

STATEMENT OF QUALIFICATIONS



BATTELLE INTERNATIONAL CONFERENCE ON THE REMEDIATION AND MANAGEMENT OF CONTAMINATED SEDIMENTS

January 9- 12, 2023
JW Marriott Austin, TX

For more information, please contact:

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Environmental Expertise from the Ground Up



GES scientists, engineers, and technical field specialists tackle some of the most complex environmental challenges. We approach each project from all angles to develop site-specific solutions incorporating proven and innovative approaches and advocating with regulators for our clients.

Areas of Expertise

- Air Quality Services
- Environmental Due Diligence
- Drone Data Collection & Inspection Services
- Site Investigation
- Remedial Design & Construction
- Technical Field Solutions
- Operations, Maintenance, & Monitoring
- Environmental Permitting & Planning
- Strategic Consulting
- Ecological Services
- Water Resources Management
- Data Management, Mapping, & Visualization

GES At-A-Glance

Founded
1985



380+
employees



47 Professional
Licenses in
States, DC, PR and USVI



28 Office
Locations



0.15
OSHA TRIR
3-Year Average

How we work

Our best-value approach combines:

- Sharp focus on client needs
- Responsive, efficient service delivery
- Highest commitment to health and safety
- Technical and regulatory expertise at the federal, state, and local levels
- Qualified and highly-trained field resources
- Client advocacy to secure regulatory approvals that meet our clients' objectives
- Disciplined program management approach

Health, Safety, Security, and Environment

0.00 Total Recordable Incident Rate (TRIR) for 2022 and 0.15 three-year industry average

10+ years with only one OSHA Lost Time Injury

0.827 Experience Modification Rate (EMR)

LPS behavior-based management system

Performance verified by ISNetwork, Avetta (formerly PICs), PEC Premier Safety Management, and National Compliance Management System

National Perspective Delivered Locally.

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Core services



Assessment and Remediation



Practical Client-Focused Solutions

GES provides consulting, engineering, and technical field services related to the assessment and remediation of environmental media.

Our teams navigate regulatory, technical, and logistical challenges to develop and implement practical solutions that work. We do this by focusing on the basics: a strategic exit plan tailored to site requirements and our client's business needs.

Practical solutions center on life cycle management; the development of a project progression plan that evaluates the costs, benefits, and risks of alternative paths to closure; and flawless execution of the site-specific strategy.

Our "whole site" approach, with its emphasis on a technically-sound and defensible conceptual site model, leads to a practical and cost-effective site management strategy.

GES develops the most cost-effective and aggressive remedial approach to site cleanup by understanding the associated contaminant concepts including mobility and degradation factors, risk analysis, and remediation technology applicability.

Innovation

Practical solutions require innovative thinking. We develop and execute state-of-the-art approaches to meet challenges in project execution. We provide added value in our evaluation of the applicability of regulatory rules and guidelines and our strong advocacy to help each client work toward their goals.

Strategies include risk-based closure, the use of innovative and traditional technologies, green remediation, and passive approaches. GES is experienced in remedial technology feasibility testing, remedial alternative evaluation and selection, and remedy design, construction, oversight and O&M. GES is continuously integrating new and existing technologies to provide the most aggressive, yet cost-effective approach to remediation.

Our solutions are practical: technically sound and designed to work. And the results are sustainable: lasting, safe, and compliant — so that the solution we deliver is the right one for your site.

Areas of Expertise

Applying strong regulatory knowledge and persuasive client advocacy

Understanding business drivers and cost impacts

Carefully evaluating site conditions

Developing an effective conceptual site model

Assessing and managing risk

Evaluating passive and traditional approaches and innovative alternatives

Safe performance by our multi-disciplinary field teams

Tying the basics together with strong management to deliver on scope, schedule, and budget

Industrial



Practical Solutions, Sustainable Results

Profitable, sustainable, competitive companies must meet the rising costs of doing business while maintaining compliance, protecting the environment, and restoring asset value. We help our clients balance these challenges within their environmental programs through innovative and practical solutions.

We partner with our clients to develop and implement tailored environmental management strategies. An efficient service delivery model integrates program leadership with operations and engineering to ensure quality, consistency, and safe performance across our client's portfolios. This best-value approach pairs specialized industry expertise with the appropriate technical and regulatory knowledge to match the right resources to each project.

