Literature Review of Existing Codes of Best Practice in Mining with Special Emphasis on Small-Scale Mining

Georgetown, Guyana

Report

NRCan (CANMET) – GENCAPD Mining Project

Our File: M-6763-1 (603430)

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SNC•LAVALIN
Environment

Member of the SNC•LAVALIN Group

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DISCLAIMER

The primary purpose of this publication is to provide a literature review of Codes of Best Practice in mining. It expresses the professional opinion of SNC-LAVALIN ENVIRONMENT INC. (SLI) regarding the matters set out herein, based on SLI's professional judgment and reasonable due diligence. It is to be read in the context of the agreement of August 4, 2003 (the Agreement) between SLI and Natural Resources Canada (the Client), and in accordance with the methodology, procedures and techniques that SLI used, the assumptions SLI made, and the circumstances and constraints under which SLI carried out its mandate. This document is meant to be read as a whole, and sections or parts thereof should therefore not be read or relied upon out of context.

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1. INTRODUCTION

SNC-LAVALIN ENVIRONMENT INC. (SLEI) has been mandated by the Guyana Environmental Capacity Development Project (GENCAPD) to carry out a literature review of existing Codes of Best Practice in mining with special emphasis on small-scale mining. This review was carried out as a preliminary step toward the drafting of 6 Codes of Practice for small and medium-scale gold and diamond mining in Guyana. These codes are:

1) Use of mercury.
2) Tailings management.
3) Effluents management.
4) Reclamation and mine closure.
5) Mining waste management and disposal.
6) Contingency and response plans.

Best Practice is a relatively new concept, especially as applied to environment and mining. As a matter of fact, the oldest Code of Best Practice (CBP) found during this review was published in 1992 and applies to placer mining. Because it is a recent development in the mining environmental management framework, there is still some confusion as to what is a CPB. For instance, we have seen documents called Best Practice Codes that are actually technical manuals or even guidelines. On the other hand, some publications called Guides or Manuals were genuine Codes of Practice. We have noted too that there is a wide range of possible content, from highly technical to very general.

1.1 Some definitions

In order to avoid further confusion, it is therefore important to define at the outset the different concepts of Best Practice, Code of Practice, Guidelines and Regulations.

A Code of Practice is a collection of rules and ethical principles related to a specific field of activity, describing the procedures and setting out standards considered to be Best Practices in the said field of activity. The code may be either voluntary or mandatory.

Best Practice is about preventing or (when this is not possible) minimizing risks to human health, as well as adverse environmental, social and economic impacts. In other words, it is "*the best way of doing things*".

Sustainable Development (SD) is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Best Practice is directly in line with the concept of SD and one of the ways to achieve it.

Guidelines are a non-abiding document, generally designed to provide the user with information, explanations, guidance and help on a specific topic. They are a commonly used tool in enforcing a new regulation. The user may be the Regulator or the industry.

Regulation is a type of "delegated legislation" promulgated by a state, federal or local administrative agency authorized to do so by the appropriate legislature. Regulations generally are very specific in nature, and are also referred to as "rules" or simply "administrative law". Regulations are official rules and must be followed.

It should be kept in mind that a CBP should never be too technical as it is basically a statement of principles. The implementation of a Code of Practice is usually described separately in technical or operation manuals that detail how a specific standard will be implemented.

2. BEST PRACTICE FOR THE USE OF MERCURY

Among the 6 topics that had to be addressed (see above), mercury is by far the best documented in the literature as far as small-scale and artisanal mining are concerned. Most of the articles on the subject focus on artisanal mining and its misuse of mercury with the resulting effects on human beings and the environment. There are basically two types of literature dealing with mercury:

1) Health and environmental effects of mercury (very abundant);
2) Preventive measures.

One the most striking features of the literature on mercury is that a great deal of effort has been devoted to investigating the environmental and health effects of mercury. As M. Veiga (1997) observes: "*In most monitoring programs, human beings are merely hair, blood, or urine donors. In many cases, affected people never learn the results of the monitoring program, unless, of course, they read the scientific literature*".

