AIPG Michigan Environmental Risk Management Workshop - The Data Tell the Story

Event Schedule

Tue, Jun 15, 2021

10:00am

Welcome Message
10:00am - 10:45am, Jun 15

11:00am

Making Data Products Available via ArcGIS Online for a 1,4-Dioxane Plume 3D Visualization Project
11:00am - 11:45am, Jun 15

Data Management Tools

A 1,4-dioxane plume in parts of Scio Township and western Ann Arbor was discovered in 1985. The State of Michigan and Washtenaw County Health Department have been tracking this plume for over 20 years in what has become a highly visible project to the public. Making data that is understandable, accurate, and available to the public is a priority for Michigan Department of Environment, Great Lakes, and Energy (EGLE).

This presentation will discuss how a team was put together to consolidate data that was posted on EGLE's Gelman Sciences, Inc. Site of Contamination Information Page in an MS Access database and other various figures and report files into a geographic information system (GIS). The GIS was then utilized to check and transform the data for use by RockWare for 3D block modeling of lithology and geochemistry using their RockWorks software. Outputs from RockWorks were then brought back into the GIS for verification checks and utilization by the project team.

Information was then published to an online GIS viewer for the purpose of making the information easily available to the team and ultimately available to the public. The presentation will preview the various layers available and will highlight insights regarding bringing different skills of team members together, the processes of managing the data and making it available for use in different programs, QA/QC, and the value of having the information available in a web GIS platform.

Speakers

K

Kevin Brown Environmental Scientists and GIS Specialist, The Mannik Smith Group

Kevin Lund, CPG, PE Senior Engineer, Michigan Department of Environment, Great Lakes and Energy

J

Jim Reed Director of Research and Development, RockWare Incorporated

3D Models – Interpretation Before Interpolation
11:00am - 11:45am, Jun 15

Data Application

Contributing Author: Curry, Patrick J., PG, CPG

Background/Objectives.

High resolution site characterization (HRSC) is a concept that has gained traction in recent years as a better way to understand mass distribution, assess risk, and develop focused site remedies. Software applications like Earth Volumetric Studio (EVS) have been widely adopted and displaying HRSC data in 3D has become almost commonplace. Updated daily, 3D models are a great way to drive adaptive characterization with updates displaying postings of lithology, analytical, and other data to help project teams understand data gaps while they are still in the field and begin to fill them. Once an investigation is complete, the result of a modeling effort can be a powerful tool to communicate with stakeholders and non-scientists alike. However, when a modeling effort takes on tasks such as hydrostratigraphic interpretation, mass flux evaluation, and analytical plumes, the results must be reviewed critically. Classical geologic interpretation is often ignored, and the numbers and predilections of the model are allowed to drive interpretation. Modeling results cannot be taken at face value, environmental scientists must be vigilant and force the 3D model to interpolate the data in a way that reflects depositional environment, contaminant distribution, and contaminant transport.

Approach/Activities.

A systematic approach is required when modeling HRSC data in three dimensions. By characterizing hydrofacies and identifying transport pathways during the investigation phase, a lithologic framework can be developed and interpreted within the 3D model. This approach often involves building the hydrostratigraphic model by hand, using classical geologic methods and geologic correlation. The hydrostratigraphy then needs to be constructed in the model before plume interpolation can begin and usually requires multiple iterations to force the model to honor the vision of the geologist. Once the hydrostratigraphic model is established, the analytical data can be interpolated with the proper context, honoring imposed limits to identify contaminant storage, migration, and mass flux.

Results/Lessons Learned.

By using real-time 3D models during HRSC, investigations can be completed more efficiently and with clear communication to stakeholders. When developing the final interpretation, incorporating hydrostratigraphy into the model is key. By creating a 3D model that reflects depositional environment and mass transport, the risks associated with a site are easy to observe and the results of the effort often lead to new revelations that can be incorporated into conceptual site model.

Speaker

K

Kristen Hasbrouck Project Geologic Specialist, Arcadis

Lessons Learned from Design Verification Testing at In Situ Remediation Sites

11:00am - 11:45am, Jun 15

Data and Remediation

Authors: Poling, Barry and Gaskill, Keith

This presentation focuses on design verification testing that directly improve existing in-situ design assumptions prior to field applications. The goal of this program is to determine what "lower-cost" field-based data collection might provide significant insight into design and application methods to optimize in situ applications; thus, resulting in improved remedial performance outcomes. Over the past 20 years, application of remedial substrates has had an uneven track record in terms of performance. Generally speaking, in situ remedial performance is the result of multiple factors. This presentation focuses on the identification of aquifer characteristics that can be documented using traditional field methods and provide the most insight into the remedial design and application programs. Specifically, this presentation focuses on those Target Treatment Zone (TTZ) characteristics that directly affect application programs and ultimately remedial outcomes.

To assist the design and application teams, a set of routine "Design Verification" steps were developed and performed on select project sites (N +30). Using these steps to identify the relationship between COC mass storage and distribution units within TTZ has contributed to an overall improvement in application programs and is seen to be a key element in higher remedial success rates.

Speaker

B

Barry Poling Regional Manager - Central/East, Regenesis

12:00pm

Networking

12:00pm - 12:00pm, Jun 15

1:00pm

PFAS Data Management Requires Different Strategies – Considerations for an Efficient and Effective Program

1:00pm - 1:45pm, Jun 15

Data Management Tools

Some site investigations of contaminated groundwater and soils are considering per- and polyfluoroalkyl substances (PFAS) as contaminants of concern due to potential human health and ecological risks. It is tempting to draw comparisons and adopt many of the same data handling and management practices that have been used previously for polychlorinated biphenyls (PCBs) or dioxins. However, many of the "old" practices are unlikely to work as well with this emerging contaminant class. Some key reasons that PFAS data require a different data management strategy include:

1. What compounds are considered PFAS chemicals? Even defining what compounds fit under the "PFAS" umbrella is a subject of debate. Current conventional wisdom is that there are approximately 3,000 unique compounds in the PFAS class. This makes managing PFAS data more challenging: What in the sampling and data reports really matter and how should it be organized?

2. Analytical methods are still under development. In practical terms, data of different vintages or from different laboratories may have different PFAS analytes reported, detection limits, and QA/QC rigor. A dataset that was acceptable five years ago may be deemed deficient at some point in the future for one or more of these reasons. What data management practices can be employed to ensure comparability between datasets using different methods?

3. Regulatory criteria are not uniform and are changing. In the absence of federal regulatory requirements, states have been developing their own numeric cleanup criteria. These vary from state to state, reflecting the knowledge limits regarding human health and ecological risks. Standards are trending lower and approaching current analytical reporting limits. This points to a need to carefully consider the use of data qualifiers so that data comparisons to standards are characterized appropriately.

4. Remediation technologies are in their infancy. Effective treatment of PFAS is still being researched. For example, granular activated carbon is more effective remediating longer chain PFAS than shorter chain PFAS. What ancillary information is needed with PFAS data to facilitate decisions regarding remediation as new technologies come online?

5. Forensics. The ability to distinguish PFAS sources based on the chemical signature is an area under development. How should data be managed today to take advantage of these techniques as they evolve in the future?

A successful data management program needs to achieve a balance between needing to backfill data later and investing too much time up front storing unnecessary information.