Our focus on site-specific strategies encourages innovation, creativity, and lasting results. We view client advocacy as a core responsibility, and we diligently work to secure regulatory approvals and enable asset acquisition, divestiture, and development to support our clients' business initiatives.

Above all, GES is focused on achieving our clients' goals, safely — with a commitment to health, safety, security, and environment (HSSE) and the use of our licensed LPS (Loss Prevention System) behavioral management system.

Our Clients

We support diverse businesses with wide-ranging needs. Sites range from active operating facilities to dormant properties with decades of diverse utilization.

Ashland Inc.	CertainTeed	General Chemical	NiSource
AT&T	Chesapeake Energy	General Electric	Northern Tier Energy
Black & Veatch	Chevron	General Dynamics	NRG Energy
BP Products NA	Consolidated Freight	Global Wire	Pacific Gas & Electric
Brenntag	Dominion Resources	Hertz	Penske Truck Leasing
Bristol Myers Squibb	Duke Energy	IBM	Republic Services
Buckeye Partners	ExxonMobil	Key Energy Services	Rohm and Haas
Catalyst Energy	FedEx	Kinder Morgan	Shell Oil Products US
CenterPoint Energy	Fortune Brands	Lafarge NA	Total Petrochemical

Areas of Expertise

GES provides environmental consulting, engineering, and technical field services aligned with the needs of our core markets to provide best value to our clients.

- Air quality
- Assessment
- Compliance
- Consulting
- Construction support
- Data management
- Demolition management
- Due diligence
- Engineering
- Environmental health & safety
- Liability management
- Field services
- Permitting
- Portfolio management
- Remediation
- Risk assessment



Ecological Services



Integrated environmental approaches to advance your project.

Groundwater & Environmental Services, Inc. (GES) has a 37-year track record of helping clients achieve regulatory success by delivering practical solutions in the areas of environmental planning, permitting, compliance, and construction support. GES Ecological Services staff have degrees (many with advanced degrees) in environmental science, zoology, biology, wildlife ecology, environmental geography, natural resource management, wildlife and fisheries resources, applied ecology, environmental engineering, forestry, and horticulture. These professionals are highly experienced and accomplished and include Professional Wetland Scientists, Certified Wildlife Biologists, Certified Arborists, FAA-qualified Wildlife Biologists, and Rosgen-trained Natural Stream Designers. supported by geologists, engineers, and technicians to provide complete environmental solutions. Our typical projects include:

- **Ecological Risk Assessments.** GES develops ERAs (and similar ecological risk evaluations) under both EPA and state guidelines at hazardous waste and fuel-release sites.
- **NEPA Documentation.** GES takes the project through the entire NEPA process for a variety of projects, including highways, utility lines, and airports.
- **Waters of the U.S. Delineations and Permitting.** GES staff have performed thousands of stream and wetland delineations pursuant to the Clean Water Act and several state programs and have developed permit applications and Mitigation Plans for many of them.
- **Stream and Wetland Mitigation Banks and Projects.** GES' Rosgen-trained Stream Designers and Professional Wetland Scientists have designed, constructed, and monitored streams and wetlands across the country.
- **Protected Species Habitat Evaluations and Surveys.** GES Ecological Services staff are experienced in evaluating habitat for protected species and, where needed, performing presence-absence surveys and guiding the project sponsor through mitigation action.
- **Biological and Natural Resource Surveys.** GES performs a broad variety of surveys for flora and fauna, sensitive habitats, and resource mapping in all types of aquatic and terrestrial settings.
- **Wildlife Hazard Management.** GES provides wildlife hazard management for airports and conducts avian risk assessments and wildlife management for towers and other facilities where wildlife could pose a conflict.
- **NPDES Permitting.** GES professionals are highly experienced in developing NPDES permit applications and monitoring for wastewater and stormwater discharges.
- **Environmental Inspection/Construction Monitoring.** GES Ecological Services staff routinely perform construction monitoring for new pipelines and other infrastructure that impact land or water. The oversight typically ensure that wetland impacts are mitigated or avoided, and impacts on protected species are avoided.