It is in the preventive measure category that documentation closer to Best Practice can be found. The most interesting and relevant works on the topic in South America are spread over two regions:

1) Andean countries (Bolivia, Ecuador and Peru);
2) Brazil

At the end of the 90's, the Swiss Agency for Development and Cooperation (COSUDE) funded three major cooperation projects with small-scale and artisanal miners in Bolivia, Ecuador and Peru. These projects, executed by Projekt Consult, a German firm, basically aimed to improve the environmental performance of artisanal mines in these countries through technical assistance in mercury management and ore dressing. The projects are:

1) **MEDMIN (in Bolivia):** Manejo Integrado del Medio Ambiente en la Pequeña Minería (Integrated Environmental Management in Small-scale Mining).

2) **GAMA (in Peru)**: Gestión Ambiental en la Minería Artesanal (Environmental Management in Artisanal Mining).

3) **PMSC (in Ecuador):** Proyecto Minería Sin Contaminación (Pollution Free Mining Project).

The field managers of these projects have jointly produced a book on Environmental Management in Small-Scale Mining (Wotruba et al., 1998) which is, to date, the best of its kind. It addresses mercury and proposes, in an appendix, a technical norm on the proper use of mercury, which serves as a solid foundation for a Code of Practice. The book is written in Spanish but is currently being translated into English.

The other reliable source of information on proper use of mercury in small-scale mining comes from Brazil. That country has more than 200,000 artisanal miners who produce in excess of 80 tons of gold every year. CETEM, Brazil's Centre for Mineral Technology (Centro de Tecnologia Mineral) has worked extensively with garimpeiros to introduce mercury abatement technologies and practices.

Dr. Marcello Veiga of the University of British Columbia, in conjunction with CETEM and the United Nations Industrial Development Organization (UNIDO), has produced an outstanding paper entitled *Introducing New Technologies for Abatement of Global Mercury Pollution in Latin America*. Among other things, this paper proposes the introduction of a small processing center called UNECA (**UN**it of Gold **E**xtraction and **C**ontrolled **A**malgamation). Such processing centers already exist in Venezuela and Zimbabwe.

3. BEST PRACTICE FOR THE MANAGEMENT OF EFFLUENTS

After mercury pollution, waterways siltation is the most severe environmental problem caused by small-scale alluvial mines. Because of the unselective mining method employed in these small operations (hydraulicking), this is strictly a small-scale mining problem that is not encountered in large-scale, highly mechanized mines.

Although water turbidity is a severe environmental problem that may damage local aquatic ecosystems and jeopardize livelihoods, it is not the object of anything like as extensive a literature as mercury. However, some very interesting and practical information is available from North American regions with extensive placer mining, namely the states of Idaho and Alaska in the US, and the Yukon Territory in Canada.

The best document we found is *Best Management Practices for Mining* published by the Idaho Department of Lands. This manual is meant specifically for placer mining and covers all steps of the mining cycle, from exploration to reclamation. It addresses issues such as settling ponds, soil stabilization, drainage collection and dispersion, sediments collection, revegetation, etc. The publication is abundantly illustrated and even provides design specifications.

Although there are many documents and web sites describing placer mining activities in Yukon and Alaska, none is as complete and relevant as the Idaho manual.

4. BEST PRACTICE FOR TAILINGS MANAGEMENT

Because tailings storage facilities represent the most significant environmental liability associated with mining operations, they have attracted much attention in recent years. During the last decade, they have been in the news frequently in the wake of a spate of well-publicized failures, and these events have led mining companies to devote substantial resources to the proper management or, as we now call it, stewardship, of tailings dams. No wonder therefore that abundant and up-to-date information on tailings facilities is found in the literature. The plethora of documentation on the subject reflects the increasing attention mining companies are devoting to these facilities.

Tailings dams are typically a medium to large-scale mining feature associated with mechanized ore processing plants fitted with a ball mill or other grinding device. They are therefore non-existent among small-scale mines and this is reflected in the literature; operation manuals, management guides, best practice codes, etc. are written and designed for large operations.

The best documentation on tailings management comes, as would be expected, from developed mining countries like Canada, Australia and South Africa. Nothing truly relevant was found in South American countries. The document closest to a Code of Practice on tailings management and currently available in the literature is the Mining Association of Canada (MAC) *Guide to the Management of Tailings Facilities*. It presents a general management framework and sets out a number of standards of practice without going into technical aspects. The Canadian Dam Association has produced its *Dam Safety Guidelines*, which are more technical than the MAC guide and resemble the International Conference on Large Dam (ICOLD) guidelines. Environment Australia has published a very interesting series of booklets called *Best Practice Environmental Management in Mining*, covering a number of mining issues, including one on *Tailings Containment*.

