Virtual EnviroTech 2021

esaa Environmental Services Association of Alberta

Contents

Virtual EnviroTech 2021

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Opening Keynote

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Virtual EnviroTech 2021

Welcome from ESAA

Welcome to EnviroTech 2021

On behalf of the Environmental Services Association of Alberta (ESAA), welcome to EnviroTech 2021 – virtual edition.

When we all met in 2020, it is fair to say that nobody thought we would be meeting virtually again in 2021. Well, here we are again, online and connecting virtual. ESAA has listened to all of the feedback we received through 2020 and we have made a number of major changes to the delivery of EnviroTech 2021.

This year you will have an enhanced virtual conference experience with both individual and group networking included within the exhibit area, 2 keynote speakers, 1 panel discussion and 28 technical programs.

Thank you to our membership and generous sponsors for continuing to support ESAA and EnviroTech. These contributions allow us to continue to showcase the great work our industry does.

We are hopeful with the recent update from the Provincial Government that RemTech 2021 will be happening in person in October. A final decision will be made in the coming weeks, but we are very optimistic. ESAA is also pleased to announce that planning has begun on RemTech East. This event will take place May 31-June 3, 2022 in Niagara Falls. The event will be co-located with the Canadian Water Summit. Please mark your calendars and watch for more information over the summer.

Thank you to all of the sponsors, exhibitors, speakers, moderators and our technical partner Simon Fraser University (SFU). We could not put on this event without you. We truly hope you enjoy this edition of EnviroTech.

Stacy Thygesen
President
ESAA Board of Directors

Joe Chowaniec
ESAA Executive Director

Agenda

Wednesday, June 2

08:30 - 09:30	**Opening Keynote** Main Stage  **Balancing People and Nature** Simon Jackson Founder of the Spirit Bear Youth Coalition	sponsored by NORTH SHORE Environmental Consultants
09:30 - 10:00	**Networking Break** Exhibit and Networking Areas	
10:00 - 11:30	**Panel Discussion** Main Stage **Indigenous Engagement, Relationships and Site Rehabilitation Program (SRP)** Steve Saddleback, Indian Resource Council Vanessa Frank, Kainai Resources Inc. / Blood Tribe Clayton Heck, Arrowhead Abandonments	sponsored by TRACE™ ASSOCIATES
11:30 - 13:00	**Virtual Lunch, Exhibit Time and Networking Break** Exhibit and Networking Areas	
	Technology Moderator: Carolyn Inglis, H3M Environmental	**Testing/Monitoring/Reporting** Moderator: Lori Forster, Environment and Climate Change Canada
	sponsored by NOVA AND ASSOCIATED COMPANIES	sponsored by Great Excavations Inc.
13:00 - 13:30	**(A) Case of Digital Transformation with Energy Operators and Consultants During the Pandemic** Vincent Lam, Matidor	**Data Management, Monitoring and a Pandemic – a Giant Mine Story** Morgan Schauerte, Dillon Consulting
13:35 - 14:05	**(A) Progressive In-Situ Remediation Approach for Dry-Cleaning Sites: Understanding The Subsurface** Patrick O'Neill, Vertex Environmental	**How Environmental Analysis Labs can Contribute in a Global Health Pandemic and the Long-Term Potential for the Future of Environmental Testing with PCR** Bryan Shaw, CARO Analytical
14:10 - 14:40	**Integration of Data Automation, Analytics and Visualization in the Areas of Field Testing, Sampling, Monitoring and Plume Analysis** Brandon Smith and Khalid Lemzouji, Analythium Solutions	**Planning Considerations for Data Collection on Large-scale Clubroot Sampling Projects** Ashley Siemens and Sahra Deagle, Trace Associates
14:45 - 15:15	**Managing Inventory: ArcGIS Online as a Solution for Orphan Well Association Contractor Engagement** Carla Incontri and Shawn Banack North Shore Environmental Consultants	**Applying eDNA for Species Detection: Tips for Successful Integration** Danielle Bourque, SLR Consulting
15:20 - 15:50	**Soil Sampling Equipment Comparison** Jordan Ernst and Josh Ernst, Ernco Drilling	**New Methods to More Accurately Quantify Hydrocarbon Contamination from Natural Background** Anthony Aquino, AGAT Laboratories

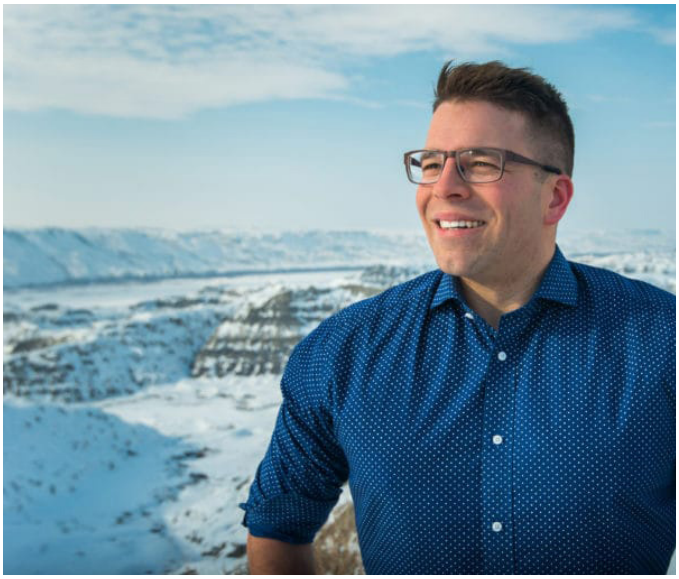
Thursday, June 3

08:15 - 09:00	**Exhibit Time and Virtual Networking** Exhibit and Networking Areas	
	GHG Management Moderator: Darrell Haight, Trace Associates	**Legal/Regulatory** Moderator: Stacy Thygesen, JSK Consulting
09:00 - 09:30	**Alternative Technologies in Fugitive GHG Emissions Quantifications for Landfills** Mosi Aghbolaghy, RWDI	**(The) Good, the Bad and the Ugly! Managing Environmental Risks & Liabilities – Civil Liability** Jacquelyn Stevens & Anand Srivastava Willms & Shier Environmental Lawyers LLP
09:35 - 10:05	**Interdisciplinary Collaboration for Effective Management of Greenhouse Gas Emissions from Oil and Gas Operations** Dani Urton, Vertex Professional Services	**(The) Good, the Bad and the Ugly! Managing Environmental Risks & Liabilities – Regulatory Liability** John Georgakopoulos & Matt Gardner Willms & Shier Environmental Lawyers LLP
10:05 - 10:30	**Networking Break** Exhibit and Networking Areas	
	Site Closure Moderator: Barry Rakewich, Nichols Environmental	**Air** Moderator: Craig Vatcher, Triton Environmental
10:30 - 11:00	**(An) Abandoned Drycleaner in Rural Alberta: A Costly and Dangerous Family Legacy** Michael Lupart, Trace Associates	**(A) Preliminary Empirical Study on the Influence of Rainfall on Urban Air Quality** Emmanuel Anglo Wood Environment & Infrastructure Solutions
11:05 - 11:35	**Incorporating Risk-based Closure into Overall Site Management** Tiona Todoruk, Advisian	**Improving Air Quality and Reducing Fugitive Emissions Through Continuous Monitoring Technology** Alex MacGregror, Qube Technologies and Kerry Mowbray, SECURE Energy
11:40 - 12:10	**Practical Closure Approaches for Salinity Impacted Wellsites** Tyler Prediger, Matrix Solutions	**EPA 325 : HOW and WHY? SOR/2020-231 Regulation: Passive Fenceline Monitoring for BTEX & 1-Butadiene (EPA 325)** Darlene Hoogenes-Stastny, ALS Canada
12:10 -13:10	**Virtual Lunch, Exhibit Time and Networking Break** Exhibit and Networking Areas	

	Emerging Contaminants Moderator: David Pritchard, Clifton Associates	Water, Wastewater, Groundwater Moderator: Bill Berzins, H3M Environmental
	sponsored by Willms & Shier Environment Indigenous Energy Law	
13:10 - 13:40	**PFAS Risk in the Oil and Gas Industry** Samantha Murphy, Cenovus	**Groundwater Surveillance Monitoring – A Consultant's Perspective** Blake Hamer, Matrix Solutions
13:45 - 14:15	**Progress in PFAS Site Investigation Procedures: Recent Cases in Canada** Leon Burger, SNC-Lavalin	**Accurate Water Table Characterization** Alanna Felske, Groundwater Resource Information Technologies and Louise Versteeg, Solstice Canada
14:20 - 14:50	**Landfill Disposal and Thermal Treatment Considerations for Solid Waste Containing Poly- and Perfluoroalkyl Substances (PFAS)** Matt Pourabadehei, SNC-Lavalin	**(A} Jurisdiction Review of Groundwater (Drinking Water) Pathway Assessments** Sheila Duchek, SNC-Lavalin
14:55 - 15:25	**PFAS: A Combination Approach for Laboratory Analysis** Tammy Chartrand, ALS Canada	**Wastewater Treatment Upgrade in Existing Lagoons with Novel Aeration System** Jan Korzeiowski, J.K. Engineering
15:30 - 16:20	**Closing Keynote and Wrap-up** Main Stage  **Gin, Tonic and Stories with Brian Keating** Pour yourself a beverage of choice and join us for a closing drink, a toast to brighter days ahead with stories from Brian Keating.	Sponsored by JSK consulting ltd.

Keynote Speaker

Simon Jackson



Movement Builder | Founder of the Spirit Bear Youth Coalition

Simon Jackson is a storyteller and movement builder who has dedicated his life to finding a better balance between the needs of people and nature.

At the age of 13, Simon founded the Spirit Bear Youth Coalition in the quest to unite the voice of young people to save Canada's endangered white Kermode or spirit bear. Through the Youth Coalition, Simon led the campaign that helped raise international awareness about the plight of the rare bear, building the organization into the world's largest youth-led environmental movement, with a global network of more than 6 million in over 85 countries.

After almost two decades of work, the spirit bear is now saved, with its last intact habitat having been set aside from development through one of the largest land protection measures in North American history.

Simon has received several honours for his work to save the spirit bear, including being awarded Queen Elizabeth II's Diamond Jubilee Medal, being named as one of the 100 Angels of the Earth by UNESCO and, most notably, being honoured as one of Time Magazine's sixty Heroes for the Planet – one of only six young people selected from around the world. His life's work was the focus of an internationally televised movie, Spirit Bear: The Simon Jackson Story.

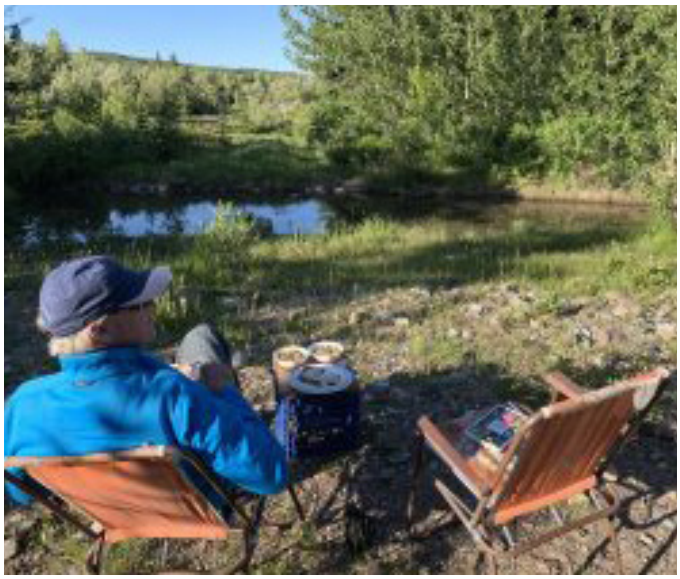
Additionally, Simon has contributed to the success of numerous non-profit organizations beyond the Youth Coalition, having served as a board member of the Jane Goodall Institute, DreamNow, the International Institute for Child Rights and Development and The WILD Foundation, amongst others.

Today, Simon is focused on advancing nature literacy as the co-founder of the Ghost Bear Institute. Its signature project, Nature Labs, is working to provide high school teachers with the critical resources they need to help a new generation understand why nature matters and what they can do to create a better balance.

Simon is a motivational speaker with agency Speakers' Spotlight, an award-winning photographer and a widely published writer. He has contributed images and chapters to eight books – including co-authoring the book A Geography of Hope: Saving Primary Forests – and has served as a columnist for CBC and the Huffington Post. Simon's writing led him to being named a Fellow of the International League of Conservation Writers.

Keynote speaker

Brian Keating



Brian previously held the position “Head of Conservation Outreach” at the Zoo, which enabled him to raise money to spend on environmental projects around the world.

He’s been leading groups on nature-based travel for three decades, exploring some of the best wildlife areas on the Planet. He’s a weekly guest on both Calgary and Edmonton’s CBC Radio, and for many years, was a regular on the Discovery Channel, using his own wilderness adventure and wildlife filming.

He’s in high demand as an international speaker, presenting at some 50 events a year. Brian’s style would best be described as buoyant, fast-paced, humorous, and always uplifting and meaningful. He’s also written five children’s books celebrating nature.

