Stream B: Remediation Case Studies

Managing Uncertainty by Planning for the Known Unknowns and the Unknown Unknowns Giant Mine Remediation Project

Mark Cronk, P.Eng, Senior Project Manager, Giant Mine Remediation Project, Public Works and Government Services Canada

In 1999, mine operations at Giant Mine in Canada's Northwest Territories ceased after 56 years of gold mining that established the mine as the most prolific producer of gold in the Territories. When the former owner, Royal Oak Mines, was forced into receivership in 1999, Indian and Northern Affairs Canada (INAC) became actively involved in the care and maintenance of the mine to protect human health and safety as well as the environment.

The roasting process used to the extract some seven million ounces of gold from refractory Giant Mine ore yielded almost 237,000 tonnes of by-product arsenic trioxide dust that was collected in a bag house. This large volume of arsenic trioxide dust that is a highly soluble and toxic form of arsenic is sealed in 14 underground mine workings/chambers. On surface, numerous hazards exist, including four separate tailings impoundments, a sludge pond, settling pond and associated dams. Most buildings on site are in an advanced state of disrepair and will eventually be demolished. Risks associated with a group of buildings known as the roaster complex are of particular concern because these buildings are heavily contaminated with arsenic trioxide dust and loose fibrous asbestos. Around the mine site arsenic, and hydrocarbon contaminated soils present additional risks, as do numerous pits and underground openings throughout the site.

In 2004, Public Works and Government Services Canada (PWGSC) was retained by INAC as a service provider to oversee management of the Giant Mine site. This placed PWGSC in the awkward situation where the organization had been charged with the responsibility of maintaining one of the largest, most complex contaminated sites in Canada, but using 60-year-old decrepit infrastructure. In addition to the surface infrastructure Giant has the added complexity of requiring management of its underground infrastructure (mine) to allow for inspection, environmental compliance and future remediation of the arsenic trioxide dust stored underground.

It was quite a challenge for PWGSC, INAC and their team of experts to put in place a contracting approach that could respond quickly and effectively to the broad range of unknowns they expected to experience during five to seven years of care and maintenance, not to mention unknown unknowns. In effect, the contract stated, "do what needs doing to keep the site in regulatory compliance" – you figure out what that means. This required an innovative approach to structuring government contracts that were flexible to accommodate day-to-day care and maintenance of the site, protection of the environment and mitigating emerging risks that come with managing an abandoned 60 year old mining site. This innovative approach established a balance of contract risks, between Canada and the Contractor, for the continuing maintenance of this contaminated site, until full remediation can commence.

This presentation will speak to the challenges associated with maintaining a 60-year old mine site using dated infrastructure, how these challenges were overcome and give examples of the types of obstacles that must be overcome routinely.

Decommissioning of the Sydney Steel Plant and the Redevelopment of the 180 Hectare Site

Gary Campbell, Nova Scotia Lands Inc.

Sydney Steel (Sysco) once generated 50% of all steel production in Canada. Continued financial losses resulted in closure of the plant in 2000. The provincial government established a $317 million fund to decommission the plant, redevelop the site and provide the Province's share in the Sydney Tar Ponds Cleanup. Over 50 major buildings and other structures had to be demolished, along with remediation of significant areas of contamination. One area of the site required a 150,000 tonne ex-situ solidification project, using a purposed built pug mill.

Decommissioning of the steel plant is basically completed and extensive work is underway toward redeveloping the site into a major commercial park facility. Areas of the site are also being redeveloped to support remediation activities of the adjacent Sydney Tar Ponds and former Coke Ovens site. Further information can be found at www.nslands.ca and www.tarpondscleanup.ca.

The presentation will review the background of the steel plant site and the decommissioning/remediation program for its redevelopment.

Long-term Environmental Project Management Strategy for North Warning System Short-Range Radar Sites in the Arctic

