

Regulatory Barrier Identification and Analysis – Green Mining

Final Report



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GLOSSARY OF TERMS

ACGIH – American Conference of Governmental Industrial Hygienists

CMIC – Canada Mining Innovation Council

CSIRO – Commonwealth Scientific and Industrial Research Organization

ERO – Environmental Rejects Objectives

GMI – Green Mining Initiative

MAC – Mining Association of Canada

MNP – Meyers Norris Penny

NRCan – Natural Resources Canada

NSERC – Natural Sciences and Engineering Research Council of Canada

SR&ED – Scientific Research and Experimental Development

TLV/TLVs – Threshold Limit Values

EXECUTIVE SUMMARY

Meyers Norris Penny (MNP) was engaged by Natural Resources Canada (NRCan) to identify any federal and provincial government regulatory barriers for the adoption of green mining technologies and practices in Canada's mining sector. Two other reports were recently completed for NRCan on barriers to green mining; however, these reports did not agree as to what current regulatory barriers exist or are perceived to exist. The purpose of our analysis was to confirm what barriers, if any, do exist and provide initial analysis on each barrier.

In addition to initial identification and analysis, an assessment was to be provided on a select number of barriers identified by NRCan as the most critical. For each of the barriers selected, analysis was to be presented on how it affects green mining innovation generally across Canada. Potential solutions to address these barriers were also to be provided.

In order to complete our analysis, it was decided that MNP would interview a number of federal, provincial and territorial government officials, as well as industry contacts. A list of contacts was developed in collaboration with NRCan which included federal regulators as well as regulators from each province and territory. The Canada Mining Innovation Council (CMIC) and the Mining Association of Canada (MAC) were also included on the list as initial industry contacts. With input from CMIC, MAC and industry regulators, a list of mining companies to contact regarding this topic was developed and approved by NRCan.

A total of 31 government and industry organizations were contacted for an interview and 24 interviews were conducted. As some interviews involved a number of participants, the total number of individuals consulted for our analysis was 33.

Our analysis suggests that there are no specific federal, provincial or territorial regulations in place that act as barriers to the implementation of green mining technologies and processes. Governments enact regulations to reflect public interest in protecting the environment as much as possible. As a result, regulations in place identify the minimum levels of compliance companies must adhere to and do not restrict companies from exceeding these levels. While barriers are not in the regulations themselves, a variety of barriers exist in regulatory processes and other factors including but not limited to regulatory criteria and the interpretation of regulations.

The major themes that emerged throughout the course of our analysis include the following four points.

1. Perceived and Real Barriers in Approval Processes

While it was noted by several respondents that regulations allow for flexibility in a company's approach to regulatory compliance, approval process may be negatively affecting the uptake of green mining technologies. The potential for delays in the environmental assessment process with introducing a new technology that does not have a demonstrated track record acts as a deterrent for some mining companies. Regulators often require verifiable evidence of a new technology's performance which takes time and resources that some companies may not be able to afford. Because of the potential for approval delays and the uncertainty as to whether a new technology will be approved, a company may choose to make use of proven technologies that will ensure a quicker approval process.

In addition to approval delays related to the use of new technologies, some jurisdictions have indicated that there is often a duplication of efforts required in order to ensure operational compliance at the provincial, territorial and federal levels.

2. Risks Associated with being a Technology Leader

Being the first company to implement a new technology involves a significant amount of risk. A large amount of money may be spent by a company to develop a technology that might not be approved by regulators due to uncertainty regarding the technology's performance. The risk undertaken by a company is not only monetary; the time and effort required for the approval of a new technology or process has the potential to cause significant project delays. As a result, while mining companies may be interested in being innovative, they are also interested in being "the first to be second" to implement a new technology as they know it will work, that the cost undertaken by the company will be less and that the approval process will be smoother as the technology has been proven to work by a preceding company.

To lessen the financial risk assumed by a company when implementing innovative technologies, it was proposed that the government could assume some of the risk by providing increased funding both at the research and development and commercialization stages. Despite the economic significance of mining to remote and Northern communities as well as across Canada as a whole, there is limited government funding available to the mining industry compared to other industries such as energy, oil and gas and forestry. Increased funding is required in order to improve the environmental performance of mining and ensure the Canadian mining industry can continue to compete with other mining jurisdictions.

3. Lack of Incentives to Encourage Green Technology Development and Demonstration

Some respondents have indicated that the business model of the mining industry does not provide direct financial incentives to exceed the regulated standard; therefore, most companies are satisfied meeting existing standards and focusing on maximizing return to their shareholders. As a result, improved government incentives are needed in order to provide motivation to pursue the implementation of new technologies that exceed the regulated standard but that also carry more financial risk. The SR&ED credit was often mentioned as a less effective tax credit that has lower uptake by industry as it requires a large amount of effort for a "minimal benefit." It was also indicated that mining companies who have been proactive and acted in advance of a regulation later had difficulty obtaining credit for their efforts once the regulation was enacted.

4. Opportunities for Improved Communication between Government and Industry

There is a need for improved communication between government and industry related to the evolution of the regulatory framework and the design of future regulations. Several interviewees indicated that it is difficult for industry to translate what the government communicates to them into something tangible – for instance, what terms such as "world class", "clean air", "clean water" and "green" really mean and what is then required from industry. More specific language such as "particulate matter" or "diesel hybrids" would provide industry with more certainty that actions they take will meet government goals, and ultimately help to alleviate some of the risk involved in investing in new technologies and practices. While regulations that are not prescriptive provide flexibility, they also create uncertainty for companies who want to ensure that the technologies they are proposing to use will adhere to regulatory requirements. Many initiatives can be undertaken to lessen the environmental footprint of mining; therefore, proper balance between being prescriptive and flexible is required to provide industry with the confidence to move forward with the implementation of green technologies.