Speaker

C

Carrie Turner, PE Senior Project Engineer, LimnoTech

Is the Conceptual Site Model Correct? A Look at Six Sites where Existing Data Gave Reason to Revise the CSM

1:00pm - 1:45pm, Jun 15

Data Application

Over the past 40 years, tens of thousands of environmental sites have been discovered in the United States. Many of these sites have been successfully characterized and remediated; however, some sites, particularly larger, more complex ones, have languished for many years with marginal progress toward restoration to acceptable conditions. Often, reams of data have been collected for these sites , yet they still lack a correct conceptual site model (CSM) and appropriate remedial strategy. Too often the data are collected and filed without greater consideration beyond the schedule of the next required monitoring event.

During the past 20 years, much of our firm's remediation work has evolved from legacy release sites where site characterization was well underway or considered complete. Many of these sites had remediation systems in place. At some sites, a detailed review of existing data, or the lack of consistent data, led us to consider and develop alternate CSMs. In this presentation, we provide before-and-after discussions of the CSMs from six sites; what the data initially suggested; what data caused us to question the CSM, and what was done to verify the revised CSM. These sites include:

1. The original remedial investigation described a single volatile organic compound (VOC) plume venting to the adjacent river; the revised CSM included discovery of a second plume trending parallel to the river for a half mile before venting to the same river.

2. Upgradient monitoring wells did not contain detectable hexavalent chromium, yet a downgradient purge well indicated the presence of a plume; the revised CSM defined an extremely narrow plume.

3. Previous work discarded an anomalous water level from the groundwater flow map; reinterpretation of the water level suggested, and an additional well later confirmed, the presence of a "window" in the semi-confining layer below.

4. Existing data indicated a thick VOC plume migrating toward multiple private wells; however, five years of monitoring data demonstrated no evidence of impact; a revised CSM identified a barrier in the bedrock aquifer and a strong vertically-downward hydraulic gradient.

5. A data gap investigation indicated only one significant VOC source in alluvial deposits; additional characterization performed during implementation of the new remedial technology revealed an upgradient dense non-aqueous phase liquid (DNAPL) source zone.

6. Proximity of a food processing plant's production well relative to a wastewater discharge lagoon and the expected flow direction of the regional aquifer suggested the well would be impacted, but the production well remained clear of contamination; a revised CSM demonstrated groundwater flow in the regional aquifer following a much different flow path to the river.

We use these examples to reveal the importance of studying and questioning the data; of not ignoring opportunities to strengthen and test the CSM, and the lessons learned from the work that informed subsequent environmental risk management decisions.

Speaker

M

Mike Colvin, CPG Senior Vice President/Principal, Fishbeck

Combined Remedy Treatment of Multi-Chemical Solvent Plume in Low Permeability Clay

1:00pm - 1:45pm, Jun 15

Data and Remediation

Background/Objectives. A former Chemical Plant started operations at this site in 1957. The facility stored, repackaged and distributed chemicals, including but not limited to: hydrogen peroxide, methylisobutyl carbinol (MIBC), tetrachloroethene (PCE), acetone, ethanol and diesel fuel. In the early 1980s a release of approximately 29,000-pounds of MIBC was released into the environment, response to the release was to cover the area with black plastic and then sand. Reportedly, as a follow-up, neither free product nor soils were removed. Numerous investigations and limited remediation were completed between 1991 thru 1999 identified approximately ten (10) halogenated solvents were present in soil vapor, groundwater, and soil. Geology at the site consists of unconsolidated silty clays, sands and gravel with most of the contamination found within the silty clay unit. It is underlain by a fine sand then gravel unit, the silty clay unit is approximately 30-40 feet thick. Most of the contamination starts below 20 feet and continues down to the silty clay sand interface (approximately 40 feet). The clay content significantly retarded movement of the groundwater plume both vertically and horizontally resulting in a total plume length of less than 400 feet. Based on the site's geology, an alternative remedial technology was evaluated in 2011, the selected technologies involved a combination of ex-situ and in-situ methods to achieve the site clean-up goals in a multi-phased approach.

Approach/Activities. High-density qualitative soil and groundwater sampling was conducted in 2011 and 2012 to refine the existing Conceptual Site Model (CSM). High density soil and groundwater sampling verified vertical and horizontal distribution of contaminant mass on and off-site, significant unsaturated mass confirmed a sustained NAPL source for a dissolved solute plume downgradient further off-site. A Phased approach utilizing combined remedies was selected as the remedial option for the facility; interim corrective action was completed in 2013 and 2014 and included 1) an off-site in-situ permeable reactive barrier utilizing Trap & Treat® BOS 100® to capture dissolved impacts leaving the facility and 2) shallow soil mixing activated persulfate to mitigate unsaturated soil impacts adjacent to source media. Full Scale Phase 1 conducted in December 2016 utilized Trap & Treat® BOS 100® + ERD to mitigate saturated source mass soil and groundwater impacts. Full Scale Phase 2 completed in September 2018 included additional off-site source and dissolved-phase treatment utilizing Trap & Treat® BOS 100® + ERD. September 2019 work includes CAT 100 injections in the source area.

Results/Lessons Learned. The presentation will discuss the development of the CSM over time and highlight the remedial action as a site-specific case study example including characterizing and injecting remediation product into tighter units (silty clay). Lessons learned and relevant data to be presented will include benefits of high-density indiscriminate (regardless of field screening/field observations) soil and groundwater sampling for qualitative analysis in the laboratory. Investigative efforts evolved to accommodate expansive clays during drilling and manage exposure to NAPL concentrations in site source area soils. Remedial evolution will highlight the development, selection, and use of a new and cutting-edge application of cometabolic synergy: granular activated carbon impregnated with metallic reactive iron coupled with an enhanced reductive chlorinating biological component. The limiting factor in most abiotic remediation technologies is the finite amount of reducing material, in this case metallic iron. Improvements to the BOS 100® platform will be specifically discussed as part of this case study and remedial technology evaluation. Improved in-situ injection techniques were developed to increase effectiveness and installation throughout all planned phases, site geology dictated multiple point installation in order to permit dissipation of injection pressure following completion of each injection interval. Daylighting is an issue on every in-situ injection project, a portion of the discussion will detail methodologies to mitigate daylighting to the extent possible while still installing sufficient reagent to manage site clean-up goals.

Speaker

Bill Brab, CPG Senior In-Situ Remediation Geologist, KY-AIPG

2:00pm

Information Management Systems: Keys to Successful Execution Remedial Investigations (A Case Study)

2:00pm - 2:45pm, Jun 15

Data Management Tools

Authors: Andrew Higgins, B.Sc.; Olga Stewart P.E.AK, Dan Pankani, P.E.OR, Jamey Rosen, M.Sc., P.Geo.ON

A "complete" Information Management System (IMS) is a crucial piece to the successful execution of field activities that generate data such as Remedial Investigations (RIs) or Risk Assessments (RAs). An IMS consists of tools and workflows built using data management best-practices to load, process, and generate outputs of data generated as part of these activities. These systems are often neglected, built haphazardly, and/or ignored leading to schedule and budget overruns, data quality issues, and increased expenditures surrounding report generation.

Atka island is a remote island in the Aleutians that contains an abandoned WWII Air Force Base. As of 2010, there were 61 people living on the island. Geosyntec and our teaming partner Ahtna Inc. were tasked with executing a comprehensive multi-year RI and subsequent RA. Major challenges on the project included:

• Overall schedule

• Remote and dangerous location; including a short field season

• Delineating contaminated areas required multiple visits to a given feature; and minimal delay making chemistry data available (unvalidated) in order to drive sample location

• Poor internet access on the island

• Distributed team

• Stringent but nonspecific requirements on figure generation as part of report efforts (need for flexibility in the look-and-feel of generated figures).

