REMEDIATION OF GIANT MINE – A PROGRESSIVE PLANNING APPROACH

Martin Gavin,[1] P.Eng, and Sven Riemer,[2] PMP
[1]Indian and Northern Affairs Canada
[2]Stratos Inc.

ABSTRACT

In 1999, mine operations at Giant Mine in Canada's Northwest Territories ceased, following 56 years of gold mining that had 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, in order to protect human health and safety as well as the environment.

The roasting process used to extract some seven million ounces of gold from refractory Giant Mine ore yielded almost 237,000 tonnes of bi-product arsenic trioxide dust that was collected in a bag house. This large volume of a highly soluble and toxic form of arsenic is currently sealed in 14 underground mine workings/chambers.

On the surface, numerous potential hazards exist as well, including four separate tailings impoundments, a sludge pond, a settling pond and associated dams.

Most of the onsite buildings 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 technical advisors, INAC completed a remediation plan for the site. During application for a water licence, the remediation plan was referred to the MacKenzie Valley Environmental Impact Review Board (MVEIRB) for an Environmental Assessment (EA). As the EA progresses, implementation planning for the project continues, as does care and maintenance of the site.

Federal government guidance for the remediation of contaminated sites exists, but does not address many of the questions raised by a project on the scale of Giant Mine. This paper will briefly describe the existing federal contaminated sites management framework, then demonstrate the progressive approach to planning during the life cycle of a major remediation project that is contiguous from inception through closeout. The focus will be on the planning challenges involved in addressing procurement, legal and delivery issues, and the strategies developed to accommodate these. The presentation will also speak to the specific and dynamic stages of 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.

FEDERAL GUIDANCE FOR MANAGING CONTAMINATED SITES

A Federal Approach to Contaminated Sites

In 1999, the Contaminated Sites Working Group (an inter-departmental working group with participation from 13 federal government departments) developed a document titled "A Federal Approach to Managing Contaminated Sites". The purpose of the document was to provide a common federal approach to managing contaminated sites under federal custody.

The working group created a 10-step process that managers of contaminated sites need to follow, from initial identification of sites and testing to determine the nature and extent of contamination, through developing and implementing remediation strategies and long-term monitoring of the remediated site.

The relevant management steps for a site following classification were condensed by INAC's Northern Contaminated Sites Program (CSP) into four main phases:

(1) initial planning and identification,

(2) project definition,

(3) project implementation, and

(4) project closeout.

Details of each phase and the steps within the federal 10-step process that they include are provided in Figure 1 below.

Giant Mine is currently in the project definition phase.