Further direction on the types of data required by government to properly assess a new technology is also required. It is felt that when it comes to the implementation of innovative technologies that the "devil is in the details." Criteria used by the government to assess new technologies are generic and vague, making it hard for companies to prepare all data required and ensure the approval

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process is not slowed as a result of insufficient data. This lack of detail regarding what is required by the government to properly assess a technology may prevent companies from including the use of green mining technologies in their operations.

Improved communication is also needed to support initiatives such as NRCan's Green Mining Initiative (GMI). It was indicated that the mining industry has had a bad reputation for a significant period of time and as a result, initiatives such as GMI are beneficial as they encourage less intrusive practices in mining and work towards improving public opinion of mining operations. However, many government and industry stakeholders were unfamiliar with the goals of the GMI and were uncertain as to what "green mining" connotes. More specific language is required to communicate the details as to why a particular technology may be greener than another in order to both guide the future technology implementation decisions of industry and to gain social licence for industry to implement these technologies.

It appears that the most significant barrier to the implementation of green mining technologies and processes is effective and efficient communication and collaboration between government and industry. Addressing this issue can ensure that industry is aware of the present and future direction of government and is provided with adequate information on regulatory criteria and standards. It can also result in increasing the knowledge base of regulators regarding new technologies, which could then assist in improving the speed of approval processes. Collaborative communication efforts can also improve public perception of mining in general as well as a mining company's ability to obtain a social licence to operate. In short, creating new and improving current methods of communication is key to addressing many of the barriers that currently discourage companies from implementing green technologies and processes.

1. INTRODUCTION

1.1. PROJECT MANDATE

Meyers Norris Penny (MNP) was engaged by Natural Resources Canada (NRCan) to identify any federal and provincial government regulatory barriers for the adoption of green mining technologies and practices in Canada's mining sector. Two other reports were recently completed for NRCan on barriers to green mining; however, these reports did not agree as to what current regulatory barriers exist or are perceived to exist. The purpose of our analysis was to confirm what barriers, if any, do exist and provide initial analysis on each barrier.

In addition to initial identification and analysis, an assessment was to be provided on a select number of barriers identified by NRCan as the most critical. For each of the barriers selected, analysis was to be presented on how it affects green mining innovation generally across Canada. Potential solutions to address these barriers were also to be provided.

For the purposes of our analysis, green mining is defined as:

Technologies, best practices and mine processes that are implemented as a means to reduce the environmental impacts associated with the extraction and processing of metals and minerals, not just during the life of the mining operation, but throughout a mine's life cycle, with a goal to make lasting environmental improvements that will continue once the mineral resource has been exhausted compared to traditional mining techniques.

Barriers are defined as:

Tangible impediments to the application of greener mining practices (technologies or processes) that result from the application or interpretation of federal and/or provincial and territorial statutes.

The report that follows is expected to be used to inform federal and provincial Ministers on green mining regulatory issues prior to the national energy and mines conference in 2011.

1.2. PREVIOUS WORK

As noted, two reports were recently completed for NRCan that spoke to barriers for the adoption of green mining technologies and practices in Canada's mining sector:

1. Status of Green Mining in the Canadian Mining Sector, April 2010
2. Identifying Policy Barriers to Implementing Green Mining Technologies and Practices in Canada – Final Report, October 4, 2010

The following provides a summary of the key issues, barriers and gaps identified in these reports that are relevant to the present study.

Status of Green Mining in the Canadian Mining Sector

Among other materials and expertise, this report is built upon the results of a survey administered to individuals in industry, academia, government and consulting to gather information regarding environmental issues facing Canada's mining industry. The report notes a number of barriers to innovation in green mining technologies and practices, including policy barriers. The report summarized the key policy barriers and potential solutions as follows:

- *A number of respondents noted that government needs to play a role in incentivizing greener practices by optimizing incentives such as financial measures that could be used to reduce or eliminate financial barriers.*
- *Other respondents noted ineffective policies and regulations as a barrier to progress whether it was intergovernmental issues, inter-ministerial issues or combinations of the two. The desire for government to take an active role in efforts towards harmonization between the provincial and federal governments on environmental issues was a recurring theme.*
- *Several respondents depicted leadership in green mining as limited. Issues such as the absence of compliance drivers (government or corporate policy), lack of incentives to act in the absence of policy drivers and insufficient economic rationale suggested that there is a role for government to facilitate interest and commitment and to bridge the gap between policy uncertainty and economic rationale for action.*

Other important barriers were noted around ecological risk assessments. The report stated that most federal, provincial and territorial authorities have guidelines regarding emissions and discharge targets for generic application. Therefore, these guidelines do not fit well with all mining operations; in some cases the guidelines are too stringent, and in others below levels that naturally occur at the site. As well, approaches to establish site-specific guidelines are limited and do not always make use of more recent tools. Concern was expressed “that in trying to meet generic criteria, some technologies that may actually be useful and effective in meeting site-specific conditions could be excluded from consideration.” Furthermore, guidelines developed by federal and provincial/territorial authorities were seen as often overlapping, sometimes causing confusion as to which guidelines to follow.