A custom mobile field app was built for field staff to collect virtually all field data. These data were synced nightly from the field office to a centralized database, where they were available on a web-based data access portal consisting of an interactive webmap and several interactive reports.

A robust and complete data management workflow was developed which included all data generating activating (inputs), plus data access and a framework for anticipated reporting needs (outputs). The system was held together using scripts to facilitate timely data access and to minimize budgets. Data collection, syncing, loading of chemistry data from Electronic Data Deliverables (EDDS), chemistry data validation, figure generation using GIS, and tabular data exports were all automated completely or to the extent possible.

More than 650 figures were generated as part of this effort, plus thousands of pages of formatted tabular data. A robust IMS and data management practices facilitated the successful delivery of the RI and RA under intense deadlines.

Speaker

A

Andrew Higgins Project Scientist, Geosyntec Consultants

3D and GIS: Underutilized Tools for Geologists

2:00pm - 2:45pm, Jun 15

Data Application

GIS and especially 3D GIS are natural tools for geologists. Borehole data can easily be extruded downward from the ground surface like well depths, screened intervals, samples, cored intervals or contaminants or minerals symbolized by concentrations. Surfaces can be created and displayed in 3D like the water table, top of bedrock, geologic structure surfaces or a contaminant plume. Examples showing surficial & subsurface geology, geophysical data, 3D contamination sites, 3D lithologic logs, formation multipatches, as well as slicing through them will be shown. GIS and especially 3D are underutilized tools that geologists can use to assist in compiling, managing, and interpreting data, but also for communicating complex subsurface geological and environmental data to their clients, management, and to the public.

Bio:

John grew up in the Grand Ledge Michigan area and received his BS in geology from Central Michigan University in 1984. He started out his career in 1984 as a geologist with Aangstrom Precision Corporation. He led a geophysical survey crew for one year and later worked as a "computer geologist" mapping the structure and isopach maps of every Paleozoic formation in the Lower Peninsula of Michigan. John constructed the first ever comprehensive glacial drift isopach and bedrock topography maps of the Lower Peninsula of Michigan as well as assisting in mapping the major faults in the basin. In 1990, John left the oil patch and took a job with the DNR (later DEQ/EGLE) conducting hydrogeologic investigations at contamination sites across the state. From 1998-2006 he has been a project geologist (geodog) on 12 Superfund sites here in Michigan. Since 2006 he has been with the Office of Geological Survey/Oil, Gas & Minerals Division. John also conducts geological mapping for the Michigan Geological Survey.

John's interests include studying the bedrock surface and structural geology of the Michigan Basin, use of unconventional geophysical techniques, groundwater surface water interactions, and the use of GIS and 3D visualization techniques to help understand subsurface geology. He chairs the EGLE GIS Committee. He is a volunteer with Lifewater International in which he trains people overseas in groundwater exploration, shallow well drilling and hand pump repair.

Speaker

J

John Esch Geology Specialist, Michigan Department of Environment, Great Lakes, and Energy

Understanding the Data Needs for a Successful Technical Impracticability Determination During the Implementation of RCRA Corrective Action

2:00pm - 2:45pm, Jun 15

Data and Remediation

Despite multiple efforts to remove VOC mass in soil source areas and address shallow groundwater, VOCs remain present at concentrations above cleanup levels. TRC prepared a justification for a Technical Impracticability (TI) decision for USEPA review by presenting site data to support the site conceptual model and evaluation of the restoration potential of the clay groundwater.

The site is a former parts manufacturing facility where chlorinated solvents used for metal degreasing, namely trichloroethene (TCE), were inadvertently released to soil and groundwater. The geology of the site consists of a low-permeability (<1x10 8 cm/sec) clay-rich lacustrine deposit, that to a considerable extent, has limited the vertical and horizontal extent of TCE migration. However, the lacustrine deposit has a vertically oriented fracture network in the upper 15 feet that allowed TCE to migrate through the fracture network and diffuse into the surrounding clay matrix. Groundwater within this fracture network exceeded cleanup levels established through a Risk Assessment. Therefore, USEPA and the former site owner executed a RCRA Administrative Order on Consent (AOC) that set forth a framework for completing a Corrective Action program at the site. As part of the AOC implementation, Corrective Measures to address affected soil, groundwater, and indoor air were selected as part of the USEPA's Final Decision (FD). The FD initially identified several remediation approaches to attain the selected cleanup levels for soil, groundwater, and indoor air. Studies concluded that the TCE mass is diffusion limited, and the presence of recoverable "groundwater" is limited. Attempts utilizing different technologies (e.g., vacuum enhanced pumping, in situ chemical oxidation (ISCO) with sodium peroxide, soil blending using ISCO with potassium permanganate, in situ thermal desorption (ISTD), and enhanced in situ bioremediation (EISB) were implemented, with different degrees of success, to remove VOC mass. However, the migration of TCE in the lacustrine deposit is limited by the same factors that impeded the distribution in the smaller, higher concentration, source areas.

In the TI evaluation, TRC concluded that no known conventional or innovative technologies can feasibly or reliably attain the cleanup levels in a reasonable timeframe. Additionally, no current conventional or innovative technologies exist that would further reduce existing risk through the current USEPA-approved Activity Use Limitations (AULs) memorialized in an Environmental Covenant (EC) for the site. The EC establishes the acceptable future uses of the property and how exposures to affected media are managed/mitigated including direct contact with soil and groundwater, and the vapor intrusion pathway. The USEPA recognized the efforts to manage contaminant source areas and agreed with the conclusions and issued an Explanation of Significant Difference (ESD) that included the revised approach for site corrective action. Periodic groundwater monitoring will continue to ensure that groundwater affected with VOCs at levels exceeding the cleanup levels established in the FD are limited to the Restricted Area/TI Zone.

A successful TI decision relies on sound data collection, documentation, and evaluation as well as ability to effectively communicate site conditions and groundwater restoration potential to USEPA.

Speakers

G

Graham Crockford Program Manager for CCR Groundwater Compliance, TRC

D

Darby Litz Senior Engineer/Hydrogeologist, TRC

3:00pm

Networking

3:00pm - 4:00pm, Jun 15

Wed, Jun 16, 2021

10:00am

Does Michigan have a need for standardized geological language and database?

10:00am - 10:45am, Jun 16

Data Management Tools

Michigan is not unlike many other geologic areas of the US, unique geology for some areas, Paleozoic, Mesozoic, Tertiary, Quaternary, Recent. However, many of those areas of the US have established regional or state standardize geologic units and databases. Michigan has not pressed forward for a standard geologic data standard, format or open file database for the major geologic lithologic units, Quaternary geology by local, region or State. Michigan consultants establish the geologic units for a project, problem or region, but there is minimal standardization of the units to correlate further than the project site. Since 2011, the Michigan Geological Survey (MGS) and even earlier, for the last 25 years through Federally funded mapping programs, the Association of American State Geologists and the USGS Core Sciences group, have endorsed standardize mapping units. The 2020 AIPG meeting presents the need for many of the Michigan data needs, a cross roads of facts and data. MGS presents the case for standardized lithologic data by geographic areas and glacial systems. If Michigan geoscientists are going to support the current regulatory needs for vapor, LNAPL, DNAPL, PFAS, etc. in the subsurface, having an open file standard lithologic format is needed. We have lithologic data using engineering language, geologic language and standard language for lithologic units in the subsurface, but no standard format and more importantly an open file database for the region, area or Michigan.