Construction Management and Monitoring

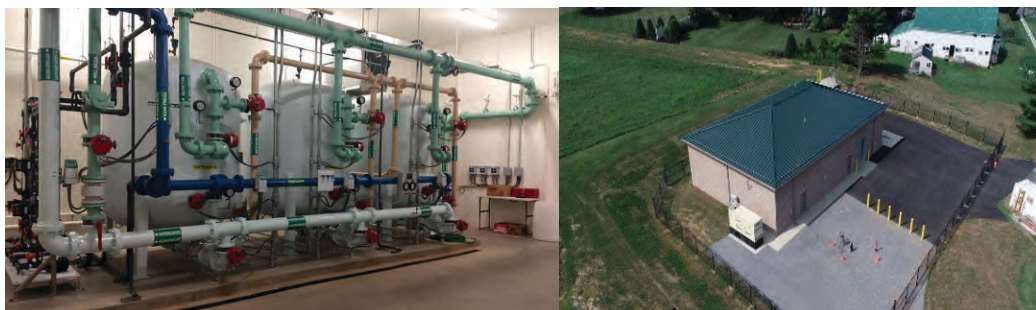


Safe, timely, and cost-effective delivery of construction projects.

GES' construction managers and supervisors, engineers, and health and safety professionals collaborate to effectively manage, monitor, and safely deliver quality environmental construction projects, on schedule and within budget. Our project staff represent our clients on-site to ensure construction projects are executed in compliance with specifications and in accordance with safety expectations. We seek opportunities to identify and implement innovation and efficiencies that increase project value. GES' construction managers keep a keen eye on schedule and cost control, and provide solutions and alternatives to resolve issues that may arise during construction.

Our team has experience managing and monitoring construction projects for major infrastructure (e.g., pipelines) projects, facility construction, and remediation projects at municipal water-treatment facilities, petroleum refineries and terminals, major pipelines, power generation facilities, large industrial sites, and chemical manufacturing plants. Our construction monitoring capabilities include ecological services; endangered, vulnerable, and threatened species and habitats; wetlands; stormwater/erosion and sedimentation; air quality; noise; odor; and vibration. In addition to developing and implementing project monitoring plans, GES can provide facility inspections for asbestos and hazardous wastes, modeling, permitting, and mitigation services for construction projects.

We are able to offer full-service construction management services by utilizing a broad array of technical specialists we employ with expertise in compliance, geology, hydrogeology, air quality, risk management, wetlands, noise, odor and vibration monitoring, stream design, endangered species, and aerial data collection and monitoring. Few construction projects are completed without deviation from plan, and you need qualified construction managers to adeptly respond to and resolve project challenges.



Areas of Expertise

- Air quality management
- Asbestos and hazardous materials inspections and mitigation
- Constructability reviews
- Construction and as-built drawings
- Cost and schedule control
- Environmental permitting and compliance
- Estimating
- HSSE management
- Resident engineering
- Odor, vibration, and noise monitoring and mitigation
- OSHA compliance and audits
- Plan and submittal review
- Pre- and post-construction site surveys
- Project monitoring
- Specification preparation
- Waste minimization

Demolition & Decommissioning Management



Maximizing value and return on your aging operating assets.

All operational plants and equipment eventually reach the end of their useful or economic lives. As market conditions and technologies evolve, businesses must make decisions to extend, repurpose, or retire less efficient assets and legacy sites.

To avoid safety risks and costly maintenance obligations, you need a partner to help safely and efficiently decommission, decontaminate, and demolish your obsolete facilities. GES has extensive experience in the assessment, planning, and construction management associated with decommissioning and demolition.

GES applies a comprehensive approach to support the retirement of industrial and commercial facilities with a focus on safety, compliance, cost control, and project management. Our environmental expertise spans every step of the facility retirement process, including:

1. **Pre-decommissioning baseline studies:** hazardous material; asbestos; permitting; compliance management; underground structures and utilities; soil, groundwater, and sediment impacts
2. **Planning and procurement:** cost estimate, risk register, specifications, bid documents, and contracting
3. **Hazardous materials management and abatement:** universal wastes, PCBs, asbestos, and lead-based paint
4. **Scrap and salvage:** reuse, recycling, and disposal
5. **Site reuse:** liability management, remediation, restoration, and property transfer support

GES serves as owner's engineer during demolition work, with responsibilities that include evaluating safety procedures, documenting work completed, reviewing change orders and invoices, and identifying nonconforming work and associated corrective measures.

Our practical approach, strong safety culture, and regulatory knowledge means your demolition project will progress swiftly and safely towards next use, while fully meeting your business objectives and regulatory obligations.