The Department of Minerals and Energy of South Africa has prepared a guideline for the compilation of a mandatory Code of Practice, which is quite straightforward and useful.

As previously mentioned, none of these documents applies to small-scale mining. Because tailings in small-scale placer gold mining are fundamentally different from

those generated in large-scale mining, this is the hardest issue to adapt in order to draft a code that is truly applicable to artisanal or small-scale alluvial operations.

5. BEST PRACTICE FOR RECLAMATION AND CLOSURE PLANS

Since the early 90's, reclamation has been considered an integral part of the whole mining cycle. This formalization was achieved via introduction into the regulatory framework in advanced mining countries (Canada, USA, Australia) of a number of provisions obliging mining companies to restore mined land to a satisfactory condition after mining has ceased.

However, developing mining countries have yet to follow suit and as such, they require support and know-how transfer. The literature on CBP for reclamation and Closure Plans faithfully reflects this situation. Once again, the best documentation on mine reclamation comes from Canada and Australia. With the USA, these are also the countries with the most stringent regulations on mine reclamation and financial safety for reclamation. Environment Australia's previously mentioned series of booklets on *Best Practice Environmental Management in Mining* includes one on *Mine Decommissioning* (although decommissioning and reclamation are different concepts). In 1997, the Ministry of Natural Resources of Québec (Canada) published *Guidelines for Preparing a Mining Site Rehabilitation Plan and General Mining Site Rehabilitation Requirements*. *Best Management Practices for Mining in Idaho*, mentioned in section 3 above, thoroughly addresses the reclamation of placer mines.

In South America, although some countries have already introduced provisions for mine reclamation in their mining regulations (e.g. Bolivia), we found only one CBP (or equivalent), in Bolivia, the *Guia Ambiental para el Cierre, Remediación y Rehabilitacion de actividades Mineras* (Environmental Guide for Closing, Remediating and Rehabilitating Mining Activities), published by Bolivia's Vice Ministry of Mining and Metallurgy. This publication is designed for small-scale mines and proposes simple technologies very similar to those found in the Idaho document.

International organizations like UNEP and the World Health Organization (WHO) are striving to ensure that developing countries catch up with the recent evolution calling for the introduction of mine reclamation requirements in mining regulations. In 1998, UNEP and WHO jointly produced a training manual for environmental and health protection that is quite exhaustive and easily adaptable to different contexts. In the 2002 final report of the Mining, Minerals and Sustainable Development Project (MMSD), a 2-year worldwide initiative launched by the mining industry to find out how the mineral

industry can contribute to sustainable development, a whole chapter is devoted to mine reclamation and mine closure.

6. BEST PRACTICE FOR WASTE MANAGEMENT AND DISPOSAL

The most extensive document we located on Waste Management and Disposal is the European Union Directive of the European Parliament and Council on the Management of Waste from the Extractive Industries. The Western Australia Department of Minerals and Energy issued in 2001 a very concise and useful Environmental Note on Waste Rock Dumps, including their reclamation. The Idaho Bureau of Land's Best Management Practices in Mining addresses topsoil and overburden management.