AIPG has the recognized geologic experts in Michigan, not topographic or geographic based programs being used in many websites. Should Michigan AIPG look at setting the standards for logging geologic samples and cores? Should this be an open file geologic data base, by location and region? Should AIPG propose or modify an existing data base? Who would be the manager or guardian of such a database? There are vast areas of Michigan that have not been mapped in any detail by quadrangle or county. Many of the areas have issues related to water, contamination, aggregate and resources that cannot be assessed, protected or, if needed, remediated. This is a consulting, regulatory and legislative issue.

Speaker

J

John Yellich, CPG Director, Michigan Geological Survey

Using multivariate statistical analysis (MVA) to help answer complicated PFAS questions

10:00am - 10:45am, Jun 16

Data Application

The analysis of per- and polyfluoroalkyl substances (PFAS) has been continuously evolving since these compounds first came into the spotlight in the mid 2000s. Individual jurisdictions have continued to grow their target list of compounds, and new analytical techniques have added more complexity to the existing landscape. Due to these varied compound lists and analytical techniques, a lot of data is often generated, but not all is not used in a meaningful way. Usually, the data is looked at simplistically, (e.g. do concentrations exceed criteria?); however, with a larger compound list, there is much more that can be understood.

Data trends can be identified using two MVA methods, agglomerative hierarchal clustering (AHC) and principal components analysis (PCA), and shed light on site-specific conceptual models. AHC is an iterative classification method where the process starts by calculating the dissimilarity between the different data sets. Then, through successive clustering operations, it produces a binary clustering tree (dendrogram), whose root is the class that contains all the observations. In general, data with similar properties tend to cluster, and those that are different form distinct groups. PCA is an advanced multivariate statistical analysis that allows the visualization of correlations and variability between multiple variables measured for a given system. The procedure performs a transformation of possibly correlated values into linearly uncorrelated values known as “principal components.” Combined, these two techniques can use the existing data to paint a picture of a specific project that when coupled with computational modeling can refine your site conceptual model, identify other potential sources, and aid in focusing future investigations.

This presentation will show examples of how these techniques are used to evaluate PFAS data to achieve the specific project goals.

Speaker

Ward Swanson

Evaluation and Remediation of a Large Comingled Dilute VOC Plume in Western, Ohio – A Case Study

10:00am - 10:45am, Jun 16

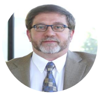
Data and Remediation

In 1998, the detection of chlorinated volatile organic compounds (CVOCs) in a public well field led Ohio EPA to begin a search for potential sources. By 2002, as many as four different consultants, representing local industries, had identified a comingled plume extending a distance of four miles. The sole source aquifer has a hydraulic conductivity on the order of 1200 feet/day and a horizontal flow velocity estimated at 10 feet/day. By chance, most of the industries lay along a common groundwater flow path and had tended to use similar CVOCs. This situation complicated the issue of source identification and potential responsibility. The objective soon became source area identification and dissection of the commingled plume to assign ownership. Following plume delineation, the sources of CVOCs were addressed through a variety of source area remedial actions (some of which are still proceeding). A GAC Treatment system was added to the public water system and affected domestic well owners were provided permanent connections to public water. The current objective is to monitor the return of groundwater quality to drinking water standards throughout the length of the plume.

Working in cooperation, the consultants shared regional-scale analytical results from hundreds of monitor wells, domestic wells, production wells, temporary wells, and surface water samples to form a groundwater and surface water quality database. Based on GIS analysis of contaminant ratios of tetrachloroethene, trichloroethene, cis-1,2-dichloroethene, and 1,1,1-trichloroethane coupled with groundwater flow data the commingled plume was found to be sourced from at least six separate areas. Each responsible party chose remedial options based on their particular goals. Remedial technologies included: excavation, in-situ chemox (potassium permanganate) injection, in-situ emulsified zero-valent iron injections, in-situ thermal desorption, and air sparge/soil vapor extraction. The treatment option for the public well field was granular activated carbon. Monitoring of the plumes, which have responded positively to the source removal, continues.

To date, four sources have been remediated and groundwater quality has improved dramatically. The use of GIS to present contaminant ratios proved to be a very powerful tool in assessing the very large and diverse dataset. The presence of cis-1,2-dichlorethene was key to locating source areas where anerobic conditions existed locally. Due to the very high hydraulic conductivity and associated groundwater flow velocities, in-plume groundwater treatment options including permeable reactive barriers, containment (pump and treat), recirculating wells, and the like proved infeasible.

Speaker



Craig Cox President, Cox-Colvin & Associates, Inc.

11:00am

Maximizing the Value of Information Management for Cost-Effective Data Evaluation

11:00am - 11:45am, Jun 16

Data Management Tools

TRC is working with clients nationally in a program management role to manage large volumes of groundwater chemistry data supporting the development of groundwater monitoring, investigation, and potential corrective action strategies for their sites under various federal and state regulations. Many sites have a long legacy and consequently a significant volume of data has been collected, while other sites have little prior groundwater monitoring performed. Efficient and reliable data/information management is a critical component of the portfolio given the large volume of data historically collected and long-term data collection associated with post closure requirements. TRC developed a strategy for implementing a common information management system which utilizes a consistent data management platform and accommodates programs with varying levels of database maturity. EQuIS™ was selected because of its ability to cross platform with other tools to leverage knowledge assets to provide a cost effective, and highly reliable compliance assurance program while meeting the expedited reporting obligations.

The use of the information management system brings added value to stakeholders by delivering data evaluation tools and dashboards that streamline analysis and reporting while providing documentation to support their forward-thinking compliance strategies. A data management plan provides the roadmap for how benefits and efficiencies are obtained through automation and accuracy through data quality control and completeness checks. Additionally, the ability for the entire project team (consultants and clients) to quickly access and evaluate data is essential for timely decision making. Stakeholders rely on the ability to identify the potential for a non-compliance situation quickly such that action to correct the situation can be taken sooner, such as additional data collection to address data anomalies, or proactive implementation of a remedial strategy to address unfavorable concentrations trends. Staying in front of compliance deadlines allows for a more comprehensive evaluation to be presented by the time a report is due.

With a strategic information management system, projects can not only maintain compliance with regulatory reporting requirements, projects also recognize short and long-term cost savings, sustain higher certainties of data quality, and provide data availability to the entire project team in an intuitive user-friendly format.

Speakers

S

Sarah Holmstrom Senior Hydrogeologist/Project Manager, TRC

K

Katy Reminga Environmental Scientist, TRC

Plastic and Microplastic Pollution: Abundance; Distribution; Structural and non

11:00am - 11:45am, Jun 16

Structural Approaches for Control and Mitigation

Data Application

Approximately eight billion metric tons of plastic has been produced since the early 1950s. About 60% of that plastic has ended up in either a landfill or the natural environment. About eight million tons of plastic end up in the world's oceans every year. Approximately 20 million pounds of plastics enter the Great Lakes each year. Although plastic is a valuable engineering material, society has become addicted to the use of single use plastics that contribute to severe environmental damage worldwide. Plastics are durable and resist degradation making them nearly impossible to completely break down in the natural environment. The plastic items that enter the natural environment never fully disappear but fragment into smaller particles known as microplastics.

Microplastics are plastic fragments smaller than 5 millimeters and can be of primary or secondary origin. Because of their small dimensions, microplastics become available for ingestion to a wide range of marine/freshwater organisms. According to recent research, microplastics can accumulate within aquatic organisms upon ingestion, potentially resulting in physical injury in the intestinal tract or translocation to other tissues or organs. Factors affecting the bioavailability of microplastics include size, shape, density, abundance, and color. Some recent research reported a significant toxicological risk to aquatic organisms. Microplastics have even been found in human stool. In addition, microplastics can act as vectors of additives incorporated during manufacture and organic pollutants sorbed from the surrounding aquatic environment to biota.