Identifying Policy Barriers to Implementing Green Mining Technologies and Practices in Canada

This study built upon the report on the status of green mining in Canada’s mining sector in order to confirm whether government regulatory barriers for the adoption of green mining technologies and practices exist and their effect. Interviews were conducted with mining stakeholders from federal and provincial governments, industry associations and the private sector. The key findings from these interviews are as follows:

1. *Regulations do not establish tangible barriers to Green Mining*
2. *The process of assessing and approving environmental performance is resulting in challenges for regulators, communities and mining companies, including:*
 - a. *Lack of information/evidence on the performance of a novel or new mining technology increases perception of risk*
 - b. *Capacity to substantiate/verify the performance of new technologies for regulators and communities*
 - c. *The ability to define the stringency of environmental standards to address local eco-system concerns*

The report’s conclusion was as follows:

When individuals (regulators, communities or business) are faced with making a decision in the presence of uncertainty they will typically migrate to what they know (existing and proven technologies and processes). This represents a noteworthy barrier to the investment in and implementation of greener mining practices.

2. METHODOLOGY

In order to complete our analysis, it was decided that MNP would interview a number of federal, provincial and territorial government officials, as well as industry contacts. A list of contacts was developed in collaboration with NRCan which included federal regulators as well as regulators from each province and territory. The Canada Mining Innovation Council (CMIC) and the Mining Association of Canada (MAC) were also included on the list as initial industry contacts. With input from CMIC, MAC and industry regulators, a list of mining companies to contact regarding this topic was developed and approved by NRCan. Several criteria were considered when developing this list:

- Location of operations: Representation of mining companies from as many Canadian jurisdictions as possible
- Size of company: Representation of both large and junior mining companies
- Type of operations: Representation of as many different types of mining operations as possible

A total of 31 government and industry organizations were contacted for an interview and 24 interviews were conducted. As some interviews involved a number of participants, the total number of individuals consulted for our analysis was 33. MNP was able to conduct interviews with regulators in all jurisdictions except Nunavut and Prince Edward Island. However, Indian and Northern Affairs Canada, which was interviewed as part of our analysis, currently acts as Nunavut's main regulator. Prince Edward Island declined an interview on the basis that the Province does not have a history of mining.

A complete list of stakeholders interviewed for this report has been provided in Appendix A. The interview guide, provided in Appendix B, outlines the topics covered during the interviews. It is important to note that questions asked during the interviews varied depending upon the responses received from the interviewees and subsequent requests from NRCan to begin inquiring about specific topics of interest.

An interim report was issued by MNP on March 31, 2011 which provided a summary of the findings from the interviews completed as of that date. A summary of findings and themes that emerged as at April 26, 2011 was also provided to NRCan. The following report outlines the key and secondary findings gathered during the course of the entire analysis. The findings were derived entirely from the interviews conducted.

3. KEY FINDINGS

Findings suggest that there are no specific federal, provincial or territorial regulations in place that act as barriers to the implementation of green mining technologies and processes. We consistently heard from stakeholders that the barriers “are not in the regulations themselves, but rather the regulatory process and other influences from external factors”. Regulations have become more stringent over the years when it comes to the protection of the environment; at the same time, it appears that when government regulations are adjusted, they are adjusted to reflect what progressive mining companies are undertaking in terms of implementation of new mining technologies and processes.

The major themes that emerged throughout the course of our analysis include the following four points.

1. Perceived and Real Barriers in Approval Processes

While it was noted by several respondents that regulations allow for flexibility in a company’s approach to regulatory compliance, approval process may be negatively affecting the uptake of green mining technologies. The potential for delays in the environmental assessment process with introducing a new technology that does not have a demonstrated track record acts as a deterrent for some mining companies. Regulators often require verifiable evidence of a new technology’s performance which takes time and resources that some companies may not be able to afford. Because of the potential for approval delays and the uncertainty as to whether a new technology will be approved, a company may choose to make use of proven technologies that will ensure a quicker approval process.

One jurisdiction indicated that geology, scoping, pre-feasibility and feasibility work for a mining operation occurs at the same time as the environmental assessment process. As a result, companies may come across technologies or processes they can use to operate more efficiently while the assessment process is occurring. Depending upon the time of this discovery it can be difficult for regulators to change direction to accommodate the inclusion of a different process or technology as information has to be provided prior to a hearing before the approvals board. If a company wants to make changes after this hearing it can lengthen the approval process significantly, especially when taking into account the additional time required to provide adequate data regarding the performance of an innovative technology or process.

Solutions to this issue are difficult to identify as proper precautionary measures must be taken by all levels of government to be certain that new technologies are safe and that appropriate contingency plans are put in place if the technologies fail. However, it was noted that there are opportunities for improving the amount and quality of ongoing dialogue between regulators and industry to discuss potential new technologies and potential requirements for approval.

In some cases the pace of regulatory change can also affect the timeliness of approval processes. In one province, mine ventilation regulations in place are currently too specific to diesel-powered equipment. These regulations determine compliance by using measurements that can only be calculated when diesel-powered equipment is used. As a result, significant effort is required from both mining companies and regulators to determine how other technologies, such as hybrid equipment, can be included in mining operations and how compliance will be measured. One company indicated that this situation is part of the reason why it does not use hybrid equipment in this jurisdiction as extensively as it does in others that recognize the use of this technology.

It was suggested that standards that are measurable regardless of the technology used, such as air quality, should be developed rather than using compliance standards specific to a certain technology. This would eliminate the need for regulatory changes as technology evolves as well as the additional effort from both industry and regulators to find ways to approve the use of new technologies at mining operations prior to regulatory change.

In addition to approval delays related to the use of green technologies, some jurisdictions have indicated that there is often a duplication of efforts required in order to ensure operational compliance at the provincial, territorial and federal levels. For instance, where regulations vary from province to province it becomes inefficient for companies.