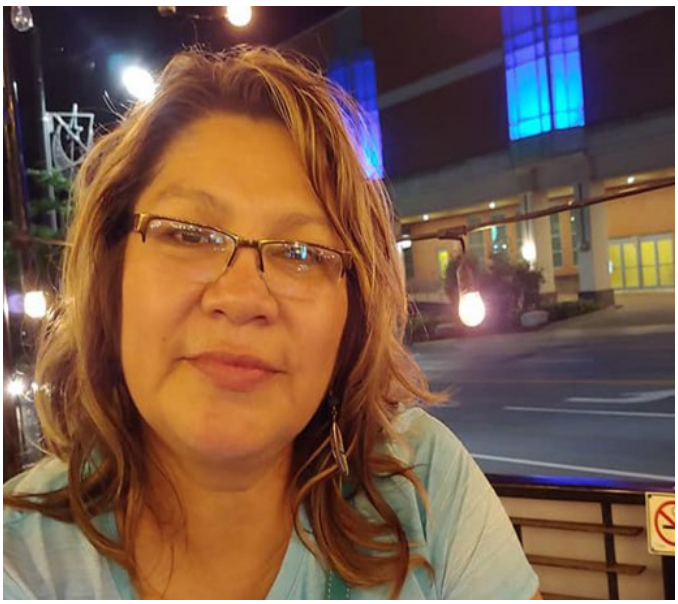
He’s a pilot, a naturalist, scuba diver, and mountaineer. His wife, Dee, is a physician and keen naturalist who always joins him on his adventures. Together, they have explored nearly 50 countries on all seven continents in the last quarter century.

Panelists

Clayton Heck

Clayton started his service rig experience in 1994 in Brooks, Alberta for Tazmanian Well Servicing and became a rig manager in 1999. He continued to work service rigs until he started his own Wellsite Supervision company in 2005 and worked for various firms for 2 years (was 1 of 2 consultants to help start Westrock) and then broke out on his own, working directly for oil companies. Some of his accomplishments are helping Baytex set up their first horizontal fracing operations and ran that program for 2 years, before transitioning over to ARC Resources and saved them ~$30,000/frac in the Waskada field. Clayton then took a job with Cenovus on the Suffield Block until the crash of 2015. For the last year and a half at Cenovus, he was their field abandonment executioner for Southern Alberta and Saskatchewan, including DDS and NR applications. When Cenovus slowed down, he enrolled at SAIT for Petroleum Engineering Technologist and graduated in 2018. He then got certified through ASET as a C.E.T. and is in the process of application approval for SPE, due to his extensive experience. After graduation, Clayton worked as a field operator for Cardinal Energy before being selected as the central Alberta Co-ordinator, but was let go in Nov 2019 due to oil prices. Clayton then partnered with his brother Kevin, due to his vast experience in downhole tool knowledge, and they started Arrowhead Abandonments and advertising our Indigenous background (Peepeekisis First Nation). We are currently the Lead contractor for CNRL, West Lake and work for the OWA, among others.

Vanessa Frank



Kainaiwa Resources Inc. Surface Land Admin

Vanessa Frank from the Blood Tribe has been with Kainaiwa Resources Inc. since 2015 as the Surface Land Administrator. She is also the Chair for the Indigenous Liaison Sub-Committee under the Education & Marketing Committee with the Alberta Common Ground Alliance.

Graduate from the Petroleum Land Admin program; and 2018 Catalyst with the 20/20 Indigenous Clean Energy program.

She has several years surface land experience within the oil and gas industry as Supervisor, Surface Land, Indian Oil and Gas Canada; Contractor with Apache Corp. Canada; Destiny Resources; Advance Line Locating; and as a Third Party administrator with Petro-Canada.

Clayton then partnered with his brother Kevin, due to his vast experience in downhole tool knowledge, and they started Arrowhead Abandonments and advertising our Indigenous background (Peepeekisis First Nation). We are currently the Lead contractor for CNRL, West Lake and work for the OWA, among others.

Panelists

Steve Saddleback

Director, National Energy Business Centre of Excellence (NEBCE) at the Indian Resource Council of Canada (IRC).

A member of the Samson Cree Nation located in Maskwacis, AB; A signatory to Treaty Number Six. Steve has worked for a number of National and International Organizations in Finance, Real Estate Investment, Banking, Economic Development, Fiscal Relations, and was a Partner of an Oil and Gas lease construction company in Northeastern British Columbia. Steve volunteers his time on numerous boards including the Indigenous Opportunities Committee at the Calgary Chamber of Commerce, SADLBAK Trucking, A member of the Steering Committee at the Clean Resource Innovation Network, Co-Chair of the Program Advisory Committee and Board member for the ReDeveLop Program – University of Calgary, and is a Fellow of the Energy Futures Lab. Steve is adamant on working towards meaningful involvement of indigenous communities in all areas of the economy with a focus on the Energy sector.

Virtual EnviroTech 2021

Thank you to all sponsors, exhibitors, presenters and participants for your continued support of EnviroTech. During these socially and economically challenging times, ESAA values and appreciates your continued involvement.

esaa Environmental Services Association of Alberta announces!

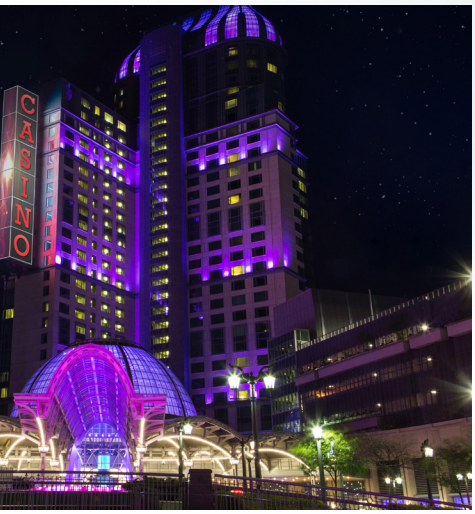
remediation technologies symposium EAST

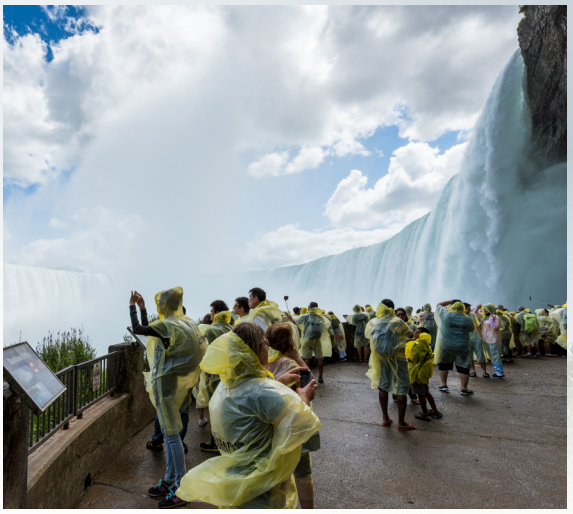
Niagara Falls | 2022

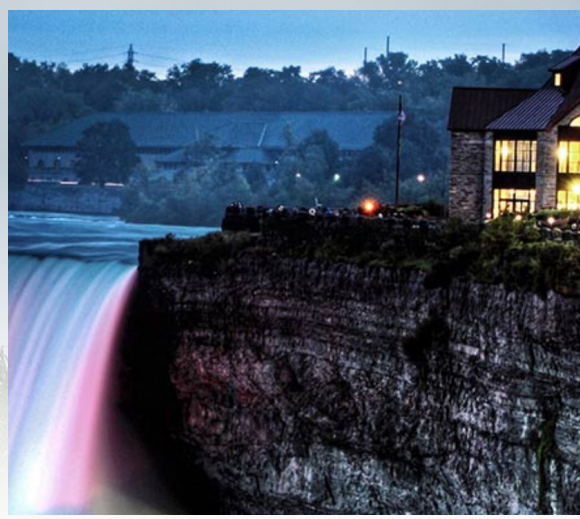
Mark the date!

May 31 – June 3, 2022, Fallsview Casino and Resort

together with the canadian water summit







Fallsview Casino and Resort, Behind the Falls tour and Dinner at Table Rock House restaurant

Exhibitor Profiles

Abacus Enterprises Inc

Abacus Enterprises Inc. is an independently owned remediation, reclamation, excavating and transportation company, operating in Morinville, Alberta. We are proud to serve Alberta wide with strong connections in the Sturgeon County, Hinton, Edson, Drayton Valley, Slave Lake, Westlock, Barrhead and Whitecourt areas. Abacus Enterprises was originated in April of 1993. Abacus believes that their passion for the industry and attention to detail is what has allowed them to succeed over the past 28 years. Abacus Enterprises Inc. has a strong commitment in having a safe work environment for all staff. Safety is one of the most important responsibilities in the operation of the company. www.abacus-ent.ca

AGAT Laboratories

AGAT Laboratories is a specialized Canadian company providing analytical solutions worldwide. As Canada's sole privately-owned laboratory network, AGAT Laboratories is renowned for providing defensible solutions to complex analytical requests with a constant focus on "Service Beyond Analysis" to its national and international clients. With 41 years of experience, over 1,200 employees Canada-wide and 43 locations coast to coast, AGAT Laboratories is comprised of 12 scientific divisions that service a wide spectrum of industries, namely, Oilsands, Rock Properties, Reservoir Characterization, Petroleum Testing, Lubricant Testing, Air Quality Monitoring, Environmental Chemistry, Forensic Chemistry, Ultra-Trace and Toxicology, Food Testing, Agricultural Analysis and Mining Geochemistry.. www.agatlabs.com

Alberta Recycling

ARMA acts on behalf of the province to oversee end-of-life processing of tires, electronics, paint and used oil materials. Additionally, ARMA supports the administration of the Northwest Territories' electronics recycling program and Yukon's tire recycling program. Our industry is rooted in the principle of circular economy where resources and products are kept in use for as long as possible and regenerated into new products and materials. We believe that supporting the creation of new products, processes and frameworks is key to advancing Alberta's circular economy and underscores our vision of Inspiring a future without waste. www.albertarecycling.ca

ALS Environmental

ALS Environmental

At the heart of our services is testing, but we do much more. At ALS, we provide high quality, innovative, professional testing services to help our clients make informed decisions. Servicing government, multi-national companies, manufacturers, retailers, consultants, and mining companies across the world, ALS processes more than 40 million samples per year and is one of the largest global testing, inspection and certification companies. As a global leader in environmental analysis, ALS delivers reliable data with exceptional service from experts who care about your projects www.aspb.ab.ca

CD Nova

CD Nova and Associated Companies is a distributor of Gas and Chemical Analyzers, Stack Sampling Systems, Moisture Analyzers, Meteorological Instruments, Energy & Power Systems, HV Transformers and Breakers, Industrial Automation, Vibration and Balancing Instruments, Test & Measurement Instruments, Switches, Transducers, Communication Products and Industrial Batteries. www.cdnova.com

Clifton Associates

Clifton, an award-winning engineering and environmental consultancy, opened its doors in 1978 as a four-person engineering start-up. The goal was simple: provide innovative and pragmatic solutions to help our clients build our communities. Forty years later, we are now one of Western Canada's most relied upon engineering firms, harnessing regional cutting-edge research and resources to deliver world-class engineering and environmental solutions. We deliver projects across Western and Northern Canada and internationally. www.clifton.ca

CORE

CORE is a company unlike any other. Our passion is using sound science to provide guidance to our clients for environmental management. We reduce waste, remediate contaminants in the environment and provide engineering and consulting services to major projects. CORE Environmental Consulting is an employee owned company with a focus on our clients' objectives. We provide well thought out, creative options to address environmental issues and understand that while there are many considerations in any project, your objectives come first. We listen. www.core-canada.com

Earthmaster Environmental

Remediating Our Past. Reclaiming Our Future. Earthmaster Environmental Strategies Inc. is a professional environmental consulting firm that provides unparalleled expertise, value and service to the commercial/industrial and upstream oil and gas industry in western Canada. We deliver innovative and practical strategies to help clients address complex environmental challenges. The Leader in Phytoremediation Systems. Along with the University of Waterloo, Earthmaster developed an innovative phytoremediation technology called PEPSystems®. Our system uses naturally occurring soil rhizobacteria plus agricultural amendments and scientific methodologies designed for site specific conditions and characteristics. PEPSystems® generates vigorous above and below ground plant growth that results in rapid remediation of soils contaminated with hydrocarbon, salt and some trace metals. www.earthmaster.ca

ECO Canada

ECO Canada is a steward for the Canadian environmental workforce across all industries. From job creation and wage funding, to training and labour market research—we champion the end-to-end career of an environmental professional. Our aim is to promote and drive responsible, sustainable economic growth while also ensuring that environmental care and best practice is a priority. We support the environmental labour force from coast-to-coast. Our services hit every touch point within the environmental workforce from educational development, to certification and soft skills training—we serve our members to ensure they can build and grow their careers. www.eco.ca

Element

Element is a leader in testing, inspection, certification and calibration services. Element exists to help make certain that the materials and products that we test, inspect, certify and calibrate for our customers are always safe, quality, compliant and fit for purpose. What we ultimately deliver is Certainty to those sectors where failure in service is simply not an option. That is The Certainty of Element. www.element.com

EnvironmentJournal.ca

The Environment Journal provides informed perspectives on the Canadian environment industry and the green economy. Content includes coverage of current news, views, and events about clean technology, renewable energy, net zero strategies, the circular economy, environmental regulations, sustainable finance, and more. Environment Journal is part of the Actual Media Inc. platform that provides quality content and actionable insights via marketing, communications, and events for the Canadian infrastructure, water, and environment sectors. Affiliate publications include ReNew Canada and Water Canada. Our premiere industry events include the Canadian Water Summit, Brownie Awards, Excess Soils Symposium, and Top100 Projects. We're excited to attend EnviroTech 2021. www.environmentjournal.ca

Envirosearch Ltd

For over 25 years EnviroSearch professionals have provided environmental consulting services throughout Western and Northern Canada. Our broad range of services are delivered through offices strategically located in Alberta, Saskatchewan and the Northwest Territories. To meet our clients' specialised needs, EnviroSearch delivers high-level technical expertise through cost-effective customized environmental and business solutions. We are committed to responsible environmental stewardship while working closely with clients to minimize the impact our operations have on the natural environment. Together with our Northern and First Nations partnerships, EnviroSearch is deeply tied to the communities in which we work through volunteerism, local employment, and community program support. www.envirosearch.ca

Equilibrium Environmental Inc.