There are no available viable technologies available yet to remove microplastics in an aquatic environment. Control or elimination of the sources of plastic and microplastics will prevent the worsening of this increasing environmental problem. For example, wastewater treatment plants (WWTPs) are a major route of microplastics to marine environments, including the Great Lakes. Unfortunately, most WWTPs are not designed to remove small microplastics from the effluent. In addition, a very large portion of microplastics is being reintroduced to the soil and water via biosolids land application. According to a study conducted by Norwegian Institute for Water Research, between 110,000 and 730,000 tons of microplastics are transferred every year to agricultural soils in Europe and North America. A large portion of the land-applied microplastics are believed to reenter the aquatic environment via agricultural runoff, and the fate and transport of these microplastics are poorly understood.

This presentation will present qualitative and quantitative data to evaluate the size of this damaging environmental problem, and the abundance and distribution of macro-plastics and microplastics in various locations. The potential microplastic loading from select WWTPs to the Great Lakes will be presented. Available data on the presence of microplastics in wastewater by their shape, type and size will be discussed. Physical characteristics of microplastics is important in identifying appropriate technologies or wastewater treatment process upgrades that can remove the greatest amount of harmful microplastics. The abundance of microplastics on Michigan beaches and other sensitive environmental sites will be showcased based on the data collected by citizen scientists. Data gaps and importance of collecting crucial data in identifying sources of plastics and microplastics to the natural environment will also be discussed. In addition, this presentation will present non-structural and structural methods that can be utilized to remove or capture plastic and microplastics before they enter the natural environment. Also, this presentation will provide vital information that is needed to outreach public to educate and obtain support in reducing the plastic pollution to protect our natural environment.

Speakers

Mala Hettiarchchi, Ph.D., PE Senior Project Engineer, Environmental Resources Group

Laura Lambert Staff Scientist, Environmental Resources Group

Catherine Young Business Development Associate, Environmental Resources Group

Utilizing Real-Time Data Collection to Adaptively Install a Propane Biosparge System to Treat 1,4-Dioxane

11:00am - 11:45am, Jun 16

Data and Remediation

Authors: Andrew Lorenz, Arcadis; Jackie Saling, PE, Arcadis; Alex Villhauer, Arcadis; Dave Favero, Deputy Cleanup Manager, Racer Trust

Utilizing an adaptive design approach for investigation and remediation incorporates the flexibility to support real-time adjustments to data and is critical to the success of site characterization and remedy. Key components of adaptive design are data discipline (i.e., only collecting reliable data that supports decision making), establishing acceptable limits for the data that require action, and anticipating required responses when data is out of range. A data driven adaptive approach is being implemented for the investigation and remedy design for a 1,4-dioxane plume present at the RACER Lansing Site. The 1,4-dioxane plume is in weathered bedrock and located in a wellhead protection area. The weathered bedrock presents a complex and dynamic environment with changing flow directions, vertical gradients, and variable transmissivity. Complicating the conceptual site model (CSM) further, the 1,4-dioxane plume originates from multiple source areas.

A robust adaptive investigation and CSM development were critical to the successful implementation of the adaptive remedial strategy. While extensive investigation activities were completed to develop the CSM prior to remedy development, additional data collection completed during the installation of the biosparge network proved to be key in optimizing the final remediation system layout. Specifically, data collected during biosparge well installations indicated dynamic plume conditions which reduced the size of the biosparge well network by nearly 50%. The investigation identified a multi-directional flow component to the plume, that allowed the biosparge well transect layouts to be adaptively adjusted to account for both flow directions. A reduction in well network size and transect orientation resulted in a significant design change that allowed for better control of the biosparge wells and a reduction in the system sparging equipment and power requirements.

Adaptive installation of the biosparge system enabled real-time optimization of the design, reducing overall cost, and with a goal of improving long-term performance. Propane biosparge is a new technology with best practices discovered through ongoing field applications and research. The biosparge system is designed with as much flexibility as possible to support optimization in the future. This project highlights the importance of data collection during remedy implementation, as well as utilizing data discipline and decisiveness to adapt accordingly during design and in the future operation.

Speakers

Andrew Lorenz, PE Project Environmental Engineer, Arcadis

Jackie Saling, PE Arcadis

Alex Villhauer Arcadis

12:00pm

Networking

12:00pm - 1:00pm, Jun 16

1:00pm

Utilizing a Large Set of Minute-Scale Water-Level Monitoring Data to Evaluate Public Supply Well Vulnerability

1:00pm - 1:45pm, Jun 16

Data Application

Co-authors: Dillon Kilroy, Eastern Michigan University, Undergraduate Student; Kayla Bicknell, Environmental Resources Group, Field Hydrogeologist

Although water-level data may be collected from monitoring wells at temporal scales ranging from 15 minutes to an hour, some applications require greater resolution. Data from several monitoring wells adjacent to public supply wells in South-Central Wisconsin show reverse water-level fluctuations (RWFs). These fluctuations are a phenomenon that occurs when water levels in wells that are open to one aquifer rise briefly in response to pumping from another aquifer. These RWFs may only occur for a few minutes at the start of pumping and may not appear in data collected at 15-minute intervals. In order to characterize these RWFs, this study utilized minute-scale water-level measurements to examine variables that may contribute to these water level responses and to determine how they may affect contaminant transport.

Pressure transducers in monitoring wells at six different sites collected water-level data at 1-minute intervals during a 30-day period in order to monitor the response to public supply well pumping. This created a large data set of approximately 500,000 time-series measurements across all sites. Manual plotting and visual identification of RWFs to determine the magnitude and duration of each was too time consuming to be practicable for the entire data set. The creation of a computer program to automate the identification of RWFs and relevant properties was necessary to evaluate the data and reach conclusions about their creation and impacts.

The RWF data from multiple locations show that they are occurring over a much larger portion of the aquifer system than previously reported. Comparison between municipal supply well and monitoring well data identified correlations between well responses and pumping cycles. Additionally, the observed magnitude and duration of RWFs were related to distance between monitoring well depth and the confining layer depth. Knowledge of how these and other variables affect monitoring well responses across multiple sites may lead to a better understanding of how to mitigate public supply well vulnerability to near surface contaminants.

Speaker

C

Chris Gellasch, Ph.D., CPG Associate Professor, Eastern Michigan University - Department of Geography and Geology

Remediation 2.0: Using the Internet of Things on Remediation Projects

1:00pm - 1:45pm, Jun 16

Data and Remediation

There are tens of billions of connected devices on the planet. As consumer and industry use of these Internet of Things (IoT) devices grows, they make our lives safer and more comfortable. The remediation industry is faced with a similar opportunity. Remediation IoT can provide lower cost data, better data quality, faster decision-making, and improved health and safety, as it reduces the need for physical site visits. The objective of this talk is to give a practical overview of how IoT can be used on remediation projects and to share examples and lessons learned from multiple IoT applications.

All remediation IoT can be described by a common set of elements: sensors which collect the data, gateways which transmit the data, storage to warehouse the data, and platforms to host the output. We will provide examples of the pros and cons of different IoT elements, as well as the importance of the platform and data visualization. A successful IoT application will start with the needs of the user, rather than forcing a technology solution into practice. This customer experience (CX) based approach is a change from the typical methods used in the remediation industry, and requires reimagining traditional methods. New approaches like design thinking, lean start-up, and agile methods get early feedback from customers to help develop new solutions faster.