Areas of Expertise

- Regulated waste surveys
- Pre-decommissioning studies
- Biological surveys
- Site assessment/investigation
- Closure planning development
- Materials handling planning
- Waste treatment and disposal
- Utility location and coordination
- Environmental remediation
- Scope of work and solicitation development
- Procurement and bid management
- Owner's engineer/agent
- Construction management
- Health and safety management
- Environmental permitting and compliance management



Chemical Contaminants of Emerging Concern



Limiting Liability from PFAS and 1,4-Dioxane

Per- and polyfluoroalkyl substances, better known as PFAS, have dominated the emerging contaminants landscape for the last decade. PFAS and 1,4-Dioxane (1,4-D) represent significant challenges in investigation, remediation, and regulatory compliance. Scientific research and advancements in technology have helped industry gain a better understanding of the potential sources, human health risks, ecological impacts, characterization methods, and treatment alternatives. As regulatory guidance of PFAS and 1,4-D continues to evolve, there is a growing sense of uncertainty and urgency in both industry and the regulatory community.

Our culture at Groundwater & Environmental Services, Inc. (GES) is to develop and implement practical solutions to our customers' current and future environmental challenges, including the challenges posed by emerging contaminants. PFAS and 1,4-D are both mobile, persistent, and challenging to remediate. The sources are varied and the regulatory requirements for investigation and remediation are rapidly evolving throughout the U.S.

What does this mean for your business? Have you identified your potential exposures for emerging contaminants? What are the regulatory requirements across the US? What actions are you required to take? What needs to be sampled and by what analytical methods? What does the data mean? What steps can you take now to limit your future liabilities? We can help.

GES can help you navigate the dynamic regulatory climate by developing assessment, treatment, and remediation methods associated with PFAS and 1,4-D. We'll start by educating you and helping you identify your potential exposures. We will help you determine what to sample, and what laboratories can perform the required analyses, and collect the samples using best practices developed for these challenging compounds. Let our experience and expertise work for you.

Every day we help clients sharpen their understanding of the current science and regulatory landscape while taking proactive steps towards future compliance in the form of data collection, modeling, and treatment alternatives to address these potential risks. Our emerging contaminants team is active in the industry in contributing to developing practices and bringing the latest information to our project teams.

Areas of Expertise

- Vulnerability assessment
- Site investigation
- Multi-media sampling
- Remedy selection and design
- Treatment and remediation
- Rapid response
- Regulatory-client advocacy
- Public participation support
- Waste management



Meet our technical experts.





Adolfo (Al) G. Murphy

Senior Vice President, Oil and Gas/Corporate Utility and Power

LOCATION

Exton, PA

EDUCATION

BS, Chemical Engineering –
Lehigh University

AFFILIATIONS

American Institute of Chemical
Engineers

EXPERTISE

- Program management
- MGP projects
- Waste management
- Process plant design and construction

Al Murphy, has over 38 years of experience in major program and project management, process design, engineering, and operations involving environmental technologies and services. His experience and expertise spans various multi-million dollar and multi-site remediation, treatment, and facility construction programs and projects involving fossil fuels, petroleum-derived chemicals, manufactured gas plant (MGP) contaminants, PCBs, dioxin, low-level mixed waste, solid waste, pathological waste, and other CERCLA and RCRA contaminants. He has specific expertise in remedial technologies including hazardous waste incineration, thermal desorption, combustion technology, soils/solids processing, air pollution control systems, material handling systems, and environmental construction and remediation projects. Additional experience includes soil stabilization, sheet piling support systems, engineering design and OM&M services for groundwater and wastewater treatment, permitting, perimeter air monitoring, transportation and disposal activities, and sediment management technologies including dredging, dewatering, and sediment and filtrate treatment.

Project Experience

Multi-Site Construction and Remediation Program at Manufactured Gas Plant (MGP) Sites, Folsom, NJ

Served as program manager for multi-year, multi-site remediation program for coal-tar contaminated sites. Developed program and site-specific strategies for construction and remediation approach, and designed/specified thermal treatment system configuration for thermal remediation of 12 former MGP sites. Program involved design and construction of shoring and sheet-piling systems, multi-point groundwater extraction systems, groundwater treatment systems (up to 200 gpm), deep soil excavation, thermal treatment, and backfill of 400,000 tons of coal-tar-contaminated soils. Supported client with strategic and technical decisions for managing the seven-year, \$30+ million program. Ensured safety, quality, and timeliness of site operations, program logistics, analytical reporting, budgeting, and resource allocation.