Equilibrium Environmental Inc.

Equilibrium is a consulting and research company focused on cost-effective mitigation of environmental liability using sound conceptualization, planning/strategizing, execution, and performance monitoring techniques. Services include Phase I to III ESAs, as well as groundwater monitoring and innovative remediation approaches such as windmill-based soil vapour extraction, chemical oxidation, and desalinization. Equilibrium provides advanced approaches for the development of site-specific and area-specific soil, soil gas, and groundwater SSRA-based remediation guidelines. The company is actively developing liability mitigation strategies related to fugitive and greenhouse gas emissions. Equilibrium is a provider of critical research to support cutting-edge techniques in environmental liability management. www.eqm.ca

Ernco Environmental Drilling & Coring Inc.

ERNCO ENVIRONMENTAL

Ernco Environmental is a family-owned drilling contractor that has been operating since July of 2008. We specialize in Environmental, Geotechnical and Exploration drilling. Our large and diverse fleet of equipment allows us to meet and often exceed our client's needs. We also do test pitting, excavations, hydrovacing, snow clearing, site mowing/maintenance, rig matting and hydrovac hole backfilling. Please see our brochure or website for a full list of services. Our client's overall satisfaction has been our number one goal. We can accomplish this by focusing on safety, production, and quality of service. www.erncoenvironmental.com

Global Analyzer Systems

GLOBAL

Global Analyzer Systems is a complete CEMS provider offering state of the art, multi-component Continuous Emission Monitoring Systems (CEMS), Data Acquisition and Control Systems, CEMS Online Reporting and a host of on-site services. We excel in building Quality Assurance Plans, performing Annual Evaluations, providing customized CEMS Training Seminars, in addition to providing a wide range of Regulatory Compliance Support, Documentation, and Certification Services. Global knows the emission monitoring industry and is committed to providing all CEMS related services that meet regulatory requirements and exceed client expectations. www.gasl.ca

Great Excavations

Great Excavations Inc. www.greatexcavations.ca

At Great Excavations, we build and improve amphibious equipment for use in Canada's north and around the world. We are the only company in North America making this equipment smarter, faster, safer, and more efficient while also building in new technologies like drones and remote-controlled systems to change how work is done on rough, wet terrain. Great Excavations specializes in environmental services in the energy sector, supporting bird aversion systems in tailings ponds and providing amphibious expertise for caribou habitat restoration, which is our passion project. We work closely with industry to upscale non-winter remediation and reclamation activities. www.greatexcavations.ca

JED Environmental

We are VERY excited to announce that we have partnered with "Project Forest" as part of our commitment to reduce our carbon footprint. Check us out@ https://projectforest.ca/partners/. Since 2004, JED Environmental has been providing environmental, geotechnical, construction and mining drilling solutions throughout Western Canada. We pride ourselves in our company safety culture and the relationships we have built with our clients. Our fleet includes a wide variety of drilling equipment including direct push, tracked and truck mounted auger, coring and rotary drills. We are centrally located to provide convenient, reliable, and cost-effective solutions to all corners of Western Canada. www.jeddrilling.ca

JSK Consulting Ltd

Founded in 1995, JSK offers a one window approach for the abandonment process. We carefully assess each project and create a customized plan, whether decommissioning a single well battery, large gas plant or pipeline integrity management solutions. We promote a comprehensive package that includes Production Optimization and Pipeline Modifications to maintain production trains, de-energizing, purging and cleaning of production equipment, associated pipeline abandonments and subsurface decommissioning including UST's, pilings, cables, process piping, concrete and other buried structures. We administer all AER Directive 56 Notifications, prepare temporary workspace and access agreements, and submit all License amendment applications to the AER. www.jskconsulting.ca

Matidor

Matidor eliminates collaboration and visibility challenges in the energy/environmental sector by consolidating all key project information on one intuitive, map-based dashboard, with real-time updates that can be shared between multiple parties. With Matidor, all stakeholders can drill down to a specific location with user-friendly GIS tools and key data such as budgets, tasks, and files, making it easy for non-technical users to update and share geospatial information along with critical projects details. Our intuitive reporting provides them with peace of mind, with regular deadline reminders and notifications of critical events. Lastly, the ability to share project data and standardize workflows for vendors using our platform facilitates better decision-making and ensures that all projects result in a better environmental footprint, cleaner resource extraction, and better operational efficiency. www.matidor.com

Matrix Solutions Inc

Matrix Solutions Inc. is a Canadian environmental and engineering consulting company. Strategically located across Canada, we help our clients, employees, environment and communities thrive. With our ability to collaborate across services, disciplines, and geographies, we deliver responsive, locally connected, and scalable solutions customized to our client's project and environmental challenges. Our integrated approach is supported by talented professionals focused on these key areas: engineering; environmental sciences and planning; geosciences; and site assessment, remediation and reclamation. www.matrix-solutions.com

North Shore Environmental Consultants

North Shore was established in 2002 upon the principle that a smaller, flexible consulting firm could provide superior client service. We are an employee-owned firm that is recognized for our company culture and innovative spirit. North Shore offers technical expertise in a unique range of consulting disciplines to help our clients meet their environmental and regulatory requirements. Our diverse family of professionals includes agrologists, air quality specialists, biologists, foresters, hydrogeologists, and engineers. We take great pride in our outstanding individuals and strive to continually push the boundaries of the consulting industry. www.northshoreenv.com

Osprey Scientific

Osprey Scientific Inc. has been providing field measurement technology and solutions to our clients since 1994. We provide solutions for measuring specific parameters, technical support, calibration standards and advice on the best technology to help you meet your data quality objectives, allowing you to make real time decisions in the field. To support this we provide repair, rental and training services for most of the technology we represent. Our expertise extends to the areas of water quality, toxicity, gas monitoring for personal safety and site evaluation, environmental assessment and remediation measurements, waste characterization and food safety. www.ospreyscientific.com

Pro-Source Insurance

Founded in 2014, Pro-Source is a boutique commercial insurance brokerage dedicated to the environmental services sector. Our expertise directly benefits our environmental clients in many ways. We fully understand the risk profile and the complex insurance products required. Our market volume enables us to consistently obtain the best policy terms and pricing from our insurance company partners. Our focus allows us to provide unrivaled service on a daily basis. Discover the Pro-Source advantage today! www.pro-source.ca

Ridgeline Canada Inc

Ridgeline Canada Inc. prides itself on developing tailor-made and comprehensive solutions for our clients through our multiple divisions and wide range of experience. Ridgeline Environment provides an integrated approach to environmental consulting, servicing oil & gas, power & utilities, renewable energy, and many other industries. Ridgeline Response provides holistic spill response and emergency management expertise that can help you before, during and after a spill occurs. Finally, Ridgeline GreenFill provides waste disposal services in Alberta & Saskatchewan for contaminated soil, oilfield & industrial wastes and recycles it to be reused for daily cover in local landfills. www.ridgelinecanada.com

RWDI

RWDI helps clients tackle complex challenges in the built environment by combining innovative thinking, collaborative problem solving and a passion for expanding the boundaries of the possible. Over the past four decades, we've evolved from a respected Canadian company with deep technical expertise in wind engineering to a global firm known for solving some of the world's most demanding building performance, climate engineering and environmental challenges. Our team of more than 500 engineers, working from 25 offices worldwide, helps to drive success on ambitious building, industry, and infrastructure projects – enhancing their performance, resiliency and efficiency, and assessing and mitigating their environmental impacts. www.rdwi.com

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Founded in 1911, SNC-Lavalin is headquartered in Canada and employs 45,000+ employees globally. Our hallmark is local execution supported by global expertise. Our local teams are reinforced with international experts to deliver quality and sustainable results on projects of any size and scope. Projects are delivered on budget and on schedule to the complete satisfaction of our clients. We are committed to ensuring social equity, environmental protection, and economic efficiency with the highest health and safety standards. Our Environment and Geosciences teams are leaders in a wide breadth of services including contaminated sites assessment, remediation, reclamation, hydrogeology, and risk assessment. www.snclavalin.com

TerraLogix Solutions Inc.

TERRALOGIX SOLUTIONS INC.

TerraLogix Solutions Inc. is a company specializing in Environmental Management in the Upstream Oil and Gas Industry. We are experienced in the development and coordination of environmental programs, environmental project management and on-site day to day project supervision. TerraLogix is built on providing excellent environmental management services and cost effective environmental solutions for the Upstream Oil and Gas Industry. TerraLogix has offices in Calgary and Edmonton, AB. www.terralogix.ca

THINK Environmental Services

THINK Envirotechnical Services Inc. is an environmental consulting support service with offices in Calgary and Regina. We provide professional drafting/GIS, borehole log entry and data tabulation services to environmental consultants across Canada. We provide support for all environmental reporting including environmental site assessments, remediation and reclamation projects, groundwater and soil monitoring programs and geotechnical assessments. Our long list of satisfied clients stays competitive by saving time, money, and best of all, providing their clients with top-notch, professional drawings, mapping, borehole logs and analytical tables. Contact us for a rate sheet or more information. www.thinkenv.ca

Trace Associates

Trace Associates Inc. is a professional services firm specializing in environmental science and engineering advisory. We provide sustainability, emergency management, remediation, reclamation, and natural science expertise. Our people work hard to understand your needs and exceed your expectations because we genuinely care about you and your success. www.traceassociates.ca

Triton Environmental Consultants

Triton Environmental Consultants knows western Canada. It's where we live and work, and it's always been that way. With seven offices strategically located across British Columbia and two in Alberta, we're always ready to identify opportunities and support our clients on the ground (and in the water!). Triton has always been mindful of its responsibility to facilitate sustainable use of the environment in the best interests of our clients and their stakeholders. From power projects and mines to interprovincial pipeline projects, clients have relied on us to successfully steward their projects from inception through approval to completion since 1989. www.triton-env.com

Waste Connections of Canada Inc

Waste Connections is the third-largest provider of solid waste collection, transfer, recycling, disposal and resource recovery services in North America. We also provide non-hazardous oilfield waste treatment/recovery/ disposal services in several basins across the U.S., as well as intermodal services for the rail haul movement of cargo and solid waste containers in the US Pacific Northwest. We believe that our services play an integral part in improving environmental quality and are mindful of having the most cost-effective waste management solutions for our customers, while investing heavily in alternative technologies to reduce landfill disposal, reduce greenhouse gas emissions, and harness bio-fuels. www.wasteconnectionscanada.com

Water Canada

Water Canada is an influencer, a networker, and a newsmaker. Our editors and researchers know the industry and the people implementing plans and projects on the frontlines. Thousands of readers turn to us for exclusive, insightful content that speaks to Canada's water expertise, connects decision-makers, and promotes better water management and stewardship. Water Canada hosts the annual Canadian Water Summit and runs the annual Water's Next Awards program. Its affiliate publications include the Environment Journal and ReNew Canada www.watercanada.net

Willms & Shier Environmental Lawyers LLP

Willms & Shier Environmental Lawyers LLP is Canada's recognized leading environmental law firm, delivering a full range of environmental, Indigenous and energy law services. For 40 years, our clients have benefitted from our innovative, practical solutions and extensive knowledge of environmental, Indigenous, and energy and natural resource issues. With 17 highly specialized lawyers, we are the largest private sector environmental law practice in Canada. Eight of our lawyers are Environmental Law Specialists, certified by the Law Society of Ontario. Willms & Shier has offices in Calgary, Ottawa, Toronto and Yellowknife. Our lawyers are called to the Bar in Alberta, British Columbia, Ontario, New Brunswick, Nunavut, the Northwest Territories, and the Yukon. www.willmsshier.com

Abstracts

(An) Abandoned Drycleaner in Rural Alberta: A Costly and Dangerous Family Legacy

Michael Lupart, Trace Associates

This presentation explores the decommissioning, assessment, and remediation of an abandoned drycleaner in a small town in central Alberta. The drycleaner was abruptly abandoned in the early 2000s, and remained untouched and unoccupied until 2017, when the executor of the family will was notified of the property.

The drycleaner closed with little notice in the early 2000s following a family tragedy. The clothing, linens, equipment, residence, and chemicals were left largely untouched until 2012. Sometime in 2012, a broken water pipe resulted in approximately 2 metres of standing water persisting in the basement (and residence) for several weeks. The water was removed, and the property again remained dormant until 2017, precipitating the growth of mould and significant damage to the residence and site.

Trace Associates Inc. was contracted to evaluate the environmental status of the site, including the potential environmental liability for the purposes of divestment. Work included the removal of clothing, linens, and process equipment. Materials were recycled or donated where possible. Derelict dry cleaning equipment required special environmental and health and safety considerations. Chemicals required specific assessment and disposal. Flood-damaged property included a former living space, process equipment, chemicals, a kitchen, and a full freezer that had sat inoperable and untouched for years. This decommissioning process incorporated the unique considerations of stakeholders, including the family, the former occupants, neighbours, and former customers.

Soil and groundwater impacts were identified during subsequent environmental assessments, which precipitated the development of site-specific guidelines. Remediation considerations included the presence of underground utilities, as well as the proximity to adjacent structures, including the derelict property. Following successful remediation, the property was sold to a local landowner in consultation with another third-party environmental professional.

Michael Lupart

Mr. Lupart is a Partner, Senior Environmental Scientist, and Division Manager, Calgary for Trace Associates Inc. (Trace) and has been working in the environmental industry since 2005. At Trace, Michael leads the Calgary office and directs work as the Principal-in-Charge for a variety of market sectors and clients.

