundwater contamination. Conducted a soil vapor screening survey with GoreSorbers to assess the condition of soil-gas within the soil throughout the site. Prepared specifications for a trailer mounted Soil Vapor Extraction System including sub-contractor communication. Activities also included coordination with city officials in conjunction with installation of the Soil Vapor Extraction system, operation and maintenance activities and quarterly monitoring.

UST Compliance Inspections – Washington, D.C. and Virginia (2007 – 2008)
Conducted compliance inspections of underground storage tanks systems. This included visiting facilities to evaluate compliance with state and federal underground storage tank requirements. Reviewed compliance with tank installation, operation, and recordkeeping, inspected tank components, dispensers, and leak detection systems. Assisted in preparation of site specific compliance report summarizing the findings, identified non-compliant issues and suggested best management practices to remain compliant.

ATS Steel Site - Arden Hills, Minnesota (2006 – 2007)
Provided oversight for the excavation of approximately 50,000 cubic yards of contaminated media, marked extent of contamination with GPS coordinates, took confirmation samples, managed disposal of waste through waste manifests,
assured trucks were in compliance with hauling requirements, handled unanticipated drum removal, worked on implementation report for the response action plan.

Multiple Projects - Minnesota
Performed hazardous material surveys identifying the extent and location of hazardous materials including the use of identification equipment and sample collection devices. Performed asbestos containing material surveys identifying asbestos containing materials, mapping locations and extent of contamination, sampling homogenous materials, preparing and shipping samples and writing reports on findings. Provided oversight for underground storage tank removal including filling out proper removal forms, soil and groundwater sampling, site map sketches, and writing reports on findings.

Multiple Projects - Minnesota, Wisconsin, North and South Dakota
Provided remedial and investigative services including subsurface drilling, sampling soil, groundwater, indoor air and soil vapor to determine magnitude and extent of contamination, identifying vapor and groundwater receptors, using monitoring equipment to monitor wells and remediation systems, operation and maintenance of remedial systems, sample collection of soil, groundwater, sludge, surface water, indoor air and soil gas vapor, use of laser induced fluorescence technologies to identify extent of contamination, subsurface magnetic location of underground storage tanks and submitting reports to appropriate state agencies.

Provided excavation oversight for long term excavations including the management of segregation, stockpiling, hauling contaminated media, waste manifest management, progress reports, pedestrian access, and contamination containment on site, pre-marking sampling locations, soil screening, soil and groundwater sampling.

Michael J. Keys

CIVIL / ENVIRONMENTAL ENGINEER / CAD DESIGN ENGINEER

PROFESSIONAL EXPERIENCE

Mr. Keys serves as a project engineer with Terracon Consultants, Inc. in Minneapolis, Minnesota.

PROJECT EXPERIENCE

MUNICIPAL SOLID WASTE LANDFILL DESIGN, CONSTRUCTION AND RE-PERMITTING

Manage landfill projects involving liner and cover system designs, operations, cost estimation, financial assurance, preparation of specifications, contract administration, and construction observation and QA/QC. Manage closure of landfill projects including final cover system design, surface water management and landfill gas control systems. Works to implement on-site and off-site leachate treatment alternatives for landfills. Use of the Hydrogeologic Evaluation of Landfill Performance (HELP) model in evaluating the leachate generation potential at proposed and existing landfills. Works on passive and active landfill gas extraction system design and evaluation.

WASTEWATER TREATMENT FACILITY DESIGN

Served as design engineer for wastewater treatment facilities for industrial and municipal systems. Provides detailed design of sewers, pretreatment, secondary and tertiary treatment facilities. Responsible for development of contract drawings for wastewater treatment facilities via AutoCAD. Prepares detailed specifications for wastewater structures, equipment, buildings construction requirements.

CITY CONSTRUCTION AND INSPECTION

Served as Project Engineer for municipal construction projects including the construction of streets, sewers, and water service systems. Provided construction inspection on multiple city construction projects.

SURVEYING

Performed calculations for land surveys, platting, and field staking on construction projects. Performed field work for land surveys, design surveys, construction staking and landfill slope staking.

COMPUTER AIDED DESIGN

Extensive experience with AutoCAD and Autodesk Civil 3D computer drafting. Some of the computer design and analysis modules include Coordinate Geometry (COGO), Digital Terrain Modeling, Earthworks, Surveying and Pipe Network.

MONITORING AND WATER WELL DESIGN

Nearly 18 years' experience in the installation, development and repair of monitoring, commercial and municipal water wells. Working for a water well company has given him hands-on experience in the day-to-day operations of a company and in the management of a variety of engineering projects.

REMEDIATION SYSTEM DESIGN AND IMPLEMENTATION

Works on a variety of ground water and soil remediation projects ranging from the remediation of underground tank spill sites to the remediation at numerous industrial sites. These projects have included the evaluation of remedial alternatives, final design of remediation systems, construction administration and operations and maintenance of remediation systems.

EDUCATION

Bachelor of Civil Engineering
Emphasis in Environmental and Water Resource Engineering
University of Minnesota
1985

Bachelor of Arts
Business Administration
University of St. Thomas
1976

CERTIFICATIONS

Nuclear Moisture Density Gauge/ Troxler Certified

Certification in Geosynthetic Materials Installation Inspection – Level II, National Institute for Certification in Engineering Technologies (NICET)

AFFILIATIONS

National Institute for Certification of Engineering Technicians (NICET)

WORK HISTORY

Terracon Consultants, Inc.
Civil/Environmental Engineer
2013-Present

Liesch Associates, Inc.,
Civil/Environmental Engineer
1990-2013

* *Work performed prior to joining Terracon.*

Rhianna Leach
STAFF PROFESSIONAL

PROFESSIONAL EXPERIENCE
Ms. Leach is a GIS Specialist with Liesch Associates, Inc., a Terracon Company in Minneapolis, Minnesota. Ms. Leach is responsible for a wide array of GIS projects throughout the office.

Prior to working at Terracon, Ms. Leach has had three GIS-related internships; two with government entities and one with a private electric cooperative. She graduated in December of 2013 with a Bachelor of Science in Geography from the University of Wisconsin-River Falls. Ms. Leach has had proficient experience in cartographic principles, manipulation of vector and raster data, updating map infrastructures and importing construction projects, as well as thorough use of ArcGIS and many GPS units.

PROJECT EXPERIENCE
COMMERCIAL
NEPA Screens
Ms. Leach assists in the completion of NEPA Screens (limited colocation exclusions, Section 106, and full FCC NEPA studies) for large cell tower portfolio projects in Minnesota, Nebraska, Iowa, and South Dakota. NEPA Screen activities including collecting all necessary archeological, cultural, and historical information, correspondence with various state and federal agencies, site reconnaissance, and final report preparation.

GOVERNMENT – HEALTH
SHIP (Statewide Health Improvement Program) – Stillwater, MN*
GIS Intern responsible for retrieving, analyzing and mapping data for the MN SHIP program via the Washington County, MN, Department of Public Health and Environment. Data include accessibility to grocery stores, fast food restaurants, parks, trails, fitness centers, and more. The data used, combined with demographic data, were used to present health disparity patterns throughout the county.

UTILITIES
5-Year Utility Pole Location Project – Ellsworth, WI*
Mapping Intern at Pierce Pepin Cooperative Services responsible for the GIS portion of a 5-year utility pole location project. Project purpose to locate all poles with GPS and import to map, along with verifying all equipment on the pole coincides with attributes in map. Responsibilities included: Teaching linemen to use GPS to properly locate poles in field, import GPS data into basemap and edit necessary attributes corresponding to information given by linemen.

EDUCATION
Bachelor of Science
Geography
University of Wisconsin-River Falls,
Minors: GIS/Cartography;
Psychology
2013

WORK HISTORY
Liesch Associates, Inc.
A Terracon Company
Staff Professional
2014-Present

City of Savage, Minnesota
GIS Intern
2014

Washington County
MN, Dept. of Public Health
GIS Intern
2014

Pierce Pepin Cooperative Services
Mapping Intern
2013

* *Work performed prior to joining Terracon.*

Jamie L. Markel

AUTOCAD TECHNICIAN II

PROFESSIONAL EXPERIENCE

Ms. Markel is currently employed as an AutoCAD Technician II in Terracon's White Bear Lake, Minnesota office. Ms. Markel has eleven years of experience in the AutoCAD field. Her AutoCAD responsibilities include drafting of various maps, figures, and boring logs. She prepares various maps including, but not limited to, Site Location Maps, Site Vicinity Maps, Groundwater Contour Maps, Cross-Sections, Monitoring Well Construction Diagrams, Well Location plotting and mapping, and Aerial Photographs. Ms. Markel also prepares environmental and geotechnical boring logs from field data for soil borings and monitoring wells.