Dr. Ken Reimer[1], Dr. Daniela Loock[1], Darren White[1], Kendra Leek[1], Marten Devries[1], Kim Kalen[2], Al Cameron[2]
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The North Warning System (NWS) is a collaboration between Canada and the United States that provides aerospace surveillance over the North American Arctic. Between 1986 and 1992, 47 unmanned short- and long-range radar stations were constructed on Canadian soil. In 1996, the North Warning Systems Office (NWSO) initiated a long-term management program for the records of environmental conditions of its short-range radar (SRR) stations. This program consists of Phase II Environmental Site Assessments to assess operational practices to date. Because of their continued relevance in Arctic environments, the Distant Early Warning (DEW) Line Cleanup Criteria for inorganic elements and polychlorinated biphenyls (PCBs) are used as standards for identifying potential areas of concern. Petroleum hydrocarbons are assessed based on the Indian and Northern Affairs Canada (INAC) Protocol for the Remediation of Abandoned Military Sites. Other contaminants of concern are assessed according to the Canadian Council of Ministers of the Environment (CCME) guidelines. These assessments will provide baseline environmental conditions for each of the sites. As of the end of 2008, nine site assessments had been completed by the Environmental Sciences Group (ESG) of the Royal Military College of Canada. The completed survey and assessment information become part of NWSO's active geographic information system (GIS). The GIS brings together all spatial and aspatial data related to the sites. Data include analytical data collected as part of assessment or remediation activities, site drawings, surveys, photographs and other information generated as part of the site operation. Managing these data in a central repository facilitates effective identification and management of common issues related to each reserve area, as well reducing data collection related to the decommissioning of the sites in the future.

Giant Mine Remediation Project: A Progressive Planning Approach

Martin Gavin, P.Eng, Manager, Giant Mine Remediation Project, Indian and Northern Affairs Canada

In 1999, mine operations at Giant Mine in Canada's Northwest Territories ceased after 56 years of gold mining that established the mine as the most prolific producer of gold in the Territories. When the former owner, Royal Oak Mines, was forced into receivership in 1999, Indian and Northern Affairs Canada (INAC) became actively involved in the care and maintenance of the mine to protect human health and safety as well as the environment.

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pond, settling pond and associated dams. Most buildings on site are in an advanced state of disrepair and will eventually be demolished. Risks associated with a group of buildings known as the roaster complex are of particular concern because these buildings are heavily contaminated with arsenic trioxide dust and loose fibrous asbestos. Around the mine site arsenic, and hydrocarbon contaminated soils present additional risks, as do numerous pits and underground openings throughout the site.

With the assistance of a Technical Advisors, INAC completed a remediation plan for the site. During application for a water license, the remediation plan was referred to the MacKenzie Valley Environmental Impact Review Board (MVEIRB) for an Environmental Assessment (EA). As the EA progresses, the planning for implementation of the project continues, as does the care and maintenance of the site.

This presentation will demonstrate the progressive approach to planning during the life cycle of a major remediation project that is contiguous from inception through close out. Focus will be on the planning challenges to address the procurement, legal and delivery issues and the strategies developed for these. The presentation will also speak to the specific and dynamic stages on major remediation projects such as pre-project planning, concept development, regulatory approvals, numerous implementation stages, closeout(s) and long term monitoring and maintenance. Development of project delivery structures to accommodate each stage will be discussed.

Site Closure of an Outdoor Firearms Range in a Municipal Watershed

Lisa Poier and Holly Herald, Royal Canadian Mounted Police

The Royal Canadian Mounted Police (RCMP) leased the use of property under the jurisdiction of Metro Vancouver (formerly Greater Vancouver Regional District) to operate an outdoor firearms training facility (Firearms Range) from 1989 to 2006. The site was located within the perimeter of the Coquitlam, BC, watershed, adjacent and upstream of the confluence of Or Creek and the Coquitlam River, so environmental protection was paramount throughout the site's use and closure. The RCMP Sustainable Development Unit devised and implemented an approach for ongoing site maintenance throughout the operation of the Firearms Range to manage the accumulation of spent munitions in backstop berms behind targets and reduce sedimentation and erosion.

In 2004, the RCMP obtained the services of Keystone Environment Ltd. to develop a site closure strategy for the site for the Firearms Range that subsequently ceased operation in April, 2006. Site closure involved a series of detailed site investigations, habitat and arbourist assessments, and communications with the landowner. A combined physical remediation and risk assessment/risk management strategy was determined to be the most appropriate solution for addressing the metals contamination which had impacted the site soils and sediments in the backstop berms, overshot areas behind berms, range alleys where site users would stand during training, and ditches and ephemeral waterways across the site.

Physical remedial works were completed in the fall of 2007 and a Human Health and Ecological Risk Assessment was conducted, including a supplementary habitat assessment to confirm that endangered species were absent from the site and not using the site surroundings as habitat. Results have confirmed that the physical remediation was successful and potential risks remaining at the site are sufficiently low to meet the site management objectives.