Michael is responsible for senior technical oversight, client liaison and successful project execution within the real estate, government, oil and gas, and industrial sectors. Michael directly supervises and mentors junior, intermediate, and senior consultants. Mr. Lupart's expertise and passion is in managing and conducting technically challenging projects on expedited turn-around times or with unique stakeholder considerations

Accurate Water Table Characterization

Alanna Felske, Groundwater Resource Information Technologies and Louise Versteeg, Solstice Canada

Site investigations, especially subsurface evaluations, require an accurate characterization of the water table. The position of the shallow water table is important to geotechnical engineers for soil strength characteristics, need for dewatering and slope stability considerations. Septic field installers need to ensure there is a sufficient thickness of unsaturated soil for septic effluent treatment. Contaminant investigators need to determine migration pathways. Environmental scientists and biologists assessing wetlands need to understand wetland processes in relation to shallow water tables and potential interaction with groundwater. Storm water engineers need to establish water table depths for storm water pond design. Road builders need to know the water table for proper road sub-base designs.

The water table can be difficult to characterize, especially in low permeability silt and clay soils or shale bedrock. In low permeability soils although no free water is observed and the soil may be thought to be dry but the water table is several meters above that soil depth.

A common method of measuring the water table is by installing a standpipe into a test pit or drilled hole and the water table is measured some amount of time after installation. Inaccuracies may result as water levels may take several weeks, months or even years to equilibrate in a well or test pit.

Deep wells that allow for measurement of water levels in aquifers can have significantly different static water levels than the water table with well water levels several tens of meters below the water table, or in the case of artesian conditions, water levels in the aquifer are higher than the ground surface.

More subtle features need to be examined which include characterization of soil mottling, change in soil moisture and change in soil strength and consistency. The use of accurate soil description, for example use of Munsell soil colours, is important to fully characterize the soil content. Other observations include presence of gypsum or anhydrite crystals, or “gleying” of the soil.

Surface conditions can provide a good guide to estimating the water table. Features to examine include elevations of surface waters with which the water table may be in good agreement. Vegetation types and indicator plant species can also be used to indicate the presence of water table as certain plants will only grow in saturated soils. Air photo interpretation is another tool that may provide a visual indication or signature of where historic surface water features may exist, which, although dry at the surface now, may indicate areas with a shallow water table.

A well with a long screened interval may have a water level that is a weighted average of the water levels of several permeable zones rather than a water table measurement. A short screen should be utilized which requires good examination of the site and strata conditions prior to well completion.

When measuring water levels in test pits it may be advantageous to install a well into a small diameter borehole augered into the base of an excavation as seeping groundwater in a small borehole will take much less time to fill than seeping groundwater into the backfilled soil of a large excavation.

The time factor for water table changes should also not be ignored as seasonal conditions, such as snow melt or spring rains may affect the water table.

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Alanna Felske, MSc, GIT

Alanna is part of the groundwater team at GRIT Ltd. and has three years of consulting experience working as a hydrogeologist (GIT) in Alberta. Her current work is focused around groundwater supply, wetland hydrology, septic field evaluations and contaminated site investigations. She holds a BSc in Petroleum Geology and a MSc in Geology, both from the University of Calgary. Her Masters thesis work focused on employing field based hydraulic, geochemical and thermal methods to determine the temporal and spatial variations in the nature of groundwater-surface water interactions at a northern prairie wetland.

Louise Versteeg BSc, PBiol, QWSP

Louise is the biophysical and regulatory team lead with Solstice. With over 20 years experience as a terrestrial and wetland ecologist, Louise has an extensive background in ecology, vegetation, wetlands, soils and wildlife. Through her experience in environmental consulting and in municipal environmental and regulatory compliance, Louise has acquired an excellent understanding of the regulatory and permitting processes at all level of government (municipal, provincial, territorial and federal) and has successfully navigated projects through various permitting and approval processes. She has worked throughout western and northern Canada undertaking and directing environmental impact assessments, as well as vegetation and wetland monitoring programs for a wide range of industries including mining, oil and gas, pipelines, municipalities and land developers. As a Professional Biologist, Louise is registered as a Wetland Practitioner under the provincial Wetland Policy and has extensive experience in overseeing and completing wetland inventories and assessments for various projects, including wetland mapping, field data collection, and compilation of wetland assessment reports and *Water Act* applications.

Alternative Technologies in Fugitive GHG Emissions Quantifications for Landfills

Mosi Aghbolaghy, RWDI

It is critical to understand the potential impacts on a business related to GHG emissions over an ever-changing regulatory environment and carbon pricing regime. Significant fugitive emissions of GHGs like methane and carbon dioxide are emitted from area sources such as landfills every day, potentially at substantial cost to the facilities and the environment. Current practices utilize simple emission factors, but large emitters and opt-in facilities can also use site-specific methodologies to calculate these emissions under the Technology Innovation and Emissions Reduction (TIER) Regulation of Alberta. Cutting edge site-specific methods can provide a more robust understanding of GHG emissions compared to current methods that use default factors. With more accurate emissions calculations, facilities can make informed decisions around mitigation strategies to lessen their environmental impact and carbon emission costs.

Learning Objectives:

- Discussing the potential shortfalls of the first-order decay (FOD) method vs direct measurements and modelling.
- What prescribed methodologies can offset projects such as aerobic composting in Alberta use and what are the flexibilities within those methodologies for the calculation of landfill-specific Methane Generation Rate?
- What flexibilities for the calculation/measurement of site-specific landfill GHG emissions exist under the TIER and federal Output-Based Pricing System (OBPS)?
- A comparison of various techniques for direct measurement at the surface and/or below and above-ground including static or forced flux chamber measurements, mass balance methods, micrometeorological measurements, and plume measurements.

Mosi Aghbolaghy, PhD, PEng

Mosi Aghbolaghy joined RWDI in 2019 after completing his PhD degree in chemical engineering at the University of Saskatchewan and working in the manufacturing sector for two years. Mosi currently acts as a Project Engineer with RWDI's air quality group and a GHG Verifier and Field Verifier under RWDI's greenhouse gas Validation & Verification Program. He has been a member of RWDI's greenhouse gas verification team for facilities and offset projects in Alberta (CCIR and TIER), and for facilities in Ontario (O. Reg 390/18), British Columbia (Regulation 249/2015), Saskatchewan (SK OBPS), and Manitoba (Federal OBPS). In addition, he has been involved in several air disepresion modelling projects across Canada and the US.

Applying eDNA for Species Detection: Tips for Successful Integration

Danielle Bourque, SLR Consulting

Environmental biomonitoring programs allow ecologists to collect species data across various geographical and temporal gradients. With this data, ecologists can characterize ecosystems and assess changes in response to various anthropogenic inputs or alterations to land use. Conventional techniques applied to collect environmental biomonitoring data can be resource intensive, costly and time consuming, and species detection accuracy can vary or have inherent collection biases. Despite ongoing efforts to update and modify standard collection protocols, conventional collection techniques can also be invasive to species and their habitats, resulting in undesirable mortality. Environmental DNA (eDNA) presents novel opportunities for non-invasive, sight-unseen species detection and enumeration using exogenous DNA signatures found in various media: soil, water, feces, tissues, and even air. Sampling for eDNA often eliminates the requirement for collection permits and can circumvent professional barriers associated with challenging sites or rare species, making it an attractive substitute for traditional methods. The application of eDNA in industry and government sectors has expanded rapidly in recent years, with commercial laboratories now offering DNA analysis services. However, eDNA survey design requires careful planning at each phase of the process: in the field, in the laboratory, and during data analysis. SLR offers end-to-end eDNA services that design surveys on a per-project level basis, offering custom solutions to clients. Here, we expand on aspects of successful eDNA survey integration, including pilot studies, field collection, assay selection and development, and results interpretation.

Danielle Bourque, MSc

Danielle Bourque is a Molecular Ecologist at SLR Consulting (Canada) Ltd. (SLR). Danielle graduated her M.Sc. at the University of Guelph in 2019, where she demonstrated that changes in eDNA concentration corresponded with changes in the biomass and abundance of water flea populations over a four month time series. Danielle has been working on various eDNA projects with government and industry collaborators at the U of G since 2015, and is experienced in aquatic field collections, eDNA assay design, and various DNA-based analyses, including DNA barcoding. Danielle has applied her knowledge of eDNA at SLR on multiple projects, monitoring amphibian, mammal, and freshwater fish Species at Risk and invasive species in both Ontario and British Columbia.

(A) Case of Digital Transformation with Energy Operators and Consultants During the Pandemic

Vincent Lam, Matidor

A case of digital transformation with energy operators and consultants during the pandemic

During these unprecedented times, the ability to maintain project efficiency and ongoing team collaboration, while continuing to regulate costs can single-handedly determine the longevity of many environmental services organizations. As difficult of a task as that may seem, it is not impossible. With new government grants available and revolutionary new software solutions, remediation and fieldwork can continue and even thrive in the current climate. In this session, we will use real-life case studies to demonstrate how upstream operators and consultants have taken advantage of technological innovations to improve collaboration and efficiency across project teams.

A case study with Rife Resources will be presented to demonstrate how Matidor.com, a digital collaborative platform, can provide managers with access to all documents, data and teams in one place to improve their efficiency by 400%. Matidor.com is a platform that allows team members to stay on top of the activity stream, report and track project progress anytime and anywhere. Its desktop and mobile app helps environmental consultants to visualize their scope of work (in a map view) and make it accessible to stakeholders at any time.

Matidor.com tremendously helped field services and operators. Their success stories are based on the introduction of digital solutions and better visibility, instead of a paper-driven work process. Matidor's users report increased productivity levels thanks to enhanced management experience, improved data transfer, elimination of paperwork redundancies and administrative overhauls. Delays and associated costs are avoided by tracking progress of physically remote projects with Matidor.com. Meanwhile stakeholders gained access to a new level of real time reporting. Lost time is often eliminated, and where it still exists, it becomes visible and trackable so consultants can address the operational bottlenecks.

Vincent Lam, MBA

Vincent Lam is the CEO and co-founder at Matidor. A visionary and 3x founder, Vincent built and sold his first Point-of-Sale system during his university years, and later joined Google to lead projects with the Google Earth team. Vincent has over 20 years of experience commercializing software innovations for environmental and energy companies, including GIS, marketplaces and AR/VR platforms. Vincent holds an MBA from the University of Ottawa and a BASc in Computer Engineering from UBC.

Data Management, Monitoring and a Pandemic — a Giant Mine Story

Morgan Schauerte, Dillon Consulting

The Giant Mine is a site that holds significant cache in the minds of Northern Canadians. A source of prosperity and wealth which now contains in excess of 237,000 tonnes of arsenic trioxide dust located primarily below the water table. While remediation is an ongoing process, currently the pump and treatment system is the primary method of preventing arsenic contamination from further impacting Back Bay and Yellowknife.

What would you do if you were responsible for the surface and groundwater monitoring? The site has complex monitoring requirements that are driven not only by regulatory instruments such as water licensing and the Metal and Diamond Effluent Regulation Act, but also requirements related to performance and historical trend analysis. How would you manage this and client expectations from 4000km away?

An isolated site, with dozens of potential effluent vectors, a challenging climate, daily reporting, complex equipment and a pandemic. Traditional spreadsheet based project management was not going to cut it. To effectively manage this site new methods of data collection, management, training and analysis were developed.

This presentation outlines the challenges modern contaminated site monitoring can present, the readily available tools and processes that can be used to not only increase efficiency, but monitoring accuracy and schedule adherence. The lessons we learned about the benefits and challenges of these new processes will be discussed, and importantly, what these new methods taught us about spreadsheet based environmental monitoring and management.

Morgan Schauerte

Morgan is an environmental consultant who has worked at projects across Canada on behalf of proponents, aboriginal groups and governments during project development, operation and closure. He was born and raised in Northern Canada, and now works and lives with his partner in Halifax, Nova Scotia.

EPA 325 : HOW and WHY? SOR/2020-231 Regulation: Passive Fenceline Monitoring for BTEX & 1-Butadiene (EPA 325)

Darlene Hoogenes-Stastny, ALS Canada

Fugitive volatile organic compound (VOC) releases from facilities in the petroleum and petrochemical sectors may pose health and environmental risks to Canadians.

As part of the Government of Canada's Chemical Management Plan (CMP), new regulations for petroleum refineries, upgraders, and certain petrochemical facilities were promulgated November 11, 2020 to reduce the risk of exposure to humans and the environment. The SOR/2020-231 Regulations, along with the accompanying Regulatory Impact Analysis Statement, are available at the following link:

https://canadagazette.gc.ca/rp-pr/p2/2020/2020-11-11/html/sor-dors231- eng.html

The regulation came into effect January 1, 2021, and after ECCC approval of monitoring program design, monitoring must start no later than January 1, 2022, with year-round adsorbent tube deployment on a 2-week cycle.

EPA 325 Background

In May 2013, the US EPA released a proposed rule as an update to the current US "national emission standards for hazardous air pollutants for petroleum refineries" which required all refineries to monitor volatile benzene concentrations around the fenceline (perimeter) of their facilities. Benzene was selected as a representative compound to evaluate overall refinery emissions.

The proposed rule was posted to the US Federal Register on June 30, 2014 with the final rule being signed and published on September 29, 2015.

EPA Method 325 "Volatile Organic Compounds from Fugitive and Area Sources" was developed to enable refineries to comply with the updated US federal regulation 40 CFR 63.

EPA Method 325 includes two sub-parts:

- EPA 325A: Sampler Deployment and VOC Sample Collection; and
- EPA 325B: Sampler Preparation and Analysis.

