

Workshop on Controlling Arsenic Releases into the Environment in the Northwest Territories

Final Workshop Report

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Environmental Protection Branch
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Prepared For:

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Table of Contents

1.0	Introduction.....	1
2.0	Methods.....	3
3.0	Results and Recommendations	6
3.1	Societal Values	6
3.2	Sources of Arsenic in the NWT.....	7
3.3	Information Needs on the Effects of Arsenic	9
3.4	Additional Technical and Management Options for Controlling Arsenic Releases into the Environment.....	10
3.5	Criteria for Evaluating Technical and Management Options	12
3.6	Recommended Actions for Reducing Arsenic Releases into the Environment.....	14
4.0	Summary and Conclusions	16
5.0	References	18

List of Appendices

- Appendix 1.** List of Participants
- Appendix 2.** Workshop Agenda
- Appendix 3.** Responses to Focus Questions

1.0 Introduction

Arsenic is a naturally-occurring substance that may be present at elevated levels in certain types of rock and soils. While arsenic occurs occasionally in its pure form, it is found most often in compounds with sulphur or oxygen. Arsenic is also commonly found in combination with such metals as cobalt, copper, gold, iron, nickel, silver, and tin. The most abundant arsenic-containing mineral is arsenopyrite, which contains arsenic, iron, and sulphur. Weathering and erosion of arsenic-enriched rock and soil can transport arsenic to lakes, rivers, and other surface waters. Arsenic can be released into the atmosphere by volcanic eruptions and by bacterial activity in soils.

In Canada, arsenic is used in the production of various metals (i.e. to increase the strength of certain alloys), wood preservatives and a herbicide. Arsenic is also used to manufacture lead shot for guns and in certain types of electrical equipment. Other uses of arsenic include glassmaking, preparing medicines, and formulating pigments for paints.

Human activities have the potential to release significant quantities of arsenic into the environment. Base metal and gold production facilities are the principal sources of arsenic released into the Canadian environment. In 1994, nearly 4 million kilograms of arsenic were released into the environment by 45 metal production facilities. The use of arsenic-containing pesticides, coal-fired power generation, and the disposal of municipal and industrial wastes also have the potential to release arsenic into the environment.

Based on the results of a comprehensive examination of the levels, fate, and effects of arsenic in the Canadian environment and on human health, it was concluded that the current concentrations of inorganic arsenic in Canada may be harmful to the environment and may constitute a danger to human life or health. Therefore arsenic and its compounds are considered to be toxic under section 11 of the Canadian Environmental Protection Act as stated in the Priority Substances List (PSL) Assessment Report for arsenic (Government of Canada. Environment Canada and Health Canada 1993). In accordance with the *Toxic Substances Management Policy* (Government of Canada. Environment Canada 1995), arsenic is to be managed as a Track 2 substance, that is, because it is naturally-occurring, the goal is to prevent or minimize the release of arsenic into the environment to the greatest extent possible,

rather than to achieve virtual elimination. In implementing this policy, the federal government adopts a precautionary approach to substance management as defined by Principle 15 of the Rio Declaration on Environment and Development. This states that "Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation". In addition, because of the assessment of arsenic and its compounds as substances for which the critical health effect (cancer) is believed not to have a threshold (that is there is some probability of harm at any level of exposure), effort should be directed toward minimizing exposure to these substances to the extent practicable (Health Canada 1994; 1995). In summary the goal of the federal government is to minimize environmental impacts and health risks associated with arsenic by examining means to reduce environmental releases of arsenic.

In June 1995, the House of Commons Standing Committee on Environment and Sustainable Development (1995) recommended that measures to reduce releases of arsenic in the north be determined in the near-term. In response, a Task Force was established in August 1995 to examine the effectiveness of the existing regulatory regime, determine if further reductions in arsenic releases were needed, and evaluate a range of management options for reducing arsenic releases, if required. The Task Force was also asked to recommend the most cost-effective and efficient option for reducing arsenic releases into the environment. The Task Force included representatives from Environment Canada, Health Canada, and the Government of the Northwest Territories (NWT).

The Task Force recognized that mines, mills, and refineries are the major man-made sources of arsenic in the NWT. While there are eight operating mines/mills in the NWT, only two utilize heat to process concentrates on site - the Giant Mine and the Miramar Con Mine. Both of these mines have utilized gold roasters in their refining process, which can release substantial quantities of arsenic to the atmosphere. The Miramar Con Mine now utilizes a pressure leaching system (or autoclave), which eliminates atmospheric emissions. Therefore, the Giant Mine is the only facility that releases arsenic into the air. As the issues associated with releases of arsenic in liquid effluents are being addressed by the NWT Water Board, the Task Force focussed its efforts on releases of arsenic to the atmosphere from the gold roaster at the Giant Mine.

The Task Force reviewed the existing information on the sources, fate, and effects of arsenic in the environment, and on the technologies available for controlling arsenic releases from gold roasters. Recognizing that the existing information was limited in

some areas, the Task Force took steps to fill the information gaps related to treatment technologies and socio-economic impacts. Following the completion of the additional studies, the Task Force presented their findings in a discussion paper, entitled *controlling Arsenic Releases into the Environment in the Northwest Territories* (Environment Canada *et al.* 1997). This report identified a range of technical and management options that could be pursued to reduce releases of arsenic into the environment.

To fulfill its mandate, the Task Force must also develop recommendations for future action. To assure that its recommendations reflect the interests and concerns of northern communities, the Task Force convened a *Workshop on Controlling Arsenic Releases into the Environment in the Northwest Territories*. This report summarizes the results of the workshop and the recommendations developed by workshop participants.

2.0 Methods

A workshop was held on July 14 and 15, 1997 in Yellowknife, NWT to obtain advice and guidance on controlling arsenic releases into the environment in the NWT. A Public Forum was held on the evening of July 14 to solicit additional input. The workshop was designed to bring together representatives of aboriginal peoples, labour, industry, non-governmental organizations, and government agencies, to develop recommendations for addressing concerns related to releases of arsenic into the environment. The objectives of this workshop were:

- (i) To provide workshop participants with an overview of the technical information compiled in the Task Force report, including:
 - Sources of arsenic releases to the environment;
 - Effects of arsenic on human health and the environment;
 - Mineral process system at the Giant Mine;
 - Technical options for reducing arsenic air emissions;
 - Air dispersion modelling;
 - Socio-economic evaluations; and,
 - Management options for future action.
- (ii) To provide workshop participants with an opportunity to:
 - Articulate their interests and concerns related to arsenic releases;
 - Evaluate the available information on the effects of arsenic on human health and the environment;

- Determine if there is a need to reduce arsenic releases into the environment in the NWT; and,
 - Identify priority issues that should be addressed in the near-term.
- (iii) To have workshop participants:
- Review the management options (identified in the Task Force Report) that are available for controlling arsenic releases;
 - Identify additional options for managing arsenic releases into the environment;
 - Develop criteria for evaluating the various management options; and,
 - Determine which options are likely to best address their interests and concerns relative to releases of arsenic into the environment.