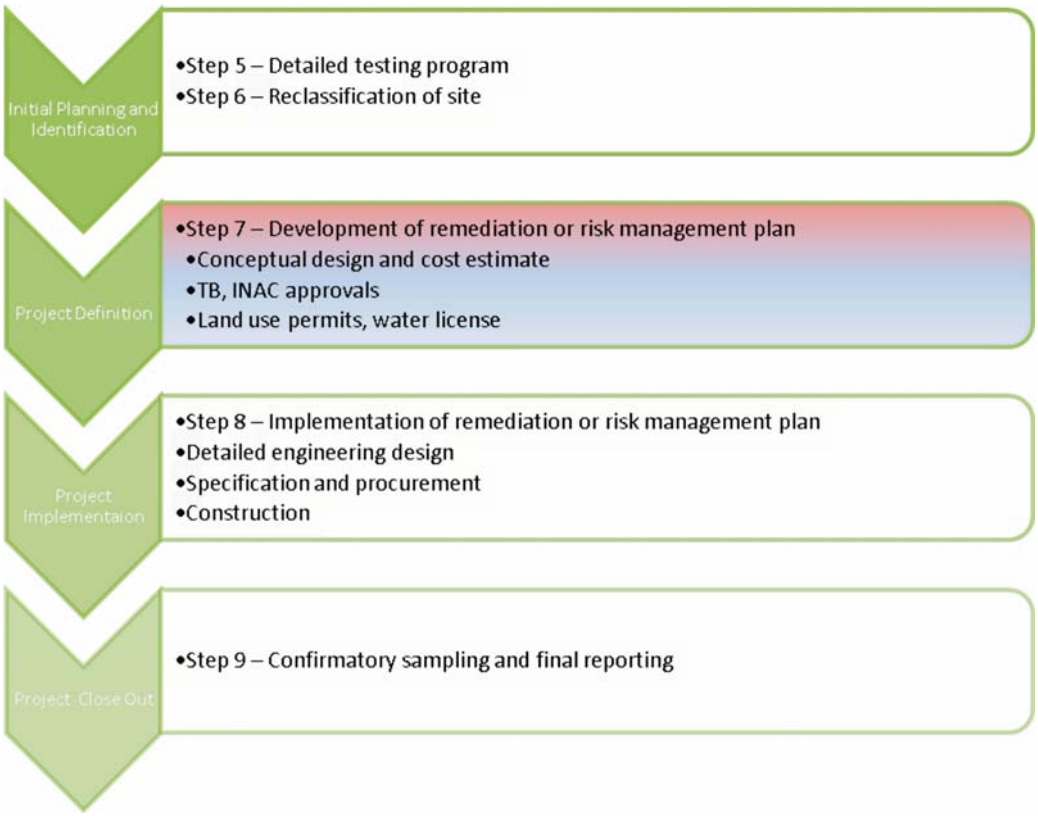

Figure 1: Main phases of contaminated-site remediation within the context of the Northern Contaminated Sites Program.

Treasury Board Secretariat

CSP remediation projects are classified by the Treasury Board of Canada, Secretariat (TBS) as capital projects.

The policy and management regime surrounding capital projects and project management has undergone significant change since INAC took over responsibility for the remediation of Giant Mine. The TBS policies that once provided guidance on further classification of projects – as well as long-term planning, approval, project management, procurement and other requirements, including the policy on Major Capital Projects (MCP) – have been replaced by the Policy Framework for the Management of Assets and Acquired Services. Within that framework, the Policy on the Management of Projects is the one most relevant to the management of contaminated sites.

Under the new policy, projects in excess of $1 million that are submitted to the TBS for funding must undergo a project complexity and risk assessment. This assessment tests the project for its risk and complexity through series of questions, and considers existing planning and management controls for the project. In total, 92 questions need to be answered, and each question has an associated score. The total score determines the complexity level between 1 and 4. Project complexity levels are defined as follows:

(1) Sustaining
(2) Tactical
(3) Evolutionary
(4) Transformational

An organizational project-management capacity assessment of the managing department establishes the project-management capacity category. Similar to the project complexity and risk assessment, the project-management capacity assessment is a criteria-based tool that uses a series of approximately 70 questions to test the department's capacity to manage a project. As a result of this assessment, a capacity category between 0 and 4 is assigned. The five categories indicating the department's capacity to manage projects are divided into the following categories:

(0) Limited
(1) Sustaining
(2) Tactical
(3) Evolutionary
(4) Transformational

The extent of TBS oversight on projects is determined by a department's capacity category, in relation to the complexity level of the proposed project. The standards for organizational project-management capacity assessments and project complexity and risk assessments, as well as their supporting tools, provide the context for conducting the assessments.

PLANNING THROUGH THE LIFE CYCLE OF A MAJOR CROWN PROJECT

Significant analysis of the scientific and engineering aspects of projects is standard practice in project planning. Project risk management has evolved into a valued component of project planning and execution. Typically, however, projects analyze and prepare for technical risks, but do not consider non-technical or sustainability risks to a sufficient extent. One sustainability risk faced by large-scale remediation projects is project transition.

Project transition occurs as a project matures. On traditional construction projects, such as a building or a highway, these stages are well known. Organizations often have specialized divisions that manage the project through one stage, then hand it off to the next.