Former MGP Sites, Remediation Technology Committee, Folsom, NJ

Evaluated and developed MGP soil and groundwater treatment technologies, including in-situ technologies to remediate deep-source contamination (30 feet below ground surface (bgs)) where traditional technologies are not feasible or economically practical. Technologies included chemical oxidation, thermochemical stabilization, and recirculating well technologies. Reviewed and assessed site investigation data, and developed bench and pilot-scale technology evaluation protocols, analytical testing procedures, field-screening procedures for contaminated source delineation, and cost models for technology implementation.

Remediation Management at Former MGP Site, Egg Harbor City, NJ

Responsible for project direction including project management, technical approach, and cost analysis to remediate site. Project included 200 gpm design/build/own/operate approach for groundwater control, extraction and treatment, sheet piling support system with tieback anchoring system, and excavation



approach. Project implementation included demolition of surface and subsurface concrete structures, with over 2,000 tons of concrete demolished and removed prior to soil remediation activities; traffic control and logistics; equipment and personnel mobilization; design and installation of 1,000-foot-long sheet piling system including vibration monitoring due to nearby structures and commuter railway; design/construction of multi-well shallow and deep groundwater extraction system; design, construction, and operation of 140-gpm groundwater treatment plant; excavation and thermal treatment of 68,000 tons of coal tar-contaminated soils (PAH and BTEX); and on-site backfill and site restoration. The \$10.5 million project was successfully completed as scheduled with no lost-time injuries.

Construction and Thermal Remediation Sites, various locations

Responsible for project and client development activities involving remediation of soil and groundwater contaminated with RCRA, CERCLA, and TSCA compounds. Involved a design/build/own/operate approach. Developed technical and business strategies for the application of remedial technologies including thermal treatment, chemical stabilization, groundwater extraction and treatment, sludge and sediment dredging and dewatering, and soil or sediment washing.

Pennsylvania Department of Environmental Protection (PADEP) Interim Response and Remediation Services Contract (IRRSC), PA

Served as technical director and program manager for \$4 million per year remediation program for various sites throughout PA. Under this program, was responsible for resource allocation, project management direction, scope of work development, technical approach, and execution of remedial actions.

US Army Corps of Engineers, Superfund Hazardous Waste Site, Commerce City, CO

Served as technical director of \$3 million pilot treatability study, which included a “white paper” study of direct-fired thermal desorption technologies as applied to hazardous-waste-contaminated soil. Responsibilities included developing process-flow diagrams and calculations for a twin-line, high-capacity thermal desorption process. Also developed equipment specifications and costing for input into the project’s economic model.

Presentations/Seminars

Murphy, A.G. “Thermal Desorption: Technology Application and Experience,” Department of Energy Site Treatment Plan, Technology Exchange Workshop, Albuquerque, NM (1993).

Murphy, A.G. “Incineration of Explosive Contaminated Soils at the Savanna Army Depot,” Environmental Performance Cooperative, Workshop on Explosives, Contaminated Soils, the Hagley Museum, Wilmington, DE (1993).

Murphy, A.G., and C. Parker “Design and Operation of a Low Temperature Thermal Treatment System,” American Defense Preparedness Association, 18th Environmental Symposium and Exhibition, Alexandria, VA (1992).



David Nakles, PE, Ph.D.

Principal Engineer II

LOCATION

Cranberry Township, PA

EDUCATION

Ph.D., Chemical Engineering and Engineering and Public Policy – Carnegie Mellon University,

BS, Chemical Engineering – Pennsylvania State University

LICENSES/REGISTRATIONS

Professional Engineer – PA

RELEVANT EXPERTISE

- Risk-based environmental management
- Soil and sediment impacts (site investigations, risk assessments, and remediation)
- MGP site portfolios (multi-site investigations and development of risk-based remediation strategies for site closure)
- Expert witness

David Nakles is a principal engineer with over 40 years of environmental consulting experience. He joined GES in 2020. David has expertise in the risk-based environmental management of soil and sediment impacted with residuals generated during the extraction and processing of coal, oil, and natural gas, with a particular focus on coal gasification and/or manufactured gas plant (MGP) sites. He has implemented multiple consulting projects for individual gas and electric utility companies and led several multi-year, multi-disciplinary MGP research projects supported by trade organizations such as the Gas Research Institute (GRI) and the Electric Power Research Institute (EPRI). He also managed several research projects focused on petroleum hydrocarbon impacts for the American Petroleum Institute, the American Association of Railroads (AAR), and the Petroleum Environmental Research Forum (PERF), as well as government agencies such as the Department of Energy and the Department of Defense. His research has emphasized the development of innovative site characterization and remediation strategies for the cost-effective management of risks to human health and ecological receptors. David is the author of numerous publications on the technical aspects and management of MGP and petroleum-impacted sites. He has organized and managed several national conferences that addressed the environmental issues at MGP sites. He has been deposed and testified in a trial as an expert witness, with a focus on the historical processes and environmental management practices of the MGP industry.

