



Tuesday, April 29, 2008
Stream A – Remediation in Northern Environments

Topic Keynote

LOCATION: GRAND BALLROOM A

8:45 am - 9:30 am



Dr. Ken Reimer,
Royal Military College of Canada

Dr. Ken Reimer is a Professor in the Chemistry & Chemical Engineering Department as well as the Director of the Environmental Sciences Group (ESG) at the Royal Military College (RMC) of Canada in Kingston. He also holds cross-appointments to several departments at Queen's University including the School of Environmental Studies.

The Environmental Sciences Group is a cost-recovery, multidisciplinary team uniquely located within an accredited university that is part of the Canadian federal government. Current interests include: the development of innovative approaches for site investigations in remote locations, ecological and human health risk assessments (that incorporate bioaccessibility measurements), the development of biological strategies for the cleanup of contaminated sites, and risk management/communication.

Dr. Reimer is a frequently invited peer reviewer for the United States Environmental Protection Agency, he has served as a Scientific Advisor to several federal departments and has provided expert advice to the Canadian International Development Agency. Ken is currently the Chair of the Environment Division of the Chemical Institute of Canada and Co-Chair of Bioaccessibility Research Canada.



TUESDAY, APRIL 29, 2008

9:30 am - 9:55 am

Case Study: Remediation of Contaminated Soil and Debris from a Remote Site with Difficult Bedrock Terrain in the Canadian Arctic, The Radio Island Experience

Tyler Barkhouse¹, P.Eng., Gordon Woollett¹, P.Eng.,
Jared Buscho², Lou Spagnuolo³

¹Earth Tech Canada Inc.

²Public Works and Government Services Canada

³Indian and Northern Affairs Canada

Radio Island, located off the southern extremity of Resolution Island at the southeastern tip of Baffin Island, was operated as a navigational aid and weather station from 1929 to 1961. The island is about 1 km long and 0.5 km wide. It is situated on Canadian Shield bedrock and consists entirely of parallel rock ridges with soil restricted to isolated pockets in gullies. There are no roads or airstrips. All that remained on the island after its closure in 1961 was two buildings left from the original site, the remains of four others, a light beacon tower, and various types of debris scattered over the island by high winds.

Over the past decade the site has been assessed by the Environmental Sciences Group of the Royal Military College of Canada (RMC) (1997) and Earth Tech Canada (2002). As a result of these assessments, a remedial action plan was developed to remediate the site. The main contaminants of concern were metals, and to a lesser degree petroleum hydrocarbons. In the spring of 2006, a tender package was prepared for the remediation and Hazco Contracting was selected to perform the remediation work, under the supervision of engineers from Earth Tech Canada.

This presentation is a case study of the unique challenges faced by the engineers and contractors in carrying out this remediation project under harsh and unpredictable weather conditions and extremely difficult terrain. The following topics will be discussed: unique site logistics; the use of soil bags for collecting and transporting contaminated soil; the collection of various types of debris from isolated bedrock gullies; equipment challenges to adapt to steep bedrock terrain and small narrow bedrock gully excavations; the use of helicopters in the remediation work; establishing a sealift accessible area on an adjacent island; polar bear control; water treatment from natural ponds located in bedrock gullies; hazardous materials handling; soil sampling techniques and challenges; and, the use of risk assessment in the remediation process.

9:55 am - 10:20 am

Site Restoration Challenges at the FOX-C: 2007 Update

David Gilbertson¹, P.Eng., Rudy Schmidtke¹, P.Eng.,
Brad Thompson², P.Eng., Mark Yetman³

¹UMA Engineering Ltd.

²Public Works and Government Services Canada

³Indian and Northern Affairs Canada

The FOX-C Intermediate Distant Early Warning (DEW) Line was constructed in 1957. In 1963, the site was abandoned and responsibility was transferred over to Indian and Northern Affairs Canada (INAC). The FOX-C site is located on the south shore of the Ekalugad Fiord on the northeast coast of Baffin Island, approximately 240 km northwest of Qikiqtarjuaq, Nunavut.

FOX-C consists of a lower site, including the beach and lake areas and the upper site which consists of the midstation and upper station areas. The upper site (elevation 770 m) is approximately 8 km from the lower site along an access road that has become impassable and is in poor repair.