Invitations to attend the Workshop on Controlling Arsenic Releases into the Environment in the NWT were extended to more than 60 individuals with a potential interest in this topic (a list of invited participants is provided in Appendix 1). Each of the participants were provided with copies of the Task Force report, entitled *Controlling Arsenic Releases to the Environment in the Northwest Territories* (Environment Canada *et al.* 1997) and the associated *Executive Summary* (MacDonald 1997). The supporting documents that were also available to the workshop participants included:

- Arsenic PSL Assessment Report (Government of Canada. Environment Canada and Health Canada 1993);
- Toxic Substances Management Policy (Government of Canada. Environment Canada 1995);
- Report on Arsenic Emissions Control (W.R. Hatch Engineering Ltd. 1996);
- Report on Socio-Economic Analysis of Management Options (Resource Futures International 1996);
- Report on Air Dispersion Modelling of Roaster Stack Emissions (Environment Canada 1996);
- Air Monitoring Information (Environment Canada unpublished data); and,
- Yellowknife - Back Bay Study on Metal and Trace Element Contamination of Water, Sediment, and Fish (Indian and Northern Affairs Canada and Department of Fisheries and Oceans) 1996.

At the workshop, several presentations based on the Task Force's work were made to provide the participants with a common understanding of the issues associated with arsenic releases in the NWT (see Appendix 2 for the Workshop Agenda). On the first

day of the workshop, these presentations covered the Task Force's mandate, background of the project, sources of arsenic releases to the environment, and health and environmental effects associated with exposure to atmospheric arsenic. The presentations on the second day of the workshop included information on the existing mineral processing and air pollution control systems at the Giant Mine, a range of technical options for reducing arsenic emissions to air, the results of air dispersion modelling, and a socio-economic evaluation. A series of management options for addressing atmospheric emissions of arsenic from gold roasting was also presented.

Three discussion groups were formed to discuss several high priority issues related to arsenic releases into the environment in the NWT. The format for the workshop (i.e., three discussion groups) was selected for several reasons. First, with nearly 60 individuals invited to the workshop, there was a need to split the participants into manageable groups to facilitate discussions. That is, it was thought that people would be more likely to voice their opinions in smaller groups. In addition, this format was considered to be more amenable to the expression of minority opinions. Furthermore, multiple discussion groups provided an opportunity to examine similarities and differences, between groups, in the responses to the questions. For these reasons, each of the discussion groups was charged with the task of answering each of the following questions:

- With respect to arsenic releases into the environment, what are the societal values that we are most concerned about conserving and protecting in the NWT (e.g., human health, environmental health, employment, etc.)?
- Relative to the conservation of these values, what are the most important sources of arsenic releases into the environment in the NWT?
- Describe any additional information that is needed to evaluate the linkages between arsenic sources and the conservation of these values.
- Considering the values that we wish to conserve, what other management options should be considered for controlling arsenic releases in the NWT?
- What factors should be considered during the evaluation of the various management options that have been identified?
- Of the management options that have been identified, which ones are likely to best support the conservation and protection of the values that were identified yesterday?

At the end of each day of the workshop, rapporteurs for each discussion group presented the group's responses to each focus question.

3.0 Results and Recommendations

The Workshop on Controlling Arsenic Releases into the Environment in the Northwest Territories was convened to facilitate the development of practical solutions to the challenges associated with arsenic releases in the Northwest Territories (NWT). Importantly, the participants at this workshop identified the societal values that need to be protected and conserved in the NWT. In addition, the most important sources of arsenic relative to the protection of these values and the limitations of the existing information on the health and environmental effects of arsenic were identified. Subsequently, workshop participants described additional technical and management options for reducing arsenic releases into the environment. Finally, selection criteria were developed and applied to facilitate selection of the most appropriate options for protecting and conserving human and environmental health in the NWT. The detailed recommendations provided by each discussion group are presented in Appendix 3. The major results and recommendations from the workshop are summarized in the following sections.

3.1 Societal Values

Definition of management goals for aquatic and terrestrial ecosystems is a fundamental step towards the implementation of an ecosystem-based natural resource management framework. Definition of these ecosystem goals requires input from a broad range of interest groups to ensure that societal values are adequately represented. There was a great deal of agreement among workshop participants in terms of the societal values that should be protected and conserved in the NWT. Three major types of values were identified for protection:

- Human Health and Well-Being, including:
 - physical health;
 - psychological health; and,
 - occupational health and safety.
- Community Health and Quality of Life, including:
 - traditional culture;

- lifestyles (i.e., consumption of traditional foods, camping, etc.);
 - economic diversity and well-being (i.e., employment income and associated benefits);
 - social stability;
 - trust between the company and the community; and,
 - livability of the area for future generations.
- Environmental Health, including:
- air quality;
 - water quality;
 - sediment quality;
 - soil quality;
 - aquatic organisms; and,
 - plants, wildlife and other terrestrial organisms.

The workshop participants agreed that human, environmental, and community health and well-being are inter-related and must be addressed together. As such, there is a need to balance economic development and environmental protection goals by assuring that the principles of responsible stewardship are respected. To achieve this balance, individuals, organizations, and society as a whole must accept responsibility for their actions and be willing to accommodate the interests and needs of others (e.g., by identifying tolerable risk levels in the community).

Importantly, all of the work groups agreed that there is a need to move towards action on controlling arsenic releases into the environment to assure that important societal values are adequately protected, both now and in the future. It was also cautioned that northern ecosystems tend to be fragile and must be managed in accordance with the precautionary principle.

3.2 Sources of Arsenic in the NWT

Workshop participants identified a number of important sources of arsenic releases into the environment in the NWT. These sources fell into two broad categories, including:

- Background Sources; and,
- Anthropogenic (i.e., man-made) Sources.

Of these, anthropogenic sources were considered to represent the greatest hazards relative to the conservation and protection of the values identified above. Five major existing (E) and potential (P) anthropogenic sources of arsenic were identified by the work group participants, including:

- Releases of roaster stack emissions from mining operations to air (E);
- Discharges of liquid effluents from mining operations to water (E);
- Leakage from underground storage vaults to groundwater (i.e., stored arsenic trioxide; P);
- Contaminated sediments in the vicinity of mining operations (i.e., due to historical releases to water; E); and,
- Contaminated soils in the vicinity of mining operations (i.e., due to historical releases to air; E).

The first three of these sources were identified as the highest priority sources for action because they pose significant actual or potential risks to the values that require protection. In addition, these sources are additive and avoidable. Furthermore, there are technical options available to address them. Therefore, emissions to air, discharges to water, and underground storage should be considered to be the top priorities for controlling releases of arsenic into the NWT environment.

A number of additional sources of arsenic releases into the environment in the NWT were also identified, including burning of municipal wastes, use of mine wasterock in construction (e.g., roads, bridge abutments), and Negus tailings pond. These sources were considered to be lower priority for action because they were thought to represent minor hazards to human health and/or the environment. Cigarette smoke was also identified as an important source of arsenic exposure in humans.