Ms. Markel's duties also include the analysis of data and the preparation of reports for environmental projects.

PROJECT EXPERIENCE

Multiple Projects - Minnesota

Drafting of information obtained by office personnel and meeting with project manager to obtain new design projects and/or discuss changes to existing projects. Prepared residential construction documents including: Site Plans, Elevations, Foundations, Floor Plans, Interior Elevations and Cross Sections.

Layout and design of fire sprinkler systems for new and existing commercial buildings. Worked with blueprints to develop working drawings and put together product submittals to be presented to the city. Perform site surveys and conducted a water flow test on city water hydrants for calculation purposes. Prioritizing multiple documents to meet deadlines in a timely and efficient manner.

EDUCATION

Specialized Associate of Science
Architectural CAD
Technology Major and Architectural Drafting
NTI School of CAD Technology
Eden Prairie, Minnesota
2001

North Hennepin Community College
Brooklyn Park, Minnesota
Generals: Math and English
1998 – 1999

Mechanical Drafting CADKEY 97
Century College
White Bear Lake, Minnesota
1997 - 1998

WORK HISTORY

Terracon Consultants, Inc.
AutoCAD Technician II
2008 – Present

Enterspace, Inc.
Architectural AutoCAD Drafter
Residential
Minneapolis, Minnesota
2007 - 2008

Croix Custom Concepts, Inc.
Architectural AutoCAD Drafter
Residential
Ham Lake, Minnesota
2005 – 2007

Summit Fire Protection
Design Engineer
Lino Lakes, Minnesota
2002 – 2004

Michael D. Johnson, P.E.
CHEMICAL ENGINEER

PROFESSIONAL EXPERIENCE
Mr. Johnson has over 31 years of experience as a chemical engineer working in the industrial air and wastewater fields doing research, design, and project management at Terracon's Minneapolis office. He specializes in industrial wastewater treatment, air permitting and emission management, wastewater research, and groundwater and soil remediation.

PROJECT EXPERIENCE
WASTEWATER
Taconite Plant – Northern Minnesota

A taconite plant was upgrading a processing line scrubber to meet the MACT standard for air emissions. Sulfur emissions removed from the flue gas by the new scrubber required removal prior to discharge to the tailings basin. Mr. Johnson was responsible for the design of the water treatment system which was designed to remove sulfate and other solids. Analysis of the water chemistry in the recycle scrubber was conducted to size the wastewater treatment equipment and optimize the operations following installation.

Plating Facility – Minneapolis, Minnesota

Mr. Johnson was retained by a plating facility having difficulty achieving compliance with metal and cyanide wastewater limits. The facility utilized membranes in combination with precipitation technologies to remove the metals and precipitated cyanide compounds. A cyanide oxidation system to remove free cyanide was followed by a precipitation system to remove complexed cyanides. Concentrated streams were treated by a batch system. Different batch recipes were developed including co-precipitation and utilizing Fenton's reaction to oxidize organic chelating agents. Mr. Johnson directed mass balances to be conducted to determine sources of metals and cyanide that were not being effectively treated. Modifications to the batch treatment system and minor chemistry adjustments in the membrane system were sufficient to consistently meet metal limits. It was determined that the cyanide precipitation treatment system was being affected by varying amounts of free chlorine being discharged from the cyanide oxidation system. Increasing the consistency of operation within the cyanide oxidation system, minor chemistry adjustments in the precipitation system, as well as careful monitoring of residual cyanide in the batch treatment system were effective at achieving consistent cyanide concentration in the discharge of the facility to below applicable regulatory limits.

Computer Hard Drive Manufacturing Facility – Bloomington, Minnesota

The facility manufactures computer hard drives and developed a new process to manufacture the head component using an etching process. Etching of the stainless steel components produced wastewater containing hexavalent chromium and nickel. Mr. Johnson oversaw the design of a wastewater treatment system required to meet Federal Categorical Discharge Standards for the metal finishing industry for chromium and nickel. The system acidified and reduced hexavalent chromium to trivalent chromium which was followed by a precipitation stage at a higher pH. A clarifier and sludge aging tank were specified in conjunction with a filter press to produce a filter cake for disposal. Mr. Johnson also oversaw the construction and successful start-up of the system.

Medical Device Manufacturing Facility – Chaska, Minnesota

The facility manufactures a chemical used for medical devices but decided to also produce the chemical as a pharmaceutical agent. The federal categorical standard for pharmaceutical companies has a chloroform limit of 30 ppb. Trichloroacetic acid (TCA) used in the process breaks down slowly to chloroform. Standard technologies such as air stripping to remove the chloroform are ineffective since chloroform continues to be produced. Carbon adsorption to remove the TCA was prohibitively expensive. Mr. Johnson led a team to research a method of high temperature and pressure treatment to quickly break down the TCA. Steam stripping and condensers were used to collect the chloroform as a by -product for disposal with air stripping to polish the wastewater to meet effluent limits.

EDUCATION
Master of Science, Chemical Engineering, University of North Dakota, 1989

Bachelor of Science, Chemical Engineering, University of North Dakota, 1985

REGISTRATIONS
Professional Engineer: Minnesota, Wisconsin, New Jersey

CERTIFICATIONS
40-Hour HAZWOPER

WORK HISTORY
Liesch Associates, Inc., a Terracon Company, Chemical Engineer, Jan. 2013-Present

Liesch Associates, Inc., Chemical Engineer, Sept. 1991-Jan. 2013

Carbonair, Wastewater Design Engineer, July 1990 – Sept. 1991

Union Carbide, Wastewater Engineer, January 1989 – June 1990

Energy and Environmental Research Center, Research Engineer – May 1985 – January 1989

* *Work performed prior to joining Terracon.*

Mike Johnson (continued)

Taconite Plant – Northern Minnesota
Mr. Johnson was the project manager for the investigation and remediation of a turbidity issue at the headwaters of a creek at a taconite facility. A series of surface and groundwater water samples were taken to determine the cause of the turbidity. Elevated levels of dissolved iron in the groundwater and precipitating out in the surface water were determined to be the major cause of the turbidity. Mr. Johnson oversaw bench scale testing of the water to determine oxidation kinetics and settling times required for treatment system design. It was determined that coagulant addition was required to reduce settling times for basin design within the space constraints at the site. An aeration and coagulant addition system followed by a designed settling pond was constructed and has resulted in consistent effluent compliance for the facility.

Taconite Plant – Northern Minnesota
Sulfate, chloride, hardness, and TDS in the discharges from mining activities have recently become a major environmental focus for EAW/EIS preparations as well as NPDES permitting activities. Over the last 10 years, Mr. Johnson has developed and refined a model for a major taconite facility in northern Minnesota to predict future concentrations of these parameters. The model incorporates current and future inputs and outputs in source water volumes and concentrations, scrubbing operations, precipitation, mine dewatering, fuel inputs, tailings void volume lock-up, and other key parameters. The model has also been used to determine future tailings basin concentrations of these key analytes with various treatment system approaches.

REMEDIATION

Former Wood Treating Manufacturing Site – Randolph, Wisconsin
Groundwater containing elevated levels of pentachlorophenol in a petroleum carrier threatened the local city water supply. Pumping wells were installed to provide capture of the plume to prevent contamination from reaching the city wells. Elevated iron levels in the groundwater were known to cause severe fouling of other remediation systems in the area. Mr. Johnson designed a carbon adsorption system with an automated pretreatment to enable efficient treatment of the water for discharge to the storm sewer system. Chlorine was fed into a static mixer followed by a detention tank to oxidize and precipitate the iron. The precipitates were removed by a sand filter to prevent fouling of the carbon adsorption system. The precipitates on the sand filters were washed with clean water prior to backwash to prevent carrying over contamination in the discharge of the solids to the sanitary sewer.

