

A Review of Mine Closure Planning and Practice in Canada and Australia

SM Zobaidul Kabir¹, Fazle Rabbi², Mamta B Chowdhury³ and Delwar Akbar⁴

This paper reviews mine closure practice in Australia and Canada and provides similarities, dissimilarities and common shortcomings of mine closure practice. Closure of mine with appropriate planning is a recent move as a part of sustainable mining practice and both Canada and Australia have developed requirements for mine closure process. By reviewing ten site-specific closure plans against international good practice criteria, this study finds that in general, both the countries share key requirements of mine closure; hence comply with good practice of mine closure planning. However, there are some common shortcomings of existing mining closure planning practice in Canada and Australia. These include inadequate social impact assessment, community consultation, inadequate analysis of alternative options, and the monitoring of post-closure activities. Finally, recommendations were made to improve the closure plans in both countries.

JEL Codes: Q01, Q43, Q54 and Q57

1. Introduction

Mine closure⁵ is the last phase of the mining cycle that includes the cessation of operations, reclamation of mine sites, including the rehabilitation of environmental and social damages, and site relinquishment (McHaina 2001, Solomon 2008). In the past, mines were closed without proper planning including the assessing impacts on the community and were inadequately regulated by either the proponent or the government (Cowan et al. 2010). Therefore there were many social and environmental problems occurred such as loss of jobs by the local community who were dependent on the mining company, community people who lose their jobs tend to move other places for jobs and therefore community bondage is broken. Furthermore, unplanned closure of mine creates environmental problems such as releasing of acid water, degradation of soil quality, disruption of agricultural production in the mining areas. While there are some literature on mine closure, relatively less academic attention has been paid to mine closure planning and practice as compared to study on the development and operational phase of mining (Warhurst et al. 2000, Wenig and O'Reilly 2005). The relative paucity of studies on mine closure presents challenges for understanding key issues across jurisdictions and advancing policy and practice (Solomon et al. 2008). Therefore, it is imperative to understand to what extent

¹ Dr. SM Zobaidul Kabir, Corresponding author, Post-Doctoral Research Fellow, Central Queensland University, Rockhampton, QLD – 4702, Australia, Email: z.kabir@cqu.edu.au or kabirz85@hotmail.com

² Fazle Rabbi, Sessioinal Lecturer, School of Business, The University of Notre Dame Australia, 29-35 Shepherd Street, Broadway, NSW 2007, Australia, Email: fazle.rabbi@nd.edu.au

³ Dr. Mamta B Chowdhury, Senior Lecturer, School of Business, University of Western Sydney, NSW, Australia, Email: mamta.chowdhury@uws.edu.au

⁴ Dr. Delwar Akbar, Senior Postdoctoral Research Fellow, Central Queensland University, Rockhampton, QLD-4702, Australia, Email: d.akbar@cqu.edu.au

current closure processes are relevant to closure requirements in practice. An understanding proper closures plan of mine and its effective implementation is important.

The aim of this paper is to examine mine closure practice in Australia and Canada against a set of good practice criteria developed by the authors. Then the practice of mine closure was compared between the two jurisdictions. This paper attempted to address the following key questions:

- To what extent the good practice of mine closure in both Canada and Australia is undertaken?
- What are the similarities and dissimilarities of mine closure practice undertaken in both the countries?
- What are the shortcomings in practice in both countries and how to improve?

The findings of the study are different from the findings of other studies previously undertaken. This is because to the knowledge of the authors of this study, no study was undertaken yet to compare mine closure practice between Australia and Canada. The findings of this study not only provide a comparison of mine closure practice between two countries, it also identifies gaps in practices in both countries. The findings of this study, therefore, provide valuable insights in terms of progress, similarities and dissimilarities of practices. This review also provides an opportunity for mutual learning between the two countries about mine closure practice and for further improvement of closure practice. The review of closure plans may provide key information in relation to the compliance of good practice criteria.

This article is divided into five key sections. Section 2 describes the methodology that outlined the development of a set of review criteria in order to review the mine closure process in Canada and Australia. The key features of the mine closure process of Canada and Australia are outlined in section 3. Section 4 provides a comparative picture of the mine closure process in Canada and Australia. This is followed by the conclusion.

2. Literature Review

In response to increasing pressure from the community regarding the social and environmental effects occurred by the unplanned mines in the past, now both project proponents and governments are now paying attention to mine closure processes (Andrews-Speed 2005, Hoskins 2005, Cesare and Maxwell 2003, Johnson and Wright 2003) through the enactment of legislations and policy guidelines (Macdonald 2006). In addition, many transnational corporations (TNCs) are integrating mine closure issues into project planning and developing guidelines and standards for sustainable mine closure (Remy et al. 2002). International organisations, for example ICMM have developed principles of mine closure and a series of good practice guidelines. There have been series of international conferences on sustainable mine closure process (for example organised by the Australian Centre for Geosciences and other partners) where representatives from academic, government and business communities come and share their experiences of good practice of mine closure and identify possible ways to improve the practice worldwide. Mine closure is now defined as an orderly, safe, environmental, and socially sound conversion of an operating mine to a closed state. Proper planning for mine closure can generate benefits both for the host community, as well as for the company (Warhurst and Noronha 2000). Planning for mine closure can enable companies to avoid social and

environmental damage in a systematic and cost-effective fashion. The primary aim of mine closure planning is to ensure that the decommissioning and reclamation of a site can be successfully achieved, whilst satisfying the following objectives:

- To allow a productive and sustainable post-mining use of the site which is acceptable to all stakeholders;
- To protect public health and safety;
- To alleviate or eliminate environmental damage and, thereby, encourage environmental sustainability;
- To conserve valuable attributes; and
- To minimize adverse socio-economic impacts (ANZMEC and MCA 2000, DITR 2006, EPA 2011).

Key elements of good practice mine closure: Every closure is site specific and local circumstances will determine local post-mining outcomes, so there is little to be learned from generalisations (Cowen et al. 2012). The elements of good practice mine closure may depend on the location, culture and aspirations of the local community and other contextual factors. However, literature indicates that there are also universally acceptable elements. The key elements include mine closure planning should include both social and environmental impacts and should be an integral part of project planning, progressive rehabilitation of social and environmental damage, community involvement, early start of closure process, and government support (ANZMEC/MCA 2000, Government of Australia 2006, Paul de Sa 2005, Warhurst et al. 2000, Jackson 2000, Miranda et al. 2005, Smith 2008).