We will share multiple remediation IoT use cases from actual projects, and the benefits to each project. Use cases will include IoT for long-term groundwater monitoring and LNAPL monitoring, remote monitoring and watershed management to manage surface water impacts, environmental remediation construction monitoring, and IoT for operation of in-situ remediation systems. We will discuss the benefits of IoT in these use cases, which includes cost reduction, improved data insights, real-time decision making, and improved health and safety.

Speaker

N

Nicklaus Welty Innovation Director for Arcadis North America, Vice President, Arcadis

2:00pm

Understanding Data Quality and Overall Usability

2:00pm - 2:45pm, Jun 16

Data Application

Environmental assessment and evaluation of a potentially contaminated site uses analytical laboratory results as the cornerstone on which assessment and mitigation decisions are made. These sample results may contain interferences, dilutions, raised reporting limits, or other qualifiers that may limit the utility of the data. Understanding the laboratory quality control for each project along with any data qualifiers reported by the laboratory helps an environmental consultant to better understand the usability of the data.

Laboratory quality control can be segregated into several general categories, including: tuning, calibration, sample preparation, and analysis. Any problems with the analysis and subsequent results are then documented on the report with appropriate qualifiers to notify the environmental consultant. It is imperative that the consultant has a high level of understanding of what laboratory results mean and to be able to comprehend the overall utility of those results.

The laboratory can, and should be, a partner with the environmental consultant to ensure both understanding and usability of the analytical results. Any unique project should be discussed before sampling to ensure quality control and reporting limits meet required project criteria. Similarly, after receiving the laboratory report, the environmental consultant needs to make sure they understand the report and any qualifiers. Data usability is based on the analytical report meeting the required quality objectives and any other regulatory criteria.

Speakers

D

Daryl Strandbergh Laboratory Director, Fibertec

H

Heather Smith Operations Manager, Fibertec

A Novel Approach to Characterize a Chlorinated Solvents Plume Beneath an Extensive Wetland System

2:00pm - 2:45pm, Jun 16

Data and Remediation

Authors: Lepczyk, Peter A., CPG, Fishbeck, Senior Hydrogeologist; Weber, Chad A., PE, Fishbeck, Senior Environmental Engineer; Wiley, Jonathan D., Stock Drilling, Operations Manager; Pitsch, John M., Mateco Drilling, Operations Manager

Investigative and remedial activities are being performed to address chlorinated solvent releases and other contamination at a legacy site in Michigan used for the manufacture of military equipment. Groundwater in a portion of the site has been documented to migrate toward a creek and extensive wetland system. A groundwater/surface water interface (GSI) monitoring well network was previously established with well screens intersecting the lower portion of the aquifer, where past vertical aquifer profiling has demonstrated the highest concentrations of volatile organic compounds (VOCs). In 2019, an investigation was implemented using a membrane interface probe/hydraulic profiling tool (MiHPT) to provide high-resolution site characterization data adjacent to the creek and extensive wetland system to better understand the fate and transport of VOCs. Given the success of the MiHPT onshore, we contacted two contractors with the concept of combining two different specialized technologies – an MiHPT mounted on an amphibious direct push drill rig – to continue the characterization beneath the creek and wetland system. The findings have resulted in a reinterpretation of the conceptual site model (CSM) and risk management approach to demonstrate protection of surface water.

The MiHPT borings utilized the Geoprobe® Direct Image® MiHPT tool to provide a semi-quantitative log of VOCs, soil electrical conductivity, and hydraulic injection pressures. Investigative activities also included the collection of groundwater samples from the MiHPT borings for the laboratory analysis of VOCs. The initial phase identified VOCs at the base of the aquifer adjacent to the wetland/creek. Subsequent push-point pore water sampling was met with limited success, due to dense vegetation and/or deep water. Where pore water sampling was performed, no significant impacts were identified. To elucidate the disconnect between the known plume and the inferred discharge zone, the MiHPT amphibious drill rig approach was employed, allowing the VOCs and hydrostratigraphy to be tracked from the lower portion of the aquifer onshore toward – and beneath – the creek and associated wetland. Surface water samples were subsequently obtained for VOC analysis to offer an additional line of evidence.

The consistent methods between the onshore and offshore investigations produced data which readily correlated to one another and allowed for a more informed construction of the CSM. After evaluation of the data, key findings included: a more uniform hydrostratigraphy between the two areas than what had been hypothesized; delineation of the high concentration VOC impacts to near shore and lower portions of the aquifer; and presence of elevated methane levels in the upper portion of the aquifer. The data shed new light on the fate and transport of VOCs underneath the creek and wetland system, identified inadequacies in the previous GSI monitoring well network, and have presented support for alternate GSI compliance options using alternative monitoring points and/or demonstration of natural attenuation.Investigative and remedial activities are being performed to address chlorinated solvent releases and other contamination at a legacy site in Michigan used for the manufacture of military equipment. Groundwater in a portion of the site has been documented to migrate toward a creek and extensive wetland system. A groundwater/surface water interface (GSI) monitoring well network was previously established with well screens intersecting the lower portion of the aquifer, where past vertical aquifer profiling has demonstrated the highest concentrations of volatile organic compounds (VOCs). In 2019, an investigation was implemented using a membrane interface probe/hydraulic profiling tool (MiHPT) to provide high-resolution site characterization data adjacent to the creek and extensive wetland system to better understand the fate and transport of VOCs. Given the success of the MiHPT onshore, we contacted two contractors with the concept of combining two different specialized technologies – an MiHPT mounted on an amphibious direct push drill rig – to continue the characterization beneath the creek and wetland system. The findings have resulted in a reinterpretation of the conceptual site model (CSM) and risk management approach to demonstrate protection of surface water.

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Speaker

P

Peter Lepczyk Senior Hydrogeologist, Fishbeck

Digital in the Field: New Solutions for Data Collection, Quality, and Safety

2:00pm - 2:45pm, Jun 16

Data Management Tools

Data is the foundation for making timely decisions about environmental risk management; however, the environmental profession has been slow to adopt new technologies that reduce the time between data collection and actionable analysis. Remediation is one of the least digitally disrupted industries on the planet, despite the fact that digital technologies are affecting every other aspect of our work and private life. The result is continued popularity of familiar, but increasingly outdated, techniques for gathering and analyzing data. It is time to move beyond the historical attitudes toward the cycle of data collection and decision making- where data were collected in physical logbooks, transcribed in the office, QA/QC'd, imported to tables and CAD drawings, and finally analyzed.

We must now embrace new ways of working, adopting the tools available for digital data collection, management, processing, and visualization. Digitizing data in the field and automating repeatable data flow processes enables teams to minimize time spent on routine data preparation, reduce potential for human error, and simplify the steps taken to reach the decision-making phase. These tools include mobile field applications with office data management capabilities (Fulcrum, Collector, and Survey123), robotic process automation (RPA), business intelligence and analytics tools (Tableau, Power BI), and augmented reality/virtual reality (AR/VR) for immersive/3-D visualizations (HoloLens, and Oculus Go).