These complementary methods outline the design, deployment, preparation, and analysis of a series of passive sampling sorbent tubes suspended around the refinery property line. After 2 weeks (14 days) of exposure, the passive sampling tubes are detached from the shelters, re-sealed, and sent to a laboratory for thermal desorption (TD) gas chromatography mass spectrometry (GCMS) analysis. Although benzene is the primary target compound, the sampling and analysis methodology can also be used to determine other VOCs, including 1,3-butadiene, toluene, ethylbenzene, xylenes, and other hazardous air pollutants (HAPs).

The objectives of the Canadian Regulations are to:

- reduce fugitive volatile organic compound (VOC) releases from equipment leaks at petroleum refineries and upgraders, and from petrochemical facilities that are operated in an integrated way with those facilities, in Canada;
- provide protection for human health by minimizing, to the greatest extent practicable, exposure to carcinogenic components contained in petroleum and refinery gases (PRGs);
- improve human health and environmental quality by reducing smog formation;
- promote a level playing field through nationally consistent VOC and PRG risk management measures;
- harmonize these measures, to the extent possible, with existing measures in other jurisdictions (e.g., provinces, municipalities, and the US); and
- provide regulatory certainty to the industry and other stakeholders, which will encourage them to plan and invest into the future with confidence (ECCC, Nov.2020).

Set-Up, Application and VOC Scope

Samples are collected using a 3.5" long x ¼" OD stainless steel tube packed with a carbon-based adsorbent. One end of the tube is outfitted with an open mesh diffusion cap and the other end is sealed with a brass cap. The tube is positioned with the diffusion cap in a downward orientation under a protective non-VOC emitting shelter. Shelters are placed at a height of 1.5 to 2 meters above the ground on a secure pole or other suitable structure. At least one co-located duplicate sample is collected for every 10 field samples. A minimum of two unopened field blanks are collected in different shelters per sampling period to ensure sample integrity associated with shipment, collection, and storage.

Monitoring points are determined using an equal radial or linear approach, e.g. Radial: Less than 750 acres, samplers

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every 30 degrees based on a central emission source point (12 samples); Linear: Boundary less than 24,000 feet, a minimum of 12 sampling locations evenly spaced ±10%. Based on 26 two-week sampling events, a yearly rolling average is created which is then compared to a specified action level.

The preferred sorbent is Carbopack X, a medium/strong sorbent (for n-C3/ C4 to n-C8 substances). Carbopack X is optimal for passive adsorption of the target analytes listed, including benzene and 1,3-butadiene, and is hydrophobic, minimizing moisture effects. The use of a diffusion cap and slow analyte diffusion rate (uptake rate) mitigate any extreme changes in wind vector.

Prior to use, new tubes are thermally conditioned and checked for desorption efficiency (DE). The tubes can be cleaned to low background levels, enabling target analyte detection at ppb/ ppt levels. Uptake rates are based on Fick's Law of Diffusion (a compound will migrate to the surface of a sorbent at a rate dependent on: distance and area between sorbent and source, time of exposure, diffusion coefficient of the compound through air, and ambient concentration). Without an uptake rate no comparison can be made between the amount of analyte measured on the tube and the concentration at the sampling point.

Table 1. Validated Sorbents & Uptake Rates for Selected Clean Air Act Compounds *McClenny, W.A., et. al., J. Environ. Monit. 7:248-256.*

Compound	Uptake rate rate (mL/min)[1]
1,3-Butadiene	0.61 ± 0.11
1,1-Dichloroethene	0.57 ± 0.14
3-Chloropropene	0.51 ± 0.30
1,1-Dichloroethane	0.57 ± 0.10
1,2-Dichloroethane	0.57 ± 0.08
1,1,1-Trichloroethane	0.51 ± 0.10
Benzene	0.67 ± 0.11
1,2-Dichloropropane	0.52 ± 0.10
Trichloroethene	0.50 ± 0.05
Toluene	0.52 ± 0.14
Tetrachloroethene	0.48 ± 0.05
Chlorobenzene	0.51 ± 0.06
Ethylbenzene	0.46 ± 0.07
m,p-Xylene	0.46 ± 0.09
Styrene	0.50 ± 0.14
o-Xylene	0.46 ± 0.12
p-Dichlorobenzene	0.45 ± 0.05

Darlene Hoogenes-Stastny

Having graduated from the Fanshawe Environmental Technology program in 1992, Darlene has been working in the environmental industry for over 30 years. Her experience, working for environmental laboratories, spans waters, soils and in the last 6 years has come to include tissue and air. Initially working in the lab (sample shipping/receiving, microbiology, SF6 testing) and from there progressing to customer service and account management, Darlene is now the ALS Canada-National Air Quality Specialist. Her early career experience includes 7 years in health care (geriatrics), 3 years in the automotive industry, as well as 2 years in environmental compliance. She is a member of OOWA (Ontario On-Site Wastewater Association), OMA (Ontario Mining Association), an associate member of AWMA (Air & Waste Management Association), and a CET (certified environmental technologist). Her interests include spending time with family, horseback riding, travel, and she is a member of a Dutch language community theatre group.

(The) Good, the Bad and the Ugly! Managing Environmental Risks & Liabilities – Part 1: Civil Liability; Part 2: Regulatory Liability

Jacquelyn Stevens & Anand Srivastava, Willms & Shier Environmental Lawyers LLP

Recent decisions from the Supreme Court of Canada, provincial courts across the country and environmental tribunals are re-shaping environmental risks, and regulatory and civil liabilities in Canada.

Part 1 – Civil Liability

Courts have clarified, and in some cases expanded, environmental liability in civil lawsuits, finding defendants liable for actions that may lead to contamination. At the same time, courts have limited the ability of some parties to initiate civil claims.

Part 2 – Regulatory Liability

Environmental regulatory liability is reaching farther than ever. Corporate directors and officers, lenders, real estate brokers and others find themselves faced with new and expanding environmental liabilities and regulatory requirements. Regulatory prosecutions are seeing higher fines and creative sentencing principles being used.

More than ever, property owners, businesses, and their professional advisors need to understand the evolving risks and potential liabilities, and how to manage them in their day-to-day operations.

John Georgakopoulos BSc (Hons), MSc, LLB

John Georgakopoulos is a Partner at Willms & Shier Environmental Lawyers LLP and is a Certified Specialist in Environmental Law by the Law Society of Ontario. John resolves complex environmental legal issues for clients, uniquely drawing on his technical knowledge as a former senior environmental scientist with Ontario's environmental regulator. John has particular expertise advising property developers, REITs, industrial manufacturers, and municipalities about managing environmental risks and liabilities associated with brownfields and contaminated sites. John provides strategic advice to help protect clients against corporate and personal environmental liabilities including civil claims, regulatory orders, prosecutions and fines. John is called to the Bar in Ontario and Alberta.

Jacquelyn Stevens BSc (Hons), MSc, MSEL, LLB

Jacquelyn Stevens is a Partner at Willms & Shier Environmental Lawyers LLP and is a Certified Specialist in Environmental Law by the Law Society of Ontario. Jacquie has significant expertise representing a wide range of clients in environmental civil litigation, defence of prosecutions by environmental regulators, and at administrative appeals and hearings. Jacquie also provides effective advice and solutions for environmental due diligence and compliance, brownfields/contaminated site remediation, and environmental approvals for air, odour, noise and waste. Jacquie advises on cross-boundary migration of contamination and remediation options and has significant expertise involving contamination issues at dry cleaning operations and gas stations. Jacquie is called to the Bar in Ontario and Alberta.

Matthew Gardner B.Sc. (Hons), LLB

Matthew Gardner is a Partner at Willms & Shier Environmental Lawyers LLP and is a Certified Specialist in Environmental Law by the Law Society of Ontario. Matthew practices environmental law and environmental litigation. He provides advice and solutions about environmental due diligence and compliance to a wide range of clients including industrial corporations, the construction and land development sectors and municipalities. Matthew also provides advice and solutions about contaminated land issues, environmental risk management, environmental transactional due diligence and regulatory compliance. Matthew regularly appears before the Courts and administrative tribunals. He also assists clients under inspection or investigation by federal, provincial and municipal environmental regulators, and defends clients against environmental regulatory prosecutions. Matthew is called to the Bar in Ontario and Alberta.

Anand Srivastava, BSc (Hons), JD

Anand Srivastava is an Associate at Willms & Shier Environmental Lawyers LLP. Anand's practice focuses on environmental legal advice and environmental litigation. With prior education and experience in environmental toxicology, Anand assists clients to facilitate practical solutions to complex environmental legal issues. Anand works with a wide variety of clients on issues relating to environmental regulatory compliance with federal, provincial and municipal laws, contaminated sites, environmental due diligence, and exposure to environmental risks and liabilities. He prosecutes and defends environmental civil lawsuits and environmental regulatory prosecutions, orders and appeals. Anand is called to the Bar in Ontario.

Groundwater Surveillance Monitoring — A Consultant's Perspective

Blake Hamer, Matrix Solutions Inc

Groundwater monitoring is required for facilities that operate under Environmental Protection and Enhancement Act (EPEA) approvals. The objective of these monitoring programs is to determine if site operations are impacting groundwater and to ensure risks associated with groundwater contamination are appropriately managed. The scope and structure of these monitoring programs has remained relatively unchanged for decades, typically including annual or semi-annual sampling frequency, large well networks, extensive laboratory analytical programs, and lengthy annual reports. The Alberta Energy Regulator (AER) has recently made an important change to these monitoring requirements in the form of Groundwater Surveillance Monitoring programs.

The new requirements provide a framework for achieving monitoring outcomes, tailored to the specific needs of a site as opposed to being strictly prescribed and broadly applied to all industrial sites. This will enable more alignment between the scope and cost of monitoring and the actual risk of contamination, thus freeing up resources for active contaminant management (i.e. source control, clean up and incident prevention). The implications for industry are significant, including:

- More onus for monitoring program design and implementation placed on the approval owner and their groundwater consultants/specialists
- Potential for significant cost savings, particularly for lower risk sites
- More opportunities to optimize groundwater monitoring programs based on the conceptual site model and site-specific risk evaluation

This presentation will provide a summary of the key changes as well as a consultant's perspective on the significance to industry, opportunities for approval owners and risks to stakeholders.

Blake Hamer, PGeol

Blake Hamer s a Principal Hydrogeologist with Matrix Solutions Inc. He has 17 years of environmental consulting experience in a broad range of projects located across Canada. His primary role is as technical advisor for contaminated sites projects and Technical Lead for Matrix's Contaminant Hydrogeology and Geochemistry technical discipline. He has been involved in hundreds of contaminated sites projects involving site assessment, remediation, risk assessment and risk management.

How Environmental Analysis Labs can Contribute in a Global Health Pandemic and the Long-Term Potential for the Future of Environmental Testing with PCR

Bryan Shaw, CARO Analytical

It has been just over a year since the reality of COVID-19 transitioned from headlines to our daily lives. The challenges presented by the pandemic also provide opportunities in unexpected places. When the first reports of examining wastewater for the presence of the SARS-CoV-2 virus began circulating around the same time as the world began to slow down it caught the attention of analytical labs. CARO Analytical Services was no exception and began gathering information to understand what is involved in this analysis and how it could help support wastewater operators in Canada. This investigation took an unexpected turn down a path towards testing patient samples for signs of infection using the now infamous PCR test. This presentation will introduce the theory behind wastewater-based epidemiology and its application towards understanding the prevalence of COVID-19 in a community. How this curiosity led to the development of a new testing regime for CARO and the lessons learned while setting up a lab from the ground up in <1 year and navigating an entirely new regulatory regime. The infrastructure and knowledge gained during this time will have a unique impact on the environmental industry for years to come. PCR based analysis serves as a powerful tool in water analysis with applications such as species identification, environmental impact studies and health and safety monitoring. This presentation will circle back and focus on the application of PCR based testing in the environmental industry while providing a high-level introduction to the value this technology can provide future projects. This will include preliminary research carried out by Caro in genetic testing utilizing the power of PCR based technology to monitor an immune response through gene expression in fish that allows one to identify stress on a species well before exposure becomes fatal or leads to irreversible effects.

Bryan Shaw, PhD

Bryan Shaw is Senior Technical Support Scientist with CARO Analytical Services. Bryan holds a Ph.D in Chemistry from the University of British Columbia as well as his Professional Chemist designation through the Association of the Chemical Profession of British Columbia (ACPBC). As a Senior Technical Support Scientist Bryan takes advantage of the industry knowledge gained while managing accounts to provide clients with technical support and operational guidance according to the latest environmental regulations and analytical practices. This role also affords the opportunity to collaborate on special project needs and the development of new analytical methods. Bryan also serves as President on the board of the Environmental Managers Association of BC

Improving Air Quality and Reducing Fugitive Emissions Through Continuous Monitoring Technology

Alex MacGregor, Qube Technologies and Kerry Mowbray, SECURE Energy

The need for accurate and trusted air quality and emissions data has increased significantly as a result of the Government of Canada implementing regulations that mandate a 45% reduction in methane emissions below 2012 levels from the oil and gas industry by 2025. Detection, quantification, and identification of emissions are all necessary steps in meeting these emissions reductions targets and the move towards continuous monitoring of oil and gas sites enables accurate capture of this emissions data. Currently, there are no commercially available technologies that provide continuous monitoring and fugitive emissions reporting, and existing practices rely on expensive, intermittent inspections to gather and analyze data in order to repair fugitive emissions. Existing practices of emission detection often have a significant lag period of several months before leaks are detected and repaired due to the frequency at which these are conducted, and this has a large impact on air quality and fugitive emissions release across the industry. The estimated cost to Alberta Producers to meet current regulations is in excess of fifty million dollars, annually.