Using this site as a case study, the RCMP has developed alternate means for delivering required Firearms Trainings, and is now currently operating a partially-enclosed and contained outdoor range with a rubberized bullet trap system which allows for enhanced environmental protection, capture and recycling of spent munitions. Plans are also being initiated to build a modern indoor firearms range facility, which will alleviate potential environmental risks in the years to come.

A Collaborative and Integrative Approach to the Assessment and Remediation of the Kingston Inner Harbour and its Associated Properties

Kenneth J. Reimer, Viviane Paquin, Astrid Michels, Tamsin Laing
Environmental Sciences Group, Royal Military College of Canada

Historical industrial activities have left a legacy of contaminated sediments within the southwestern portion of the Kingston Inner Harbour (KIH). The Environmental Sciences Group (ESG) of the Royal Military College of Canada (RMC) has been conducting studies in the KIH to determine the ecological impact of these legacy contaminants. This research is being guided by the Cataraqui River Stakeholder Group (CRSG) whose primary task is to identify an environmental management strategy for the contaminated sediments. The CRSG members are Parks Canada, Transport Canada, Environment Canada, Fisheries and Oceans Canada, the Ontario Ministry of the Environment, Rideau Renewal Inc., the City of Kingston, Canadian Forces Base Kingston and ESG. The CRSG has adopted the Canada-Ontario Decision-Making Framework for Assessment of Great Lakes Contaminated Sediment to guide sediment management decisions for the KIH. The research program developed by ESG addresses all of the scientific questions considered in the framework, so that a definitive management decision can be made. A preliminary delineation of the area in which contamination is having adverse ecological impacts, and where management actions will likely be required, has been performed. The group must now come to a consensus on the design of a remediation approach and what supplemental studies are needed, if any, to further refine the area requiring management action. This presentation will describe ESG's role in facilitating a collaborative approach to the assessment and remediation process, and the benefits of such collaboration when multiple stakeholders share responsibility for a site and where the investigation and cleanup of adjacent properties must be integrated into the overall assessment and remediation approach.

Contaminated Site Management Contributes to Maintaining and Improving Ecological Integrity in Canada's National Parks

Mikaïlou Sy, Kathie Adare, Jean-Claude Prévost
Parks Canada Agency

With respect to the management of protected areas, Ecological Integrity (EI) refers to a condition characteristic of the respective natural region which likely persists in its biotic and abiotic components, and interactions therein, as well as in its overall functionality, including the supporting processes and their rates of change. Protected areas, such as National Parks, which maintain and improve their EI, often exhibit both a strong resistance to stress and a high resilience following disturbance, and are therefore valuable management tools for resource conservation. However, perturbations such as contamination, more often than not, from pre-park establishment may disrupt EI equilibrium and pose long-term environmental and human health risks, if not properly managed. Along with sound environmental stewardship, the assessment and remediation or risk management of contaminated sites in National Parks may thus contribute to maintaining or restoring healthier ecosystems. This paper will summarize key environmental risks posed by 20 contaminated sites from 20 National Parks throughout the Parks Canada network, highlighting the exposure pathways and receptors at risk along with risk mitigation measures in place. This review will further demonstrate how the ongoing assessment, remediation and risk management activities contribute to maintaining and improving EI in Canada's National Parks, and help provide quality visitor experience while promoting sound environmental stewardship.

The Port Hope Area Initiative: Application of Project Management Tools to Contaminated Site Remediation Projects

Tim Palmeter, Public Works and Government Services Canada
Marcia Blanchette, Natural Resources Canada
Glenn Case, Atomic Energy of Canada Limited

This presentation is intended to demonstrate the importance of applying project management tools and processes to contaminated site remediation projects.

The management of projects is key to providing value for money and demonstrating sound stewardship in program delivery. A comprehensive approach to managing projects, which is integrated across the department and is appropriate for the level of risk and complexity, will enhance the likelihood of realizing project outcomes.

The Port Hope Area Initiative (PHAI) is a community-based program directed at the development and implementation of a safe, local long-term management solution for an estimated two million cubic metres of historic low-level radioactive waste (LLRW) in the Port Hope, Ontario area. Since 2001 the PHAI has undergone extensive public consultation, environmental assessment and licensing review of proposed solutions for the safe, long-term management of LLRW in the Port Hope area. The PHAI is now entering a transition phase with a key objective of establishing an appropriate governance and procurement framework for project delivery.