Natural sources were understood to account for a proportion of total exposure to arsenic. However, it was recognized that little could be done to reduce releases from these sources (e.g., dust from native rock and soils, leaching of arsenic from native rock and soils to surface waters and groundwater, etc.). Therefore, natural sources should be considered to be a low priority for action.

3.3 Information Needs on the Effects of Arsenic

The workshop participants agreed that there is an immediate need for action to control arsenic releases into the environment. That is, a precautionary approach must be adopted to address concerns related to arsenic releases in the NWT. Nevertheless, several important information needs were identified by workshop participants. The following information needs should be considered to be the highest priority because they were identified by multiple work groups:

- Groundwater hydrology in the vicinity of the underground arsenic trioxide storage areas at the Giant Mine (i.e., to evaluate the fate of the arsenic following mine closure);
- Background levels and cycling of arsenic in the environment (i.e., to distinguish between natural and anthropogenic sources and to evaluate the fate of arsenic that was historically released to soils and sediments);
- Sub-lethal effects of arsenic on human health, including controlled studies which monitor key indicators of arsenic toxicity (e.g., biomarkers, such as skin condition, muscle control, lung condition, etc.);
- Effects of arsenic in soils on invertebrates, plants, and wildlife in the vicinity of the Giant Mine;
- Effects of arsenic in sediments on benthic organisms;
- Speciation of arsenic in air, water, soil, sediments, food products, and humans (i.e., certain forms of arsenic are more toxic than others; therefore, the forms of arsenic in each environmental compartment should be determined);
- Effective communication of the effects of arsenic on human health and the environment (i.e., use plain language, standardize units, etc.);
- Effectiveness of various technical options for controlling arsenic releases on emissions of sulphur dioxide and other substances;
- Integrity of underground storage vaults for arsenic trioxide; and,
- Options for addressing concerns related to the underground storage of arsenic trioxide, including technical capabilities, management plans, regulatory obligations, and costs;

Lower priority should be assigned to the following information needs because they were identified by one work group only:

- Review of the research conducted since 1994 (i.e., after publication of the PSL Assessment Report; Government of Canada. Environment Canada and Health Canada 1993) on the effects of arsenic on human and environmental health;
- Effects of arsenic discharges from tailings ponds on water quality and water uses (i.e., drinking water, fish and aquatic life, etc.);
- Cumulative effects of arsenic on human health and the environment when it occurs with other contaminants (i.e., synergistic and/or antagonistic effects);
- Standardized testing procedures to support continuous monitoring of arsenic levels in air;
- Levels of arsenic in wildlife, vegetables, and soils in the vicinity of Yellowknife; and,
- Plans and finances of Royal Oak Mines (e.g., life of the Giant mine) to facilitate evaluation of the costs and benefits of various management options.

It was also agreed that the community and industry must be involved in the development and implementation of any research programs that are conducted to address these information needs.

3.4 Additional Technical and Management Options for Controlling Arsenic Releases into the Environment

Workshop participants generally agreed that the range of technical and management options presented in the Task Force report, *Controlling Arsenic Releases into the Environment in the Northwest Territories*, provided a comprehensive basis for addressing releases of arsenic into the atmosphere. However, these options did not provide a basis for addressing releases of arsenic into other environmental media, such as water or groundwater. For this reason, workshop participants identified a number of additional technical and management options for controlling arsenic releases into the environment. The additional technical options included:

- EMR microwave process (which was developed by the EMR Microwave Technology Corporation) could provide a means of improving gold recoveries, reducing emissions, lowering operating costs, and addressing the underground storage of arsenic. Therefore, it was recommended that this technology be fully evaluated. It was noted that the Canadian Auto Workers Union is willing to cover the costs associated with conducting a preliminary evaluation of this process with the refractory ore and arsenic trioxide from the Giant Mine;
- MIT-13 microbe process could provide a means of transforming arsenic trioxide into a less soluble form. However, limited unpublished information suggests that this process converts arsenic pentoxide to arsenic trioxide. More information is needed to evaluate the applicability of this technology;
- Alkaline scrubbing technology could provide a means of simultaneously reducing both arsenic and sulphur dioxide emissions to air. While this technology could be very effective, the costs associated with its implementation could be prohibitive (i.e., dolomite lime would need to be transported to the mine site). In addition, the arsenic would be sequestered in a soluble form, potentially limiting its long-term stability. More information is needed to evaluate this option; and,
- A cost-sharing arrangement could be developed with the Con Mine to employ its' autoclave to deal with a portion of the arsenic trioxide produced at the Giant Mine.

Workshop participants indicated that the range of management options presented in the Task Force report were likely to provide an appropriate basis for addressing concerns related arsenic releases to the atmosphere. However, several additional management options were also proposed, including:

- Develop a negotiated agreement which includes site-specific management plans that have been agreed to by industry, labour, aboriginal peoples, non-governmental organizations, and government agencies;
- Develop incremental management plans, either voluntary or mandatory, which identify specific actions that must be completed by specific dates. The plans should provide incentives for successful completion of tasks on schedule and disincentives for falling short of the targets identified in the plans;

- Develop a negotiated, binding, multi-party, multi-faceted (i.e., addressing multiple issues) agreement which includes both voluntary and regulatory components;
- Implement an interim Ministerial Order to facilitate immediate action on high priority environmental management issues;
- Create a Pollution Control Board similar to the NWT Water Board;
- Create a community-driven process to address concerns related to historical releases of arsenic, including environmental monitoring;
- Increase the performance bond held by the NWT Water Board; and,
- Establish a mine reclamation fund to assure that sufficient funds are available to address concerns related to existing arsenic emissions and mine reclamation (i.e., Royal Oak would make annual contributions to the fund).

It was recognized that implementation of an effective management plan for reducing arsenic releases in the NWT would require coordinated efforts by NWT Water Board, federal government, territorial government, industry, labour, non-governmental organizations, aboriginal peoples, and municipalities.

3.5 Criteria for Evaluating Technical and Management Options

Workshop participants were asked to identify the factors that should be considered while evaluating various technical and management options for controlling arsenic releases into the environment. The members of each work group responded to this challenge by developing a series of selection criteria for evaluating the various technical and management options that were identified. Some of these criteria apply equally well to either the technical options or the management options, while other criteria are most appropriate for evaluating one or the other type of option. While the technical and management options are tightly linked, it would seem appropriate to establish independent criteria for evaluating each type of option. For this reason, factors identified by workshop participants were sorted into two groups, one for evaluating technical options and the other for assessing management options. The criteria for evaluating the various technical options included:

- Effectiveness - can provide a high degree of certainty of achieving the desired objectives (i.e., reduce loadings of arsenic to specific environmental media);
- Efficiency - can provide a means of achieving the desired objectives with a variety of measures or processes (i.e., establishment of performance-based standards provides more flexibility for all participants);
- Feasibility - can be successfully implemented at the Giant Mine;
- Timeliness - can provide a means of reducing arsenic releases in the near-term (i.e., technology is currently available);
- Cost:Benefit Ratio - can justify costs based on the benefits to human, community, and environmental, health and well-being;
- Reliability - can be used for an extended period of time and potentially have a high resale value (e.g., if an autoclave were purchased to address arsenic emissions, it would be advantageous to apply this system during the entire life of the mine and to be able to sell the system to another mine following mine closure);
- Comprehensiveness - can address multiple issues (arsenic and sulphur dioxide releases) and multiple sources (i.e., emissions to air and water); and,
- Quality - can provide safe solutions to protect the health of employees, the community, and the environment.