Some companies indicated that the lack of alignment of regulations and targets between the provincial, territorial and federal systems leaves them in the position of “middle-man” between the different government departments. The differences between green house gas emissions targets set by the federal and provincial governments was put forth as an example of where coordinated efforts amongst government departments to more closely align regulations would be beneficial, allowing for more certainty that a particular technology will comply with all regulations.

It was suggested that instituting a single national regulator could help to streamline the approval process within Canada. However, it is important to recognize that there are a number of constitutional realities that make this a potentially unlikely outcome. As well, one provincial/territorial jurisdiction indicated that it manages its internal approval processes by having a single environmental assessment act. Although it was indicated that regulators still spend a significant amount of time assessing new technologies and asking for multiple opinions including that of the public, less work is required from mining companies to ensure compliance with multiple systems.

2. Risks Associated with being a Technology Leader

Being the first company to implement a new technology involves a significant amount of risk. A large amount of money may be spent by a company to develop a technology that might not be approved by regulators due to uncertainty regarding the technology’s performance. The risk undertaken by a company is not only monetary; the time and effort required for the approval of a new technology or process has the potential to cause significant project delays. As a result, while mining companies may be interested in being innovative, they are also interested in being “the first to be second” to implement a new technology as they know it will work, that the cost undertaken by the company will be less and that the approval process will be smoother as the technology has been proven to work by a preceding company.

To lessen the financial risk assumed by a company when implementing innovative technologies, it was proposed that the government could assume some of the risk by providing increased funding both at the research and development and commercialization stages. Despite the economic significance of mining to remote and Northern communities as well as across Canada as a whole, there is limited funding available to the mining industry compared to other industries such as energy, oil and gas and forestry. The amount of funding that is available to the mining industry appears to be decreasing as well. For example, it was indicated that the Natural Sciences and Engineering Research Council of Canada (NSERC) has shifted from multi-year funding to funding that must be renewed annually, affecting the types of projects that can be undertaken with NSERC assistance. Increased funding is required in order to improve the environmental performance of mining and ensure the Canadian mining industry can continue to compete with other mining jurisdictions. Funding increases would be particularly valuable for smaller mining companies who may be financially able to implement new technologies but not to develop them themselves.

Another method to lessen risk proposed the formation of collaborative partnerships to support the development and demonstration of applied green technologies specific to industry needs. While the protection of proprietary and patented technologies can provide barriers to such partnerships, there is room for mining companies to work together and pool financial resources to forward new technologies that would be of benefit to the entire industry.

Several examples of existing partnerships in Canada were noted including CMIC. In general, it is understood among the mining companies interviewed that CMIC is working towards coordinating efforts related to research and development of new and innovative technologies and processes in order to

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minimize duplication of efforts. CMIC will also play a role in the demonstration of new technologies and will be ready to start funding certain types of projects soon. However, this organization is still in its infancy and in a few years it will be better understood what progress has been made.

It is also felt that some mining companies may not be receiving enough support from provincial mining associations. Provincial associations do not always include all industry players; as a result, major companies may be overrepresented, while smaller companies do not receive enough representation and therefore may not be aware of what is occurring in the industry around them.

As a result, some jurisdictions feel that there is room for improvement in this area at both the provincial and national level. The Commonwealth Scientific and Industrial Research Organization (CSIRO) and AMIRA International in Australia were given as examples of successful research partnerships. Both organizations are funded by both the public and private sectors and complete many collaborative and applied research projects. One interviewee indicated that companies with operations in both Canada and Australia spend more on research in Australia through organizations such as CSIRO and AMIRA as they currently see more positive results there rather than in Canada.

On the other hand, it is felt among some companies that government-industry partnerships that sponsor non-proprietary research are not always relevant to industry needs. Research needed by larger companies can be very specific and, as these companies tend to have their own research and development departments, this research can be completed in-house without outside assistance. This method ensures the protection of intellectual property rights as well. One large private firm indicated that it finds more benefit from forming research consortiums with other private companies to pursue research initiatives when it is perceived as needed, such one consortium that sponsors research on acid mine drainage. As a result, it is felt that research organizations funded by both the public and private sector provide greater benefits to smaller mining companies who may not have in-house research capabilities.

3. Lack of Incentives to Encourage Green Technology Development and Demonstration

Some respondents have indicated that the business model of the mining industry does not provide direct financial incentives to exceed the regulated standard; therefore, most companies are satisfied meeting existing standards and focusing on maximizing return to their shareholders. As a result, improved government incentives are needed in order to provide motivation to pursue the implementation of new technologies that exceed the regulated standard but that also carry more financial risk. The Scientific Research and Experimental Development (SR&ED) credit was often mentioned as a less effective tax credit that has lower uptake by industry as it requires a large amount of effort for a “minimal benefit.” It was also indicated that mining companies who have been proactive and acted in advance of a regulation later had difficulty obtaining credit for their efforts once the regulation was enacted.

An exception was noted in one jurisdiction where there is a regulation in place that acts as a contract between mining companies and the government and requires mining companies to try to find ways to reduce environmental rejects levels. Companies must try to reach Environmental Rejects Objectives (ERO) calculated by the government and prove that they employed all possible efforts to achieve the objectives. During this time, a fee is charged to companies on rejects over ERO levels. After five years the ERO are then written into regulations. Therefore, this process involves both a regulation incentive and a financial incentive to exceed the current regulatory standard.

It was also indicated that progressive mining companies realize that a larger investment in a green technology up front can provide more benefits in the long-term, including operational efficiencies resulting in cost savings and becoming known as a leader in the industry. It is felt that the cost-benefit of these technologies should be stated more clearly by government and that this could contribute to an increase in the number of companies choosing to implement new technologies. Nevertheless, it was indicated that smaller mining companies may not have the expertise or financial means to invest in new green technologies, leading them to focus upon meeting existing standards rather than pushing forth innovation.