The PHAI project consists of:

- Remediation of some 17 major sites and an estimated 400 minor sites with a total contaminated soil volume of 575,000 cubic metres;
- The remediation of two existing radioactive waste management facilities with a total contaminated soil volume of 950,000 cubic metres;
- Remediation of five industrial sites with a total contaminated soil volume of 50,000 cubic metres; and,
- Construction of two engineered above ground facilities for the long-term waste management facilities with a combined capacity of 2.5 million cubic metres.

Natural Resources Canada (NRCan), Atomic Energy of Canada Limited (AECL) and Public Works and Government Services Canada (PWGSC) have committed to deliver this project in a manner that reflects the federal accountability framework, industry best practices, with appropriate project management, risk management and quality assurance considerations.

NRCan, as the project sponsor, has overall responsibility for all aspects of the PHAI. AECL, as the delegated project proponent and as the licensee, is responsible for overall conduct of the project. PWGSC, as the main contract arm of the Government of Canada, is responsible for managing the major contracts and acquisition activities associated with the project.

Utilizing project management (PM) tools and processes, such as project charters, and work breakdown structures, is an essential component of managing complex, multi-stakeholder projects such as the PHAI. Strategic implementation of PM tools helps to build an awareness of the broader project context for the project team members, and allows for a better integration of specific project objectives and strategies.

Challenges in Barrier Wall Construction and Site Remediation on Esquimalt Harbour: Remediation of the Yarrows Shipyard, CFB Esquimalt

Jeff Nyman, SLR Consulting
Duane Freeman, CFB Esquimalt, Department of National Defence
Andrew Smith, Public Works and Government Services Canada

The remediation of the former Yarrows Shipyard, property acquired by Department of National Defence (DND) in 1996, utilized innovative remediation technologies to remediate the site. The remediation was both technically challenging due to site conditions, as well as due to location: an active military-industrial harbour, with prominent First Nations, recreational, and economic components.

In September 2008, DND undertook remediation of the former Yarrows Ltd. Shipyards, property acquired by DND in 1996 in lieu of taxes and known environmental liabilities. The acquisition of the property, with estimated environmental liabilities (soil) of $1-2 Million (1995 estimate), represented a “once-in-a-lifetime” opportunity to join Naden, the administrative area of CFB Esquimalt, with HMC Dockyard, the operational home of Canada’s Pacific Naval Fleet, gaining valuable waterfront property with access to deep water, while reducing travel time and security costs between the two areas.

The site has a long and varied history, with military and industrial presence pre-dating the Confederation of Canada in 1867, and a First Nations presence likely pre-dating Jesus Christ. Shipbuilding and repair activities became

significant in the 1890's. In 1924, a large area of Lang Cove was in-filled to create site boundaries. The choice of fill materials included boulders, concrete, bricks, clinker, slag, lead shavings, sheet metal, pipes, and creosoted timbers.

When DND acquired the site, most infrastructure had been removed or buried, and the site was capped with gravel to make a laydown area. In 2000, DND removed known contaminated surface soils and placed them in an engineered waste storage cell and then later disposed of them off-site in permitted landfills. Monitoring wells were installed and the site was monitored as part of the risk management strategy.

In 2005, free-product was detected in two monitoring wells at opposite ends of the site. The risk management strategy was reviewed, additional investigation was undertaken, and expert support was provided by Fisheries and Oceans Canada and Health Canada as part of the Federal Contaminated Sites Action Plan to determine the best approach to manage the site. This work resulted in the site being classified as a Class I Contaminated Site, requiring remediation.

A remediation plan was developed in 2007, but due to the heterogeneous site fill, DND, working with Public Works and Government Services, did not wish to prescribe what kind of method to employ to allow for deep excavation of the foreshore, only what objectives needed to be met. This was done to minimize DND liability and maximize contractor innovation and competitiveness.

The remediation, undertaken in September 2008, involved installation of 3,200 m^2 of barrier wall, utilizing bentonite slurry and drilled caissons, to depths of –14 m, footed in either 3' of native clay or resting on bedrock. This allowed for bulk excavation to bedrock of 60,000 m^3 of contaminated soil, within two metres of Esquimalt Harbour. The installation was significantly challenging with many lessons learned, as was the excavation of contaminated soil itself. Numerous underground storage tanks were found at great depth containing free product, which greatly increased the scope and magnitude of soil contamination found at the site.