While there is a few literature on mine closure practice (for example Wenig and O'Reilly et al. 2005, Miranda et al. 2005, Smith 2008) , there is hardly any specific study on good practice mine closure undertaken using universally accepted good practice criteria. The relative paucity of studies on mine closure presents challenges for understanding key issues across jurisdictions and advancing policy and practice (Solomon et al. 2008). In particular, there is hardly any comparison of mine closure processes across jurisdictions; particularly for those countries that already have long experience in regulating mining operation. To the best of the authors' knowledge, no study was previously undertaken between Australia and Canada. In this paper, the authors developed a universally accepted good practice criteria of mine closure and reviewed and compared the good practice mine closure of Canada and Australia.

3. Methodology

This paper reviews the adequacy of mine closure practice against a set of review criteria between Canada and Australia. The review criteria were developed by the authors based on good practice of mine closure process. The reasons behind choosing these two countries are that Australia and Canada are two large countries that have similar socio-economic, administrative and geographic characteristics, as well as large mining sectors. They also have a long history of regulation of mining activities. Given the potential social and environmental consequences of mine closure, efforts have been made by both countries to adopt policy guidelines and legislation that addresses the impacts.

The methods of data collection and development of review criteria are explained in the following sections.

3.1 Development of Selection of Criteria

A desktop review of literature including scholarly journal articles and internationally applicable guidelines for mine closure was undertaken in order to develop a set of universally accepted good practice criteria. According to Wood (2003) evaluation criteria are, in effect, shorthand versions of requirements of a process. If carefully articulated, the criteria can have considerable advantages in terms of brevity and clarity (Wood 2003). It is recognised that mine closure planning may vary from jurisdiction to jurisdiction given variation in geographical, historical, political, and socio-economic factors that partially explain the differences. As well, mine closure plans may vary according to the particular feature of each mine/location and the nature and size of the mine. Nevertheless, there are always key requirements of mine closure processes that generally remain common to each jurisdiction, regardless of geographic or socioeconomic background or types of mine (IIED 2002, World Bank 2010). With this in mind a set of criteria were selected as outlined by the Table-1. It is to be noted that the authors have developed these criteria and hence an improvement of current closure practice has been done.

Table-1: Criteria to assess the mine closure processes

Evaluation criteria	Data source
Does the planning explicitly state the legal framework in place that requires mine closure?	Desktop review of policy guidelines and legislations. Available mine closure plans of major mining projects in Canada and Australia
Does the closure planning clearly outline the objectives of closure?	
Is the closure planning integrated to project lifecycle as early as possible?	
Does the mine closure planning identify all possible domains of mine closure?	
Does the closure planning include progressive reclamation of mine closure?	
Does the mine closure planning adequately include social and environmental impacts?	
Does the planning recommend for mitigation measures to address social and environmental impacts?	
Does the mine closure planning provide information on alternative analysis of closure options?	
Does the closure planning adequately analyse the alternative closure options with justification?	
Does the planning outlines monitoring the implementation of closure tasks?	
Are the responsibilities for monitoring clearly outlined?	
Does the planning incorporate post-closure management and monitoring of impacts?	
Does the closure planning include costing of the tasks of closure to be implemented, including monitoring program implementation?	
Does the closure planning explicitly outline the relinquishment criteria?	
Is there any community engagement strategy at each phases of the mine closure?	
Does plan include input from community in relation to impacts and strategies for mitigation of impacts?	

Sources: ANZMEC and MCA 2000, Government of Australia 2006, ICMM 2006, Peck 2005, World Bank 2010, and Government of Western Australia 2011

3.2 Selection of Mine Closure Plans

In this study, ten plans were purposively selected for review from Canada and Australia representing a cross section size and nature of mine (Table-2). The closure plans were prepared during the operation or immediately before the closure of mines so that they reflect

the closure requirements in detail. While the sample size is small, it is possible to analyse the practices undoubtedly and draw general inferences. This comparative study is a general overview of the mine closure process in Canada and Australia.

Table-2: List of Mine Closure Plan reviewed

Closure plan ID	Name of project	Year	Proponents	Characteristics	
				Employees	Type
Canada					
MCP-1	Diavik Diamond Mines	2011	Diavik Diamond Mines Inc.	800 (construction)	Diamond Mine
MCP-2	Red Dog Mine	2009	Teck Cominco Alaska Inc	400 (operation)	Zinc Mine
MCP-3	Hollinger Mine	2010	Goldcorp Canada Ltd	368 (operation)	Gold Mine
MCP-4	Bellekeno Mine, Keno Hill Silver District	2011	Alexco	280 (operation)	Silver Mine
MCP-5	Doris North Project	2005	Miramar Hope Bay Limited	371 (operation)	Gold mine
Australia					
MCP-6	Iron Ore at Yandicoogina Closure Study	2011	RioTinto	2000 (construction)	Iron Mine
MCP-7	Wonarah Phosphate Project Mine Closure Plan	2009	Coffey Natural System Ltd.	---	Phosphate Mine
MCP-8	McArthur River Mine Phase 3 Project	2012	Xstrata Zinc	440 (operation)	Zinc Mine
MCP-9	Titton Copper Mines	2009	Straits Resources Ltd	200 (operation)	Copper Mine
MCP-10	Nelson Bay River Mine project	2011	Shree Minerals Limited	581 (construction)	Magnetite Mine

It is to be noted that these closure plans have been prepared between 2005 and 2011 and the mines are either under construction or operation. While each of the plans does not mention how much time for rehabilitation of mine sites will be needed, practice shows that usually it takes two to five years to rehabilitate a mine site. However, it takes more time to rehabilitate mine sites depending on characteristics of a mine site, for example, dam, tailings and quality of water. In this study all the MCPs belong to large mine projects, the closure plans may still differ according to the size, type, location, cost, and life of a mine. For example, if a mine is located near agricultural land, the design closure plan of such mine will differ from a closure plan of a mine located in non-agricultural land.