A broader range of criteria were proposed for evaluating the various management options for reducing arsenic releases into the environment, including:

- Effectiveness - can provide a high degree of certainty of achieving the desired objectives (i.e., reduce actual and potential exposure to arsenic);
- Timeliness - can provide a means of reducing arsenic releases in the near-term (i.e., to reflect the urgency of the issue);
- Comprehensiveness - can provide a means of addressing multiple issues and sources (e.g., air emissions, underground storage, etc.);
- Progressiveness - can provide a means of dealing with air in the near-term and other issues subsequently;

- Openness - can facilitate involvement by all interested parties and is based on full disclosure;
- Enforcement - can include mechanisms that assure compliance, including monitoring of emissions, incentives to encourage compliance, progressive discipline for non-compliance, and a regulatory hammer;
- Cost:Benefit Ratio - can justify costs based on the benefits to human, environmental, and social health and well-being; and,
- Acceptability - can be readily accepted by the community (i.e., fosters trust, balances resource use and environmental protection, etc.).

In addition to supporting the option selection process, many workshop participants indicated that these criteria could also be used to refine specific management options to assure that they fully address the interests and needs of workshop participants and the organizations that they represent.

3.6 Recommended Actions for Reducing Arsenic Releases into the Environment

Workshop participants were asked to evaluate a wide range of management options, including those that had been proposed by the Task Force and those that were identified during the workshop. More specifically, workshop participants were requested to identify the management option or options that would provide the most effective means of controlling arsenic releases into the environment, thereby conserving and protecting human, community, and environmental health and well-being. Rather than selecting a single management option, workshop participants recommended a more comprehensive approach, which included both voluntary and regulatory components. It was agreed that this type of integrated approach is more likely to be successful because:

- It can be used to address a range of high priority issues;
- The voluntary component can be used to build partnerships and trust; and,
- The regulatory component can be used to assure compliance.

Most of the workshop participants indicated that a multi-faceted agreement should be negotiated with Royal Oak Mines Inc. in the near-term. While workshop participants did not express a clear preference for either a Structured Voluntary Agreement or a Community Covenant, the essential characteristics of such an agreement were articulated. Specifically, it was recommended that such an agreement include:

- Clearly defined goals;
- Clearly defined performance standards (specific loading reduction targets and associated rationales for their selection);
- Provisions which facilitate action on emissions of arsenic to air in the near-term;
- Provisions which facilitate action on a broader range of issues (e.g., SO₂ emissions, mine safety, underground arsenic storage, etc.);
- Schedules for compliance with the terms in the agreement and evaluation of the success of risk management initiatives;
- Incentives to encourage compliance (e.g., tax incentives, etc.);
- Significant penalties to discourage non-compliance (e.g., performance bonds and other remedies);
- Local multi-participant mechanism for invoking penalties (this provision is needed to assure the participants in the process that a negotiated agreement will be enforced by government);
- Research and monitoring requirements (e.g., roaster stack emissions, air quality, environmental effects, human health, etc.);
- Specific mechanisms to facilitate consultations and coordinated communications with the community;
- Provisions for resolving any disputes that might arise; and,
- Provisions for periodically amending the agreement.

Several approaches to drafting the agreement were suggested by workshop participants. For example, a draft agreement could be prepared by government and used to facilitate discussions among all interested parties (e.g., in a workshop setting). Alternatively, a working group (consisting of representatives from aboriginal peoples, industry, labour, non-governmental organizations, and government) could be formed to draft an agreement, which could be circulated for broader review and refinement. It is likely that the signatories to such an agreement would include, at

minimum, the federal, territorial, and municipal governments, the Giant Mine, and aboriginal groups.

Work group participants also recognized that gold roasting is still a viable technology and that additional gold roasters could be built elsewhere in Canada in the future. Therefore, it was recommended that the process of drafting regulations for air emissions under the Canadian Environmental Protection Act (CEPA) be initiated in the near-term. These draft regulations were considered to be essential for providing a regulatory back-up should a negotiated agreement prove to be unworkable.

4.0 Summary and Conclusions

A workshop was conducted on July 14 and 15, 1997 in Yellowknife, NWT to obtain advice and guidance on controlling arsenic releases into the environment in the NWT. The workshop brought together participants from aboriginal peoples, industry/labour, non-governmental organizations, and government agencies to cooperate in the development of workable strategies for reducing or eliminating arsenic releases into the environment. The workshop participants discussed a number of issues during the meeting, including:

- Goals for ecosystem management;
- Sources of arsenic releases to the environment;
- Effects of arsenic on human health and the environment;
- Mineral process system at the Giant Mine;
- Technical options for reducing arsenic air emissions;
- Air dispersion modelling;
- Socio-economic evaluation of various technical options; and,
- Management options for future action.

During the deliberations in the discussion groups, workshop participants worked cooperatively to identify the societal values that require protection in the NWT, the priority sources of arsenic releases to the environment, and the information needs for better evaluating the effects of arsenic releases on human, community, and environmental health. Importantly, workshop participants also identified additional management options for controlling arsenic releases into the environment and a series of criteria that could be used to evaluate these options.

Based on the recommendations developed by workshop participants, there is a need

for timely and coordinated action to address concerns related to existing and potential releases of arsenic into the environment in the NWT. While emissions of arsenic to air were viewed as important, releases of arsenic to water, underground storage of arsenic trioxide, and sulphur dioxide emissions also merit management action in the near-term. For this reason, it was recommended that the federal, territorial, and municipal governments, together with aboriginal groups, negotiate a binding, multi-party, multi-faceted agreement with Royal Oak Mines to address these issues and, in so doing, protect human, community, and environmental health and well-being. It was recommended that such an agreement include goals, performance standards, provisions for addressing each priority environmental management issue, and schedules for compliance. Workshop participants noted that the potential for successful implementation would be enhanced if the agreement included incentives to encourage compliance, penalties to discourage non-compliance, and a local mechanism for invoking such penalties. It was also noted that the agreement would require provisions for periodic amendment and dispute resolution. Therefore, it was recommended that the process of drafting regulations for air emissions under the Canadian Environmental Protection Act (CEPA) be initiated in the near-term. These draft regulations were considered to be essential for providing a regulatory back-up should a negotiated agreement prove to be unworkable.

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Appendix 1

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Appendix 2

Workshop Agenda

Workshop on Controlling Arsenic Releases in the Northwest Territories

A G E N D A

Monday, July 14, 1997

8:30 - 9:00 Registration

9:00 - 9:05 Welcome Bill Howard (Environment Canada)

9:05 - 9:30 Introductions (D. MacDonald, MacDonald Environmental Sciences Ltd.)