Former Plating Shop – Salt Lake City, Utah
Prcoess leaks from a former plating shop contaminated vadose zone soils and groundwater with hexavalent and trivalent chromium. Mr. Johnson evaluated potential in-situ options for converting hexavalent chromium to the less toxic trivalent chromium and stabilizing the trivalent chromium ions. Cost estimates for the different options and intangible differences in the potential remedial approaches were also produced.

University of Minnesota, Minneapolis Campus
Contaminated groundwater adjacent to an underground library requires continuous pumping, treatment and discharge to prevent infiltration into the book storage facility. The groundwater is contaminated with naphthalene, benzene, and elevated levels of hydrogen sulfide. A horizontal well was installed previously with a submersible pump on rails. Liesch was initially hired to troubleshoot problems with the submersible pump which had a history of performance issues. Removal of the pump was a multi-day task and Liesch recommended replacement with an above ground pump which has performed well for a number of years. Mr. Johnson designed a carbon adsorption system followed by air stripping to remove the hydrogen sulfide. Hydrogen sulfide gases are removed by a vapor phase carbon adsorption system. The automated system has consistently met air and water discharge limits with significantly reduced oversight compared to previous operations.

Former Manufacturing Facility – Penns Grove, New Jersey
A former manufacturing site had tetrachloroethylene soil and groundwater contamination over an area of several acres. Soil excavation was used to remediate the highest soils concentrations. Mr. Johnson oversaw pilot testing of an air sparging and soil venting system to develop radius of influence data required for the design of a full scale system. A total of 44 vertical air sparging wells and accompanying horizontal soil venting wells were installed. An air to air heat exchanger system was incorporated into the design to allow lower cost PVC air sparging wells to be utilized. The system was operated 24 hours a day initially until groundwater concentrations dropped approximately an order of magnitude. Intermittent operation was then performed with air sparging and soil venting limited to approximately 2 hours per day to lower electrical operating costs. A final polish of sodium permanganate was utilized to complete remediation at the site.

Mike Johnson (continued)

Manufacturing Facility – Chicago, Illinois
A chlorinated solvent spill contaminated soils and groundwater next to a building at an operating facility. Proximity to the building and depth to groundwater prevented excavation from being a practical solution. Mr. Johnson oversaw the chemical injection design to remediate the soils and groundwater to below required regulatory levels. Naturally occurring iron at the site was used to activate hydrogen peroxide. Monitoring of the process to optimize injection pressures and locations was critical to minimize short circuiting of the oxidant. Post injection sampling showed that chlorinated contaminant concentrations were below levels required for closure.

Major International Airport Petroleum Site
A petroleum and methane impacted site at a major international airport required investigation and remediation as part of negotiations with a federal tenant for a property swap. Mr. Johnson assisted with the investigation and oversaw the remediation of the project including preparation of an environmental response plan (ERP) to address explosive methane concentrations and elevated petroleum compounds such as benzene. The ERP included three main elements; a soil vapor extraction system, a sub-floor vapor ventilation system, and long term indoor air quality monitoring. The tenant accepted the plan and Mr. Johnson designed and oversaw the construction of the system. Target levels have been achieved and the system is currently in the final long term monitoring phase prior to closure.

Pipeline Terminal Wastewater Treatment
Design engineer for conceptual design of wastewater treatment system for petroleum impacted wastewater from tank bottom and miscellaneous spills. Design included oil water separator, activated carbon, pumping, storage and truck loadout systems.

Major International Airport Petroleum Site
A petroleum and methane impacted site at a major international airport required investigation and remediation as part of negotiations with a federal tenant for a property swap. Mr. Johnson assisted with the investigation and oversaw the remediation of the project including preparation of an environmental response plan (ERP) to address explosive methane concentrations and elevated petroleum compounds such as benzene. The ERP included three main elements; a soil vapor extraction system, a sub-floor vapor ventilation system, and long term indoor air quality monitoring. The tenant accepted the plan and Mr. Johnson designed and oversaw the construction of the system. Target levels have been achieved and the system is currently in the final long term monitoring phase prior to closure.

Pipeline Terminal Wastewater Treatment
Design engineer for conceptual design of wastewater treatment system for petroleum impacted wastewater from tank bottom and miscellaneous spills. Design included oil water separator, activated carbon, pumping, storage and truck loadout systems.

LITIGATION SUPPORT

Municipal Utility – Marshall, Michigan
A fuel spill at a municipal electric generating plant caused soil and groundwater contamination near a river. A liner system underneath the storage tanks failed due to improper installation. Mr. Johnson provided engineering support to the legal team to assist in the determination of the cause of the release. Mr. Johnson was deposed prior to the case being settled. In addition, Mr. Johnson was retained to assist in the remediation of the contamination.

Large Municipality in Wisconsin
Assisted in the preparation of Expert Report in defense of lawsuit filed by paper manufacturing industry accusing City of not providing adequate wastewater treatment for PCBs in wastewater industry had discharged to City sewer system.

AIR QUALITY

Coating Manufacturer – Madison, Wisconsin
A manufacturing company that coats prefinished millwork required the installation of an air pollution control system in order to increase production at the facility. The existing manufacturing process utilized large volumes of air and natural gas burners to dry the boards following coating. Most of the emissions from the process were released inside the facility. Mr. Johnson designed a recirculating air system to dry the boards with high velocity air, decrease the volume of air requiring treatment, and prevent the solvent from being released into the building. A comparison of different air pollution control systems was made and a regenerative thermal oxidizer was chosen for installation. The increased solvent concentration in the bleed-off from the recycled air was high enough to typically operate the RTO with natural gas. Excess heat produced in the RTO from the combustion of the solvents was re-introduced back into the recycled air stream and the natural gas burners were removed from the process.

Mike Johnson (continued)

Commercial Shooting Range – Jacksonville, Florida

Mr. Johnson designed start-up and tested a ventilation system for a shooting range. The ventilation system utilized recycled air to minimize air conditioning requirements due to the climate. Carbon monoxide concentrations are controlled by exhaust dampers with make-up air controlled to maintain negative pressure within the space. All air exiting the range is filtered through a three stage system with HEPA filtration as the final stage to remove lead. Mr. Johnson also conducted OSHA compliance testing of the range under heavy fire conditions to demonstrate that acceptable levels of lead and carbon monoxide were being achieved.

Pharmaceutical Manufacturer – Denver, Colorado

A pharmaceutical manufacturing company was expanding production that would increase solvent emissions to the atmosphere. An air permit review in this non-attainment area indicated that the increase in solvent emissions would require air pollution control equipment installation. A wet scrubber system was evaluated due to the low capital cost requirement. However, significant long term incoming water and sanitary sewer fees indicated that the total present worth cost of the system would be higher than thermal oxidation. Drying rooms, drying ovens, granulation rooms, and a fluid bed were evaluated for air flow rates and peak VOC emissions to size a regenerative thermal oxidizer (RTO) and to ensure that solvent concentrations stayed below 10 percent of the lower explosive limits. Mr. Johnson designed a control valve and piping network to connect the processes to the RTO and successfully started started up the system.

PROCESS SAFETY ENGINEERING

Sapphire and Ruby Manufacturing Facility – Washougal, Washington

At a previous employer, Mr. Johnson conducted a process safety review and process optimization on a new hydrogen annealing system treating synthetic precious gems. The water cooled annealer was operated at a temperature of over 3600 degrees F and a hydrogen gas concentration of 50%. The process safety review primarily consisted of analyzing standard operating and failure scenarios to evaluate safety considerations for hydrogen or steam explosions. Mr. Johnson also conducted calibration experiments following start-up of the pyrometer system to enable the annealer to operate as close to melting temperatures as practical to minimize cracking of the annealed gems while preventing melting.

Brett W. Larsen, P.E.
GEOTECHNICAL ENGINEER

PROFESSIONAL EXPERIENCE
Mr. Larsen is a geotechnical engineer in the geotechnical group at Terracon's Minneapolis, Minnesota office. He manages geotechnical explorations, analyzes field and laboratory data, and prepares reports and proposals.

Mr. Larsen's project experience includes providing geotechnical recommendations for a wide variety of projects. He has served as project manager for grain storage facilities, schools, and residential buildings. Other projects include office buildings, utility lines, and industrial buildings. He has also managed numerous geotechnical projects for commercial, industrial, and government clients in Minnesota. Additional areas of experience include slope and embankment stability, deep and shallow foundation design, retaining wall design, soil nail wall design, and shoring design.