Therefore, there is a need for an increased number of incentives to research, develop and implement green technologies. The process involved to obtain incentives should also be faster and more efficient, as it is felt that this would lead to greater uptake of these incentives by industry. While the additional risk associated with implementing new technologies would still be higher than that of proven technologies, the financial reward would be higher as well with more numerous and easily obtainable incentives. Potential incentives suggested by stakeholders included the following:

- Accelerated depreciation on new technologies
- Tax credits for capital costs related to developing new technologies
- Royalty rate reduction linked to environmental performance on a sliding scale where the first company to implement a new technology receives the largest benefit, the second receives less and those that follow afterward receive little or no benefit

It is clear that incentives based on hard deliverables as well as incentives for research and development are needed. While some stakeholders have indicated a preference for results-based incentives, they have also stated the importance of funding research that may not result in the successful development of a new technology. Research that demonstrates that a new technology will not be effective in the field is as valuable as research that results in technology development since it indicates areas where resources should not be used in the future. It was suggested that further analysis of incentives and supports to other strategic, high-gross industries should be undertaken to determine whether the mining sector is receiving an equivalent proportion.

4. Opportunities for Improved Communication between Government and Industry

There is a need for improved communication between government and industry related to the evolution of the regulatory framework and the design of future regulations. Several interviewees indicated that it is difficult for industry to translate what the government communicates to them into something tangible – for instance, what terms such as “world class”, “clean air”, “clean water” and “green” really mean and what is then required from industry. More specific language such as “particulate matter” or “diesel hybrids” would provide industry with more certainty that actions they take will meet government goals, and ultimately help to alleviate some of the risk involved in investing in new technologies and practices. While regulations that are not prescriptive provide flexibility, they also create uncertainty for companies who want to ensure that the technologies they are proposing to use will adhere to regulatory requirements. Many initiatives can be undertaken to lessen the environmental footprint of mining; therefore, proper balance between being prescriptive and flexible is required to provide industry with the confidence to move forward with the implementation of green technologies.

Currently, it is felt that the onus is on industry to try to find out what government regulators are trying to communicate to them. This situation makes it difficult for companies to prepare and invest in advance of future regulatory direction. While some firms strive to exceed the regulated standard for reputation purposes in spite of this, other companies are apprehensive about spending money to implement technologies that exceed current standards as they are unsure that they will receive recognition for implementing these technologies once new regulations are in place. As a result it is felt that industry should be consulted by government regarding the refinement of government standards and principles to provide them with the clarity and direction needed to plan for the future.

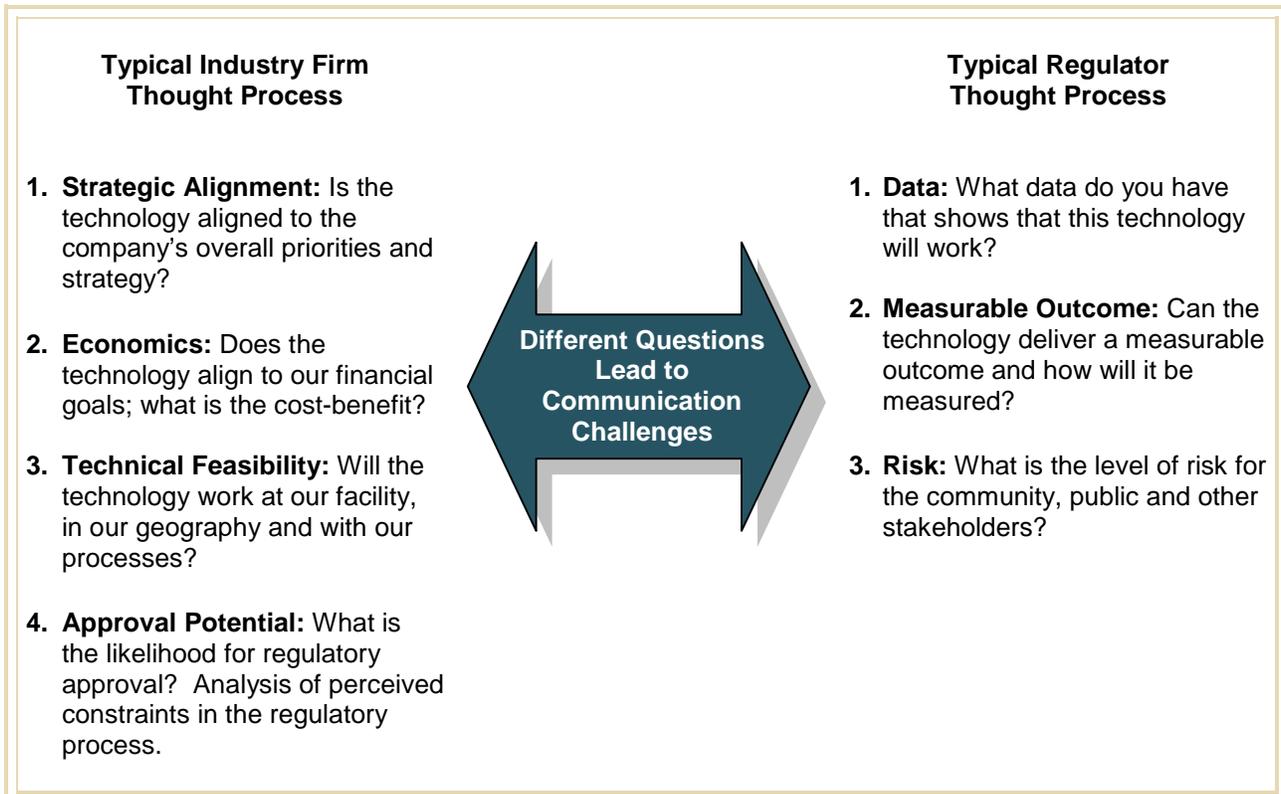
In addition to clarity on current and future regulations, further direction on the types of data required by government to properly assess a new technology is required. It is felt that when it comes to the implementation of innovative technologies that the “devil is in the details.” Criteria used by the government to assess new technologies are generic and vague, making it hard for companies to prepare all data required and ensure the approval process is not slowed as a result of insufficient data. This lack