- Welcome participants, identify objectives and anticipated outcomes; and,
- Provide each participant with an opportunity to introduce themselves.

9:30 - 10:15 Presentation on Arsenic Releases to the Environment (Laura Johnston and Ed Collins, Environment Canada)

- Introduction and background of the project;
- Sources of Arsenic Releases to the Environment (brief discussion of water and role of NWT Water Board; focus on atmosphere); and,
- Health and Environmental Effects of Arsenic.

10:15 - 10:35 Refreshment Break

10:35 - 11:30 Questions (All)

11:30 - 12:00 Work Group Session on Issues and Concerns

- The purpose of this workgroup session is to identify the issues and concerns associated with arsenic releases to the environment, to evaluate the available information for assessing the effects associated with environmental arsenic, and to determine the need for management actions to control releases of arsenic in the NWT. Focus questions to guide the discussions will be formulated based on the input received from participants.

12:00 - 13:30 Lunch

13:30 - 15:00 Work Group Session on Issues and Concerns (continued)

15:00 - 15:30 Refreshment Break

Monday, July 14, 1997 (cont.)

- | | |
|---------------|---|
| 15:30 - 16:00 | Work Group Session on Issues and Concerns (continued) |
| 16:00 - 16:30 | Work Group Reports (10 minutes each) |
| 16:30 - 17:00 | Group Discussion on Reports |

Tuesday, July 15, 1997

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|-------------|--|
| 9:00 - 9:15 | <ul style="list-style-type: none">■ Welcome and Introduction of New Participants■ Results of Public Meeting |
|-------------|--|

- | | |
|--------------|---|
| 9:15 - 10:15 | <p>Presentation on Options for Controlling Arsenic Releases to the Environment (Ed Collins and Laura Johnston)</p> <ul style="list-style-type: none">■ Description of Existing Mineral Processing System;■ Technical Options for Reducing Arsenic Air Emissions;■ Air Dispersion Modelling;■ Socio-Economic Evaluation; and■ Options for Future Action. |
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10:15 - 10:35	<i>Refreshment Break</i>
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| 10:35 - 11:30 | Questions and Clarification of Options |
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|---------------|--|
| 11:30 - 12:00 | <p>Work Group Session on Management Options</p> <ul style="list-style-type: none">■ The purpose of this work group session is to identify, evaluate, and prioritise a range of management options for controlling arsenic releases into the environment, if required. Focus questions to guide the discussions will be formulated based on the input received from participants. |
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12:00 - 13:30	<i>Lunch</i>
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|---------------|--|
| 13:30 - 15:00 | Work Group Session on Management Options (continued) |
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15:00 - 15:30	<i>Refreshment Break</i>
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|---------------|--------------------------------------|
| 15:30 - 16:00 | Work Group Reports (10 minutes each) |
| 16:00 - 16:30 | Group Discussion on Reports |
| 16:30 - 17:00 | Wrap-Up and Next Steps |

Appendix 3

Responses to Focus Questions

Q1. With respect to arsenic releases into the environment, what are the societal values that we are most concerned about conserving and protecting in the NWT (e.g., human health, environmental health, employment, etc.)?

Work Group A	Work Group B	Work Group C
<p>Work group participants recognized that everything is connected and that an ecosystem-based approach is needed to effectively conserve and protect societal values. Therefore, there is a need to move toward action on controlling arsenic releases into the environment to assure that important societal values are adequately protected. Three major types of values were identified for protection, including:</p> <ul style="list-style-type: none"> ■ Human Health and Well being, including: <ul style="list-style-type: none"> - physical health; and - mental health. ■ Community Health, including: <ul style="list-style-type: none"> - traditional culture; - lifestyles (i.e., consumption of traditional foods, camping, etc.); - economic well being (i.e., employment income and associated benefits); and, - trust between the company and the community. ■ Environmental Health, including: <ul style="list-style-type: none"> - air quality; - water quality; - sediment quality; - soil quality; - aquatic organisms; and, - plants, wildlife, other terrestrial organisms. <p>The members of the work group agreed that human health, environmental health, and social health are inter-related and must be addressed together (i.e., "life is a stew"). Therefore, there is a need to balance resource use and environmental protection goals. To achieve this balance, individuals, organizations, and society as a whole must accept responsibility for their actions and be willing to compromise (i.e., by identifying tolerable risk levels). It was also cautioned that northern ecosystems tend to be fragile and must be managed using the precautionary principle.</p>	<p>The members of the work group agreed that the First Nations traditional knowledge perspective must be incorporated into any discussion of societal values in the NWT. This perspective does not compartmentalize values, but recognizes that human, environmental, community health are strongly inter-related. This perspective also takes a long-term view, which assures that the interests of future generations are respected. The values included in this perspective include:</p> <ul style="list-style-type: none"> ■ Human Health, including: <ul style="list-style-type: none"> - physical health; - psychological health (including having confidence in the regulatory agencies); and, - perception of a healthy environment (being able to dip a cup in the lakes and rivers). ■ Environmental Health, including: <ul style="list-style-type: none"> - intrinsic value of the environment; and, - confidence in food sources. ■ Community Health, including: <ul style="list-style-type: none"> - socio-economic well being (including individual jobs and the societal costs of management options (e.g., remedial action plans); and, - transparency in determining costs and benefits. 	<p>Work group participants emphasised the importance of sustainability and stewardship, particularly as it relates to harmonization and balance between environmental health, human health and development. Participants stressed the linkages between the various mediums, emphasising that nothing is isolated and everything is connected with the environment. Participants highlighted the need to move towards the adoption of ethics of accountability and responsibility including the proper management of arsenic. Work group participants identified the need for balanced and integrated environmental data processes to monitor and gauge progress towards sustainability in the form of either voluntary or regulatory mechanisms. Two principle themes were identified for conservation and protection:</p> <ul style="list-style-type: none"> ■ Human Health and Quality of Life, including: <ul style="list-style-type: none"> - the human condition or well being to support the ability to enjoy all aspects of living for the community at large; - the occupational health and safety of employees; - social stability associated with community and economic diversity (e.g., housing, employment); and, - the livability of the future for our children. ■ Environmental Health, including: <ul style="list-style-type: none"> - quality of the water, air, food, sediments, aquatic and terrestrial species.

Q2. Relative to the conservation of these values, what are the most important sources of arsenic releases into the environment in the NWT?