PROJECT EXPERIENCE
RETAIL REDEVELOPMENT
Liberty Crossings – Golden Valley, Minnesota
Responsible for directing the subsurface exploration and providing geotechnical recommendations for re-development of the site.

CVS Pharmacy Sites – Minnesota
Project manager for multiple CVS Pharmacy Site redevelopment projects in Minnesota. Sites were commonly required close coordination with environmental professionals for proposed earthwork activities. As project manager, Brett was responsible for directing the subsurface exploration and providing geotechnical recommendations for construction. Geotechnical analyses included recommendations for building foundations, earthwork, and stability and settlement analyses for proposed retainging walls and slopes.

861 Hennepin Avenue – Minneapolis, Minnesota
Responsible for directing the subsurface exploration and providing geotechnical recommendations for re-development of the site.

Oak Park Plaza – Blaine, Minnesota
Responsible for directing the subsurface exploration and providing geotechnical recommendations for re-development of the site.

ENERGY SECTOR
CAPX 2020– Brookings, South Dakota
Project Manager responsible for the geotechnical exploration's for an approximately 70-mile, 345 kV transmission line proposed between the new Big Stone South Substation near Big Stone City, S.D., and the Brookings County Substation near Brookings, S.D. Recommendations were provided for others use in designing transmission tower foundations.

North Star Solar PV – Chisago, Minnesota
Project Manager responsible for the geotechnical exploration's for 1.2MW-AC photovoltaic vacility located near Blue Lake Wastewater Treatment Plant in Shakopee, Minnesota. Recommendations were provided to support the proposed structures on screw piles.

Blue Lake Solar Farm – Shakopee, Minnesota
Project Manager responsible for the geotechnical exploration's for 1.2MW-AC photovoltaic vacility located near Blue Lake Wastewater Treatment Plant in Shakopee, Minnesota. Recommendations were provided to support the proposed structures on screw piles.

Geronimo Energy Solar Farms – Various Sites
Project Manager responsible for the geotechnical exploration's for photovoltaic facilities at sites in Northfield, Taylor's Falls, Collegeville, Farmington, North Branch, and Paynesville, Minnesota. Recommendations were provided to support the proposed structures on driven piles.

EDUCATION
Masters
Civil Engineering
Iowa State University
2007

Bachelors
Civil Engineering
University of Minnesota
2006

REGISTRATIONS
Professional Engineer
Minnesota

AFFILIATIONS
American Society of Civil Engineers

WORK HISTORY
Terracon Consultants Inc.
Geotechnical Engineer
Minneapolis, Minnesota
20014 - Present

Terracon Consultants Inc.
Staff Engineer
Lenexa, Kansas
2008-2014

Minnesota, DOT
Student Worker
2005-2006

PUBLICATIONS/PRESENTATIONS
Larsen, B., White, D.J., and Jahren, C. (2008). "Evaluation of Dynamic Cone Penetration Quality for Cohesive Soil Embankment Construction: Pilot Project for New Specification for Quality Control and Quality Assurance", Journal of the Transportation Research Board, Volume 2081, 92-100, doi 10.3141/2081-10.

Camargo, F., Larsen, B., Chadbourn, D., Roberson, R., and Siekmeier, J. (2006). "Intelligent Compaction: A Minnesota Case History." Proceedings 54th Annual University of Minnesota Geotechnical Conference, February, Minneapolis, CD-ROM.

TRANSPORTATION SECTOR

I-35 / 4th Street Ramp – Minneapolis, Minnesota
Geotechnical engineer responsible for explorations along a slope that experienced steady seepage out of the face of the slope. The remediation included designing drainange improvements along existing slopes which had

I-35 and Pleasant Valley Road Interchange – Claycomo, Missouri
Geotechnical engineer responsible for the geotechnical design recommendations of mechanically stabilized earth (MSE) retaining walls, slopes, pavements and pile foundations for the bridges.

Highway 291 and 71 Interchange – Harrisonville, Missouri
Geotechnical engineer responsible for the geotechnical design recommendations of mechanically stabilized earth (MSE) retaining walls, slopes, pavements and pile foundations for the bridge.

kcICON I-29/I-35 Highway Project – Kansas City, Missouri
Staff engineer responsible for the geotechnical design of mechanically stabilized earth (MSE) retaining walls and pile foundations for the roadway and bridge structures to accommodate widening of I-29/I-35 Highway corridor through existing industrial, commercial, and railroad property in Kansas City, MO.

SHORING

I-80 Soil Nail Wall – Omaha, Nebraska
Responsible for the geotechnical design of multiple soil nail walls cut into native loess slopes to accommodate widening of the existing I-80 Highway corridor through Omaha. Work included development of plans and specifications.

Kansas City Wizards Stadium Shoring – Kansas City, Kansas
Responsible for the geotechnical design of soil nail walls cut into sandstone. Work included development of plans and specifications.

RAIL

BNSF Willmar Wye Railway Bypass – Willmar, Minnesota
Geotechnical engineer involced with geotechnical explorations and report writing for railway bypass which included two bridges being constructed over Highway 12 and Highway 40.

BNSF Video Tower System Improvements – Minnesota and Wisconsin
Project Manager responsible for geotechnical explorations within BNSF Rail Yards in Minneapolis, MN; LaCrosse, WI; and Willmar, MN. Professional opinions and recommendations were provided to design foundations to support proposed communication towers.

BNSF Siding Extensions – Kansas
Project manager for work to construct siding extensions at multiple proposed sites in the Fort Scott subdivision. The project has involved coordination with BNSF to perform explorations in the vicinity of existing rail lines and structures. Geotechnical recommendations were provided to develop track subgrades for proposed siding extensions. Additionally, foundation recommendations were provided for extensions of existing bridges structures crossing creeks.

INDUSTRIAL

Ford Plant E-Coat Expansion – Claycomo, Missouri
Responsible for directing the subsurface exploration and providing preliminary geotechnical and screening borings for proposed expansion at Ford Plant. Impacted soils were identified in preliminary site exploration and subsequent explorations and environmental borings were performed to develop recommendations for construction of the proposed building.

GM Fairfax Assembly Plant Expansion – Kansas City, Kansas
Responsible for directing the subsurface exploration and providing preliminary geotechnical and screening borings for proposed expansion at Ford Plant. Impacted soils were identified in preliminary site exploration and subsequent explorations and environmental borings were performed to develop recommendations for construction of the proposed building.

WATER RESOURCES

Coffee Creek Regional Detention and Wetland – Overland Park, Kansas
Project manager responsible for directing the subsurface exploration and providing geotechnical recommendations for construction of an approximately 800 foot long, 15 foot high earthen dam for temporary retention of storm water runoff.

Geotechnical analyses included recommendations for foundations, earthwork recommendations for preparation of the ponded area and dam, slope stability, settlement analyses, and recommendations for erosion control.

David C. Reynolds, P.E.

CIVIL ENGINEER

PROFESSIONAL EXPERIENCE

Mr. Reynolds is a Senior Environmental Project Engineer in Terracon's Minneapolis, Minnesota office. Mr. Reynolds has over 26 years of experience working with clients throughout the United States which includes preparing or supervising air permitting projects including Title V and Prevention of Significant Deterioration (PSD) construction and operating permit applications, atmospheric dispersion modeling, Best Available Control Technology (BACT) evaluations, greenhouse gas (GHG) reporting, NESHAP and NSPS compliance assistance, Risk Management Plan (RMP) preparation, Reasonably Available Control Technology (RACT) evaluations, potential to emit (PTE) calculations, compliance assurance monitoring (CAM) plans, evaluating federal and state permitting requirements and the preparation of annual emission reports. In addition to air quality projects, Mr. Reynolds also prepares and supervises the preparation of environmental compliance assessments, SARA Title III reports (Tier II and TRI), SPCC plans, stormwater permitting, and hazardous waste evaluations.