3.3 Analysis of Documents and Review Process

The mine closure planning in Canada and Australia were analysed using the criteria outlined in the Table-1 and then comparisons were made. Each of the criteria is graded as 'yes', 'no' or 'partially' according to whether the criteria are meet. Documents including legislations, policy guidelines of mine closure in Canada and Australia were analysed. Also the closure plans collected were reviewed against the criteria outlined under table-1.

4. Mine Closure Process in Canada and Australia-An Overview

4.1 Key Features of Mine Closure Process in Canada

4.1.1 Institutional Framework

In Canada, over the last twenty years, a number of changes have been made in legislation affecting the closure of mines (Roberts et al. 2000; Cowan et al. 2012). Under the Canadian federal system, responsibility for mining falls within the exclusive domain of the provinces. Canada has instituted a series of legislative initiatives designed to create procedural and enforcement mechanisms support of mine closure planning, implementation and subsequent outcomes across all provinces. Table-3 shows mine closure related legislation of six provinces and territories.

Table-3: Legislation for mine closure process in Canada

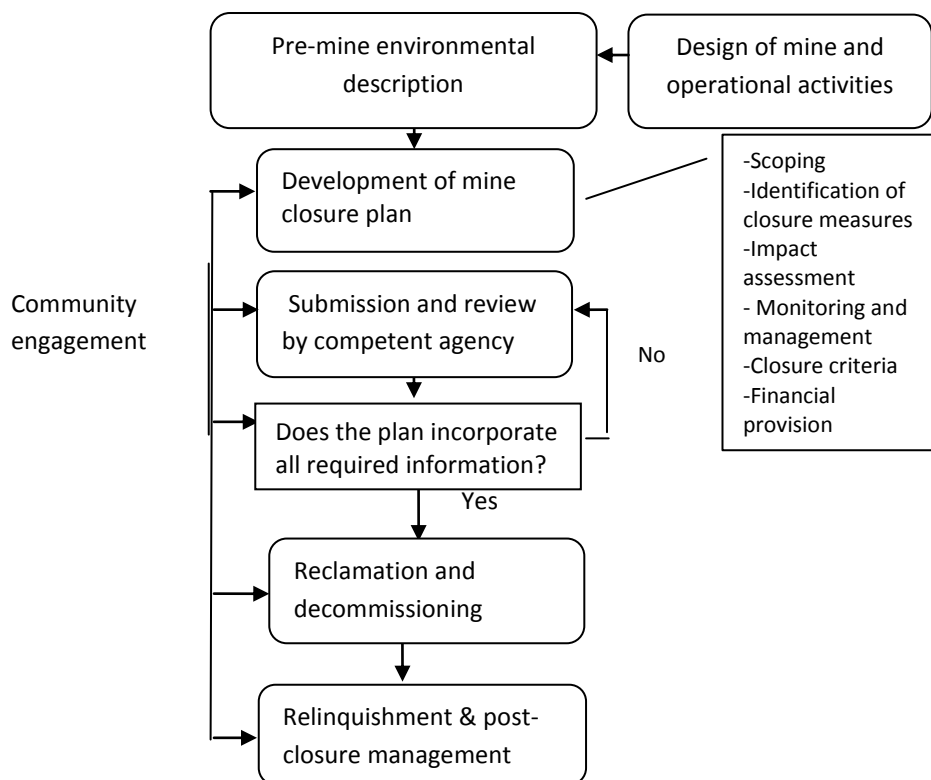
Jurisdictions	Key legislation for mine closure	Regulatory agencies
British Columbia	<ul style="list-style-type: none"> Mines Act 1989 Environmental Assessment Act 1995 Contaminated site regulation 2011 	Ministry of Energy, Mines and Petroleum Resources, Ministry of Environment
Ontario	<ul style="list-style-type: none"> Mining Act 1990 (Part VII) Ontario Regulation 24/00. Environmental Protection Act 1990 Ontario Water Resource Act 1990. 	Ministry of Northern Development and Mines Ministry of Environment
Quebec	<ul style="list-style-type: none"> Environmental Quality Act 1972 Quebec Mining Act (QMA) of 1995 	Ministry of Sustainable Development, Environment and Parks (MSDEP), Ministry of Natural Resource and Wildlife
Saskatchewan	<ul style="list-style-type: none"> The Environmental Assessment Act 1995, The Environmental Management and Protection Act 2002 The Reclaimed Industrial Sites Act 2008 	Saskatchewan Ministry of Environment Ministry of Industry and Resources
Northwest Territories	<ul style="list-style-type: none"> Environmental protection and Enhancement Act 2002 Mines and Mineral Act 1984 	Alberta Environment and Sustainable Resource Development
Manitoba	<ul style="list-style-type: none"> Mine and Minerals Act 1991 Contaminated Sites Reclamation Act 2005 Workplace Safety and Health Act W210 	Department of Innovation, Energy and Mines Department of Conservation and Water Stewardship

In addition to legislation on mine closures, there are guidelines for mine closure available in each province of Canada, outlining the provisions of mine closure in detail. For example, General Closure Plan Guidelines (2006) in Manitoba (Industry, Trade & Mines 2006).

4.1.2 Timing, Preparation and Submission of Mine Closure Plan

Canadian mining regulation jurisdictions require proponents to submit mine closure plans prior to receiving approval to commence mining development (Figure 1). In general, proponents submit an application for mining development along with a conceptual mine closure plan, EIA and SIA reports. In some jurisdictions (Ontario, Manitoba, Nunavut and the Yukon) in Canada, an advanced exploration application triggers a Closure Plan requirement (IIED 2002). The conceptual closure plan submitted along with the application for the approval of mining development is reviewed and approved by relevant government agency. During the operation of mine, the proponents are required to prepare closure plans in detail as well as review and update routinely, usually after every three to five years.

Figure 1: A generic process of mine closure planning in Canada



4.1.3 Reclamation of Land and Decommissioning

In Canada, an impact management plan is prepared within the mine closure plan. The management plan includes reclamation of land, revegetation, and remediation of other environmental impacts, and social and economic rehabilitation of affected community and employees. A monitoring program to monitor the progress of implementation activities and accuracy of predicted impacts is also put in place undertaken by respective agencies.