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of detail regarding what is required by the government to properly assess a technology may prevent companies from including the use of green mining technologies in their operations.

In the latter stages of our interviews, we inquired with a select number of individuals to understand what the thought process is when evaluating a green technology. The table below serves to highlight the very different thought processes that each party undertakes in analyzing new technology solutions.

Diagram: Varying Questions Asked by Industry and Regulators



The comment we heard was that since the thought process for how the two parties enter into the conversation is so different, there is bound to be challenges in communication.

While some jurisdictions have indicated a need for a collaborative process between government and industry to provide clarity on regulations and data required for assessments, others feel that communication between government and industry is strong in this area. To facilitate effective communication, some jurisdictions hold panels between different levels of government and industry associations or companies. In Quebec, a permanent panel involving the Quebec Mining Association and the Quebec Ministry of Environment is in place, as well as a panel between the Quebec Mining Association and Environment Canada.

Nova Scotia employs a one-window approach, where federal and provincial regulators are brought together to meet with a mining company regarding its proposal. At the end of this meeting the company knows whether their proposal is in compliance with all levels of government regulation or if adjustments need to be made. A successful variation of the one-window approach used in Greenland involves a company submitting a proposal to one individual who then discusses the proposal with regulators and provides information back to the company regarding any issues with its proposal.

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A number of industry firms indicated that they proactively approach regulators to discuss any technologies they feel may cause issues with the approval process. One firm employs its own one-window approach by gathering regulators together to ensure that the company has been diligent enough in their proposal. Another indicated that they bring regulators to sites that are using the technologies they will be proposing to use in order to provide regulators with a greater understanding of these technologies.

Therefore, in addition to providing opportunities to discuss current and future regulations, collaborative processes such as panels and the one-window approach can also play a role in providing government with a greater understanding of green technologies, lessening government uncertainty and the perception of risk involved in approving such technologies.

A collaborative approach could also assist industry in communicating success stories related to innovation in green mining technologies and processes. In general, companies are tasked with promoting their own success stories. This practice does not ensure that these positive messages are received by all audiences who would benefit from them. Currently, many mining companies hear of innovative technologies that would be useful to implement in their operations by chance. Creating a mechanism to better communicate innovation in technology could increase the use of green technologies that some companies may not currently be aware of. Improving the communication of successes in innovation to the general public as well would assist mining companies in obtaining a social licence to operate which could then improve the length of time needed to receive approval for mining operations.

Improved communication is also needed to support initiatives such as NRCan's Green Mining Initiative (GMI). It was indicated that the mining industry has had a bad reputation for a significant period of time and as a result, initiatives such as GMI are beneficial as they encourage less intrusive practices in mining and work towards improving public opinion of mining operations. However, many government and industry stakeholders were unfamiliar with the goals of the GMI and were uncertain as to what "green mining" connotes.

Terms like green mining are difficult to grasp as they "can mean a thousand things to a thousand people." Labelling a technology as green does not necessarily make it so and does not always result in the social acceptance of the technology. For instance, wind turbines are identified as a clean technology, but road construction is required to be able to access and maintain the turbines which may interfere with the migration patterns of certain species. Wind turbines also contribute to the deaths of many birds. Furthermore, in some cases, open pit mining may be the only technique that can be used in order to mine ore. This technology is the cleanest possible in this particular situation, but it causes long-term damage to the landscape and as a result is not socially accepted. More specific language is required to communicate the details as to why a particular technology may be greener than another in order to both guide the future technology implementation decisions of industry and to gain social licence for industry to implement these technologies.

4. SECONDARY FINDINGS

Unintended Consequences of Government Regulations

Certain regulations put in place to reduce the environmental impact of mining may have unintended negative effects on the government and industry's efforts towards greener practices. For example, the American Conference of Governmental Industrial Hygienists (ACGIH) provides information on Threshold Limit Values (TLVs), stating that TLVs are not standards:

They are guidelines designed for use by industrial hygienists in making decisions regarding safe levels of exposure to various chemical substances and physical agents found in the workplace. In using these guidelines, industrial hygienists are cautioned that the TLVs... are only one of multiple factors to be considered in evaluating specific workplace situations and conditions.

TLVs... are health-based values established by committees that review existing published and peer-reviewed literature in various scientific disciplines.... [As they] are based solely on health factors, there is no consideration given to economic or technical feasibility.¹

Respondents indicated that certain provinces have adopted the TLVs themselves into regulations without proper consideration of other relevant factors. The consequences of this practice include increased amounts of certain toxins resulting from the processes used to reduce other toxins to ACGIH TLVs. Multiple stakeholders provided examples of this; one involved increased green house gas emissions resulting from the use of technologies that manage sulphur dioxide emissions.