PROJECT EXPERIENCE

GRAIN/OIL EXTRACTION

Canola Oil Extraction Plant, Oklahoma

Mr. Reynolds was the senior project manager for the preparation of a PSD construction permit application for a proposed 2,500 ton/day oil extraction plant in Oklahoma. The permitted processes at the facility included grain receiving and preparation, solvent extraction, oil refining, and other ancillary processes. The emissions from the facility resulted in the project being classified as major for PSD for PM_{10}, $PM_{2.5}$, VOC, and greenhouse gases. PSD permitting for the project required that the permit application include Best Available Control Technology (BACT) analyses for PM_{10}, $PM_{2.5}$, VOC, and greenhouse gases. Additionally, the processes at the facility were subject to several New Source Performance Standards (NSPS) and National Emission Standards for Hazardous Air Pollutant (NESHAP) requirements that had to be reviewed to verify the facility could achieve and document compliance with the requirements. Refined dispersion modeling was performed for the project using AERMOD to document compliance with PSD Increments and the National Ambient Air Quality Standards (NAAQS) for PM_{10} and $PM_{2.5}$. After the submittal of the permit application, Terracon worked closely with the Oklahoma Department of Environmental Quality which resulted in the permit being issued on schedule.

Professional Services Completed: 2012-present

PAPER INDUSTRY

Recycled Cardboard Plant, Minnesota

Mr. Reynolds was the senior project manager responsible for the preparation of applications for the Title V operating permit and several Title V major modifications. A BACT analysis was prepared for the original application and has continued to be updated as the facility makes modifications to the process. One of the major modifications involved the facility being able to operate temporary boilers. This fast track project was able to be permitting quickly after negotiations with the USEPA resulted in the USEPA issuing an exemption from NSPS requirements for the temporary boilers.

Professional Services Completed: 1994-present

EDUCATION

Bachelor of Science, Civil Engineering, North Dakota State University, Fargo, North Dakota, 1991

CERTIFICATIONS

P.E.: Professional Engineer - Minnesota

SPECIALIZED TECHNICAL TRAINING

Trinity Consultants Dispersion Modeling

AWMA's "Strategies for Obtaining and Complying with Operating Permits Regulations"

AWMA's "Fundamentals of New Source Review"

RTP's "Advanced New Source Review Workshop"

WORK HISTORY

Liesch Associates, Inc., a Terracon Company, Civil Engineer, Jan. 2013-Present

Liesch Associates, Inc., Civil Engineer, Nov.1992- Jan. 2013

* *Work performed prior to joining Terracon.*

David C. Reynolds, P.E. (continued)

AEROSPACE

Fiberglass Products Manufacturer, Washington

Mr. Reynolds acts as the senior project manager responsible for air permit compliance for two of the client's facilities. Terracon has prepared an operating permit revision for the installation of an RTO for one facility. Terracon is also assisting the facility develop a test plan for capture and destruction testing. Terracon is also preparing an operating permit application and a BACT analysis for the second facility.

Professional Services Completed: 2013-present

MANUFACTURING

Lined Pipe Manufacturer, Minnesota

Mr. Reynolds is the senior project manager responsible for regulatory compliance projects at three facilities operated by the client. All three facilities have been issued synthetic minor permits to avoid Title V. One of the facilities elected to install a regenerative thermal oxidizer (RTO) to control emissions in order to remain a synthetic minor source. Mr. Reynolds assisted the facility prepare a test plan for the facility to document capture efficiency and oversaw the stack testing that was performed. He also supervises the preparation of monthly emission tracking spreadsheets that document that the facilities are all in compliance with the air permit requirements.

Professional Services Completed: 2006-present

Valve Manufacturer, Minnesota

Mr. Reynolds was the senior project manager responsible for the preparation of a Title V permit application, development of an environmental management system (EMS) system, and monthly and annual reporting calculations and submittals. The Title V permit application primarily included the permitting of spray and hand applied coating, blasting, and combustion equipment. The permit application also included the preparation of CAM plans for several sources. An EMS was developed for the facility to identify all tasks that are required to be completed by the facility and/or consultant to attain and document compliance with air permit and EPCRA reporting requirements. Monthly compliance calculations are performed to document compliance with air permit requirements and to verify compliance with applicable NESHAP regulations. Terracon also prepared annual compliance calculations and submittals for air permit and EPCRA (Toxic Release Inventory and Tier II) reporting.

Professional Services Completed: 2011-2015

Specialty Glass Manufacturer, Illinois

Mr. Reynolds is the project manager responsible for regulatory compliance services provided to the client. He prepared the Federally Enforceable State Operating Permit (FESOP) application that was submitted to the Illinois EPA. Major processes included in the FESOP include hydrofluoric acid etching controlled by multiple scrubbers and a coating operation controlled with a regenerative thermal oxidizer (RTO). Terracon also assists with annual air emissions reporting and EPCRA reporting under SARA 313 (Tier II and TRI). In addition to air permitting and other regulatory compliance activities (Form R, Tier II, hazardous waste), Terracon assisted the client with process ventilation design and installation of the RTO.

Professional Services Completed: 1995-present

Specialty Laminate Manufacturer, Wisconsin

Mr. Reynolds is the senior project manager responsible for regulatory compliance projects. Mr. Reynolds assisted the client with a major modification to their Title V permit to allow the replacement on a process line. The modification included AERMOD dispersion modeling to document that the ambient impacts from the new line do not exceed ambient thresholds. In addition, Mr. Reynolds oversaw the preparation of a permit compliance spreadsheet that is used by the facility to document compliance with the monthly tracking requirements.

Professional Services Completed: 2012-present

Coating Manufacturer, Illinois

Mr. Reynolds is the senior project manager responsible for the regulatory compliance activities including the preparation of construction and operating (FESOP) permit applications. Major processes at the facility include the manufacturing or a variety of coatings. Terracon has assisted the facility is identifying which regulations apply to the facility and how the facility can best document compliance. Terracon also prepares SARA 313 (Tier II and TRI) and annual emission reports for the facility. Terracon has also prepared a stormwater permit application and a Storm Water Pollution Prevention Plans (SWPPP) for the facility.

Professional Services Completed: 2010-present

David C. Reynolds, P.E. (continued)

Electronics Manufacturer, Wisconsin
Mr. Reynolds acts as the senior project manager overseeing the regulatory compliance assistance provided to the facility. The regulatory compliance services provided to the client include air permitting, SPCC preparation, SWPPP preparation, annual reporting (air emissions, Tier II, and TRI), control equipment review, and process review. Major processes at the facility include plating, etching, stripping, coating, drilling and routing, and combustion sources.
Professional Services Completed: 1995-present

AIRPORT

International Airport, Minnesota
Mr. Reynolds acts as the senior project manager responsible for air permitting activities at the facility. Emission sources at the facility include many boilers, generators, other combustion sources, a paint shop, gasoline fueling operations, and other fugitive emission sources. Mr. Reynolds supervises the preparation on the mandatory greenhouse gas (GHG) annual report and the annual emissions inventory. The facility has implemented a full scale EMS system. Mr. Reynolds is responsible for making sure that the air permitting compliance section of the EMS system is current.
Professional Services Completed: 1992-present

INDUSTRIAL LAUNDRY

Industrial Laundry, Several States
Mr. Reynolds is the project manager responsible for air permitting projects at an industrial laundry with facilities in multiple states. He has prepared or supervised the preparation of construction and operating permit applications (including Title V permits) for the client in Wisconsin, Pennsylvania, Indiana, and South Carolina. Major processes permitted include the laundering of solvent laden towels, dry cleaning, and combustion sources. Terracon also assists the client with permit compliance documentation.
Professional Services Completed: 1992-present.

Jason A. Gelling, CPG
SENIOR GEOLOGIST

PROFESSIONAL EXPERIENCE

Mr. Gelling is a Senior Geologist in Terracon's Minneapolis, Minnesota office. He is responsible for management and mentoring of entry and junior level environmental staff, developing scopes of work for various environmental projects, preparing cost proposals, scheduling, reviewing technical reports, and managing project budgets.

Mr. Gelling has over 20 years of experience in the environmental consulting field, focusing primarily on property acquisitions, tanks and spills, pollution prevention, site investigation, soil and groundwater remediation projects and pre-demolition/redevelopment surveys.

Experience includes preparing cost estimates and managing all components of Phase I and Phase II Environmental Site Assessments on a wide variety of commercial and industrial facilities throughout the United States and Canada, located in various physical and hydro-geological settings.

Conducted investigations and/or cleanups on numerous leaking underground and leaking aboveground storage tank sites located primarily in Minnesota, North Dakota, and South Dakota.