Project Experience

Bioavailability of Polynuclear Aromatic Hydrocarbons (PAHs) in Sediment for Sediment Contaminant Bioavailability Alliance (SCBA), GRI, and Other Groups

Led a research initiative that focused on defining the bioavailable fraction of PAHs in impacted sediment to define risk-based remedial action levels. Research led to the development of an analytical method for the characterization of low concentrations of PAHs in sediment pore water. As part of the project, inter-laboratory validation studies were designed and conducted, and approval of the analytical method by both the ASTM (ASTM D7363-13) and US EPA (U.S. EPA 8272) was obtained. This analytical method is now being accepted by many state and federal regulators for use at PAH-impacted MGP sites for determining risk-based remedial action levels and delineating reduced remediation footprints. The research was initiated on coal tars in soil but quickly expanded to include other hydrocarbon matrices, e.g., oil and gas exploration residuals and sediment. It led to the generation of a one-of-a-kind database for PAH-impacted sediments, which included analytical assessments of contaminant bioavailability and synoptic laboratory bioassay tests.

Hydrocarbon Bioavailability Investigation for Sediment Contaminant Bioavailability Alliance

Investigated the state of knowledge on the bioavailability of hydrocarbons and other organic chemicals in sediment with the intent of incorporating this information into risk-based, environmental policies for defining cost-effective remedial action levels that are protective of human health and the environment. This research was initiated on coal tars in soil but quickly expanded to include other hydrocarbon matrices, e.g., oil and gas exploration residuals and sediment. It led to the generation of a unique database for PAH-impacted sediments, which included analytical assessments of contaminant bioavailability and synoptic laboratory bioassay tests.

Management of MGP Sites for GRI

Served as manager of a multi-year, multi-million-dollar project to investigate environmental impacts associated with historic processes that converted coal to gas in the 1800s to produce heat and light, i.e., the manufactured gas industry. This research program was the first to address this technical area for the gas and electric utility industry, which included nearly 3,000 legacy sites across the US, and emphasized the development of an understanding of the historic environmental practices of this industry and the contemporary management of environmental issues associated with these past operations, e.g., cyanide and coal/oil tar contamination. The project identified the contaminants of interest at the sites, assessed the human health and environmental risks, and performed research to investigate the performance and cost-effectiveness of remediation strategies to reduce risks to acceptable levels. The project team consisted of industry partners, commercial analytical laboratories, and several university researchers. Led the effort to publish the research results in a book, "Management of Manufactured Gas Plant Sites – Two-Volume Practical Reference Guide of the Gas Research Institute".

Risk-Based Characterization Protocol for Mobile Dense Non-Aqueous Phase Liquids (DNAPL) in the Subsurface Environment at MGP Sites for EPRI

Managed a project to develop a site characterization protocol at MGP sites to delineate DNAPL in the subsurface environment. The presence of mobile DNAPL represents a potential barrier to environmental site closure, which is not risk-based. The development of a site characterization protocol that addresses these potential impacts and places them into a risk-management context has the potential to eliminate costly site remediation requirements. A DNAPL mobility characterization protocol was developed and published by EPRI and a workshop comprised of a quorum of state and federal environmental regulators was conducted to secure a consensus regarding the use of characterization protocol to accurately assess the nature of these subsurface impacts and the subsequent need for remediation.