Qube Technologies is a Calgary-based startup that has developed environmental surveillance technology to accurately monitor emissions through continuous monitoring and low-cost solutions for regulatory compliance. Using an Industrial Internet of Things (IIoT) that monitors meteorological conditions and emissions from five gases, machine learning, and edge computing, Qube Technologies, in partnership with SECURE Energy Services, is tackling air quality and emissions challenges at a SECURE waste treatment facility by providing continuous monitoring to help mitigate odour issues on site. Real-time gas concentration and wind data is used to identify fugitive and source potential locations of odour emissions that leads to timely leak repair, a decrease in odour release, and an increase in air quality. Environmental sustainability, stewardship, and improved stakeholder relations have been the focus of this project in the La Glace area of Alberta for both Qube Technologies and SECURE Energy Services.

Cost-effective, continuous monitoring of fugitive emissions will enable industry leaders to use real-time data to remediate and repair leaks and predict operational issues to effectively improve emissions reduction. Qube Technologies is providing emissions reduction support across primary industries and improving reporting for regulatory and ESG purposes.

Alex MacGregor

Alex has worked as a professional in the oil and gas industry for over 10 years including eight years in energy technology. He was formerly the Canadian sales and distribution manager for Ambyint and prior to that worked as a consultant for Aucerna in their Canadian, Australian, and Houston offices. He holds a Bachelor of Applied Science in Geological Engineering from the University of British Columbia.

Kerry Mowbray

Kerry is a senior oil and gas professional with more than 20 years' experience in Health, Safety, and Environment. He formerly held positions as Environmental Health and Safety Manager and Environmental Advisor at EnCana, Strategic Oil and Gas, and Harvest Operations Corporation before joining SECURE Energy Services in 2017 as the Manager of HSE, Regulatory, and Land. Kerry holds a Technical Diploma in Environmental Science from Camosun College.

Incorporating Risk-based Closure into Overall Site Management

Tiona Todoruk, Advisian

Risk-based closure has been recognized as a practical and cost-effective approach to contaminated sites management in Canada, the United States and Internationally for many decades. As the focus of Corporations has shifted towards sustainability in overall site management, risk assessment is increasingly becoming an important element of contaminated sites management frameworks. With the likelihood of incorporating a risk-based approach into site management increasing, this becomes an important consideration during planning and implementation of site management programs such as compliance monitoring, environmental site assessments, decommissioning, remediation and closure. This presentation discusses the specific considerations to be factored into various project and program phases, with the goal of optimizing spend, reducing liability, protecting human health and the environment, and maximizing sustainability throughout the site management process. The presentation will include discussion of relevant case studies where this approach has been effectively applied.

Tiona Todoruk, PhD, PChem

Dr. Todoruk is a Principal Risk Assessor with more than 20 years of experience in the environmental industry. She has worked on high liability human health risk assessments in a range of urban and remote areas, and has completed ecological risk assessments of sensitive and culturally important habitats. She has been involved in risk assessments across Canada, the US, Europe, Asia, Africa, South America and Australia. She is currently the technical practice lead for risk assessment within Advisian's Decommissioning and Restoration group for North America.

Integration of Data Automation, Analytics and Visualization in the Areas of Field Testing, Sampling, Monitoring and Plume Analysis

Brandon Smith and Khalid Lemzouji, Analythium Solutions

Each day we find ourselves bombarded with adds and recommendations for new data visualization software and data integration platforms claiming to revolutionize data-management and analysis workflows. While on one hand these advancements have provided a unique opportunity for many to integrate new technologies into their daily lives these innovative analytics options have also introduced added difficulty when it comes to finding the 'right tool for the job'. Many of the data solutions offered today center around pre-existing platforms providing a generalist 'one-size fits all' approach and the onboarding of such data-analytics software can often introduce new and unforeseen challenges. In this presentation we will unravel the often-tangled web of data integration from databasing to analytics to visualizing and display and present real-world options for providing simple, effective, and fit-for-purpose data analysis.

We will explore several brownfield data sets from projects completed earlier this year in Alberta. Each of these projects will offer a unique view of the challenges faced in contaminated sites assessment and how data-analytics and visual display helped inform not only the 'desk-top' review and reporting effort but also informed the field-execution and risk-based analysis of the sites. From field testing and sampling to groundwater analysis and modeling we will showcase how properly integrated data analysis improves efficiency and knocks down data-silos. The presentation will showcase fit-for-purpose data analytics software options and unravel the tangled web of information commonly associated with legacy brownfield remediation. From historically impacted upstream well sites in northern Alberta to a downstream gas station located within the City of Edmonton this presentation will build on the problems faced when attempting to integrate data-analytics into your daily workflow and provide relevant solutions for optimizing data integration. The presentation will conclude with realized cost-savings from the seamless integration of data management, analytics, modeling, and visualization.

Brandon Smith

Mr. Smith has over a decade of experience working as both a human and ecological health risk assessor. He brings with him a strong background in both human and environmental toxicology. Most recently, Mr. Smith has focused on environmental liability reduction in relation to alternative remediation strategies and technologies.

He has completed risk-based reclamation and remediation programs throughout Canada from the busy urban landscapes of the Greater Toronto Area (GTA) to a variety of remote access location across the Canadian Arctic and throughout much of Alberta, Saskatchewan and British Columbia.

His skills set utilizes advanced modeling techniques to seamlessly integrate conceptual risk models with real-data results. He has spoken internationally on the benefits and risks associated with in-situ remediation techniques and technologies and on the integration of advanced computational analytics and sound risk-based analysis.

Khalid Lemzouji

Mr. Lemzouji is a senior statistician and data scientist. He has 15 years of experience in environmental, public health, and pipeline reliability risk decision. Khalid is skilled in using statistical and machine learning tools to transform data to knowledge. The knowledge is used for informed decision making by environmental scientists, cardiac surgeons, and pipeline engineers. As a professional statistician with double bachelor's in chemical engineering and statistics he specializes in sampling design and statistical modeling for environmental data for regulatory compliance in Canada and USA.

His work in the environmental sector focuses include surface water, hydrogeology, hydrology, soil, contaminated soils analysis, geophysics, air, fish and wildlife health evaluation. Most recently his work integrates public health statistics through automation, data streaming, statistical modeling, and machine learning. Khalid builds customized applications for the environmental industry which automate data analysis and visualization for better communicating the result to decision makers.

Interdisciplinary Collaboration for Effective Management of Greenhouse Gas Emissions from Oil and Gas Operations

Dani Urton, Vertex Professional Services

Oil and gas operators in Alberta are required to manage greenhouse gas emissions, particularly methane emissions, from production operations by adhering to a number of new and intersecting regulatory requirements. These regulations include monitoring and inspection requirements, vent gas limits for facilities, equipment-specific vent gas limits, emission intensity reduction requirements, and detailed reporting, verification, and record keeping requirements. With government commitments to meeting greenhouse gas emission reduction targets, many of these regulatory requirements will continue to evolve as limits become more stringent and as regulatory bodies gain more insights into existing emission profiles in the province.

In addition to emissions management requirements outlined by regulatory frameworks, operators also have access to government funding opportunities for emission reduction projects at provincial and federal levels, as well as access to carbon offset markets. While there are a variety of options available to operators, many emission reduction opportunities could be eligible for multiple funds or programs. In order to determine the best option for a particular company, it is critical to assess the anticipated return from each opportunity in alignment with the company's exposure to upcoming regulatory limits, its emission reduction goals as part of applicable environmental, social, and corporate governance (ESG) targets, as well as its short-term financial obligations and long-term financial position.

This presentation will discuss the need for interdisciplinary collaboration to determine a company's greenhouse gas emissions management strategy. We will discuss examples of emission reduction projects which would be subject to multiple regulatory requirements and where a variety of funding opportunities exist, highlighting the affected disciplines and internal stakeholder groups that should be consulted for input, and will discuss opportunities for cross-disciplinary learning to lead to an effective strategy for emissions reduction opportunities that provide the best net returns for the company.

Dani Urton

Dani Urton manages the Emissions Management service group with Vertex Professional Services in Calgary, providing a variety of emissions management services to oil and gas operators in Western Canada, including field-based emissions inspections and measurements, compliance reporting, and support for funding programs including carbon offset projects. She has been working in the environmental sector of the oil and gas industry for 8 years, with a focus on regulatory compliance, project management and business development. She has a range of experience in project execution and technical reporting for environmental projects. Dani is also involved in developing client relationships and supporting strategic and ongoing growth of Vertex's emissions management services.

(A) Jurisdiction Review of Groundwater (Drinking Water) Pathway Assessments

Sheila Duchek, SNC-Lavalin

A key exposure pathway in environmental assessment of contaminated sites is groundwater for drinking water use (including drinking water or domestic use aquifers). Protection of drinking water aquifers is a key focus for most jurisdictions to protect public health via current water supplies and preserve future groundwater sources. Drinking water pathway assessments feed into environmental site management: for on-going groundwater monitoring, preparing risk assessments reports, risk management plans, and determining remediation target concentrations.

This presentation will provide a brief overview in how Alberta and other jurisdictions consider drinking water pathways assessments, with the intent of sharing best practices and identifying supplementary paradigms. There are jurisdictions that have allocated significant resources to aquifer protection, especially in geographically arid regions, such as New South Wales (Australia), Nevada and Kansas (United States). Other governing bodies have had to address long histories of groundwater contamination or have been compelled to accommodate natural and economic factors in established urban areas, such as European nations like the United Kingdom and Germany. Consideration of other Canadian ministries will be included. Understanding differing approaches and alternate strategies exposes practitioners to a global view of how contamination near and within groundwater resources are managed.

The intended audience will be site managers and environmental professionals who assess site data with the intent of maintaining aquifer protection while balancing reasonable and practical conservation. A key outcome of investigating other jurisdictions is to apply science-based methods and avoid overly conservative approaches to ensure environmental management funds are spent effectively and provide value-added benefits to aquifers, the public and the holistic environment.

Sheila Duchek, MSc, PGeo

Ms. Sheila Duchek is a senior hydrogeologist with nearly 20 years of experience. Ms. Duchek's current focus is managing and providing senior technical support for groundwater assessment, monitoring, and operational compliance programs. As a lead technical advisor in hydrogeology, Ms. Duchek has reviewed, analyzed and provided recommendations to various clients, with varied groundwater assessment needs. Ms. Duchek is adept at groundwater assessments and working with regulators and the public in addressing concerns with respect to groundwater use and management.

Ms. Duchek has spearheaded key technical hydrogeology field support teams, provides senior technical support of environmental site assessments for site characterization and liability estimates. She leads water resource exploration programs with large-scale water well drilling and testing components. She is a technical resource for a wide range of groundwater assessment programs, both local and regional in scale, using a variety of drilling and well completion methods. Ms. Duchek also prepares and advises clients with respect to regulatory filing and applications.

Landfill Disposal and Thermal Treatment Considerations for Solid Waste Containing Poly- and Perfluoroalkyl Substances (PFAS)

Matt Pourabadehei, SNC-Lavalin

The generation of excess soil and/or water during environmental investigations at contaminated sites is inevitable. Although each jurisdiction in Canada provides policies and regulations for waste disposal, there is an absence of federal and provincial regulatory framework for the disposal of waste containing PFAS. Despite significant global attention for PFAS as persistent organic pollutants, these contaminants have not been categorized as hazardous materials in Canada as of yet, and subsequently they are not treated as such.

In the absence of regulations for PFAS solid waste, some waste generators may choose thermal treatment (as a destructive approach) and some may prefer on-site encapsulation in an engineered facility (with or without stabilization/solidification). Thermal treatment is a cost prohibitive method, particularly for large volumes of waste. Stabilization/solidification is a more cost-effective approach than thermal treatment, but the cost of purchasing the binding agent and building an engineered soil treatment facility is still considerable.

Currently, transferring excess soil or other sources of solid waste containing PFAS, including exhausted granular activated carbon generated by water treatment systems, to landfills is the preferred option for some waste generators, as it is the least expensive approach to manage PFAS solid waste.

Waste facility acceptance of solid waste containing PFAS is a commercial decision, but lack of knowledge about the fate and transport of PFAS in landfills as well as the absence of an environmental regulatory approval process, may cause potential environmental liability for waste generators if the leachate is reused or released without an appropriate PFAS analysis/treatment.

It is crucial that waste generators determine the types and concentrations of PFAS in the waste to understand the potential risk of PFAS in leachate which may pose risks to human health and environmental receptors of concern. Current regulations across the globe imply that it is the waste generators' responsibilities to sufficiently characterize the PFAS waste, to reflect the nature of the waste and the associated risk to the waste receiver.

The main objective of this presentation is to summarize current understanding of PFAS fate and transformation in Canadian landfills and review available regulations in other jurisdictions internationally. This presentation will summarize recommended considerations (in a few other countries) for PFAS solid waste generators, prior to transporting the PFAS wastes to landfills. Additionally, advantages and limitations of thermal treatment of waste containing PFAS will be discussed.

In the absence of PFAS disposal regulations, it is recommended to evaluate conditions of landfills, where receiving the PFAS solid waste, such as landfill siting and lining design, landfill operation, and leachate management and monitoring systems. Details of each condition will be discussed and examples from Australia and United States' regulations will be deliberated.

Keywords: PFAS, Solid Waste, Landfill, Leachate, Thermal Treatment, Regulations

Matt Pourabadehei, PhD, PEng

Matt Pourabadehei is an environmental engineer with over nine years of experience in the assessment and remediation of contaminated sites. His area of expertise is in phased environmental site assessments (ESAs), remedial option analysis, and remediation of PFAS-impacted soil and groundwater. Matt also has three years of international experiences in water resources and hydrotechnical engineering design. Since 2017, Matt was profoundly involved in technical site assessment and remediation / containment option analysis for PFAS impacted sites in Ontario and British Colombia. His responsibilities include project task management, client liaison, interpretation of complex PFAS data, and report writing. Dr. Pourabadehei has a professional engineering license and is a Qualified Person (QPESA) in the Province of Ontario.