Performed site visits and authored reports on numerous ASTM Phase I Environmental Site Assessments and Site Investigations on a variety of sites including industrial, commercial and undeveloped sites in 35 states. Provided oversight and senior review for reports authoured by junior and mid-level staff.

As an Asbestos Inspector and Hazardous Materials Supervisor, Mr. Gelling has conducted numerous pre-demolition hazardous material surveys on residential, commercial, and industrial facilities focusing on identification, inventory and management of asbestos containing materials, lead-based paint, and special waste items.

PROJECT EXPERIENCE

MUNICIPAL/UTILITY

Building Decontamination, Old Moorhead Public Service Power Plant – Moorhead, MN*

Served as the Field Superintendent for project and was on-site daily to document site conditions and contractor work efforts to verify work was carried out in accordance with specified plans and represent the client. Work consisted of removal of asbestos containing materials, stabilization of peeling lead-based paint, removal of hazardous and solid wastes materials, removal of old process residues in boilers, stacks, and floor drains, decommissioning/removal of instrument panels, and mercury cleanup of the old part of the off-line plant. As part of work, conducted mercury vapor monitoring with a Lumex 915+ mercury analyzer, assisted with waste profiling (i.e., analytical testing) and consolidation, reviewed contractor waste disposal tickets, manifests, bill of ladings, clearance testing, and close-out report for the project, performed final inspection and collection of confirmation mercury-wipe and Lumex vapor readings, and prepared final documentation report.

MUNICIPAL/FEDERAL

EPA Phase II Environmental Site Assessments, Central City Corridor - City of Moorhead, Minnesota*

Served as the Field Superintendant on three targeted sites selected for possible redevelopment under the MPCA/EPA Brownfields Program funding. Coordinated and directed subcontractors with drilling, excavation, and off-site analytical testing. Conducted field work consisting of soil and groundwater sampling during push-probe installation and excavation of test pits, logging and classification of soils, as well as targeted wipe sampling. The project included sampling for a wide variety of contaminants including DRO, GRO, VOCs, PAHs, PCBs, and RCRA Metals

EDUCATION

Bachelor of Science, Environmental Geology and Technology, University of North Dakota, 1997

CERTIFICATIONS

Certified Professional Geologist (CPG) with AIPG, 2014

Certified Asbestos Inspector: MN

Petroleum Release Remediator: SD Registration No. 11527

OSHA 40-Hour Hazardous Waste Operation Certification (HAZWOPER)

OSHA 10-Hour Construction Safety and Health Certification

OSHA Confined Space Entry Training (29 CFR 1910.146)

OSHA Aerial Platform Lift Training (29 CFR 1919.66/67)

Niton X-Ray Fluorescence (XRF) Analyzer Certification

Liquid Boot/Geo-Seal Installation Inspector

AHA First Aid, CPR & AED Trained

AFFILIATIONS

American Institute of Professional Geologists (AIPG)

Geological Society of America (GSA)
Minnesota Ground Water Association (MGWA)

North Dakota Solid Waste & Recycling Association (NDSWRA)

WORK HISTORY

Terracon Consultants, Inc., Minneapolis, MN, Senior Geologist, 2014 – Present

Terracon Consultants, Inc., Fargo, North Dakota, Department Manager I - Environmental, 2012-2014

Peer Engineering, Inc., Project Manager, 2008-2012

Great Plains Environmental, LLC, Fargo, North Dakota, Senior Project Manager, 1997-2008

* *Work performed prior to joining Terracon.*

for soil, groundwater, and stained surfacing. Collected and reviewed technical data for completion of three Phase II ESA reports for final submittal to the MPCA and EPA. The purpose of the testing was to provide the EPA and MPCA with technical data related to concentrations and magnitude of potential contamination, determine the need for remedial action, and to aid in determination of additional costs associated with future development.

MUNICIPAL

Hazardous Material Surveys/Flooded Home Mitigation Project – City of Moorhead, Minnesota*

Served as the Certified Asbestos Inspector, Lead-based Paint Risk Assessor, and Field Superintendent during the inspection, abatement, demolition, and/or relocation of approximately 150 homes along the Red River in Moorhead, MN. The purpose of the work was to remove flood-prone homes along the banks of the Red River to facilitate construction of new permanent levees and/or storm water lift-stations in the affected areas. Initial inspections consisted of hazardous material surveys to assess and quantify regulated materials that must be removed from homes prior to demolition or relocation (i.e. asbestos, lead-based paint, special waste items, etc.). Also provided oversight during the abatement of asbestos, lead-based paint, hazardous materials, and other special waste items identified during the surveys. Provided oversight during whole house/foundation demolition or relocation to assess for unknowns. Provided the client with periodic status updates as significant work efforts were completed. The project demanded constant communication with numerous abatement, house-mover, and demolition contractors. Provided the client with a comprehensive close-out report which summarized the inspection, abatement, and demolition/relocation activities for all affected properties.

FEDERAL

Asbestos and Lead-based Paint Testing and Abatement – Cavalier AFB Radar Station- Cavalier, ND*

Served as the Certified Asbestos Inspector, Lead-based Paint Risk Assessor, and Field Superintendent during the inspection and subcontract abatement of client specified sections of cooling water piping systems. The purpose of the work was to test and remove asbestos and/or lead-based paint from cooling water piping to facilitate integrity (i.e. wall thickness) testing of the piping performed by others. Provided general oversight during the abatement of asbestos and lead-based paint identified during the surveys. The site was complicated with a permitted entry confined space (i.e. pipe vault) where the inspector and abatement workers were expected to enter. Provided the client with periodic status updates as work efforts were completed. Provided the client with a comprehensive close-out report which summarized the inspection and abatement portions of the project. Asbestos and Lead-based Paint Testing – Grand Forks AFB - Emerado, ND

Served as the Certified Asbestos Inspector and Lead-based Paint Risk Assessor prior to planned renovation activities of six buildings on the property. The purpose of the work was to test and quantify asbestos containing materials and/or lead-based paint in order to prepare abatement bid specifications prior to renovation of the facilities. Provided client with final reports summarizing the findings of the inspections.

MUNICIPAL

Hazardous Material Surveys & Pre-Demolition Inspection – St. Paul, MN/Ramsey County*

Served as the Certified Asbestos Inspector and Lead Risk Assessor during the inspection of approximately 35 foreclosed/tax-forfeited homes slated for either demolition or renovation. Initial inspections consisted of hazardous material surveys to assess and quantify regulated materials that must be removed prior to demolition or renovation (i.e. asbestos, lead-based paint, special waste items, etc.). Homes slated for renovation required HUD-type lead-based paint inspections using a Niton XL X-ray fluorescence (XRF) analyzer. Also quantified lead-containing building components at each site. Collected and reviewed technical data for completion of a Hazardous Materials Survey Report for the client.

PRIVATE SECTOR

Limited Site Investigation; Soil Gas Survey; Design, Installation and Oversight of Sub-slab Depressurization System – Multi-tenant Apartment Complex – Minneapolis, MN

Served as the Senior Project Manager during the continued investigation of identified impacts to soil, groundwater, and soil gas at a multi-tenant apartment Site that was being acquired by another party. Responsible for reporting the identified release to the regulatory agency (MPCA); on-behalf of the client, completed an application for the voluntary investigation and cleanup program to attain assurance letters including a petroleum closure letter, no further action letter, and a no association letter for the buyer. Prepared costs estimates and provided oversight during additional investigation of identified impacts within the property boundaries. Represented the seller of the Site who was responsible for the installation of a sub-slab depressurization system (SSDS) to mitigate potential chlorinated solvent vapors from entering the buildings. Assisted with the in-house design of a retrofitted SSDS; prepared contractor bid specifications; provided oversight during the installation of the SSDS; coordinated with the contractor, building owner, and management company for access to

the building interior. The site was complicated by the age of the building, lack of available as-built drawings, presence of asbestos containing materials and lead, as well as work taking place in tenant occupied spaces.