It is to be noted that progressive rehabilitation is one of the key aspect of mine closure planning in Canada (Cowan and Robertson 2000). The progressive rehabilitation usually includes rehabilitation of some section of mine sites, vegetation of land and waste minimisation during the operation of mine.

4.1.4 Relinquishment

After the implementation of closure activities the proponent submits an application for relinquishment. Site assessment/verification is required in this regard as a part of acceptance procedure. Mining land is returned to the Crown after close out, under the authority of an Act. Surrender procedures in some provinces (Newfoundland, Labrador, Quebec, Saskatchewan and Alberta) require sign-off by more than one agency. Third party consultation for the return of mining land takes place in Nova Scotia, Quebec, Ontario, Manitoba, Saskatchewan, Alberta and Yukon. All provinces accept back properties that require monitoring and maintenance in perpetuity. However, environmental liability rests with the proponent.

4.1.5 Financial Assurance for Mine Closure

All of the ten Canadian provinces, North West Territory (NWT) and the Yukon have in place legislations that requires mining companies to specifically set aside funds to be used for reclamation following mine closure (IIED 2002). In Canada, the government requires that companies secure the necessary funding by providing guarantees for mine-closure funds prior to mine construction and operation. The form of financial fund includes bond, insurance, and trust funds among others (Miller a2005). The calculation of financial cost is undertaken by the proponents and tools for calculation may vary across the jurisdictions (Cowan 2010).

4.2 Mine Closure Process in Australia

4.2.1 Legal and Institutional Framework

All the states (New South Wales, Western Australia, Queensland, South Australia, Victoria) and the Northern Territory in Australia have mine closure legislation. Table-4 shows the key acts and regulations relevant to mine closure in Australia. In general, the mineral acts provide statutory requirements enforcing the management and rehabilitation of the affected environment of mining. Detailed guidelines of mine closure (for example, Government of South Australia 2009, Government of South Australia 2012, Environmental Protection Agency 2011, Queensland Mineral Council 2001) area available in each of the states except the Northern Territory and New South Wales.

Table-4: Legislative framework of mine closure process in Australia

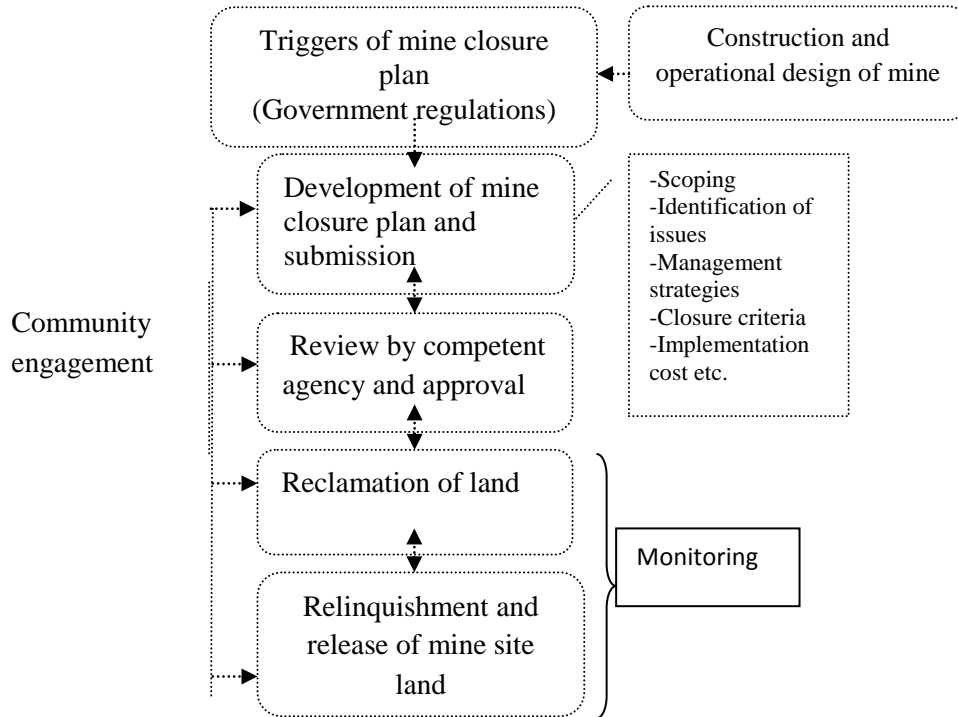
Jurisdictions	Key legislation for mine closure	Regulatory agencies
New South Wales	<ul style="list-style-type: none"> • NSW Mining Act 1992 • NSW Environmental Planning and Assessment Act 1979. 	Department of Planning, Department of Environment
Western Australia	<ul style="list-style-type: none"> • Western Australia Mining Act 1978 • Environmental Protection Act (part IV) of 1986. 	Department of Industry and Resources, WA Environmental Protection Agency
South Australia	<ul style="list-style-type: none"> • Mining Act 1971 • Environmental protection act 1993 	Department of Primary Industries and Resources South Australia (PIRSA)
Queensland	<ul style="list-style-type: none"> • Mineral Resource Act 1989 • The Environmental Protection Act of 1994 • Environmental Protection Regulation 1998 (effective in 2001) 	Department of Natural Resources and Mines (DNRM), Environmental Protection Agency
Victoria	<ul style="list-style-type: none"> • Mineral resources Act of 1990 • Extractive Industry development Act 1995 and associated regulations. 	Department of Primary Industry
Northern Territory	<ul style="list-style-type: none"> • Mining Management Act (2011) section 40. • Environmental Assessment Act 1994 	The Department of Primary Industry, Fisheries and Resources, Arts and Sports, Department of Environment

4.2.2 Timing and Development of Mine Closure, Submission

In Australia any mining proposal submitted for approval as required must be accompanied by the preliminary mine closure plan. The common steps for the development of a mine closure plan includes: baseline information, identification of closure issues (domains), impacts of closure, closure management strategies including strategies to address the closure impacts, development of closure criteria, identification of monitoring strategies and relinquishment process (Figure-2). Community inputs are needed at each stage of development.