Managing Inventory: ArcGIS Online as a Solution for Orphan Well Association Contractor Engagement

Carla Incontri and Shawn Banack, North Shore Environmental Consultants

The Orphan Well Association (OWA) is an Industry funded collaboration between Provincial Regulators, the Alberta Government, and Oil and Gas Producers, which aims to protect the public and the environment from potential risks of existing oil and gas infrastructure where the parties liable no longer have funding to reclaim or maintain such infrastructure. Recent government funding has led to an increase in the volume of site work that can be completed by the Orphan Well Association. These sites are in the process of being assigned a prime contractor, which other specialized contractors can contact to offer their services for sites located in their region.

North Shore Environmental Consultants Inc (North Shore) has long been involved with assisting the OWA with tracking sites and maintaining accurate data using Peloton's SiteView software. However, without the ability to visualize the site locations, it is difficult to be efficient when assigning sites. Communicating accurate geographical locations alongside prime contractor information to prospective subcontractors is critical for the OWA to be able to carry out their mandate and manage inventory. Our presentation will demonstrate how the OWA, in collaboration with North Shore, has leveraged ESRI's ArcGIS Online platform as a mechanism for distributing this information, making collaborating with prime and subcontractors much simpler and more efficient for all parties involved.

Carla Incontri, MGIS, GISP

Carla is a GIS Analyst with over 14 years of experience supporting environmental planning and environmental projects. Carla has accumulated a wide range of experience from her career in consulting. She has provided cartographic support for all stages of project work, from field planning and report mapping to the creation of wall maps for open houses. She has worked on a wide variety of projects ranging from large pipeline projects spanning multiple provinces and UTM zones, to transmission line siting, wetland mapping, traditional use mapping, municipal data management, land use planning, pipeline engineering, and groundwater well siting. She has been responsible for database design, webmap layer design, methodology development, process documentation, small team leadership, and training and mentoring others in GIS. Although she is most familiar with GIS data in Alberta and British Columbia, she has worked on projects in Saskatchewan, Manitoba, Yukon, Ontario, Quebec, Nunavut, the United States, and Australia.

Shawn Banack, BSc, MBA, RTAg

Shawn Banack has over a decade of experience working within the upstream oil and gas industry and the environmental field. Shawn is currently the Senior Manager of North Shore's Corporate Consulting Group. Shawn has experience in a wide range of activities including SiteView implementation, maintenance, training, programming, data migration and business process improvement. His expertise also includes Site specific liability assessments (SSLAs), environmental due diligence assessments for acquisitions, Phase II Environmental Site Assessments (ESAs), remediation of active and abandoned upstream oil and gas facilities, detailed site assessments (DSAs), and reclamation projects. In addition, Mr. Banack has completed his MBA and is a member of the Management Operations Board at North Shore.

New Methods to More Accurately Quantify Hydrocarbon Contamination from Natural Background

Anthony Aquino, AGAT Laboratories

Examination of hydrocarbon contaminated environmental sites by traditional gas chromatographic (GC) methods reveals that natural background hydrocarbon signals often interfere with signals from petroleum or anthropogenic sources suggesting anthropogenic contamination may be greater than in actuality. In some cases, such as peatlands and other boreal forest environments, the natural (biogenic) hydrocarbon signal may exceed regulatory guidelines even without additional anthropogenic materials present. Traditional single-dimensional gas chromatography, used as the current standard prescribed method does not accurately allow for the quantifiable differentiation of biogenic inputs from anthropogenic ones. This may result in potential mitigations being implemented on uncontaminated or marginally contaminated sites, unnecessarily disturbing the natural environment.

To overcome the limitations of traditional GC, two-dimensional gas chromatography (GCxGC) can be used resolve petrogenic and biogenic compounds, enabling unambiguous group quantitation of both. We will present data from case studies showing the amount of mixing of petrogenic and biogenic compounds using traditional methods such as silica gel removal, environmental subtraction and biogenic interference calculation (BIC) versus GCxGC.

Anthony Aquino

Anthony Aquino graduated from St. Francis Xavier University with a Bachelor of Science in Chemistry in 2017. He then completed a Master's degree in Forensic Science, specializing in Forensic Chemistry, at the University of Strathclyde in 2018. He was hired by AGAT Laboratories in September 2019 to work in their Forensics Division and in particular to develop their two-dimensional gas chromatography technology. He was been with the company for a year and a half and with this presentation will showcase one of the most interesting and exciting areas of development with this technology.

PFAS: A Combination Approach for Laboratory Analysis

Tammy Chartrand, ALS Canada

PFAS represents a group of thousands of man-made organofluorine compounds which have been shown to be globally distributed, environmentally persistent, and bioaccumulative. Due to their unique water and oil resistant properties and thermal stability, PFAS have been used in a wide range of commercial applications including food packaging, cleaners, floor polishes, photographic film, cosmetics, insecticides, Teflon® production, and in surface treatments of paper, clothing, carpets, and other products. Large-scale environmental releases have been associated with their use in firefighting foams (AFFFs, aqueous film-forming foams), where fluorinated surfactants are key ingredients that provide low surface tension, enabling film formation on top of fuels, to starve fires of oxygen.

Conventional PFAS analysis by LC/MS/MS typically quantifies a relatively small set of key analytes (~30 compounds) and therefore may greatly underestimate the total extent of PFAS presence in the environment. Leading international PFAS environmental management programs stress the importance of incorporating qualitative tests into environmental assessments to consider the likely total mass and distribution of all PFAS present, using techniques such as the Total Oxidisable Precursor (TOP) and Total Organofluorine (TOF) assays, to provide multiple lines of evidence for informed risk assessments. The US EPA also recognizes both TOP and TOF assays as important "emerging techniques" for non-targeted "Total PFAS" analysis.

The TOP assay is particularly useful to predict the formation potential for PFAS parameters with specific regulatory importance. However, a key limitation of the TOP test is that it relies on the analytical scope provided by conventional LC/MS/MS analysis and therefore fails to account for oxidation products with carbon chain lengths <C4 and >C14, and other non-targeted PFAS. The oxidation process also forms perfluoroalkyl carboxylic acid products from fluorotelomer "precursors" with chain lengths shorter than the parent fluorotelomer; the fluorinated portions of the carbon chains lost during this process are therefore also excluded.

While TOF analysis is not subject to these limitations, it provides no information about chain length and is not selective for PFAS, rather providing an estimate of the total fluorine content from organic (carbon-based) substances in a sample. TOF analysis can therefore be used to verify the degree to which the TOP assay accounts for potential precursors. The TOF analysis is a less sensitive measurement technique than LC/MS/MS for discrete PFAS parameters, with a higher limit of reporting (LOR). It may therefore not be suitable for low-level environmental screening, but is more appropriate as a screening and diagnostic tool for higher impact zones and circumstances where information on carbon chain length is not required.

Ultimately, a combination of TOP, TOF, and standard LC/MS/MS analysis for discrete PFAS parameters can provide the most well-rounded information about the current and potential future PFAS content of a sample or site.

Tammy Chartrand

Tammy Chartrand is the Business Development Representative for ALS Canada in the Ottawa area. She has over 5 years of client facing experience supporting environmental projects, and more recently specializing in PFAS testing. Tammy holds a BSc. in Biology from the University of Ottawa, and has been working in the environmental industry for over 10 years.

PFAS Risk in the Oil and Gas Industry

Samantha Murphy, Cenovus

Per- and polyfluoroalkyl substances (PFAS) are a group of emerging contaminants often referred to as "forever chemicals" due to their persistence in the environment. Certain PFAS compounds are known to cause adverse impacts to human and environmental health, and regulatory limits for PFAS compounds in water and soil are being established in Canada at extremely low concentrations (parts per trillion).

Many oil and gas companies rely on PFAS-containing aqueous film-forming foam (AFFF) for firefighting. The surfactant and temperature-resistant properties of PFAS make AFFF the quickest and most effective product to fight large hydrocarbon fires, and it is trusted by industry firefighters. Although AFFF can save lives and reduce asset damage, an unintended consequence of its use is that PFAS compounds are released to the environment. This can occur when AFFF is inadvertently sprayed offsite or migrates in surface runoff and/or groundwater flow. AFFF releases can lead to extensive PFAS impacts that require characterization and remediation, which can be much more complex than for other contaminants due to the unusual behavior of PFAS compounds in the environment.

It is important for oil and gas facilities to understand and mitigate risk from AFFF use while maintaining the ability to train for and provide effective emergency response. This presentation will review how oil and gas operators can reduce PFAS risk from AFFF, learning from experiences of the military and aviation industries. The discussion will cover understanding sources of AFFF and migration pathways; stakeholder mapping and communication best practices; potential prevention and mitigation measures; and considerations for characterization and remediation.

Samantha Murphy, Bsc, Msc

Samantha Murphy is a hydrogeologist with Cenovus Energy. She is originally from Ontario, where she obtained a B.Sc. from Carleton University and an M.Sc. from University of Ottawa in environmental and earth sciences. She worked in the environmental consulting industry for 9 years before joining Husky Energy in 2018 as a hydrogeologist on the corporate Water Team; Husky became a subsidiary of Cenovus Energy in 2021. Samantha provides technical support for upstream and downstream business units on a variety of water-related topics and is the Chair of Cenovus's PFAS Steering Committee. She currently lives in Calgary with her partner and two cats.

Planning Considerations for Data Collection on Large-scale Clubroot Sampling Projects

Ashley Siemens and Sahra Deagle, Trace Associates

Since 2015, Trace Associates Inc. (Trace) has become an industry leader for the planning, field characterization, and investigations related to clubroot on large scale projects. Clubroot disease in agricultural areas have expanded throughout the Canadian prairies in recent decades. The disease is most commonly spread by wind, water, farming operations, or urban development activity. Clubroot disease most commonly affects canola, cabbages, broccoli, cauliflower, brussels sprouts, radishes, turnips, stocks, wallflowers, and other plants of the family Brassicaceae (Cruciferae).

Trace has successfully collected more than 125,000 soil samples for the characterization of clubroot as a component of the pre-disturbance planning for long linear disturbances related to the midstream industry. Data gathered from clubroot sampling programs are used to mitigate biosecurity risk pertaining to the preventable spread of clubroot disease during pipeline construction activities or other disturbances on agricultural land.

- When setting up large scale clubroot sampling programs, upfront planning is critical to ensure a successful and quality focused program executed in the field. Trace will share our learnings for planning, field collection, and quality assurance / quality control (QA/QC) methods used during the completion of several large scale clubroot sampling programs including:
- Biosecurity commitments by the client to the regulator
- Seasonal planning considerations related to agricultural activity, ground conditions, and weather
- Integration of large geospatial data sets and Geographic Information System (GIS)
- Land access on large scale
- Field team member selection
- QA/QC of large field data sets
- Design of a clubroot sampling program to meet objectives
- Analytical methods used to meet project objectives
- Samples storage in field and long-term storage
- Data retention

Sahra Deagle, BAppSc, RT (Ag)

Sahra Deagle is an Environmental Scientist with Trace and has seven years of experience conducting vegetation monitoring and control, reclamation and remediation activities, environmental site assessments, groundwater and surface water monitoring and sampling, spill response, Detailed Site Assessments, and preparing Reclamation Certificate Applications. Sahra has experience working in both the Alberta white and green zones working for oil and gas, industrial, midstream, and commercial clients. Sahra led large scale clubroot field collection programs for several of Canada's midstream producers.

Ashley Siemens, MSc, EIT

Ashley Siemens is an Environmental Engineer-in-Training with Trace and has five years of experience providing project support for environmental assessments of oil and gas, industrial, forestry, commercial, and agricultural sites. Ashley is responsible for assisting with regulatory/sustainability projects including greenhouse gas data analysis, decommissioning and reclamation plans, and application submissions in Saskatchewan and Alberta. Ashley led clubroot field collection programs for one of Canada's largest historical clubroot sampling programs.

Practical Closure Approaches for Salinity Impacted Wellsites

Tyler Prediger, Matrix Solutions

As there are limited soil and groundwater remediation options for addressing salinity (chloride) impacts, it is critically important that salinity-impacted sites are appropriately assessed, and the data is interpreted correctly. Many salinity sites are remediated using extensive excavations, which results in large volumes of soil being landfilled and significant carbon emissions from the removal and transportation of excavated soils. In many cases, sites are over-excavated; and in these cases, an effective assessment and data analysis program would have resulted in more targeted remediation efforts. There are multiple, practical approaches to interpret salinity data, which help reduce remediation volumes and expedite wellsite closure while still protecting receptors. Data analysis approaches with successful results include linear regression analyses, estimating the soil chloride contribution towards sample-specific electrical conductivity (EC), estimating background EC in soil samples with slightly elevated chloride, and estimating background total dissolved solids (TDS) concentrations in groundwater samples with slightly elevated chloride. For sites with more extensive salinity impacts, contaminant transport models are used to estimate future risks to nearby receptors and to estimate success of different remediation options.

In order to provide additional strength to linear regression analyses, Matrix compiled an extensive dataset of soil chemistry to quantify how subsoil chloride concentrations contribute to EC values. A dataset of more than 20,000 subsoil salinity samples from 126 oil and gas sites across Alberta, Saskatchewan, and Manitoba has been compiled. This dataset spans a range of different soil textures, varied natural (background) EC conditions, and varying concentrations of soil chloride and sulphate. Linear regression analyses of chloride (meq/L) versus electrical conductivity have been completed, using methods similar to those documented in Diagnosis and Improvement of Saline and Alkali Soils (Richards 1954). This linear regression demonstrates the linear relationship of anion concentrations versus EC, can used to estimate anion concentrations contribution towards EC, and for QA/QC checks of laboratory results.