Phase I ESA, Asbestos Survey, Lead in Water & Radon Testing – Dallas and Houston Texas regions*

Served as the lead Environmental Professional (EP) during a survey of two occupied multi-family rental facilities in Texas. Field work consisted of performing the site visit during a standard ASTM Phase I site assessment which would identify the presence and use of petroleum products and hazardous substances on the properties; reviewing government database records; and reviewing other pertinent

historical documents. The project also entailed oversight of a sub-contracted and state certified asbestos inspector who collected representative building materials suspected to contain asbestos; placement of a select number of radon test canisters in individual living

units to test the air for the presence of naturally occurring radon gas; collection of tap-water samples from a select number of living units for off-site analysis of lead in drinking water. The purpose of the Phase I and the additional sampling was to evaluate site conditions for the client prior to acquisition of the sites and to satisfy the lending agencies involved (i.e., Housing and Urban Development (HUD), Fannie Mae, and others). The results of the site visit; records review; historical review; asbestos, lead in water, and radon results, were compiled into one final report with recommendations for additional assessment.

Phase I ESA, Soil Remediation, Vapor Mitigation System – West Fargo, North Dakota
Served as the lead EP and Senior Project Manager during a survey of a former gasoline filling station/convenience store slated for redevelopment as an automotive service center. Field work consisted of performing the site visit during a standard ASTM Phase I site assessment which would identify the presence and use of petroleum products and hazardous substances on the property; reviewing government database records; and reviewing other pertinent historical documents as needed. Completed a Development Response Action Plan (DRAP) for approval by the North Dakota Department of Health (NDDH). The DRAP documented existing site conditions that would be encountered during construction and the methods and procedures that were in place to address petroleum impacted soils. Project required testing and segregation of nearly 2,000 cubic yards of petroleum impacted soils during excavation of footings and underground utilities. Provided oversight during the transport and disposal of impacted soils to a local land treatment facility. During building construction, provided oversight during the installation of a sub-slab vapor mitigation system (VMS) to ensure the system was installed as designed by Terracon while meeting manufacture's specifications. Completed a comprehensive DRAP Implementation Report which detailed the environmental activities performed on the site during re-development of the site.

Phase I ESA, Soil Gas Investigation, Vapor Mitigation System – Grand Forks, North Dakota
Served as the lead EP and Senior Project Manager during a survey of a 25-acre tract of undeveloped land slated for development as a multi-building student housing complex. Field work consisted of performing the site visit during a standard ASTM Phase I site assessment which would identify the presence and use of petroleum products and hazardous substances on the north adjacent property operations (gasoline station); reviewing government database records; and reviewing other pertinent historical documents as needed. Upon our recommendations, completed a soil gas investigation which identified low-levels of volatile organic compounds (VOCs) in soil gas adjacent to three of the proposed buildings at the site. Assisted with the design of a passive sub-slab vapor mitigation system (VMS). During building construction, provided oversight during the installation of the VMS to ensure the system was installed as designed by Terracon while meeting manufacture's specifications as well as provide assurance to the client. Completed a comprehensive Project Summary Report which detailed the environmental activities performed on the site during development.

ENERGY SECTOR

Phase I Environmental Site Assessment, proposed wind-farm site - N. Central S. Dakota & S. Central N. Dakota*
Served as the lead EP on a 26,000-acre, multi-owner subject property. Coordinated site visits by airplane for a broad view of the site for access availability. The ground site visit was performed using all-terrain vehicles (ATVs) and four-wheel drive pick-ups as well as foot travel. The project focused on areas which were marked for wind towers, roads, and buried and overhead lines. Special attention was paid to those areas with environmental conditions and their proximity to the proposed improvements. Areas of concern were pinpointed using handheld GPS units for geo-referencing to client attained aerial photographs.

Phase I Environmental Site Assessment / Naturally Occurring Radioactive Material (NORM) Surveys - Western North Dakota and Eastern Montana regions
Served as the lead EP on nine operational saltwater disposal (SWD) well sites located in the rapidly developing oil patch of western North Dakota and eastern Montana. Responsible for coordinating all site visits in one trip to minimize mobilizations, performed site visits during a standard ASTM Phase I site assessment which would identify the presence and use of petroleum products and hazardous substances on the properties; reviewing government database records; reviewing pertinent historical documents; reviewing oil and gas regulatory records as well as site-specific operator records. The project also included conducting a baseline survey of each facility for potential occurrence of NORM utilizing a Ludlum Model 19R gamma ray scintillometer. Prepared reports for the client on an expedited schedule.

Jacqueline M. Finck

SENIOR STAFF GEOLOGIST

PROFESSIONAL EXPERIENCE

Mrs. Finck is a Senior Staff Environmental Geologist in Terracon's West Fargo, North Dakota office. Her responsibilities include proposal preparation, project management, report preparation, and client
relations. Mrs. Finck's concentrations are in Phase II Environmental Site Assessments (ESAs) / Limited Site Investigations (LSI) and remediation and reclamation on a wide range of sites in North Dakota and
surrounding regions. Mrs. Finck also assists with Phase I ESAs and has experience in groundwater monitoring well installation and development. She is also responsible for Terracon's aggregate exploration program within North Dakota and surrounding regions.

Mrs. Finck has experience with drilling, sampling, and oversight of hydrocarbon and brine spills requiring remediation and reclamation. She has worked with subsurface exploration and evaluation consisting of mapping, sampling, developing, and permitting of mineral resources, working primarily with aggregate industries. Within these projects she has done geomorphology & landform mapping as well as mapping for crushed rock resources. She also has experience in mineral assessments and evaluations, data interpretation, and report writing. She is experienced in visual rock and mineral identification and description as well as creating geologic maps and cross-sections. She has experience working with Geographical Information System (GIS) in ArcMap and uses Digital Elevation Models (DEM) and topographic maps for aggregate potential mapping and creating maps for environmental assessments. She also has experience with geophysical studies consisting of electronic resistivity imaging (ERI) and seismic refraction tomography (SRT) surveys.

PROJECT EXPERIENCE

STATE

NDIC – Environmental and Spill Response/Reclamation

Assists with managing and conducting environmental assessments for the North Dakota Industrial Commission (NDIC) to remediate and reclaim legacy sites damaged by exploration and production activities and unclaimed hydrocarbon and brine releases associated with former well pads, pits, and seismic boreholes under the Abandoned Oil and Gas Well Plugging and Site Reclamation Fund (AWPSRF). Work includes providing site assessments to determine extent and magnitude of contamination, prioritizing corrective action based on environmental risk, and corrective action planning to provide reclamation of sites. Responsibilities included oversight and inspection of excavation through field screening soils and laboratory analysis, segregation and stockpiling of soils, reclamation through backfilling and topsoil grading, and sediment and erosion controls.

North Dakota Industrial Commission (NDIC) – Brine Remediation Technology Study

Assisted with site assessment conducted for the research to identify in situ remediation technologies for brine pond pits associated with petroleum exploration. Work includes providing site assessment to determine extent and magnitude of contamination, designing and constructing test plots using in situ remediation techniques, and monitoring brine concentration and vegetation growth in treated soils.

Confidential Client – Petroleum Brownsfield Program – MN

Assisted with an LSI delineating petroleum contaminants at a site that was previously a bulk oil tank warehouse. Samples were taken from seven soil-probes that were drilled. Samples collected were tested in the field and laboratory setting. Sampled and monitored soil removal and disposal at the site in accordance with the Responsive Action Plan written as well as Minnesota Pollution Control Agency's (MPCA) requirements. Assisted with report writing and creating maps & tables based on observations and findings. Oversaw site reclamation including backfilling, topsoil replacement, and revegetation. In order to have site closure, Receptor surveys were also conducted for the MPCA to identify potential receptors and the their associated risks.

EDUCATION

Bachelor of Science, Geology, University of Minnesota Duluth

REGISTRATIONS

Geologist In-Training: Minnesota
No. 152583

Petroleum Release Remediator:
SD Registration No. 13389

CERTIFICATIONS

Certified Monitoring Well Contractor: ND

Erosion and Sediment Control Construction, NDDOT

OSHA 40-Hour Hazardous Waste Operation & Emergency Response Certification (HAZWOPER)

OSHA 10-Hour Construction Safety and Health Certification

MSHA Part 48, Mine Safety and Health Administration

H2S Awareness
North Dakota Safety Council

First Aid/CPR/AED
American Heart Association

AFFILIATIONS

North Dakota Geological Society
Bismarck, North Dakota

Society for Mining, Metallurgy and Exploration (SME), Minnesota

WORK HISTORY

Terracon Consultants, Inc., Staff Geologist, West Fargo, ND, 2015-Present

Golder Associates Inc., Geologist, Bismarck, ND, 2013-2015

* *Work performed prior to joining Terracon.*

Jacqueline M. Finck (continued)

Confidential Client – Petrofund Program – MN
Conducted an LSI delineating petroleum contaminants at a site that is currently a filling station and automotive repair shop to determine impacts to soil and grandwater. Samples were collected from five soil probes that were tested in the field and laboratory setting. Created a report, exhibits, probe logs, and tables containing findings and observations at the site. Oversaw underground storage tank (UST), piping, and dispenser removal and replacement and collected soil and groundwater samples for analysis. Completed an excavation report summarizing site activities and analytical results. Receptor surveys were also conducted for the MPCA to identify potential receptors and the their associated risks.