Site restoration activities began in June 2006 and continued in 2007. This presentation will review the restoration activities completed in 2006 and 2007, and the associated challenges encountered during construction to satisfy the design intent. Specific challenges included: active layer instabilities; equipment access; crossing of glacier meltwater and borrow material quality and quantity. Performance of remedial techniques for specific challenges completed in 2006 will be discussed.

It is hoped that by sharing these experiences, similar situations can be identified during future northern site investigations and specific solutions can be developed at the tender/design stage.

**TUESDAY, APRIL 29, 2008**

10:50 am - 11:15 am

CAM-F Intermediate DEW Line Site Clean-up in Nunavut: From Procurement to Project Completion

Sylvain Laberge¹, Jared Buchko², Mark Yetman³, Roland Merkosky⁴, Jean Pierre Pelletier¹, Yvan Pouliot¹

¹Biogénie S.R.D.C. Inc.

²Public Works and Government Services Canada

³Indian and Northern Affairs Canada

⁴UMA Engineering Ltd.

CAM-F (Sarcpa Lake) is a former radar station constructed as part of the Distant Early Warning (DEW) Line system (63 stations in the Arctic/42 in Canada) at the height of the cold war in 1957. It was operated jointly by the Department of National Defence (DND) and the U.S. Airforce, closed in 1963 and transferred to Indian and Northern Affairs Canada (INAC) in 1976, along with 20 other stations. The station was comprised of the following infrastructure; module train, garage, warehouse, sheds, communication tower, POL tank storage facility, etc. Wastes and contaminants present on site included; PCBs in the soil, oil and painted material, hydrocarbon in the soil, metals present in soils, etc.

INAC Intermediate DEW Line site remediation projects are managed by Public Works and Government Services (PWSGC), who awarded the CAM-F cleanup contract to Biogénie in July 2005. After two field seasons, the project was completed in October 2007. Works consisted of: mobilization to site (overland); demolition of buildings; construction of a non-hazardous waste landfill; construction of a Tier 2 secure soil disposal facility; construction of a temporary storage area for hazardous material; collection of waste and debris on land and in and around Sarcpa Lake; containerization of hazardous waste for future disposal; excavation of contaminated and hazardous soils; and, excavation of waste dumps.

From freshly compiled results, this presentation will feature some challenges and issues encountered during the project. Topics such as the procurement process, winter/over-tundra transportation, and precautions in response to the climate change in the North will be addressed and discussed.

11:15 am - 11:40 am

An Expedited, Risk-Based Remediation Strategy for Large-Scale Diesel Contamination in Northern Communities

Linda Kemp¹, Ian Hers¹, Trish Miller¹, Robyn Weisner², Reidar Zapf-Gilje³

¹Golder Associates Ltd.

²First Nations' Emergency Services Society

³GeoEnviroLogic Consulting Ltd.

This case study describes a risk-based remediation strategy developed for large-scale diesel contamination at remote First Nations sites. This strategy has the three-pronged objective of: (1) identifying contamination situations that may pose an immediate human health or environmental threat and implementing interim control measures; (2) investigating contaminant sources and pathways to determine whether human health and environmental risks require the implementation of remediation and/or management works; and, (3) implementing enhanced natural attenuation of contamination for long term site improvement even for those sites where no direct risk was identified. To achieve the objectives, an expedited approach was developed to address the challenges presented during work on federally-owned sites in remote areas. This expedited approach involved conducting the detailed site investigation, detailed risk assessment investigation, and remediation pilot testing activities concurrently, to more rapidly identify risk mitigation measures potentially required and to reduce the number of procurement cycles and field programs.

The case study demonstrates how conducting multiple tasks (i.e., site investigation, risk assessment, and pilot testing) during one procurement cycle, allowed for a large data-set to be collected and reviewed holistically to reach a risk-based remediation solution in an efficient manner. The work at this site involved consideration of interim protection measures and longer-term remediation options. Based on results of pilot testing it was found that that monitored natural attenuation was best suited for addressing the diesel contamination. Sufficient data was collected such that an active remediation or risk mitigation system could be implemented, based on on-going monitoring of soil vapour and groundwater conditions.