Work Group A	Work Group B	Work Group C
<p>Work group participants recognized two distinct sources of arsenic release into the environment, including:</p> <ul style="list-style-type: none"> ■ Background Sources; and, ■ Anthropogenic (i.e., man-made) Sources. <p>While natural sources can account for a significant proportion of total exposure to arsenic, it was recognized that little could be done to reduce releases from these sources (e.g., dust from native rock and soils, leaching of arsenic from native rock and soils to surface and groundwater, etc.). Five major anthropogenic sources of arsenic were identified by the work group participants, including:</p> <ul style="list-style-type: none"> ■ Emissions from mining operations to air; ■ Emissions from mining operations to water; ■ Underground storage of arsenic trioxide (this was identified as a potential source of arsenic); ■ Contaminated sediments in the vicinity of mining operations (i.e., due to historical releases); and, ■ Contaminated soils in the vicinity of mining operations (i.e., due to historical releases). <p>The first three of these were identified as the highest priority sources for action because they pose significant actual or potential risks to the values that require protection, because technical options to address them are available and because they are additive and avoidable. Work group participants also noted that technical options for remediating contaminated sediments were readily available (e.g., capping with clean sediment).</p>	<p>Work group participants identified three different types of arsenic, based on the type of risk that each represented, including:</p> <ul style="list-style-type: none"> ■ Perceived high risk arsenic sources; ■ Real high risk arsenic sources; and, ■ Potential high risk arsenic sources. <p>Emissions of arsenic from the Giant Mine into the atmosphere were identified as a perceived high risk source of arsenic. While this source should not be ignored, work group participants indicated that contaminated soils and sediments probably presented higher risks to human health and the environment than do current releases of arsenic to air. It was also noted that underground storage of arsenic trioxide represents a very important potential source of arsenic. Leaching of arsenic from the underground storage stopes at the mine site could dramatically increase the risks associated with this source.</p>	<p>Arsenic releases were defined in terms of anthropogenic or natural sources. Work group participants further refined these categories to water and air emissions. Participants identified releases as existing and/or potential risk to the health and well being of the environment and community.</p> <p>The principle anthropogenic sources of arsenic releases associated with mining processes included:</p> <ul style="list-style-type: none"> ■ Water discharges as a result of existing practices (e.g., liquid effluent from tailing ponds), as well as those associated with historical practices and accumulations of contaminants in various mediums (e.g., soils and sediments); ■ Air emissions from various sources such as stack emissions, and dust blown off site (e.g., tailing ponds, contaminated soils); ■ Leakage from storage sites such as the underground storage of arsenic in stopes or vaults and the existing licensed hazardous waste disposal site; and, ■ Ground water contact and migration of arsenic materials in the stopes if the existing pumping systems required for the current storage practices is discontinued. <p>The first two sources were identified by participants as existing risks, with the latter two sources identified as existing and potential risk. In addition, work group participants identified cigarette smoking as a potential exposure route to arsenic, as well as an existing risk.</p> <p>Natural background levels of arsenic associated with air emissions and surface and ground water contact of soils and sediments were identified as existing and potential risks.</p>

Q2. Relative to the conservation of these values, what are the most important sources of arsenic releases into the environment in the NWT?

Work Group A	Work Group B	Work Group C
<p>A number of additional sources of arsenic releases into the environment in the NWT were also identified, including burning of municipal wastes, use of mine wasterock in construction (e.g., roads, bridge abutments), and Negus tailings pond. These sources were considered to be lower priority for action because they were thought to represent minor hazards to human health or the environment.</p>		

Q3. Describe any additional information that is needed to evaluate the linkages between arsenic sources and the conservation of these values.

Work Group A	Work Group B	Work Group C
<p>The work group agreed that the existing information indicates that arsenic releases in the NWT pose significant risks to human health and the environment. Nevertheless, several important information needs were identified, including:</p> <ul style="list-style-type: none"> ■ Groundwater hydrology in the vicinity of the underground arsenic trioxide storage areas at the Giant Mine (i.e., to evaluate the fate of the arsenic following mine closure); ■ Cycling of arsenic in the environment (i.e., the fate of arsenic that was historically released to soils and sediments); ■ Speciation of arsenic in air, water, soil, sediments, food products, and humans (i.e., certain forms of arsenic are more toxic than others; therefore, the forms of arsenic in each environmental compartment should be determined); ■ Effects of arsenic in soils on invertebrates, plants, and wildlife in the vicinity of the Giant Mine; ■ Effects of arsenic in sediments on benthic organisms; ■ Sub-lethal effects of arsenic on human health, including controlled studies which monitor key indicators of arsenic toxicity (e.g., biomarkers, such as skin condition, muscle control, lung condition, etc.); ■ Cumulative effects of arsenic and other contaminants when they occur together (i.e., synergistic and/or antagonistic effects); ■ Effects of various technical options for controlling arsenic releases on emissions of sulphur dioxide and other substances; and, ■ Plans and finances of Royal Oak Mines (e.g., life of the mine) to facilitate evaluation of the costs and benefits of various management options. 	<p>The work group participants agreed that there was a need to move toward action to control releases of arsenic into the environment, even though the existing information is incomplete. The information needs identified included:</p> <ul style="list-style-type: none"> ■ A central, synthesized source of available information which is easily accessible to the public; ■ Groundwater hydrology/hydrogeology in the vicinity of the Giant Mine; ■ Integrity of underground storage vaults and the potential for re-establishment of permafrost to stabilize this source following mine decommissioning; ■ Technologies to reduce emissions to all environmental compartments (air, water, soil, sediments, and underground) with associated cost/benefit analyses; ■ Levels of arsenic in wildlife, vegetables, and soils in the vicinity of Yellowknife; and, ■ Speciation of arsenic in air, water, soil, and biota. 	<p>Given the current knowledge base, work group participants highlighted that action can be taken in specific areas to control arsenic releases. However the following information gaps were identified:</p> <ul style="list-style-type: none"> ■ Baseline information on background levels of arsenic to distinguish between natural versus anthropogenic sources; ■ Sublethal effects on humans and other species and the cost of these effects in such areas as increases in health care costs; reductions in the overall ecosystem health; reductions in quality of human life; ■ Impact of air emissions on the health of the Yellowknife community; ■ Impact of discharges and leakages from tailing ponds on water quality and the protection and conservation of associated societal values (e.g., fishable, drinkable); ■ Relationship between arsenic and sulphur dioxide; ■ Compilation and review of literature sources on the effects of arsenic since the Health Canada 1993 Health Assessment Report; ■ Management options available to control the various sources of arsenic releases and the time frames associated with implementation; ■ Options available to deal with underground storage of arsenic in terms of scientific and technical capabilities, management plans, regulatory obligations, financial requirements; ■ Scientific and technical options to stabilizing solubilized arsenic over the long term to avoid an environmental risk in the future;

Q3. Describe any additional information that is needed to evaluate the linkages between arsenic sources and the conservation of these values.

Work Group A	Work Group B	Work Group C
		<ul style="list-style-type: none"> ■ Standardize air emissions testing procedures to ensure continuous monitoring; ■ Translation of levels of emissions from the scientific and technical terminology to plain language that can be readily understood by the broader community; ■ Provision of adequate and timely information to the Yellowknife community to enable sufficient assessment and evaluation of risks and options in decision making processes; and, ■ Pursue communication linkages between mining operators and the community of Yellowknife (e.g., community health authorities) to facilitate the exchange of information on arsenic releases to the air as a consequence of significant malfunctions in the mining processes. Such a linkage would assist the community of Yellowknife in implementing appropriate health responses.