After submission of the plan, the relevant agency reviews the plan in relation to adequacy and consistency of information provided. The timeline for approval are specified, for example, in Western Australia, a mine closure plan is supposed to be approved within 30 days after its submission (WA Guidelines, 2012).

Figure-2: A generic process of mine closure planning in Australia



4.2.3 Reclamation Plan

In Australia, reclamation plan is prepared within the Mine Closure Plan and is submitted to the competent agency along with Environmental Management Plan of the mining project for approval. While actual reclamation occurs at the end of mine closure process (after the operation is closed), in some cases reclamation starts during the operation of mine called progressive rehabilitation. Also decommissioning or taking apart of mining processing facilities and equipment occur when the operation is stopped.

4.2.4 Relinquishment and Post-closure Management

In Australia mining land is returned to the owner or the state after proper rehabilitation. Site assessment is required in WA prior to acceptance of land. The inspection is geared to the terms and conditions of the permit. Sign-off by Minister for Mines (or Minister of Stage Agreement Acts) and Minister for Land and possibly Minister for Environment (if bonds are required by under Environmental Protection Act) may be required. However, the relinquishment process varies across states in Australia in terms of closure criteria, against which the inspection is undertaken, the release of land by the mining companies, the issuance of certificate for relinquishment by the relevant agency.

4.2.5 Financial Requirements

Both the legal and administrative ‘punishment’ mechanisms available to state agencies in Australia are generally viewed as supplementary to performance guarantee bond systems. The bond systems have been developed across all states in Australia to enforce rehabilitation requirements (White et al. 2012). Performance bonds are monetary guarantees to perform a required standard of post-mining rehabilitation. In most cases in Australia, the lodgement of an environmental bond is a precondition for the issue of a

mining lease (Sommer and Gardner 2012). In addition, there is other financial assurance for example; rehabilitation fund has been introduced in Western Australia (Sommer and Gardner 2012, White et al. 2012). However, the determination of cost in terms of rate and calculation vary across the states based on policies adopted by the state governments (Miller 2005).

5. Results and Analysis

Table-5 shows a comparative picture of the current mine closure planning in Canada and Australia. It is to be noted that the comparison is somewhat limited at a more detailed level, given the number of states of each of the countries (Australia and Canada) and the limited time and space. Notwithstanding this analytical challenge, the analysis shows a general comparative picture of the mine closure process in Canada and Australia. To determine the extent of the practice of mine closure, the authors used their experience in undertaking mining impact assessment, their expert judgment and background knowledge available.

Table 5: Evaluation of mine closure planning in Canada and Australia

	Evaluation criteria	Canada	Australia	Comments
Legal basis	Does the planning explicitly state the legal framework in place that requires mine closure?	√	√	Legislation of mine closure occurs within mining acts.
Planning (Scoping)	Is the closure planning is clearly outline the objectives of closure?	√	√	Plans outlines objectives of closure
	Is the closure planning integrated to project lifecycle as early as possible?	√	√	Closure plans are considered part of mining projects
	Does the mine closure planning identify all possible domains of mine closure?	√	√	There is a lack of focus on social rehabilitation
	Does the closure planning include progressive reclamation of mine closure?	√	√	Mine closure plans are regularly reviewed, reflecting progressive rehabilitation
Impact identification	Does the mine closure planning adequately include social and environmental impacts?	*	*	Mine closure plans focus on social and environmental issues, but inadequately focuses on social issues.
	Does the planning recommend for mitigation measures to address social and environmental impacts?	*	*	Mitigation measures on social issues are inadequate.
Anal ysis	Does the mine closure planning provide information on alternative analysis of			Little clear and detail analysis on closure

Kabir, Rabbi, Chowdhury & Akbar

	closure options?	*	*	options
	Does the closure planning adequately analyse the alternative closure options with justification?	X	X	No alternative analysis in relation to site closure, mitigation of social impacts.
Implementation and monitoring	Does the planning outlines monitoring the implementation of closure tasks?	*	*	Monitoring of social impacts is largely absent
	Are the responsibilities for monitoring clearly outlined?	√	√	Responsibilities are outlined among government agency, proponent and other stakeholders
	Does the planning incorporate post-closure management and monitoring of impacts?	*	*	Not all plans mentioned post-closure monitoring and management
	Does the closure planning include costing of the tasks of closure to be implemented, including monitoring program implementation?	√	√	Provision of costing is in place, but costing of social impact management is largely absent.
Community engagement	Does the closure planning explicitly outline the relinquishment criteria?	*	*	Not all plans outlined criteria specially mentioning social issues
	Is there any community engagement strategy at each phases of the mine closure?	√	√	No strict provision, depends on site condition
	Does plan include input from community in relation to impacts and strategies for mitigation of impacts?	*	*	Yes, but not about post-closure monitoring

Legend: √ (Yes); X (No); * (Partially)

The study indicates that both countries in general comply with key requirements of mine closure process and develop closure plans. Both countries have established legislations that outline the requirement of mine closure. The legislation has not been written as specific acts, but is part of other legislative acts that govern mining activities. Mine closure laws have occurred either within the mining sector or via specific environmental legislation that is applicable to the mining sector. Furthermore, Guidelines for mine closure are available in both Canada and Australia, particularly in each of the mineral resource rich provinces or states and territories.

The closure plans reviewed also indicate that proponents in both countries design progressive closure strategies. This means that proponents are sincere to minimise closure costs in the long run. Proponents take initiative to include closure plan at the early stage of

planning for mining and closure plans are considered as an integral part of the whole project.

5.1 Key Dissimilarities

5.1.1 Legal Regime

While there are well documented legal provisions of mine closure, the legislation for mine closure in Canada, however, is more detailed and comprehensive than that in Australia. For example, the Saskatchewan province in Canada has detailed legislation for mine closure processes. The province of Saskatchewan has established a process under its 'Reclaimed Industrial Sites Act' and related regulations and policies to provide an approach for long-term care and monitoring following closure. Manitoba has separate regulations (Mine Closure Regulation 67/99) for the mine closure process. In Ontario, the requirement for progressive rehabilitation throughout the life of a mine came into force in 1991 by way of the modification of the Ontario Mining Act (part-VII). The regulation also outlines the key contents of a mine closure.