TUESDAY, APRIL 29, 2008

11:40 am - 12:05 pm

Site Characterization and Remediation Planning in Remote Arctic Locations: Case Study of Roberts Bay and Ida Bay Abandoned Mine Sites, Nunavut, Canada

J.A. Morakinyo¹, J. Buchko²¹Indian and Northern Affairs Canada²Public Works and Government Services Canada

The special circumstances that exist in the remote arctic locations of Northern Canada pose challenges for contaminated sites' characterization and remediation planning. Sites are isolated from communities and can only be accessed by sea, air or ice winter roads. The arctic climate limits site investigation and remediation construction to about two to three months in a year. In most cases, there are no applicable cleanup protocols; existing protocols are validated with southern, warmer parameters not applicable in the north. Labour supply is limited, causing planning difficulties when competing with other works in close-by locations.

Roberts Bay and Ida Bay mines are two abandoned silver mines located about 115 km southwest of Cambridge Bay, Nunavut, Canada. The sites are isolated and are located in the high arctic region of Northern Canada. They were operated between 1964 and 1974 and have been abandoned since 1975. The current site features, deteriorating buildings, camp wastes, mine openings, mine debris, waste rocks, tailings ponds, and areas of petroleum hydrocarbon and metals contaminated soils, have resulted in significant human health and safety risks, thereby justifying site clean-up.

Several investigative works were conducted on the sites, resulting in the development of a remediation strategy and the identification of the mitigative measures for the remedial works proposed. The remoteness of the Roberts Bay and Ida Bay sites and the arctic climate play significant roles in the derivation of the remedial solution for the sites. Competing with other work in the immediate area (Hope Bay Mine) also influenced the remedial design decisions. Cleanup criteria were set using prevailing site conditions, precedent set by previous cleanups by the Department of National Defence (DND) and Environment Canada (EC), and Indian and Northern Affairs Canada (INAC)'s abandoned military site remediation protocol.

This presentation looks into the logistical issues associated with site characterisation and design of remediation solutions for sites in remote arctic locations in general. The case of the Roberts Bay and Ida Bay abandoned silver mine sites is provided to illustrate these challenges.

1:30 pm - 1:55 pm

Northern Mine Decommissioning: Case Study of Remedial Works for Closure of Port Radium, Canada's Original Uranium Mine

C.F. Gravelle¹, H. Wong¹, G.M. Wiatzka²¹Decommissioning Consulting Services Limited²SENES Consultants Limited

This presentation provides a case study perspective on key aspects of the remedial activities associated with closure of the former Port Radium Mine site, located on east side of Great Bear Lake, Northwest Territories. Port Radium consisted of multiple closed mines (Port Radium, Echo Bay and Cross Fault Lake) and a former town site. Following closure in 1982, equipment was removed from the site, the majority of the buildings were demolished, shafts and adits were secured and tailings were covered. To address concerns expressed by the residents of community of Déline, located some 265 km west of the mine site on the opposite side of Great Bear Lake, about residual contamination on the site, the Canada-Déline Uranium Table was formed in 1999. Subsequently, several environmental site investigations and human health and ecological risk assessments were undertaken to address these concerns and a remediation plan was developed as an outcome of this unique, wide ranging, and intensive co-operative effort.

The remediation plan for the site comprised: closure of the vertical and horizontal mine openings; installation of an engineered cap over a tailings area; demolition of structures remaining on-site; management of various designated substances; preparation and construction of a local landfill; placement of a soil cover over areas identified as having elevated gamma radiation levels; and, recovery and management of petroleum impacted soils. The case study provides insight into the physical, technical and logistical challenges associated with implementation of remedial works in northern remote locations.

**TUESDAY, APRIL 29, 2008**

1:55 pm - 2:20 pm

Remedial Action Plan for the Abandoned Tundra Mine, Northwest TerritoriesTanya Schulz¹, P.Eng., Valerie Bertrand¹, M.Sc., P.Geol.,Lisa Dyer², Brent O'Rae³¹Golder Associates Ltd.²Public Works and Government Services Canada³Indian and Northern Affairs Canada

Tundra Mine is an abandoned underground gold mine under federal custody, in the Northwest Territories, 240 km northeast of Yellowknife. It operated as a mine and mill from 1963 to 1968, and from 1983 to 1987 a mill, leaving behind a legacy of mine tailings, an arsenic contaminated tailings pond, and hydrocarbon impacted soil. Indian and Northern Affairs Canada (INAC) has completed several previous investigations on geochemistry of the tailings and surface waters, characterization of the hydrocarbon impacted areas and ecological risk assessments. Various closure plans have been postulated and reviewed. Currently Golder Associates Ltd. (Golder) is developing a remedial action plan (RAP) for the closure of Tundra Mine using a capillary break design of tailings cover. This cover design is expected to be the closest to achieving INAC's goal of a permanent, walk-away solution. This presentation will describe the main aspects of the RAP.