Another example involves a proposed change in the nitrogen dioxide TLV from 3 ppm to 0.2 ppm. If this change is adopted by government, it is expected that ventilation requirements will increase. Greater amounts of energy will be consumed in order to meet the ventilation requirements which will result in increased green house gas emissions. Additional ventilation requirements can also increase the amount of dusting underground, requiring greater use of chemicals and increased water consumption for dust abatement. Furthermore, attempts to reduce diesel particulate emissions underground may increase nitrogen dioxide emissions. Therefore, if the nitrogen dioxide TLV reduction is implemented, companies will also have less incentive to adopt greener fuels or otherwise implement technologies or processes that reduce diesel particulate emissions in underground operations.

These examples demonstrate that certain regulations may not be reducing mining's environmental impact effectively as greater emissions and energy usage may be required to control issues resulting from the management of certain regulatory targets. Government regulators need to ensure that they take into account the overall impact a regulation will have on lessening mining's environmental footprint as a whole to ensure that efforts are not wasted on attempts to adhere to multiple regulations that do not align with one another. Consultation with industry regarding mining technologies and their outputs may assist regulators in determining the potential environmental consequences of regulations.

Another solution suggested the creation of a multi-stakeholder review panel that would determine both the scientific and health-based merits of TLVs. The panel would assess how a TLV affects other occupational health, safety and environmental factors to determine whether it improves worker health and safety while responsibly minimizing environmental outcomes. The review team could also evaluate the technical, social and economic viability of implementing the TLV and provide recommendations to government.

¹ <http://www.acgih.org/TLV/>, accessed May 12, 2011.

Need for Reasonable Standards

Respondents indicated that regulators often use generic standards and criteria to determine compliance to regulations. These standards may be unreasonable depending upon the situation of a particular mining operation. For instance, changes in regulations in one jurisdiction decreased the amount of suspended solids allowed in effluent receiving water to levels lower than the naturally occurring levels at some sites. Companies located at these sites are now tasked with the responsibility of managing naturally occurring toxins in addition to their operations' wastes in order to achieve compliance with regulations.

Furthermore, one company indicated that its tailings treatment system will leave behind fewer hydrocarbons than were present before the company began its operations. Despite this, regulators have required that the company lower the hydrocarbon level even further than the amount that will already be achieved and below the level that naturally exists in the environment. Therefore, there is a need to acknowledge the uniqueness of each mining site in order to establish reasonable compliance standards that properly assess a company's efforts towards the restoration of a mining site to its natural condition.

Insufficient Regulator Knowledge

There are currently gaps felt in the knowledge base of government regulators. As companies recruit experienced regulators out of government to work for their operations and baby boomers begin to retire, often the remaining regulators are younger and have minimal experience outside of formal education, presenting challenges for regulators to work with industry on an equal footing. It was indicated that a new model is needed as the frequent turnover in regulators has affected industry's ability to sustain effective, long-term relationships with regulators who have significant knowledge of the mining industry.

Insufficient regulator knowledge can make it difficult for companies to receive approval to use new, innovative technologies and processes. Additionally, it is felt that regulators lack sophistication regarding global issues and trends and that this can also make it difficult for companies to implement innovative ideas. There is a need for industry and government to work together to increase regulator knowledge of both current issues and new developments in the industry, which could then result in lessening the perception of risk related to new technologies and improving upon the length of time needed to approve the use of such technologies.

5. CONCLUSION

Our analysis suggests that there are no specific federal, provincial or territorial regulations in place that act as barriers to the implementation of green mining technologies and processes. Governments enact regulations to reflect public interest in protecting the environment as much as possible. As a result, regulations in place identify the minimum levels of compliance companies must adhere to and do not restrict companies from exceeding these levels. While barriers are not in the regulations themselves, a variety of barriers exist in regulatory processes and other factors including but not limited to regulatory criteria and the interpretation of regulations.

It appears that the most significant barrier is effective and efficient communication and collaboration between government and industry. Addressing this issue can ensure that industry is aware of the present and future direction of government and is provided with adequate information on regulatory criteria and standards. It can also result in increasing the knowledge base of regulators regarding new technologies, which could then assist in improving the speed of approval processes. Collaborative communication efforts can also improve public perception of mining in general as well as a mining company's ability to obtain a social licence to operate. In short, creating new and improving current methods of communication is key to addressing many of the barriers that currently discourage companies from implementing green technologies and processes.

6. APPENDIX A – LIST OF STAKEHOLDERS INTERVIEWED

Provincial Contacts	
Province	Provincial Government Organization
British Columbia	<p>Ministry of Energy, Mines and Petroleum Resources</p> <ul style="list-style-type: none"> Anne Currie, Executive Director Policy and Sustainability and Chief Gold Commissioner Jim Lewis, Mineral Economist Kim Bellefontaine, Senior Mine Review Geologist Tania Demchuk, Environmental Geoscientist <p>Ministry of Forests, Lands and Natural Resource Operations</p> <ul style="list-style-type: none"> James Sandland, A/Manager of Climate Change
Alberta	<p>Energy and Resources Conservation Board</p> <ul style="list-style-type: none"> Terry Abel, Executive Manager, Oil Sands and Coal Branch
Saskatchewan	<p>Energy and Resources</p> <ul style="list-style-type: none"> Cory Hughes, Director, Mineral Policy Hal Sanders, Assistant Deputy Minister, Minerals, Lands and Policy
Manitoba	<p>Innovation, Energy and Mines</p> <ul style="list-style-type: none"> Chuck Jones, Resource Management Geologist, Mining Engineering Section, Mineral Resources Division Doina Priscu, Chief Mining Engineer, Mineral Resources Division Ernest Armitt, Director Mines Administration, Mineral Resources Division
Ontario	<p>Ministry of Northern Development, Mines and Forestry</p> <ul style="list-style-type: none"> John Malczak, Senior Policy Advisor, Mining Act Modernization, Mines and Minerals Division Leslie Cooper, Manager, Mine Rehabilitation, Inspection and Compliance
Quebec	<p>Association Miniere du Quebec</p> <ul style="list-style-type: none"> Jean-Claude Belles-Isles, Director Environmental Affairs