Speciation of Cyanide Complexes in Soil and Groundwater at MGP Sites for EPRI and Northeast Gas Association

Led research initiative to develop a risk-based approach for the management of cyanide impacts in soil and groundwater at MGP sites. The research focused on the development of an analytical method for the determination of free cyanide, which is the chemical form of cyanide that is toxic and forms the basis for state and federal groundwater regulations, e.g., the Federal MCL. Historically, it was necessary to rely on the use of an EPA-approved method for the determination of total cyanide to provide a basis for regulatory compliance. However, at sites that are dominated by high-temperature processing of coal, total cyanide is dominated by a non-toxic chemical form of cyanide, i.e., iron-cyanide complexes, and free cyanide typically comprises less than 1% to 3% of the total cyanide. The research program collected samples from multiple sites and demonstrated that only a small fraction of the total cyanide was in the toxic, free cyanide form. It then focused on securing US EPA approval of an ASTM method for the measurement of free cyanide. Study results were

accepted by US EPA, resulting in the publication of the method, US EPA Method No. 9016. The use of this method for making a risk-based assessment of environmental compliance at impacted sites has the potential to eliminate the need for the application of costly remediation strategies that are focused on the unnecessary reduction of total cyanide concentrations to meet regulatory discharge limitations.

NAPL Study for Technical Protocol for Environmental Closure of MGP Sites, US

Served as senior technical advisor of a research project that: (1) defined a technical protocol for determining the presence and volume of organic source material that exists in the subsurface at MGP sites and (2) established the relationship of these materials to groundwater impacts. Project objectives were: (1) to identify methods or techniques that are capable of distinguishing between free- and residual-phase NAPLs, (2) to quantify the fraction of organic source materials that are “available” to the environment and rate at which they are released into groundwater, and (3) to develop a quantitative relationship between the presence of NAPL and groundwater impacts. Conventional investigation methods, innovative laser-induced fluorescence techniques, and other advanced NAPL characterization techniques were used to document subsurface NAPL architecture and its impact on groundwater quality. The relationship between NAPL presence and groundwater impacts is critical to any comprehensive closure strategy for MGP sites and ultimately dictates the extent of NAPL remediation, if any, that is required to achieve the desired site management goals.

Representative Publications

- Geiger, S. C., N. A. Azzolina, D. V. Nakles, and S.B. Hawthorne, “Predicting Toxicity to *Hyaella azteca* in Pyrogenic-Impacted Sediments - Do We Need to Analyze for all 34 PAHs?,” *Integrated Environmental Assessment and Management*, Vol 12, No. 3, pp. 493-499 (2016).
- Ran Liu, E. B. Altschul, R. S. Hedin, D. V. Nakles, and D. A. Dzombak, “Sequestration Enhancement of Metals in Soils by Addition of Iron Oxides Recovered from Coal Mine Drainage Sites,” *Journal of Soil and Sediment Contamination*, Vol 23, No. 4, pp. 374-388 (2013).
- McDonough, K.M., N.A. Azzolina, S.B. Hawthorne, D.V. Nakles, and E.F. Neuhauser, “A Quantitative Evaluation of the ability of Chemical Measurements to Predict PAH-Contaminated Sediment Toxicity to *Hyaella Azteca*,” *Environmental Toxicology and Chemistry*, Vol. 29, pp. 1545-1550 (2010).
- Biksey, T., D.V. Nakles, F. Kremer, “Monitored Natural Attenuation Forum: Monitored Natural Recovery of Contaminated Sediments,” *Remediation*, Winter (2006).



Nick Azzolina, PhD

Principal Data Scientist II

LOCATION

Green Bay, WI

EDUCATION

PhD, Environmental Management and Science - Carnegie Mellon University

MS, Hydrogeology - Syracuse University

BA, Geoscience - Princeton University

EXPERTISE

- Statistical analysis
- Sediment assessments
- PAH chemistry & bioavailability

Nick Azzolina is a Principal Data Scientist II with 25 years of industrial and consulting experience. He is a subject matter expert specializing in statistical analysis and modeling of complex multidimensional datasets and the environmental chemistry and bioavailability of polycyclic aromatic hydrocarbons (PAHs).

Nick specializes in the characterization of PAHs in soil, groundwater, and sediment associated with former manufactured gas plant (MGP) and other hydrocarbon sites. As the Program Manager for the former Sediment Contaminant Bioavailability Alliance (SCBA), Nick managed sediment investigation activities at more than 20 sites across the U.S. and Canada for multiple utility and manufacturing clients. The outcomes of these investigations provided multiple lines of evidence supporting risk-based remedial action footprints that were significantly smaller in area and volume than those derived using technical guidance sediment screening values (e.g., 1.6 and 22.8 mg/Kg total PAH).

Nick combines his PAH chemistry and bioavailability experience with his statistical background to provide data-driven solutions for clients that minimize remedial action costs while remaining protective of human health and the environment.