The RAP incorporates: a) treating the arsenic rich water in the tailings pond; b) capping the tailings with a capillary break design of cover; and, c) bio-remediating the contaminated soil.

The tailings pond was a small natural lake which has been diked and had its level raised to submerge the tailings. In order to expose the tailings so that a soil cover can be placed over them, the water in the lake must be drained, but before it can be drained, the arsenic concentration will have to be dramatically reduced. Golder is testing, on a bench-scale, various arsenic precipitation techniques. Once the tailings pond water has been treated and drained, the sludge and exposed tailings will be covered.

The capillary break cover design is based on the property that large grain-sized material have of not wicking moisture upwards. The first layer that will be applied over the tailings will be coarse-grained waste rock to inhibit capillary action. The second layer will be fine-grained silty native material which is designed to retain precipitation water and release it via evaporation and evapo-transpiration without permitting it to infiltrate down to the tailings. The third and final layer will be coarse-grained native material to protect the underlying fine material from erosion. Surveying local eskers and soil deposits to find appropriate quantities of geo-materials was part of Golder's recent field investigation.

The hydrocarbon-contaminated soil occurred as a result of leaking bunker oil and diesel fuel storage areas. With the mine's buildings now gone, Golder has recently completed delineation of the hydrocarbon impacted zones. The hydrocarbon-contaminated soil will be excavated and placed in open bioremediation cells. Bioremediation has been proven to work at Northern sites, and has the advantages of being low-maintenance.

The remediation action plan will be submitted to the Mackenzie Valley Land and Water Board for approval.

2:20 pm - 2:45 pm

Addressing Historic and Present Concerns About the Former Port Radium Uranium MineOrlena Modeste¹, Julie Ward²¹Déline First Nations²Contaminants and Remediation Directorate, Indian and Northern Affairs Canada

In 1998, Déline First Nations approached Canada about historic and present day concerns related to the former Port Radium Uranium Mine. After a year of internal discussion, Déline agreed to Canada's offer to begin a partnership to investigate health and environment issues and develop a common understanding relating to concerns. This approach started the Canada-Déline Uranium Table (CDUT) in 2000. It took five years to complete studies identified in the action plan developed by subject matter experts, government officials and Déline community members. Both Indian and Northern Affairs Canada (INAC) and Déline First Nations were happy with the process through which issues were being discussed. Due to the success of this approach, the CDUT process became the foundation for consultations under the contaminated sites remediation program through INAC's Northwest Territories region.

The CDUT ended with a final report identifying 26 recommendations, ranging from health and the environment, to capacity and knowledge. Though remediation of this site is occurring in 2007, this site will not be remediate to the community of Déline until all recommendations are addressed.

All presentations will be delivered in English, unless noted otherwise.

**TUESDAY, APRIL 29, 2008**

3:15 pm - 3:40 pm

Challenges in Developing a Remediation Plan, Procurement Plan and Long-Term Monitoring Program for the Former Port Radium Uranium Mine that Meets the Needs of the Community of DélineJulie Ward¹, Orlena Modeste²¹Contaminants and Remediation Directorate, Indian and Northern Affairs Canada²Déline First Nations

After a five-year political process to investigate historic and present day concerns about the former Port Radium Uranium Mine, the site is being remediated. Prior to remediation Indian and Northern Affairs Canada (INAC) worked with Déline First Nations to develop a remediation plan that was suitable to the known environmental conditions and identified risks on site. The remediation plan formed the structure for the work specifications under the request for proposal and the regulatory applications for land use permit and waste nuclear substance licence. After the remediation plan was complete, a procurement plan was developed that followed contracting policies, met the requirements under the Sahtu Dene and Métis Comprehensive Land Claim Agreement, and abided by INAC's commitment under the Canada-Déline Uranium Table to maximize local participation and subcontracting opportunities. Lastly, INAC is working closely with Déline to develop a monitoring plan that will begin to restore their confidence in their environment while continuing to monitor existing conditions at the site.

3:40 pm - 4:40 pm

Panel Discussion – Live and Unplugged