We advocate taking a comprehensive data collection, management, and visualization approach to enable increased data accuracy, faster delivery of data, and simpler management of complete project portfolios. We capture our field data digitally using an electronic data collection platform (called FieldNowTM; available on desktop, tablet, and mobile). These mobile field applications deliver dynamic field forms that can be quickly adjusted to meet changing field needs to speed up the collection of information and provide instant access to data from the field, allowing us to begin analyzing and delivering results faster. Insight to this real-time, quality data simplifies the decision-making process and promotes reliability of data. Business analytics software offers powerful tools that identify data relationships and simplify the visualization process while fostering better presentation and communication of meaningful patterns within the data results and implications. AR/VR technology enables sharing immersive visualizations of environmental data and onsite conditions with key stakeholders.

We will share lessons learned through years of implementing digital technologies on field projects, case studies illustrating best practices and the value of adopting digital technologies, and a hands-on demonstration that will allow attendees to try the technologies themselves and ask questions.

Speakers

K

Kalan Briggs Staff Geologic Specialist, Arcadis

N

Nicklaus Welty Innovation Director for Arcadis North America, Vice President, Arcadis

3:00pm

Networking

3:00pm - 4:00pm, Jun 16

Thu, Jun 17, 2021

10:00am

Understanding PSIC, a Statistical Approach

10:00am - 10:45am, Jun 17

Data Application

A series of Pre-Investigation soil sampling studies and particulate air sampling had previously been conducted in residential neighborhoods near heavily industrialized manufacturing facilities located along the Detroit River in the cities of Ecorse and River Rouge, Michigan. Soils data had been collected using a biased sampling approach focusing on bare ground areas proximate to roadside areas that could be easily accessed. The Michigan Department of Environment, Great Lakes and Energy (EGLE) Particulate Soil Inhalation Criteria (PSIC) represents concentrations of hazardous substances in soil which could generate particulates at levels that may cause adverse human health effects.

The EGLE Remediation and Redevelopment Division (RRD) along with Kern Statistical Services initiated a more robust and systematic (i.e., unbiased) statistical sampling approach to evaluate soil sampling intervals and determine the number of samples to be collected to most effectively compare to the Mn PSIC. These data were analyzed using a statistical interpolation method called Kriging.

The EGLE-RRD also conducted air sampling and utilized existing meteorological stations to help assess whether the PSIC accurately predicted levels of Mn. Data from those sources indicated that iron oxides are very common and generally account for the bulk of the Mn present in 0 to 6-inch soil in the Study Area. EGLE also speciated select soil samples, and results indicated that large grain-size slag from a pyro-mineralogical process was one source of Mn to residential properties and was not deposited through aerial deposition. The data are not adequate to determine if Mn concentrations observed in soil samples originates primarily from coarse or fine fraction material, and, hence, it is not possible to rule out a substantial source of Mn to residential properties through aerial deposition of stack emissions or from uncovered slag piles, or slag used as roadway base (fill) material.

EGLE also looked closely at source size and how contaminant distribution affects the resulting PSIC. PSIC declines with increasing source size to account for the increasing mass of metals that may become airborne from larger sources. Soils in some Study Area neighborhoods may be considered as a source of Mn in airborne particulates; therefore, it is possible that groups of properties may exceed the corresponding source-sized adjusted PSIC for intermediate-sized source areas (10 to 50 acres) while individual properties considered separately do not exceed the higher PSIC associated with smaller source areas. Data analysis revealed the variability of soil Mn concentrations at any given property and, hence, the unreliability of single-point sample results to characterize soil inhalation risks at any given location or area.

Although not definitive, the geostatistical techniques that integrate multiple samples proximate to an individual property should be considered more reliable than interpretations based on individual samples; therefore, point-by-point comparisons of Mn data in Study Area soils are not expected to be reliable. Rather, averages over specified areas (e.g. parcels, blocks, neighborhoods) would provide more reliable data to compare to criterion.

Speakers

S

Steve Hoin Senior Geologist, Michigan Department of Environment, Great Lakes and Energy

Rick Dunkin, CPG Senior Geologist, Fishbeck

J

John Kern, Ph.D. President, Kern Statistical Services, Inc.

Site Characterization and ERH Remediation of VOCs in Soil, Groundwater, LNAPL and DNAPL (Part 1)

10:00am - 10:45am, Jun 17

Data and Remediation

Background/Objectives. The site is a former manufacturing facility that encompasses approximately 148 acres. The primary building was 2 million square feet. The manufacturing operations spanned approximately 55 years between 1957 and 2012.

Remedial investigations (RIs) were completed using traditional soil and groundwater sampling along with extensive membrane interface probe (MIP) and laser induced fluorescence (LIF). Light non-aqueous phase liquid (LNAPL) and dense non-aqueous phase liquid (DNAPL) were identified in addition to chlorinated volatile organic compounds (cVOCs) and 1,4-dioxane in NAPL, soil, groundwater, and soil gas. Data visualization using a 4D model helped define areas for further characterization and ultimately areas and volumes for remediation. A remediation work plan was prepared using data from the RI and results of a risk assessment. The objectives of the work plan were to remove NAPL, reduce source area concentrations, prevent human exposure, and prevent off-site migration of the contaminants.

The objectives were met by excavating shallow impacted soils and completing dewatering activities near the property boundary and by implementing a robust electrical resistivity heating (ERH) program in the larger heavily impacted areas of the site.

Approach/Activities. An ERH system was designed for the simultaneous treatment of five separate source areas located across the property totaling approximately 156,000 square feet and extending to a depth of approximately 25 feet below ground surface. There was an estimated 28,000 pounds of cVOCs within the target zones to be thermally removed through direct volatilization, steam stripping and hydrolysis. A secondary goal was to remediate the LNAPL and petroleum hydrocarbon impacts within the vadose zone above the target zones. The ERH system included 620 electrodes, 80 multi-phase extraction (MPE) wells, 50 temperature monitoring points, and 50 vapor monitoring points. The recovered steam and soil vapors were transported to condensers where the mixture was passed through a vapor/liquid separator and heat exchanger. Entrained fluids and condensed steam were recovered and conveyed to an oil-water separator. The extracted air was treated via a regenerative thermal oxidizer or vapor phase granular activated carbon. Electronic collection of field notes and data were streamlined into a project dashboard to track the project. Heat-up data were utilized in a 4D model to help identify areas requiring attention to optimize remediation.

Results/Lessons Learned. ERH system startup was June 26, 2019. The system operated for 241 days and used a total of 17,174,240 kWh of energy to heat the soil to achieve treatment objectives.

Project remediation goals were met by to reducing cVOCs by a minimum of 99 percent or to reduce TCE and TCA to below 1 ppm. ERH removed approximately 6,721 pounds of VOCs based on a vapor phase treatment monitoring and an additional 7,665 gallons, or approximately 56,600 pounds, of LNAPL. The usage of digital data compilation and analysis helped streamline both the characterization and remediation activities for this complex project.

Speaker

T

Tom Kinney Senior Geologist/Team Leader, GHD

11:00am

Development of Closure and Postclosure Strategy for an Inactive Landfill in Saginaw Bay

11:00am - 11:45am, Jun 17

Data Application

Consumers Energy is working through the elements of a robust program for postclosure care and remediation for a Coal Combustion Residual (CCR) landfill located in Essexville, Michigan.