Q4. Considering the values that we wish to conserve, what other management options should be considered for controlling arsenic releases in the NWT?

Work Group A	Work Group B	Work Group C
<p>Work group participants identified a number of additional technical and management options for controlling arsenic releases into the environment. The additional technical options included:</p> <ul style="list-style-type: none"> ■ EMR microwave process could provide a means of improving gold recoveries, reducing emissions, lowering operating costs, and addressing the underground storage of arsenic. Therefore, it was recommended that this technology be fully evaluated. It was noted that the CAW is willing to cover the costs associated with conducting a preliminary evaluation of this process with refractory ore and arsenic trioxide from the Giant Mine; ■ MIT-13 microbe process could provide a means of transforming arsenic trioxide into a less soluble form. More information is needed to evaluate the applicability of this technology; and, ■ A cost-sharing arrangement could be developed with the Con Mine to employ its autoclave to deal with some of the arsenic trioxide produced at the Giant Mine. <p>Work group participants indicated that the Task Force report presented a range of management options that were likely to provide a means of addressing concerns related to arsenic releases to the atmosphere. However, several important refinements to these management options were proposed, including:</p>	<p>The members of the work group reviewed the technical and management options that were identified in the Task Force report. Based on the results of these discussions, work group participants agreed that there was a need to develop a comprehensive approach to controlling releases of arsenic into the environment. Such an approach would include the following elements:</p> <ul style="list-style-type: none"> ■ Identification of the targets for source of arsenic, including air, soil, underground storage, surface storage, and water; ■ Determination of which of the technical options best protect each environmental compartment; and, ■ Implementation of a comprehensive management approach which relies on a continuum of options ranging from voluntary to regulatory. The selection of specific options for addressing particular issues would consider the need to protect human, community, and environmental health over the short-term and well into the future. <p>More specifically, it was agreed that monitoring would be best carried out by developing effective partnerships between non-governmental organizations, First Nations, municipalities, industry, government of the Northwest Territories, and the federal government. Any agreements that are negotiated should be binding, cover a range of issues (e.g., emissions to air, underground storage, discharges to water, and sulphur dioxide emissions), and include a broad range of interest groups. Such arrangements would encourage good science, good engineering, and good government.</p>	<p>Work group participants considered the list provided by Task Force participants to be comprehensive and inclusive of the various available technologies. Participants did highlight the need to seriously consider the viability and feasibility of other technologies specifically EMR. Participants agreed that one should aim to eliminate as many pollutants as possible with a single technical solution.</p>

Q4. Considering the values that we wish to conserve, what other management options should be considered for controlling arsenic releases in the NWT?

Work Group A	Work Group B	Work Group C
<ul style="list-style-type: none"> ■ Development of a negotiated agreement which includes site-specific management plans that have been agreed to by industry, labour, First Nations, non-governmental organizations, and government agencies; ■ Development of incremental management plans, either voluntary or mandatory, which identify specific actions that must be completed by specific dates. The plans should provide incentives for successful completion of tasks on schedule and disincentives for falling short of the targets identified in the plans; and, ■ Development of a reclamation fund by Royal Oak to assure that sufficient funds are available to address concerns related to existing arsenic emissions and mine reclamation. 	<p>Thus arsenic management could have the federal government manage arsenic under CEPA, the Territorial government manage sulphur dioxide emissions, and the NWT Water Board and local governments manage water and underground storage issues.</p>	

Q5. What factors should be considered during the evaluation of the various management options that have been identified?

Work Group A	Work Group B	Work Group C
<p>Work group participants identified a number of factors that should be considered during the evaluation of the various technical and management options for controlling arsenic releases into the environment. With respect to the technical options, the criteria for selecting the most appropriate actions include:</p> <ul style="list-style-type: none"> ■ Effectiveness - that is, the technical option should reduce the risks to human health and the environment associated with arsenic releases (i.e., reduce loadings of arsenic); ■ Feasibility - that is, it should be likely that the technical option can be successfully implemented at the Giant Mine; ■ Cost:Benefit Ratio - that is, the costs associated with implementation of the technical option should be justified based on the benefits to human, environmental, and social health and well being; ■ Reliability - that is, the technical option should be effective for an extended period of time and have a high resale value; and, ■ Synergy - that is, the technical option should address multiple issues, such as arsenic and sulphur dioxide releases. <p>A broader range of criteria were proposed for evaluating the various management options for reducing arsenic releases into the environment, including:</p> <ul style="list-style-type: none"> ■ Effectiveness - that is, the management option should provide a basis for reducing the risks to human health and the environment associated with arsenic releases (i.e., reduce actual and potential exposure to arsenic); 	<p>The members of the work group identified a total of five factors that must be considered while evaluating various options for controlling arsenic releases into the environment, including:</p> <ul style="list-style-type: none"> ■ Determine management goals (that is, the end result of the management process must be clearly defined); ■ Establish definite emission standards (that is, clear target must be defined and appropriate rationale provided for those targets); ■ Assess the feasibility of the option (that is, can the option be implemented with the technology that is currently available, is it likely to be successful, and are the results of the cost/benefit analysis favourable); ■ Implement the management plan in a timely manner (that is, it should be practicable to implement the option in the near-term); and, ■ Monitor performance (that is, are there mechanisms to ensure compliance and to alleviate public concerns). 	<p>Work group participants identified a number of factors that should be considered in the screening of the various management options. Participants also highlighted the need to consider weighting these various factors in such an evaluation process. The following themes emerged, including:</p> <ul style="list-style-type: none"> ■ Multifaceted approach that enables the ability to control more than a single source of arsenic releases. ■ Highly effective, including: <ul style="list-style-type: none"> - complementing other existing regulatory structures and time tables (e.g., Water Board, License Renewal process); - providing a high degree of certainty in achieving desirable outcomes based upon specific time frames and commitments; and, - alternative or secondary mechanisms for non-compliance to ensure the enforceability of desired outcomes (i.e., regulatory performance specifications, positive and negative leverages). ■ Efficient, including: <ul style="list-style-type: none"> - flexibility to achieve outcomes through alternative measures or processes rather than specific techniques (i.e., does one specify a process or establish a standard based upon Best Available Technology (BAT) or health effects base; quantitative measurements by concentration or volumetric flow rate; or ambient quantity); and providing a degree of economic gain with respect to cost/benefits to both the company and to society.