Furthermore, mine closure guidelines in Canada are more up-to-date than those in Australia. Given the constant change in the legislation relating to closure plans, governments should regularly review, identify areas of modification and update the guidelines. In Australia, only the guidelines for mine closure in Western Australia are comprehensive and up-to-date. In addition to comprehensive and clear legislation, guidelines for mine closure detailing the legal provisions of mine closure may increase certainty and reduce delays for proponents as they become aware of the requirements and expectations to be met in advance (Waldeck et al., 2003).

5.1.2 Community Engagement

In both Canada and Australia, requirements of community participation during the planning and implementation of mine closure are in place, although the mechanism may differ. In some Australian states (for example, Queensland and New South Wales), there are requirements to form a Community Consultative Committee (CCC), including representatives of the local community, the government and companies (Department of Planning 2007). In Canada, no such form of community participation exists, although the provision of an 'Impact and Benefit Agreement' between aboriginal communities and companies is working as a formal approach to involve the community in decision making related to the operation and closure of a mine.

In Australia, legislation for mine closure plans does not clearly specify consultation with the indigenous community relating to cultural heritage protection, although companies consult with indigenous communities under Native Title Act about land use during the development of mine sites. Only the guidelines of Western Australia require the assessment of the impact of mine closure on the indigenous community and their culture (Government of Western Australia 2012). In contrast, mine closure legislation or guidelines in Canada specify the requirements of indigenous culture and their participation more explicitly than Australia. For example, provinces such as Ontario, British Columbia, and Manitoba have provision for consultation during the planning of mine closures and there are also respective administrative units or branches to review whether inputs from the aboriginal community are taken into account by the proponent (Cowan 2010).

5.1.3 Social Impact Management Plan

In Queensland, Australia, the mandatory requirement for a Social Impact Management Plan by the proponents of mining and petroleum development is a recent development that incorporates social and economic concerns relating to mine operation and closure (Queensland Government 2012, Rolfe et al. 2012). The aim of the SIMP framework is to operationalize the SIA as part of the approvals of for mine closure plans, as well as project plans, and many recent projects have developed SIMPs to comply with the requirement. This is a positive step towards identifying and dealing with social issues relating to mining operation and closure. In Canadian provinces, there is no provision for development of separate Social Impact Management Plan to address social and economic issues of mine closure. Social and economic issues of mine closure are usually addressed through an Environmental Management Plan.

5.2 Key Shortcomings

5.2.1 Inadequate Address of Social Issues

While a mine closure has potentially significant environmental and social impacts on the local community and the employees of the mining project, consideration of social issues have been found inadequate in practice in both Canada and Australia. It was found that the closure plans are still more concerned with revegetation and geophysical aspects rather than social and community needs relating to income, displacement, social cohesion, and the re-establishment of cultural connections and heritage. It is to be noted that the documents of mine closure plans reviewed in this study have no specific section relating to social impacts of mine closure on local community and employees and subsequent rehabilitation and remedial measures to address the impacts (Goldcorp Canada Ltd 2010, Alexco, 2011, Coffey Natural System Ltd 2009, Straits Resource Ltd. 2009). This suggests that adequate analysis of the social consequences of mine closure must be integrated with the closure planning process if the closure is to be made socially acceptable.

5.2.2 Monitoring of Closure Implementation/Follow Up

The key objective of mine closure planning is to rehabilitate the mine sites and prevents the affected community from being worse off. Therefore, the monitoring of the implementation of mine site reclamation tasks and measures to develop community capacity to cope with situation after the mine closed is crucial to the success of a plan for closure (Warhurst and Noronha 2000). With this in mind, a closure plan needs to clearly outline time and location of monitoring, the frequency and methods of monitoring, the parameters to be monitored, and the system of reporting (EPA 2011). Although the reviewed mine closure plans in Canada and Australia clearly specify the requirement of monitoring of rehabilitation and reclamation of mine site, this mostly the monitoring of biophysical condition. There is little information about the monitoring of social and economic condition of community to be affected by mine closure. The proponents may tend to avoid this task, because the monitoring of social indicators is more difficult than those relating to the physical environmental. Furthermore, the MCPs reviewed in this study failed to clearly outline concerning what physical components should be monitored and cared for, who is going to monitor them and who will pay for it particularly at the post-closure stage. Often companies might think that it is the responsibility of government to monitor the impacts at the post-closure stage.

5.2.3 Alternative Analysis of Closure Options

Alternatives are choices or courses of action (Steinmann 2001) and, from the alternative analysis, closure strategies that meet the closure objectives can be developed and discussed with affected communities and other stakeholders (ICMM 2006). In both Australia and Canada, there is little provision for the alternative analysis of mine closure, such as the use of technology for rehabilitation, the use of land after reclamation or the use of tailings. In addition, the MCPs reviewed in this study rarely mention an alternative analysis of mine closure options (for example, Shree Minerals Ltd 2011, Coffey Natural System Limited, Diavik Diamond Mines Inc 2011). Where issues of alternative analysis were mentioned, this was limited to environmental and physical issues such as tailings management and demolition of structures. The analysis of alternative approaches and designs of mine closure may result in cost-effective planning and more benefit to both the community as well as the proponent.

To improve the practice of mine closure planning, legislation for mine closures needs to be more comprehensive in both Canada and Australia. While the primary legislation needs not to be specific in terms of what should or should not be included in each of the key elements, the laws can be supported by regulations and guidelines to specify the requirements in detail. This may facilitate the proponents to be consistent and comprehensive in the development of closure plans. While companies may have their own guidelines and standards, uncertainty about the commitment of the companies and inconsistency in the compliance of closure requirements may arise in the absence of clear, comprehensive and up-to-date mine closure regime. Given the changing expectation of resource community it is imperative to review the mine closure regime and identify the areas of modification.