Historically, as early as 1982, groundwater quality at this location was determined to be

impacted with a number of inorganic constituents, including arsenic. Demonstrations were made and accepted to allow for performance-based administrative mechanisms to assure water quality compliance for continued permitted operations of the ash disposal within the areas of operation until numeric criteria groundwater surface water interface (GSI) was adopted in Michigan Solid Waste Rules by the Department of Environmental Quality (MDEQ). On February 14, 2002,

MDEQ issued a Letter of Warning (LOW) indicating that some numeric water quality

compliance criteria may not be achieved at the GSI – arsenic and low-level mercury were

primary suspects. A detailed investigation culminating in a September 2005 groundwater

characterization report outlined the nature and extent of elevated arsenic at the site and provided for a compliance monitoring program achieved through alternative monitoring points. This

program was eventually adopted through a groundwater mixing zone authorized by MDEQ on August 26, 2009 and reauthorized with minor modifications on December 23, 2015 that has been successfully executed to present day.

Nearly 40 years of water quality data exists from sampling at this location with the last 20 years of that data extending to multiple methods of evaluating GSI alternative monitoring points for

compliance. As the operations at this location have moved from wet deposition (sluicing) to dry, moisture conditioned disposal to now a closed landfill with a geomembrane cover, several

sources of data are being explored to better understand and forecast the improvements to water quality at this location from operational changes and reduced loading conditions. The water

quality data has also been compared to hydrogeology to better understand the effects of

“seasonality” with respect to occurrence and observation of the primary constituent of concern – arsenic. Lastly, this data has also been evaluated for improving the understanding of measured parameters or constituents that are most closely correlated to changes in the occurrence of

arsenic at the location and the relative sensitivity of these parameters with the changes in

observed arsenic. These observations tell a story of the changing landscape and custodianship of this operating site but also offer insight and strategies to improve achieving remedial objectives to manage arsenic (and any other constituent of concern) through the maintenance of constructed systems completed to reduce potential contaminant mobility and to robustly monitoring long-

term water quality in compliance with the authorized mixing zone with additional analysis of

certain indicator parameters that signal potential shifts in the observation of arsenic at this

location.

Speaker

H

Harold D. Register, PE Principal Engineer, Consumers Energy

Site Characterization and ERH Remediation of VOCs in Soil, Groundwater, LNAPL and DNAPL (Part 2): A Digital Implementation Strategy

11:00am - 11:45am, Jun 17

Data and Remediation

Authors: Tom Kinney, Tom Fewless and Kaitlyn Trestrail

This is Part 2 of the presentation for this project. The focus will be on the digital strategy employed to make this remediation project a success.

Background/Objectives. This project utilized emerging and historic digital technologies to characterize, design, implement, and monitor remediation at a former manufacturing facility (Site) impacted with chlorinated volatile organic compounds (CVOCs) in soil and groundwater.

The Site is a former manufacturing facility and encompasses approximately 148 acres. The primary building was 2 million square feet. The manufacturing operations spanned approximately 55 years between 1957 and 2012. The manufacturing facility was demolished in 2017. The site needed to be characterized and remediated to achieve a risk-based closure for property reuse and redevelopment, with land-use restrictions.

Approach/Activities. The initial conceptual site model (CSM) was developed using soil, groundwater, laser induced fluorescence (LIF), and membrane interface probe (MIP). This Site data was plotted in 3D visualization and projection software Earth Volumetric Studio (EVS).

The project team formulated a remediation strategy utilizing targeted in situ electrical resistance heating (ERH). The ERH implementation called for 574 electrodes, 50 temperature-monitoring points (TMPs), and 80 multi-phase extraction points (MPEs).

Electronic field forms were developed to streamline field data collection and monitor progress. Collected information included installation of electrodes, TMPs, and MPEs, as well as site conditions and health & safety reporting. This information was uploaded to a cloud storage database and was immediately available for review by the project team. A project dashboard instantly displayed pertinent information vital to the success of the project. Automated daily reporting and progress metrics were also available for review by the project team and stakeholders. Comprehensive 3D visualization tools were utilized to demonstrate completeness of remediation goals. Unmanned Aircraft (UAV) footage was collected for both the visible spectral light range and periodically using a thermal camera to track warming of the site.

Results/Lessons Learned. This investigation utilized a mixture of newer technologies, traditional sampling techniques, and advanced 3D mapping/projections to result in a cost effective and accurate characterization of the Site; satisfying the project team, client, and regulators. The deployment of electronic data capture techniques during remediation allowed for more accurate information to be immediately conveyed to decision makers, resulting in more timely and accurate decisions which have helped keep the remediation program on track.

Speaker

T

Tom Fewless GHD

12:00pm

Networking

12:00pm - 1:00pm, Jun 17

1:00pm

Are Water Well Logs a Reliable Resource for Conceptual Site Model Development? Yes, but Know and Manage the Pitfalls!

1:00pm - 1:45pm, Jun 17

Data Application

Water well logs may provide the only available alternative geologic and hydrogeologic information for a project site that has little or no site-specific investigation data, or where more regional information is needed in addition to site-specific data. However, water well logs can be dismissed as an unreliable resource because drillers logs tend to omit lithologic detail and may have limited well location information. Nevertheless, water wells logs can be used very successfully for developing, supplementing or expanding a Conceptual Site Model (CSM) if care is taken to ensure proper up-front data processing (including identification and management of potential problems inherent with online state databases) and all available logs are considered (when feasible) before screening out apparent outliers.

Techniques used to process and synthesize water well log information for use in CSMs include obtaining original scanned well logs in addition to processed logs from State databases (such as the Michigan Wellogic database) because some level of interpretation and transcription error is inherent in well log information that has been processed to conform to a standardized database template. Users of water well log data should expect to budget sufficient time for data collection and processing, including a rigorous review and confirmation of available well location information.

One project example is an industrial site in northwest Ohio where the CSM was expanded using Ohio DNR well log data to successfully identify an alternative location for a Village drinking water supply (originally situated approximately 1000 ft downgradient of groundwater impacted by site activities). The expanded CSM was used with Visual MODFLOW: to simulate the effect on groundwater flow of candidate alternative supply well locations in and around the Village; to inform subsequent environmental risk management decisions; and, for design and performance monitoring of site-specific remedial actions. Test borings were drilled at the proposed new Village Well Field location to confirm the presence of a deeper, more productive and more protected aquifer that initially was identified in less than 5% of the available water well logs and had not been encountered in any of the shallower site-specific borings.

Speaker

Joyce Dunkin, CPG, PG Senior Geologist/Hydrogeologist, LimnoTech

Matching Remediation Efficiency to Site Goals for In-Situ Bioremediation

1:00pm - 1:45pm, Jun 17

Data and Remediation

Author: Keith Gaskill

How Long Will It Take? How Much Does It Cost? These are the two most common questions asked by project stakeholders pursuing implementation of in-situ remediation at a project site. The answers are not mutually exclusive, however. As in business, the time-equals-money maxim also applies to in-situ remediation.

For well over a decade, we have assessed the effects of numerous in situ bioremediation (ISB) treatments to promote the destruction of the four most common chlorinated ethenes: perchlorethene (PCE), trichlorethene (TCE), cis-1,2-dichloroethene (cis-DCE) and vinyl chloride (VC). Typically, these treatments have included the injection of a controlled-release electron donor mixture either through injection wells or direct push rig tooling followed by subsequent monitoring of performance. In recent years, several technologies have been brought to market which when added to the electron donor, can optimize efficiency of the treatment and in some cases, drastically reduce the time required to eliminate risk and/or meet the project goals. These include bioaugmentation agents, iron agents (zero valent and divalent) and colloidal activated carbon.

This presentation is a data-driven, multi-site review utilizing various technologies currently available for ISB treatment of chlorinated ethenes and what their combined usage equates to in terms of ability to meet closure objectives, the time required to meet them and relative costs form implementing these approaches.

Speaker

Barry Poling Regional Manager - Central/East, Regenesis