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	Ministere des Ressources naturelles et de la Faune <ul style="list-style-type: none"> Louis Bienvenu, Direction generale de developpement de l'industrie minerale
New Brunswick	Natural Resources <ul style="list-style-type: none"> Cory Neumann, Mine Reclamation Engineer, Minerals and Petroleum Development Branch
Nova Scotia	Natural Resources <ul style="list-style-type: none"> Mike MacDonald, Executive Director, Mineral Resources Branch
Newfoundland and Labrador	Natural Resources <ul style="list-style-type: none"> Alex Smith, Director, Mineral Development
Yukon	Energy, Mines and Resources <ul style="list-style-type: none"> Robert Holmes, Director Mineral Resources
Northwest Territories	Industry, Tourism and Investment <ul style="list-style-type: none"> Kelly Mahoney, Senior Mining Advisor, Mining
Federal Government Authorities	
Federal Government Organization	Contact
Environment Canada	<ul style="list-style-type: none"> Chris Doiron, Chief of Mining and Processing
Fisheries and Oceans Canada	<ul style="list-style-type: none"> Christine Stoneman, A/Director General, Major Projects Review
Indian and Northern Affairs Canada	<ul style="list-style-type: none"> James Chau, Mining Analyst, Mineral Resources Directorate
Industry Associations and Companies	
Industry Organization	Contact
Canada Mining Innovation Council	<ul style="list-style-type: none"> Tom Hynes, Executive Director
Mining Association of Canada	<ul style="list-style-type: none"> Justyna Laurie-Lean, VP Environment and Health
Cameco Corporation	<ul style="list-style-type: none"> Liam Mooney, Director of Environmental Affairs
Franklin Geosciences	<ul style="list-style-type: none"> Jim Franklin, President
Shell	<ul style="list-style-type: none"> Jeff Roberts, Mine Development Manager Margwyn Zacaruk, Regulatory Approvals

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Teck	<ul style="list-style-type: none">• Mark Edwards, Director of Environmental and Corporate Affairs
Vale	<ul style="list-style-type: none">• Chantal Clement, Manager Environment
Vismand Exploration	<ul style="list-style-type: none">• Richard Moore, VP Exploration; also Chair of the Prospectors and Developers' Association of Canada's Geosciences Committee
Xstrata	<ul style="list-style-type: none">• Robert Prairie, Director Ecological Effects Assessment

7. APPENDIX B – INTERVIEW GUIDE

MNP has been engaged by NRCan to identify any federal and provincial government regulatory barriers for the adoption of green mining technologies and practices in Canada's mining sector. Two other reports were recently completed for NRCan on barriers to green mining; however, these reports did not agree as to what current regulatory barriers exist or are perceived. The purpose of the report we are undertaking is to confirm if barriers do exist and provide an assessment of the barriers that NRCan identifies as the most critical. The assessment will outline how the barriers affect green mining innovation generally across Canada, and provide potential solutions to address the barriers. The findings of our report are expected to be presented to Mines Ministers in July.

Please be assured that the responses you provide us with during this interview will remain confidential. All information gathered during our interviews will be reported to NRCan in a consolidated format.

Questions

1. Anecdotal evidence suggests regulatory barriers to green mining innovation might exist. Has your organization identified any federal, provincial, or territorial government regulations that may inhibit the implementation of new green mining technologies and processes?
 - a. If so, please reference which regulations provide barriers and what these barriers are.
 - b. How could these barriers be overcome? What solutions could be effective?
 - c. If you have not identified any specific barriers, do you think it might be more of a perception issue? If so, what could be done to address it?
2. If any barriers have been identified, please describe how these policies or practices impact the different stages of a mine's lifecycle (exploration and prospecting, commissioning, ongoing operations and mine closure)?
3. How would you describe the communication of current federal or provincial/territorial government environmental policies to industry? Is it complete with economic rationale?
4. Considering changes made to environmental policy and targets might impact the future relevance of technology and processes that companies invest in, how would you assess the communication of future environmental goals of the federal and provincial/territorial governments? Does it allow organizations to invest in technology and processes with the certainty that if additional changes were made to environmental policy and targets the technology and processes will still be relevant?
5. Has your organization identified any barriers or issues involved in the assessment processes to obtain necessary permits or permissions (ex. Federal and provincial environmental assessments, provincial permitting/Certificate of Approval, federal and provincial ecological risk assessments, etc.) for new technologies and processes related to mining?
 - a. What would you suggest to improve the assessment process?
6. Are you aware of any federal and provincial/territorial government regulations that conflict with one another?
 - a. If so, can you reference which regulations conflict?
 - b. Is there adequate assistance available to industry regarding what regulations to follow in the event of conflicting regulations?

7. Has the absence of government legislation/regulation ever impeded the implementation of green mining technologies and processes?
 - a. If so, please provide examples of where this has been an issue.
8. If you have identified any barriers, what are some specific examples that you can site that would illustrate the nature of the barrier and the magnitude of the problem?
9. If you have identified any barriers, what do you consider to be the top three most significant regulation-related barriers to the approval and/or implementation of green mining technologies and processes?
10. If you have identified any barriers, how would you assess their relative importance and impacts in comparison to other barriers to innovation, such as financial or risk-related ones?