6. Conclusions

The purpose of this study was to examine the extent of mine closure practice in Canada and Australia and identify the shortcomings and areas of further improvement. In this study, the findings, in general, show that no one system is superior to the other. Both countries have established mine closure legislation and are working towards the advancement of mine closure planning and moving to satisfy global good practice requirements. Despite this advancement, the ten mine closure plans reviewed in this study lacked detailed information relating to these issues of good practice. The study therefore also identified some shortcomings in mine closure practice common to both countries needing further improvement. These include the analysis of social impacts, the analysis of alternative closure options and the monitoring of social impacts. These findings confirm the findings of other similar studies for example, Sommer and Gardner (2012), White et al. (2012), and Cowen et al. (2012). In order to facilitate decision makers to take decisions about sustainable mine closures, the closure plan need to contain clear and adequate information on these issues.

The study was limited to Australia and Canada and used generalized criteria of good practice mine closure. The information contained by the closure plans of various mines in both Australia and Canada were reviewed against the generalized good practice criteria. It was not possible to study in details of each of the mine site given the limited time, resources and scope.

Nevertheless the findings of the research will improve understanding on good practice mine closure particularly in the context of both Australia and Canada. This is the first kind of study

that compares mine closure practice between Canada and Australia. The criteria of good practice mine closure developed by the authors in this study can be used for other similar studies. The significance of this study is that the study identified some shortcomings in good practice of mine closure in both Australia and Canada despite the fact that both the countries are resource rich and have long experience of mining. Given the common shortcomings there are room for further improvement of mine closure in both countries. Also other resource rich countries with similar context can learn lessons from this study and thereby improve their policy and practice. The findings of this study can be useful to academic and policy maker of other countries.

Endnotes

⁵ In this article, mine closure is broader approach that includes a period of time when the operation of mine starts to scale down and the time it takes to undertake the final decommission and rehabilitation or reclamation. In this case, the term mine closure encompasses processes including rehabilitation, decommission and relinquishment and outcomes.

References

- Andrews-Speed, P, Ma, G, Shao, B and Liao, C 2005, 'Economic response to the closure of small-scale coal mines in Chongqing', *China, Resource Policy*, Vol.3, pp. 39-54.
- Australia Pacific 2011, Gladstone Regional LNG Community Consultative Committee, Gladstone, Queensland.
- Australia and New Zealand Mineral and Energy Council (ANZMEC) and Mineral Council Australia (MCA), 2000, *Strategic Framework for Mine Closure*.
- Australian Government, 2006, *Mine Closure and Completion-Leading Practice sustainable development program for the mining industry*, Department of Tourism, Industry and Resources, Caberra, Commonwealth of Australia.
- Burton, M, Zahedi, SJ and White B 2012, Public preferences for timeliness and quality of mine site rehabilitation- The case of bauxite mining in Western Australia, *Resources Policy*, Vol. 37: pp. 1-9.
- Coffey Natural System Ltd., 2009, *Mine Closure and Rehabilitation Plan*, Northern Territory, Australia.
- Chouard, R 2004, Mine Reclamation guidelines for the Northeast Territories and Nunavut, *Conference paper*, Canada.
- Cesare, P and Maxwell, P 2003, Mine closure legislation in Indonesia: The role of mineral industry involvement, *Natural Resources Forum*, Vol. 27, pp. 42-52.
- Coaltech 2010, Socioeconomic impacts of Mine Closure and Sustainable Development, Report 1 of 2, Centre for Sustainability in Mining and Industry (CSMI), South Africa.
- Clerk, AL 2002, An international overview of legal framework of mine closure, in Clerk, AL., 2002, *Policies, regulatory regimes and management practices for the mine closure*, pp. 67-94.
- Cowan, WR and Robertson, JGA 2000, Mine Rehabilitation in Ontario, Canada: Ten Years of Progress, pp. 1043-1037, available at <http://www.gov.on.ca/MNDM/MINES/MG/minrehab.html>.
- Cowan, WR, Mackasey, WO, Roberston, GA 2010, The policy framework in Canada for mine closure and management of long-term liabilities: A guidance document, National Orphaned/Abandoned Mines Initiative, Cowan Minerals Ltd, Sudbury, Ontario.
- Department of Planning, 2007, Guidelines for establishing and operating Community Consultative C committees for mining projects.

- Dalupan, C 2001, *'Mining and Sustainable Development: Insights from International Law'*, Claredon.
- DITR 2006 *Mine Closure and Completion*, Leading Practice Sustainable Development Program For The Mining Industry produced by the Department of Industry Tourism and Resources, Canberra, available at <http://www.dmp.wa.gov.au/documents/mine_closure.pdf>
- Environmental Protection Agency, 2011, *Guidelines for Preparing Mine closure*, Western Australia, Australia.
- Government of South Australia, 2012, Guidelines for miners: preparation of a program for environment and rehabilitation (PEPR) for extractive mineral operations in South Australia (Version 2).
- Government of South Australia, 2009, *Guidelines for miners: preparation of a mining and rehabilitation program (MARP) for extractive mineral operations in South Australia*, Australia.
- Hoskins, W 2005, *Mine Closure: the 21st Century Approach- Avoiding Future Abandoned Mines*, in Bastida, E. Wälde, T. and J. Warden-Fernández (eds), 2005, *International and Comparative Mineral Law and Policy. Trends and Prospects*, Kluwer, The Hague, pp. 627-639.
- IIED, 2002, Social Impact Assessment in the Mining Industry: Current Situation and Future Directions, United Kingdom.
- IAIA, 1999, Principles of environmental impact assessment best practice, <http://www.iaia.org> accessed on 28/11/2012
- Miller, CG 2005, Financial Assurance for mine closure and reclamation, ICMM,
- ICMM, 2011, A Guide to leading practice Sustainable Development in mining, Australia, available at <http://www.ret.gov.au>.
- Jackson, RT 2000, Introduction, in Khanna, T. (ed.), 2000, Mine Closure and Sustainable Development: Results of the Workshop organised by the World Bank Group Mining Department and Metal Mining Agency of Japan, *Mining Journal Books*, London.
- Johnson, SL and Wright, AH 2003, *Mine Void Water Resource Issues in Western Australia*, Report No. HG 9, Water and Rivers Commission.
- Kahn, JR, Francesche, D, Cun, A and Vale, E 2002, Economic and Financial Aspects of mine closure, *Natural Resource Forum*, pp. 1-19.
- Laurence, DC 2002, Optimising mine closure outcomes for the community-lessons learnt, *Minerals and Energy*, vol. 17 (1), pp. 27-34.
- McDonald, P, Mayes, R and Pini, B 2012, 'Mining Work, Family and Community: A Spatially-Oriented Approach to the Impact of the Ravensthorpe Nickel Mine Closure in Remote Australia', *Journal of Industry Relations*, SAGE Publications Ltd., London.
- Metserve Ltd., *Mine Closure Plan*, MacArthur River Mine Phase and Development Project, Northern Territory, Australia.
- McHaina, 2001, DM, 'Environmental Planning Considerations for the Decommissioning, Closure and Reclamations of a Mine Site', *International Journal of Surface Mining, Reclamation and Environment*, Vol.5 (3), pp.163-176.
- MMSD 2002, *Breaking New Ground*, Earthscan, London.
- Miles, M & Huberman, AM 1994, *Qualitative data analysis: An expanded sourcebook*. Newbury Park, CA: Sage.
- Miranda, M, Chambers, D and C. Coumans, 2005, *Framework for Responsible Mining: a Guide to Evolving Standards*, available at www.frameworkforresponsiblemining.org, pp. 38-40.
- Peck, P 2005, *Mining for Closure: Policies and Guidelines for Sustainable Mining Practice and Closure of Mines*, Geneva.