Environmental remediation projects on the scale of Giant Mine represent a new type of project. Our understanding of the transitional stages and required planning for projects of this scope is only now becoming apparent. Lessons learned have shown that these transitions, if not properly managed, can have significant detrimental effects on the project's development and implementation, as well as on the human resources involved. The table below shows the alignment between the federal 10-step process and com-

Table 1: Transitional Stages of Remediation Projects

Federal 10-Step Process	Stages of Large Remediation Projects
Step 1 – *Identify Suspect Sites:* Identifies potentially contaminated sites, based on activities (past or current) on or near the site.	***Recognition and Investigation:*** Identifying a contaminated site and investigating to determine the extent of the contamination.
Step 2 – *Historical Review:* Assembles and reviews all historical information pertaining to the site.	
Step 3 – *Initial Testing Program:* Provides a preliminary characterization of contamination and site conditions.	
Step 4 – *Classify Contaminated Site Using the CCME National Classification System:* Prioritizes the site for future investigations and/or remediation/risk-management actions.	
Step 5 – *Detailed Testing Program:* Focuses on specific areas of concern identified in Step 3, and provides further in-depth investigation and analysis.	
	Transition Phase
	Care and Maintenance and Containment: Also known as pre-remediation activities, this stage maintains the site in its current condition. Efforts are taken during this stage to limit the potential of regulatory, health and safety impacts on and off the site.
Step 6 – *Reclassify the Site Using CCME National Classification System:* Updates the ranking, based on results of the detailed investigations.	
Step 7 – *Develop Remediation/Risk Management Strategy:* Develops a site-specific plan to address contamination issues.	***Remediation Planning:*** Planning for remediation of the site (Remedial Action Plan).
	Regulatory Approval *(if required):* Canadian Environmental Assessment, Mackenzie Valley Resource Management Act, etc.
	Remediation Implementation Planning and Design: Detailed planning and design of the remediation plan.
	Transition Phase
Step 8 – *Implement Remediation/Risk Management Strategy:* Implements the site-specific plan that addresses contamination issues.	***Remediation Implementation:*** Conducting the activities in the remediation plan.
Step 9 – *Confirmatory Sampling and Final Reporting:* Verifies and documents the success of the remediation/risk-management strategy.	***Post-Remediation Activities and Monitoring:*** Monitoring and maintenance activities following remediation.
Step 10 – *Long-Term Monitoring:* If required, ensures remediation and long-term risk-management goals are achieved.	

mon stages in large remediation projects, and further highlights where significant project transitions occur.

The federal 10-step process provides a useful classification of sites, and lays out the major steps in remediating contaminated sites. It does not consider the major element of care and maintenance and early remediation. Particularly large sites can pose a significant threat to human health and safety, and to the environment. Substances may have to be contained until remediation, and site infrastructure must be maintained to allow containment.

The challenges associated with major transitions are discussed below.

TRANSITION-RELATED CHALLENGES AND SUSTAINABILITY RISKS

Remediation projects face numerous challenges as they mature towards completion. The requirements of each stage can present drastically different requirements, skill sets, and pressures. This can be easily demonstrated by the resource skill sets required for each stage of the project, as described below.

In the earlier stages, a small scientific team is often required, along with some construction experience for care and maintenance activities. As the project matures, conceptual planners are needed to determine the way forward for remediation. The regulatory approval stage requires regulatory, political and legal expertise. As the project moves into the final stages, detailed engineering and construction project-management skills are mandatory. Finally, ongoing monitoring requires a long-term involvement on an ad hoc basis by general technical resources.

Identifying the risks and challenges within the remediation project is key to establishing solutions. Transitional challenges and sustainability risks can be categorized as described below.

Organizational Risks

The need to address the requirements of multiple organizations with a stake in the project presents organizational and governance challenges. Project stakeholders may include central agencies such as the TBS, whose guidance on project management or major Crown projects needs to be considered. Territorial, municipal or Aboriginal governments may impose additional demands on the project from a regulatory, socio-economic or geographical perspective.