Confidential Client – Agricultural Voluntary Investigation & Cleanup – MN
Conducted an LSI delineating fertilizer and pesticide contaminants at a site that is currently an agronomy facility to determine impacts to soil and grandwater. Samples were collected from soil probes that were analyzed in the field and laboratory setting. Completed an assessment report and a corrective action plan fro remediation. Oversaw excavation and land-spreading of contaminated soil and collected soil samples for analysis. Completed a corrective action report summarizing excavation, site activities, land-spreading, and analytical results.

Confidential Client – Petroleum Release Compenstation Fund – SD
Conducted a receptor and exposure survey to identify potential sources, pathways, and receptors. The survey consisted of reviewing wells and water uses, contacting the city departments and/or property owners for information regarding subsurface structure receptors, and identifying other potential sensitive receptors. Completed a report, exhibits, and tables, discussing the results of the initial pathway, receptor identifation survey, and potential completed exposure pathways of concern.

COMMERCIAL

Northern Improvement – Erionite Survey – ND
Developed a work plan that was approved by the North Dakota Department of Health (NDDoH) to sample the presence of erionite in an aggregate deposit. A survey was conducted and consisted of sampling material from borings that were advanced within the deposit.and from stockpiles onsite. The samples were submitted to be analyzed using scanning electron microscopy (SEM) and x-ray diffraction.

Dickey-Sargent Joint Water Resources District – Monitoring Well Installment and Groundwater Sampling – ND
Responsibilities included installing a permanent groundwater monitoring well next to a proposed drainage ditch. Other field activities included collecting groundwater samples at the newly installed monitoring well and three other wells within the area to be that were analyzed in the field and laboratory setting. Assisted in writing report, creating exhibits and tables, and filing a monitoring well report with the State of North Dakota.

Legacy – Geophysical Study, Bowman, ND*
Assisted with a geophysical survey that was conducted to detect underground coal mine voids. The field study consisted of collecting ERI to a depth of 50 feet ranging in length of 150-200 feet. SRT data was also collected in areas that were indicative of underground cavities.

ONEOK – Geotechnical Study, Watford City, ND*
Assisted with a geotechnical study for a pipeline delineation that was based on land accessibility, topography, and erodibility of soil and formation. Field study consisted of locating subsurface piping and slumping within the steep and highly erodible terrain.

Positive Train Control (PTC) Towers of Canadian Pacific (CP) Rails, ND, IA, MO, and IL*
Federal Communication Commission and Selection 106 Regulatory Compliance for Positive Train Control Telecommunication Towers for Canadian National Railroad Line right of ways (ROWs).

Phillips and Jordan, Sand & Gravel Assessment – Alexander, ND *
Assisted with Phase I and Phase II ESAs for potential sand and gravel resources. Compiled existing soils, geological, and topography information for Phillips and Jordan and analyzed major landforms that typically contain sand and gravel resources. Summarized the information on base maps to complete site evaluations.

Gravel Products Inc. - Sand and Gravel Mapping – Minot, ND *
Completed a class III reconnaissance level aggregate assessment for Gravel Products Incorporated consisting of mapping potential gravel resources. Evaluation of potential consisted of looking at aerial photography, using GIS, topographic maps, previous well data and gravel pits as well as current gravel pits to locate gravel potentials.

Fisher Sand and Gravel - Sand and Gravel Mapping - Sterling I-94 Corridor, ND *
Completed a class III reconnaissance level aggregate assessment for Fisher Industries consisting of mapping potential gravel resources. Evaluation of aggregate potential consisted of looking at aerial photography, using GIS, topographic maps, previous well data and gravel pits as well as current gravel pits to locate gravel potentials.

Hodges, Harbin, Newberry & Tribble (HHNT) - Aggregate Assessment - Major Shale Plays in US*
A reconnaissance level study conducted categorizing geologic data within the major shale plays and basins on their quality potential for construction aggregate. Potential categorized and arranged by rock and sediment type as well as the process of deposition using ArcMap. Surficial geologic data within the contiguous United States was clipped from the major Shale Basins and Plays.

Crushed Rock Sales (CRS) - Aggregate Mapping of McKenzie County, ND*
Completed a class IV reconnaissance level aggregate resource assessment. Evaluation of aggregate potential consisted of looking at aerial photography, using GIS, topographic maps, previous well data, and gravel and scoria pits as well as current gravel and scoria pits to locate gravel and scoria potentials.

Confidential Client - Silica Resource Screening, MT, WA, ID, and OR*
Pre-screening sites for high-quality silica deposits. Pre-screening sites consisted of gathering and compiling information of the location, resources/reserves, status and size of mine operations, quality, accessibility to site, and ownership.

MN Land Trust - Mineral Remoteness Assessment, MN*
A minerals resource evaluation/mineral remoteness assessment was completed to determine the potential for mineral resources. The mineral assessment consisted of aggregate (crushed stone, sand & gravel, and silica sand), industrial minerals (clay, peat, marl), oil and gas, coal, and metals.

Knife River Corporation - Sand and Gravel Mapping, ND*
Completed reconnaissance level aggregate assessments that consisted of mapping potential sand and gravel resources. Projects in North Dakota include Antelope Hills wind farm near Beulah, the Watford City bypass, I-94 Corridor near New Salem, infrastructure for Bismarck/Mandan and Williston. Evaluation of potential resources consisted of field mapping, aerial photography, topographic maps, well data, previously mined and current gravel pits, and DEMs to help map the geomorphology indicative of sand and gravel deposits.

EXPLORATION

Aggregate Exploration and Drilling
Responsibilities include developing scope of work documents, health and safety planning, field work oversight and report preparation and recommendations. Desktop overview consists of reviewing the topography and DEM, geologic maps, well data, gravel pit locations, and aerial photos. Field activities consist of field oversight while drilling borings and reviewing the material during drilling activities. Created maps and report on approximate aggregate (sand & gravel) quantities and qualities.

Aggregate Mapping
Responsibilities include completing a desktop study analyzing maps, plates, and publications of the area of interest. Reconnaissance level field work includes observing the sediment type seen within the area being mapped. Well data, soils maps, topographic maps, aerial photography, gravel pit locations, DEMs, and hillshading data are compiled in ArcMap. With the help of the compiled data, aggregate potential areas are able to be defined by mapping the geomorphology.

DUE DILLIGENCE

Phase I Environmental Site Assessments
Assist in conducting Phase I ESAs for agricultural, healthcare, retail, commercial, and telecommunication facilities. Responsibilities include obtaining and reviewing historical research, conducting interviews, and report preparation.

Phase II Environmental Site Assessments / Limited Site Investigations
Responsibilities include developing scope of work documents, health and safety planning, obtaining historical information, contacting various government entities, and field work oversight. Field activities included conducting soil, groundwater and soil gas/vapor investigations using push probe and hollow stem auger drilling techniques. Additional responsibilities include multimedia sampling, soil logging and classification, installation and sampling of groundwater monitoring wells, as well as documentation and report preparation for the above activities.

Jacqueline M. Finck (continued)

LEGAL SUPPORT

Confidential Client – Petroleum Impacted Property: Minnesota

Provided expert witness testimony regarding a historical petroleum spill associated with a retail gas station and dispute of property ownership due to contamination on an adjoining parcel of land. Project activities associated with the site included a site investigation to determine extent and magnitude of petroleum contamination including groundwater and surface water receptor surveys; UST removal and associated soil management oversight, submission of applicable documents to the MPCA for regulatory closure, and submission of eligible costs for reimbursement to the Minnesota Department of Commerce Petrofund Division. Expert witness testimony was used to obtain an opinion regarding historical contamination associated with the site.