- Queensland Government, 2012, Social Impact Assessment Guidelines, Department of State Development, Infrastructure and Planning, Australia.
- Queensland Mining Council, 2001, *Guidelines for Mine Closure Planning in Queensland*, Australia.
- Rolfe, J, Ivanova, G and Lockie, S 2006, Assessing social and economic impacts of Coal Mining on communities in the Bowen Basin: summary and recommendations, *Research Report No. 11*, Queensland, Australia.
- Rolfe, J, Miles, B and Lockie, S, 'Lessons from the Social and Economic Impacts of the Mining Boom in the Bowen Basin 2004-2006', *Australasian Journal of Regional Studies*, Vol. 13, No. 2, pp. 134-153.
- Rolfe, J, Greer, L, Akbar, D and Kabir, SMZ 2012, *Social Impact of Assessment of Blair Athol Mine Closure*, Rio Tinto, Australia.
- Paulo de Sa 2005, 'Mineral Policy: a World Bank Perspective', in Bastida, E. Wälde, T. and J. Warden-Fernández (eds), 2005, *International and Comparative Mineral Law and Policy. Trends and Prospects*, Kluwer, The Hague, pp. 493-504.
- Remy, Felix and Gary MacMahon 2002, '*Large Mines and Local Communities: Forging Partnerships, Building Sustainability*', Mining and Development (April 2002). World Bank Group, Mining Department, Washington, D.C.
- RioTinto 2008, Minutes of the Clermont Community Consultative Committee meeting, Clermont, Queensland.
- RioTinto 2011, RioTinto Iron Ore, Yandicoogina Closure Study Report, Western Australia.
- Saskatchewan Ministry of Environment, 2008, *Guidelines for Northern Mine Decommissioning and Rehabilitation* (version-6), Canada.
- Solomon, F, Katz, E and Lovel, R 2008, Social dimensions of mining: Research, policy and practice challenges for the minerals industry in Australia, *Resource Policy*, Vol.33, pp. 142-149.
- Sommer, N and Gardner, A 2012, 'Environmental securities in the mining industry: A legal framework for Western Australia', *Australian Resource and Energy Law Journal*, Vol. 31, pp. 242-262.
- Smith, B 2008, *Sustainable Mine Practices, Rehabilitation and Integrated Mine Closure Planning*, Master's Thesis, University of New South Wales, Australia.
- UNEP, 2005, Mining for Closure: policies and guidelines for sustainable mining practice and closure of mine, Geneva.
- Veiga, MM, Scoble, M and McAllister, ML 2001, Mining with communities, *Natural Resources Forum*, Vol.25, pp. 191-202.
- Warhurst, A and Noronha, L 2000, *Integrated Environmental Management Through Planning for Closure from the Outset: The Challenges*, in Warhurst, A. and L. Noronha (eds), 2000, Environmental Policy in Mining- Corporate Strategy and Planning for Closure, Boca Raton, Lewis.
- Warhurst, A and Nornoha, L 1999, Integrated environmental management and planning for closure: The challenges, Minerals and Energy-Raw Materials Report, vol.14:3, pp. 6-11.
- Warhurst, A Macfarlane, M and Wood, G 2000, *Issues in the Management of Socioeconomic Impacts of Mine Closure: a review of Challenges and Constraints*, in Warhurst, A. and L. Noronha (eds), 2000, Environmental Policy in Mining- Corporate Strategy and Planning for Closure, Boca Raton, Lewis.
- Welsh, DR 2007, *Mine Closure-A Regulators Guide to the Things that Matter*, SKM Minemetal, Chile.

- Wenig, MM, O'Reilly, K and Chambers, D 2005, *The Mining Reclamation Regime in the Northwest Territories: A comparison with Selected Canadian and U.S. Jurisdictions*, Canadian Institute of Resources Law, Canada.
- Waldeck, S, Morrison-Saunders, A and Annandale, D 2003, Effectiveness of non-legal EIA guidance from the perspective of consultants in Western Australia, *Impact Assessment and Project Appraisal*, vol. 21, issue 3, pp. 251-256.
- White, B, Doole, GJ, Pannell, DJ and Florec, V 2012, 'Optimal environmental policy design for mine rehabilitation and pollution with a risk of non-compliance owing to firm insolvency', *The Australian Journal of Agricultural and Resource Economics*, volume 56: 280- 301.
- Wood, C 2003, *Environmental Impact Assessment: a comparative review* (2nd edition), Prentice Hall, Longman.
- World Bank, 2010, *Towards Sustainable Decommissioning and Closure of Oil Fields and Mines: A Toolkit to Assist Government Agencies*, version 3, Washington, USA.
- World Bank, 2008, *Guidance notes for the implementation of financial surety for mine closure*, Oil, Gas and Mining Policy Division, Washington, USA.