Project Delivery Risks

Traditional project management focuses on delivering the project on time and on budget. Large-scale remediation projects need to consider their associated political and media pressures, and proactively manage those to the extent possible.

Regulatory Requirements

There are requirements that the project will need to accommodate if it is to be successfully implemented. These may be part of an environmental assessment, or may involve operational regulatory monitoring in accordance with legislation.

Stakeholder Management Needs

The needs of the stakeholders or interested parties such as end users, special interest groups or local residents need to be managed. This requires proactive identification of stakeholders and their respective needs (stakeholder mapping).

SOLUTIONS

Minimizing the effect of project-stage transitions is a difficult task that is often overlooked. It is, by all accounts, planning for iterative change. Projects are at risk during these transitions, as they bring uncertainties and pressures, and require teams to change their established approaches, often resulting in high stress.

Planning for these transitions means considering the following elements.

Governance

Ensure that the governance structure for the project is dynamic and robust. A robust/dynamic structure accommodates changes, and is able to adjust to accommodate the pressures of transitions. The governance structure should reflect the size and complexity of the project itself at its current stage, and needs to adapt as the project develops and matures.

Human Resources

Large projects often suffer from a high turnover in human resources, due to the fast-paced high-stress working environment. The transitional nature of these projects requires different skill sets at early project stages, as compared to the skills needed at later stages of the project. Large projects often cover a broad temporal scope, which means that human resources will come and go through normal turnover.

Resources

Contractors and consultants also present a challenge on large remediation projects. Work on these projects can take over a decade. Traditional agreements with contractors and consultants do not allow for long-term commitments, particularly within a government procurement environment. Additionally, the skill sets for contractors and consultants vary greatly during the various stages of a project. Finally, economic pressures can affect the availability of contractors and consultants.

The best approach for dealing with transitional stages of a large capital project is to plan for them. Planning and pre-

paring ahead of transition, from one stage to the next, will ensure that transitional changes do not have a negative effect on project delivery.

GIANT MINE APPROACH

The early days of the Giant Mine Remediation Project took the same route as most remediation projects. The early stages were very successful; however, pre-planning for transitional stages was a concept that had not been introduced. At present, the project is concurrently proceeding with regulatory approvals and remediation implementation planning and design.

As a multi-proponent project funded under the Federal Contaminated Sites Action Plan, as well as the Government of the Northwest Territories, the project has highly complex organizational needs. The complexity of the remediation, the level of stakeholder interest, and the overall profile of the project, are also significant factors which require due consideration in project planning.

The Giant Mine team has completed the needs analysis, and is currently developing the project plan. Considering the transitional stages of the project, and allowing for each of these, is a daunting task, as the project is very large, involves multiple layers of government, and takes place over a 20-year timeframe.

Utilizing a progressive planning approach in developing a *strategic project plan* (SPP) that identifies the needs of the project – followed by a *project execution plan* (PEP) that fleshes out details identified in the strategic plan for the Giant Mine Remediation Project – has enabled successful identification of the key components which need to be incorporated into the overall project plan in order to ensure success.

The SPP determines the overall project values and objectives that guide the project from start to finish. It then focuses on the outcomes of the project definition phase, and the conditions that need to be created in order to successfully implement that phase.

The project execution plan establishes the management approach for the site, which includes management of the project team and project risks. The issues highlighted above in relation to project transition and sustainability risks are considered, and management approaches identified, within the execution plan.

CONCLUSIONS

Existing guidance on the remediation of contaminated sites provides a high-level framework for the identification and management of remediation projects. This is a prudent approach, considering the range in size and nature of contaminated sites in Canada. As some of the country's largest contaminated-site remediation projects mature, two main themes emerge:

- identification and management of sustainability risks; and
- transition phases, during which projects are at high risk, as a result of the factors imposed by change.

Both themes need careful consideration in project planning and execution, to allow the successful remediation of large contaminated sites. Strategic project planning and diligent project management planning can help mitigate the risks associated with the above.