7. BEST PRACTICE FOR CONTINGENCY AND RESPONSE PLAN

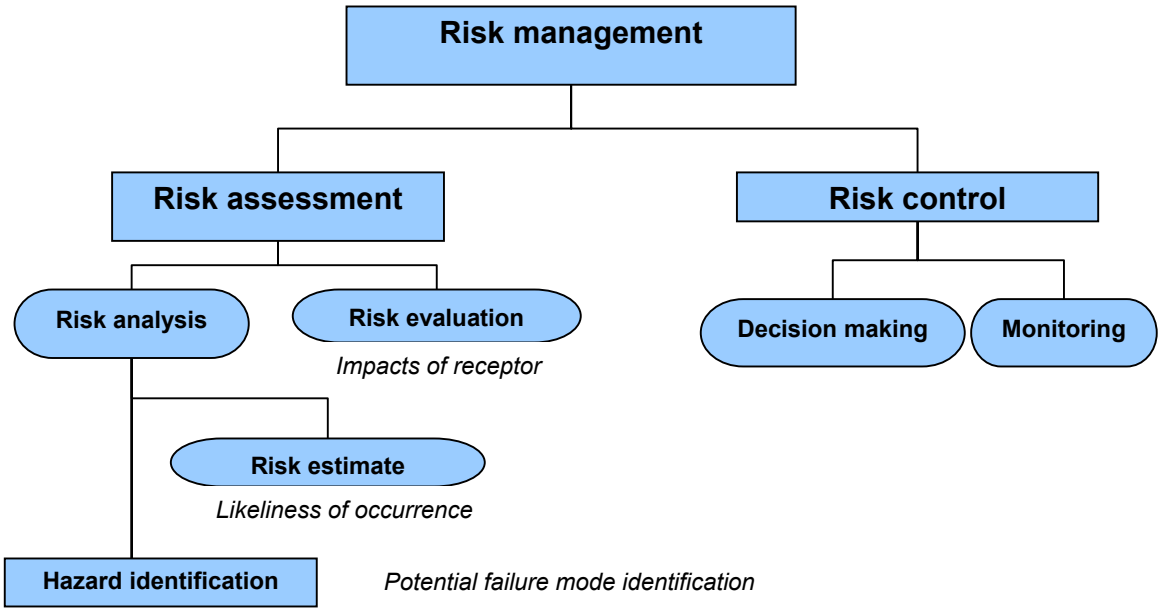
The tailings dams failures (Los Frailes, Omai, Porco, etc.), cyanide spills (Baia Mare) and other mining accidents that occurred during the last decade have led the mining industry to raise the level of awareness and preparedness within and around its operations around the world. These accidents were a disastrous blow to an industry that traditionally does not enjoy a favorable image and who is seen as depredating, overly conservative and old fashioned.

The appearance of the ISO 14001 standards, pressure from public opinion and insurance companies concerned about potential disastrous liabilities were other factors that forced a change upon the industry in terms of contingency and response plans (CRP). CRP are a natural consequence of Risk Analysis, a rather new approach in mining and an essential part of overall Risk Management. Identifying what can go wrong naturally leads to taking prevention measures and to being better prepared in case of a disaster. Failure is never an option but accidents may occur.

The most recent development in terms or preparedness is the concept of **A**wareness and **P**reparedness for **E**mergency at the **L**ocal **L**evel **(APELL)**. It applies not only to mining but to all industrial sectors. The most relevant publication we found regarding APELL in mining was produced by UNEP. It provides detailed and step by step guidance for the preparation of APELL in mining while mentioning the limitations of APELL for small-scale or artisanal mining.

Risk management is an essential step of any CRP or APELL. Literature abounds with documentation on Risk Management and its components: Risk Analysis and Risk Assessment (see fig.7-1). The proceedings of the 1998 Buenos Aires Workshop on *Risk Management and Contingency Planning in the Management of Tailings Dams* are a useful document and contain case histories that help in understanding the concepts. Environment Australia's booklets on Best Practice for Environmental Management in Mining have published an issue devoted to Environmental Risk Management. There is actually more information available on Risk Management than on CRP or APELL, most likely because this is an insurance companies' requirement.

Figure 7-1
Risk Management



8. CONCLUSIONS

- With the exception of mercury and drainage control (effluents management), Codes of Best Practice are mostly devoted to large-scale mining.

- Codes of Practice exist for different mining-related activities (tailings management, cyanide management, placer mining, risk management, etc.).

- The best available documents come from developed countries with a long and solid mining tradition (Canada, Australia, USA and, to some extent, South Africa). Australia is the most advanced country in the elaboration of Best Practice manuals for its mining industry.

- There is only one truly international Code of Practice: the International Cyanide Management Code.

- International Organizations such as UNEP, UNIDO, WHO, International Council on Metals and the Environment (ICME) are trying to develop international guidelines for the global mining industry. These guidelines are generally a very good base for developing Codes of Practice.

- Codes of Practice are just making their appearance in South America.

- Canadian, US and Australian mining companies are usually implementing their own in-house or domestic Codes in countries where they operate who don't have such Codes.

- There is no typical Code. There is a wide range of Codes whose framework may vary substantially, even within the same series (e.g. Environment Australia's booklets).

This report has been prepared par Marc Arpin, M. Sc., P. Geo., project manager, and reviewed by Benoît Demers, M. Sc. A., Eng., Director, Mining and Environment.

SNC-LAVALIN ENVIRONMENT INC.

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Verified for conformity
with ISO 9001 by : _____

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