Project Experience

Sediment PAH Forensics, Gowanus Canal Superfund Site, New York City, NY

Worked on behalf of a group of 16 Gowanus Canal Superfund Site allocation participants to conduct a forensic assessment of canal sediment samples. This work used several chemical lines of evidence, focusing on hydrocarbon contamination and specifically on polycyclic aromatic hydrocarbons (PAHs). His expert report and subsequent rebuttal report described the application of established environmental forensics methods to distinguish the contributions of specific parties to the present-day PAH impacts to the Gowanus Canal sediment. These reports successfully helped the group to minimize their share of the cost allocation.

Sediment PAH Bioavailability Assessments, Multiple Sites, United States and Canada

Program Manager for the former Sediment Contaminant Bioavailability Alliance (SCBA), an industry consortium established to incorporate measurements of the bioavailability of sediment-bound PAHs into risk-based, environmental policies for defining cost-effective remedial action levels that are protective of human health and the environment. Managed work plans, sample collection, sample analysis, data analysis, and reporting for 20 case studies that were conducted throughout the U.S. and Canada at MGP, aluminum smelter, and other pyrogenic PAH sites. Organized meetings with U.S. EPA and various state agencies to review the case study results and advance the SCBA goals and objectives. These case study data were transferred to the Electric Power Research Institute (EPRI), where the data are available to Program 50 utility members.



Sediment Quality Triad (SQT) Studies, Multiple MGP Sites in New York State

Managed work plans, sample collection, sample analysis, data analysis, and reporting for multiple SQT studies in the Hudson and Mohawk Rivers, NY. Applied statistical techniques to assess relationships among benthic macroinvertebrate community data and site-specific measurements of sediment chemistry, toxicity, and physical parameters. Developed remedial action footprints using weight-of-evidence, risk-based approaches, which were significantly smaller in area and volume than those derived using technical guidance sediment screening values of 1.6 and 22.8 mg/Kg total PAH.

Sediment Passive Sampling Study for PCBs, Portland, OR

Evaluated measurements of PCBs in sediment and sediment-exposed polyethylene (PE) from the Lower Willamette River. The data were collected to inform remedial cap design by estimating pore water PCB concentrations, which could then be used to develop site-specific partitioning coefficients from sediment to pore water. Served as a technical advisor focused on data quality, analysis, and interpretation.

Sediment Data Analysis for Expert Testimony, Badin, NC

Analyzed historical PCB congener data in lake sediment, lake water, and fish tissue to refute the claim that site-related PCBs were the source of fish tissue PCB concentrations. Incorporated multiple statistical approaches to show that fish tissue more closely resembled background sources than site-specific PCB profiles.

Sediment Feasibility Study and Remedial Design, Ashland, WI

Project Manager for post-RI/FS data analysis of sediment NAPL and PAH concentrations at the Ashland/ NSPW Lakefront Superfund Site. Created and evaluated 3D models of contaminant distributions and assessed process calculations for sediment volumes, removal, dewatering, and disposal. Assessed FS cost estimates using Monte Carlo simulation. Represented Xcel Energy in meetings with U.S. EPA Region 5 and the Wisconsin DNR.

EPRI Sediment Research White Paper

Compiled over 20 years of EPRI (Electric Power Research Institute) sediment-related research into a white paper for a prospective Program 50 utility member. While the research covered a wide array of topics, most of the documents could be classified according to three topic areas, which were the focus of the white paper: (1) sediment PAH bioavailability and toxicity; (2) monitored natural recovery; and (3) sediment capping.

EPRI Groundwater Research White Paper

Compiled over 20 years of EPRI groundwater-related research into a white paper for a prospective Program 50 utility member. While the research covered a wide array of topics, most of the documents could be classified according to five topic areas, which were the focus of the white paper: (1) source characterization and leaching; (2) groundwater contaminant transport modeling; (3) monitored natural attenuation; (4) in-situ groundwater treatment; and (5) ex-situ groundwater treatment.

EPRI Sediment Assessment Protocol

Developed a technical brief for a sediment assessment protocol entitled, "Incorporating Direct Measurements of Bioavailability into Sediment PAH Assessments at MGP Sites". This technical brief discusses the incorporation of analytical method ASTM D7363-13 (SPME pore water method) into ecological risk assessments and the establishment of sediment regulatory clean-up goals for environmental closure of MGP sites.