This talk will discuss the practical data interpretation approaches described above, with reference to sitespecific examples. The outcomes of the interpretation approaches will be reviewed, showing how these practical interpretation approaches helped to reduce remediation volumes and streamline wellsite closure on salinity-impacted sites.

Tyler Prediger, MSc, PAg.

Mr. Prediger is a Senior Environmental Scientists and Professional Agrologist in Alberta and Saskatchewan with Matrix Solutions, based in Lloydminster, SK. His work focuses on finding practical solutions to complex salinity-impacted sites in the Canadian Prairie provinces. Through his more than 12 years of experience, he directly manages and advises on numerous salinity-impacted sites ranging from single well-sites to quarter section-sized sites; from sites with no ecological risk to sites with environmental protection orders (EPOs) that are impacting receptors; on sites with litigation; and on large-scale spills that are often into waterbodies. Mr. Prediger is a registered Forensic Agrologist in Saskatchewan and has acted as an expert witness is in civil litigation matters regarding salinity-impacted sites. At Matrix, he also instructs internal and external courses on salinity-impacted sites.

(A) Preliminary Empirical Study on the Influence of Rainfall on Urban Air Quality

Emmanuel Anglo, Wood Environment & Infrastructure Solutions

Precipitation can theoretically improve air quality through scavenging or washout of pollutants, a process that is quantified in regulatory dispersion models to calculate their wet deposition rates. The same models, however, do not account for any reduction in ambient concentrations caused by scavenging. This paper aims to investigate this process empirically by analyzing relationships between rainfall and concentrations of criteria pollutants at seven urban monitoring stations in Alberta.

Mean concentrations between dry hours (hours with no rainfall) and wet hours from May to September were compared at each station. Bootstrap resampling was used to calculate confidence intervals and significance of the differences. The comparisons are limited to days with some rain to reduce the disparity in the number of samples. Comparisons were also made between hours with clear and overcast skies. Testing the effect of rainfall intensity could not be performed due to the low number of hours with rainfall.

The results found concentrations of SO_2 and $PM_{2.5}$ to be generally lower during wet hours as anticipated. The effect is strongest at night. NO is also lower during wet hours particularly during its early morning maximum. For total hydrocarbons (THC), H_2S, and CO, nighttime hours with rain have lower mean concentrations at selected stations only. Rain decreases NOx and NO_2 concentrations at night but increases them in the daytime; an opposite pattern is seen with ozone. The influence of rainfall is less pronounced at stations with lower average concentrations.

Comparisons between hours with overcast and clear skies showed that for SO_2 and $PM_{2.5}$, higher cloudiness results in lower nighttime concentrations. The effect remains less than that of rain. However, for ozone and oxides of nitrogen, cloudiness causes stronger anomalies than rainfall. For THC, the effect of cloudiness on lowering concentrations at night was also found to be larger than that of rain.

$NOx/NO_2/O_3$ results are consistent with how cloudiness associated with rain disrupts normal daytime photochemistry. Cloudiness is also an indicator of atmospheric stability, and has an opposite effect on pollutant dispersion during day and night. These factors make it difficult to isolate the influence of rainfall on air quality.

Emmanuel Anglo, PhD

Emmanuel is a Senior Associate Scientist at Wood Environment & Infrastructure Solutions specializing in regulatory dispersion modelling and emissions reporting for facilities in the Alberta Oil Sands. His project experience covers energy, mining, cement, petrochemicals, transportation, and waste management in the rest of Canada, Australia, Southeast Asia, South America, and the Middle East.

He completed his Ph.D. in Meteorology from the University of the Philippines, and received a Fulbright Scholarship for post-doctoral studies at the Colorado State University.

His research interests include developing innovative methods in dispersion modelling, modelling urban air quality, and statistical applications in climate change and tropical meteorology.

Progress in PFAS Site Investigation Procedures: Recent Cases in Canada

Leon Burger, SNC-Lavalin

Within the emerging field of environmental site assessment at sites impacted by per- and poly-fluoroalkyl substances (PFAS), it is widely understood these compounds are commonly occurring man-made substances in many everyday household, commercial and industrial products by virtue of its properties, including heat-, stain-, water- and stick-resistant surfaces. Products range from non-stick cookware, food packaging to clothing and shoes but long chain PFAS was also widely used from the 1970s through the early 2000s in aqueous film forming foam (AFFF) - perfluorooctane sulfonate (PFOS) legacy foam - before its replacement by modern firefighting foams, which were developed in the early 2010s. PFAS are commonly dubbed "forever chemicals" which do not naturally attenuate or decompose and persist in the environment once released.

As such, whenever site assessments are carried out, the potential for cross contamination of environmental samples from mere presence of PFAS containing materials at the sample site must be controlled. To reliably carry out field investigations for PFAS, we have reviewed various publications on field sampling of PFAS and compiled a robust field protocol with the aim to combine stringent but practical ways to carry out site assessment for PFAS.

This presentation will explore PFAS site assessment techniques from a number of recent studies in Canada and present practical approaches to sampling environmental media including soil, sediment, surface water and groundwater. Additionally, the methods to evaluate and qualify the field and laboratory analytical data will be explored to evaluate the analytical data quality and subsequent uses of the data. Field and laboratory analytical data were evaluated based on known contaminant sources as well as evaluated compared to quality control samples.

The presentation will include a timeline and characterization of the approach to field investigations for PFAS and how these practices have evolved with time, what current emerging field sampling practices are, and what future sampling techniques may entail.

Leon Burger, BSc, PGeo

Mr. Leon Burger is a Geoscientist (Hydrogeology) with over 16 years of experience in the field of contaminated site assessments, contaminant hydrogeology and management of remedial options and risk management strategies. Leon has extensive technical and environmental assessment experience, including coordinating and execution of programs designed to assess PFAS impacts in the environment within various environmental media. Leon is a Professional Geoscientist, registered in Ontario and a Qualified Person in accordance with O. Reg. 153/04.

(A) Progressive In-Situ Remediation Approach for Dry-Cleaning Sites: Understanding The Subsurface

Patrick O'Neill, Vertex Environmental

Contaminated Site investigations using High Resolution Site Characterization (HRSC) technologies such as Membrane Interface Probe (MIP) have changed how delineation and ultimately environmental site closures can be efficiently managed from the start of the Environmental Site assessment process. This is especially true when there is uncertainty surrounding chlorinated solvent compounds such as tetrachloroethene (PCE) and Trichloroethene (TCE) presents significant environmental challenges with regards to persistence in the subsurface and the associated long-term risk to human health. Often sites are much more complex then when first encountered with different subsurface configurations. Remediation of these contaminants in ever changing subsurface conditions with limited soil and groundwater data can quite challenging. Proper vertical and horizontal delineation of these subsurface impacts in real-time during can often bring clarity during site investigations and can be crucial for understanding the bigger picture for stakeholders and bringing a Site to closure.

The MIP technology works by using a heated probe to vapourize the contaminants in the subsurface and bring these vapours up a dedicated trunkline using an inert gas to a field gas chromatograph where they are swept across three (3) detectors. The responses from these detectors are displayed versus depth at surface. This allows the MIP technology to provide accurate detections versus depth, as well as information on the type of contaminant, distribution and magnitude of the impacts at the specific depths. Deploying the MIP technology on any site where suspected Volatile Organic Compounds (VOCs) may be present provides an efficient way to profile and understand the impacts on-Site in real time at the screening level. Incorporating these HRSC techniques into the initial phases of site investigation activities can be very powerful and reveal important information relating to the distribution of the of the VOC impacts that may not be obvious from traditional environmental investigations or historical assessments.

In this presentation we will describe how the MIP technology was successfully utilized as part of screening level investigation to support an in-situ remedial design and how to optimize the design for increase efficiency for a Site in Edmonton, AB. This type of site investigation added value to the project and clarity to the stakeholders involved by decreasing the overall in-situ remedial costs for the Site. Without this rapid deployment and information gathered by the MIP on-Site remedial design may not have been effective or multiple traditional site investigations would have been required to come to similar delineation data.

Patrick O'Neill, MASc, PEng

Mr. O'Neill is a project manager at Vertex Environmental Inc., manages the high resolution site characterization division, and has years of experience designing and implementing high resolution site characterization programs targeting chlorinated solvents and petroleum hydrocarbons. Mr. O'Neill holds a Master's degree from the University of Waterloo where he studied groundwater modeling of the Grand River watershed and how climate change scenarios will affect the watershed.

Soil Sampling Equipment Comparison

Jordan Ernst and Josh Ernst, Ernco Drilling

The growing need to sample soil, rock, and ground water has produced several different drilling methods. With ground conditions changing from one kilometer to the next, choosing the best option or options is not always a clear choice. Making the wrong choice can turn a small problem into a much worse problem and choosing the "cheaper" option may cost more in the long run. Our goal is not to sell anyone on which method is the best but rather which option or options would be best for the site. In this presentation we will discuss the pros and cons from six different sampling methods.

Josh Ernst and Jordan Ernst

Josh Ernst and Jordan Ernst along with their father Gerald started Ernco Environmental in July 2008. Growing up on a farm and previously working in Alberta's oil & gas industry was motivation enough to start a company with the goal in mind of helping the environment. Thirteen years later Ernco has grown to over 45 associates and 25 rigs with no plans of slowing down.

Wastewater Treatment Upgrade in Existing Lagoons with Novel Aeration System

Jan Korzeiowski, J.K. Engineering

The wastewater treatment system outlined herein employs navel aeration technology with high efficiency wastewater effluent pump and air aspirator-mixer. Multiple aeration units can be installed, as required, in aeration pumping station beside the lagoons to be upgraded or new lagoons, or concrete tanks.

Wastewater is pumped through the air aspirator-mixer which aspires air and mixes it with the wastewater pumped. The wastewater and air mixture is discharged to the lagoons for the wastewater treatment or for odour control.

The wastewater treatment is provided with activated sludge treatment process which includes wastewater aeration and activated sludge settling and recirculation to the aeration system. Two small cells with total volume of approximately two-day retention capacity can be used or one small cell can be divided to aeration and clarifier cells.

The wastewater aeration and activated sludge recirculation to the aeration system, and activated sludge waste, are done by the aeration pump.

The aeration cell and the clarifier cell are provided with perforated PVC piping mounted at the cells' bottom on concrete strips or continuous concrete floor, 100 mm thick. There is not any equipment in the cells to break or plug and be replaced which would require draining the cells.

The aerated wastewater can be used to control odour in anaerobic cells by discharging the wastewater into the cells through perforated horizontal pipe laterals installed approximately 1.2 m below the wastewater operating level and located around the cells such that there is a cross flow of the aerated wastewater through the cells. The laterals extend into the cells between 2 and 3 meters and they are spaced between 8 and 15 meters apart, and they are 75 or 100 mm diameter. The wastewater is withdrawn from the cells to the aeration system at the opposite end from the raw wastewater inlet into the cells and discharged in the area of the raw wastewater inlet. The aeration system for the odour control is independent from the aeration system for the wastewater treatment. The odour control system provides aeration and biological activity in the anaerobic cells which control odour.

The treatment system is designed for 4500 m^3/day, peak day flow, Phase 1 and 9000 m^3/day, peak day flow, Phase 2, Phase 1 was installed.

Two anaerobic cells A and B are retained as anaerobic and cell D is used for aeration and cell C is used as clarifier for activated sludge settling and recirculation to the aeration system. Waste activated sludge is discharged to anaerobic cells A and B.

The aeration system uses four 30 hp high efficiency effluent wastewater pumps, one pump is used for the anaerobic cells A and B odour control and two pumps are used for the wastewater aeration in cell D and activated sludge recirculation from cell C. One pump is stand-by to both aeration systems.

The treatment system outlined above includes the following features and benefits:

- The treatment system can be designed to secondary treatment level for control of TSS and CBOD or to tertiary treatment level with nutrient control in BNR system.
- The treatment system aeration provided with air aspirator-mixer and wastewater recirculation pump provides high efficiency oxygen transfer to wastewater as the wastewater and air contact begins at the air aspirator-mixer and it continues in the downstream piping and in the aeration cell. The oxygen transfer can be over 50%. Air blowers and diffusers are not used.
- The air supply to the air aspirator-mixer may contain dust or odour from headworks or other treatment units.
- The aeration cell is provided with engineered perforated PVC pipes perforated at the top with small holes for air discharge and at the bottom with larger holes for wastewater discharge to provide uniform supply of aerated wastewater throughout the aeration cell.
- The secondary clarifier call is provided with engineered perforated PVC pipes perforated at the bottom for uniform collection if activated sludge throughout the cell. Sludge scrapers are not used.
- The wastewater recirculation pump provides three functions; aerates wastewater in aeration cell, returns activated sludge from secondary clarifier to aeration cell and wastes access activated sludge to sludge holding cell.

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- The multi-function of the wastewater recirculation pump ensures high performance and operating efficiency with less costly and locally available equipment.
- The system is not prone to plugging with suspended solids or dust which eliminate needs for the system shutdown, repairs or replacements and which reduces operating costs.
- The overall installation and operating costs are 30 to 40% lower than those of conventional treatment systems.

Jan Korzeniowski

Jan Korzeniowski has 40 years of professional experience related to water supply and wastewater disposal systems design and project management. He has been involved in over 100 project which included all phases of implementation and related structures. Jan's experience includes engineering and environmental site investigations, feasibility studies, detailed design, specifications, cost estimating, construction supervision, commissioning, operation/maintenance manuals, staff training applications for approval and overall project management.