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<ul style="list-style-type: none"> ■ Timeliness - that is, the management option should provide a means of reducing arsenic releases in the near-term (i.e., reflect the urgency of the issue); ■ Comprehensiveness - that is, the management option should provide a means of addressing multiple issues (e.g., air emissions, underground storage, etc.); ■ Flexibility - that is, the management option should provide a means of dealing with air in the near-term and other issues subsequently; ■ Openness - that is, the management option should facilitate involvement by all interested parties and should be based on full disclosure; ■ Enforcement - that is, the management option must include mechanisms that assure compliance, including monitoring of emissions, progressive discipline for non-compliance, and a regulatory hammer); and, ■ Cost:Benefit Ratio - that is, the costs associated with implementation of the management option should be justified based on the benefits to human, environmental, and social health and well being; 		<ul style="list-style-type: none"> ■ Quality, including: <ul style="list-style-type: none"> - overall safety of various alternative solutions with respect to health of the employees, community and ecosystem; - technical capacity to operate the management options and the potential for training of employees; and, - technical performance of the various options should provide an environmental gain, that is the by products of the technology should not create a greater negative environmental impact (e.g., in terms of toxicity and requirements for storage of hazardous materials). ■ Quantity as it relates to the ability to respond to more than other sources of pollutants rather than being limited to only arsenic releases. ■ Costs, including: <ul style="list-style-type: none"> - the financial resources required to create mechanisms to control releases (e.g., Is the cost to society to create regulations more or less expensive than covenants?); - the implications of not taking action, but rather maintaining the status quo (e.g., the environmental cost with regards to ecosystem health and societal well being); - the economic viability of the option to the company with respect to capital and operating expenditures (e.g., although pressure oxidation is the Best Available Technology (BAT) today, it is not economically feasible for the company given existing reserves); and, - the opportunity for economic gain to the company, or the ability to recoup costs associated with implementing one technology over another (e.g., the cost and benefits).

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		<ul style="list-style-type: none"> ■ Time Frame, including: <ul style="list-style-type: none"> - the necessity for an immediate solution versus delaying action, and for how long. Based upon this judgement the evaluation of various options will vary particularly as to whether technical options for control and remediation are currently available; and, - the schedule required for implementation and establishment of a management regime for a given technical process. For example the technological capacity to control air emissions is available and can be implemented fairly quickly, however tenacious effort will be required to deal with the long term ramifications of underground storage of arsenic. ■ Probability of Community Acceptance, including the opportunity: <ul style="list-style-type: none"> - to create multi-task agreements through cooperation versus an adversarial atmosphere; - to address the historical divide and absence of trust between the community and the operators of the mine; - to establish a community monitoring program (e.g., health of citizens, drinking water, food) in concert with a proposed management option; - to differentiate between and raise awareness of historical environmental impacts versus existing and potential impacts in order to solve problems that exist, rather than focusing limited resources on perceived problems; and, - to evaluate impacts on levels of employment.

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		<p>In the creation of covenants and agreements work group participants highlighted the following questions with regards to structuring participation, including:</p> <ul style="list-style-type: none"> - How do you determine who is the community (e.g., City Authorities, First Nations, citizens)? - How do you involve the community effectively? - What level of governments should be involved (e.g. local, territorial, federal)?

Q6. Of the management options that have been identified, which ones are likely to best support the conservation and protection of the values that were identified yesterday?

Work Group A	Work Group B	Work Group C
<p>The work group participants evaluated the various management options that were proposed by the Task Force and during the workshop in terms of their ability to conserve and protect human, environmental, and social health and well being. Based on this evaluation, it was recommended that a two-pronged approach be used to control arsenic releases into the environment in the NWT, including a voluntary and regulatory component. The voluntary component would consist of some type of agreement with Royal Oak Mines that would be drafted by a working group (consisting of representatives from First Nations, industry, labour, NGOs, and government) and:</p> <ul style="list-style-type: none"> ■ Employ a staged approach, in which emissions of arsenic to air are addressed in the near-term and a broader range of issues (e.g., SO₂ emissions, mine safety, underground As storage, etc.) are included as the mechanisms for developing and implementing the agreement are established; ■ Include specific loading reduction targets (and associated rationale) and schedules for compliance; ■ Include incentives to encourage compliance and penalty provisions to dissuade non-compliance (e.g., performance bonds and other remedies); ■ Eliminate the Minister's discretion to not invoke penalties for non-compliance (this provision is needed to assure other participants that a negotiated agreement will be enforced by government); ■ Identify research and monitoring requirements (e.g., stack emissions, air quality, environmental effects, human health, etc.); 	<p>The members of the work group agreed that a legally-binding, multi-party, multi-faceted agreements should be negotiated to control releases of arsenic into the environment in the NWT. It was also agreed that such an agreement should address a range of environmental issues, including releases of arsenic to air, releases to water, and underground storage of arsenic trioxide. Releases of sulphur dioxide to air should also be included in this agreement. It was recognized that the terms of the agreement should include a continuum of options ranging from voluntary to regulatory. A number of regulatory instruments that could assist in achieving the desired level of environmental protection were also identified, including:</p> <ul style="list-style-type: none"> ■ An interim ministerial order; ■ Increasing the performance bond by the NWT Water Board; ■ Creating a Pollution Control Board similar to the NWT Water Board; and, ■ Creating community driven processes to deal with historic releases of arsenic, which could include multi-party monitoring beyond geographic boundaries of a single mine. <p>Importantly, the members of the work group agreed emissions to air are important; however, releases to water and underground storage of arsenic trioxide represent more urgent issues that must be effectively addressed by the NWT Water Board.</p>	<p>Applying the factors identified above, work group participants provided a preliminary assessment of the various management options likely to best support the conservation and protection of the values that were identified yesterday. The management options considered, included: 1) maintaining the status quo; 2) regulatory mechanisms; and, 3) negotiated agreements (e.g., structured voluntary agreements and covenants). Based upon the discussions, participants did not support maintaining the status quo. Clearly the conservation and protection of the values identified on Day One would not be supported by a do nothing approach. Whether the mechanism was regulatory or negotiated a multi-faceted approach was favoured over single focus. In addition, participants favoured the inclusion of binding mechanisms over non-binding in negotiated agreements (i.e., VSA or covenants). In terms of an overall assessment it was felt that a binding, multifaceted covenant would best support the conservation and protection of human health, quality of life and environmental health values identified on Day One.</p> <p>Work group participants provided a preliminary screening of the various technical options presented by the Task Force. It was felt that pressure leaching although technically viable is economically unfeasible. Biological leaching was considered to be technically achievable, but high risk. Atmospheric leaching was deemed not to be applicable to the management situation.</p>

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<ul style="list-style-type: none"> ■ Facilitate consultations and coordinated communications with the community; ■ Include provisions for resolving any disputes that might arise; and, ■ Include provisions for periodically amending the agreement. <p>Work group participants also recognized that gold roasting is still a viable technology and that additional gold roasters could be build elsewhere in Canada in the future. Therefore, it was recommended that the process of drafting regulations under CEPA be initiated in the near-term. Such regulations were considered to provide a regulatory back-up should a negotiated agreement prove to be unworkable.</p>		<p>Wet scrubbing, wet electrostatic precipitation and wet electrostatic precipitation plus carbon absorption are all technically and economically viable; however, none of the options address multiple sources of releases or types of pollutants. It was noted that the wet scrubbing is the most cost effective of the three processes. Participants concluded that improvements to the existing processes would provide little to no potential for an overall gain, however maintaining the status quo would not be deemed acceptable. Although the Task Force did not propose EMR participants noted that this option should be more fully investigated. Participants cautioned that this initial evaluation is very preliminary in nature, and requires more detailed discussions.</p>