

THE CHALLENGE TO DEVELOP A RECLAMATION AND CLOSURE PROGRAM FOR MINING ACTIVITIES IN CHILE

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ABSTRACT

Mining exports represents approximately fifty percent of Chilean exports, with foreign investments amounting to US \$ 7 billions between 1990 and 1996 for mining projects. The new mining operations and the older one have to comply with the just enacted environmental regulations during the whole life cycle of the mining activity. Regarding those aspects it is important to highlight the positive attitude of the mining sector towards to solve pollution problems.

However, at the moment Chile does not have an specific regulation to control efficiently the closure and reclamation stages of a mining site. Therefore, the real challenge is to develop a competent policy, program and regulation of closure and reclamation of mining sites in order to prevent significant pollution problems at the beginning of the mining project and to permit mining Chilean land in a sustainable form.

The Chilean Ministry of Mining is leading the aims to develop a policy, program and regulation for the closure and reclamation of mining sites. This process involves many organisations such as public institutions, mining companies, academic community and the community in general in order to develop a realistic policy, program and regulation.

1.0 Introduction

Mines activities are not new for the Chileans. Ever since the country was conquered by the Spaniards, mining activities have had a significant effect on the economics, political and socio-cultural fabrics of Chilean society, also establishing the basis for the evolution of Chilean State. However, regarding closure, abandonment, restoration and reclamation of mining activities, the country does not possess a long experience.

However, Chile possesses a large number of environmental regulations and a recently published environmental law (1994) that control indirectly the closure of a mine. Additionally, there are a large number of new¹ and old mines operations that together represent approximately the 50 % of the export of the country. Therefore, at the moment the development of a regulation of closure, abandonment, restoration and reclamation of mine projects represent a real challenge in order to non-stop the mines growth and protect the environment.

Regarding the closure of a mine site it is important to highlight the importance to introduce the closure programme at the beginning of the project, in order that consequently might be possible to verify that programme during trough the whole life of the mine project. Additionally, in order to be efficient it is recommendable to develop in parallel the closure plan with the mine programme.

In Chile at the moment it is compulsory to present an environmental impact statement or study to the environmental authority in order to obtain the environmental permits or comply with the environmental law. However, following the presentation and authorisation of the environmental permit it is recommendable for large and medium mine operations to implement an environmental management system in order to be efficient in terms of the environment and production. In that case it is efficient to introduce the closure and reclamation plan within the environmental management system.

Therefore, at the moment the Chilean government is working on the development of a proposal of regulation regarding the closure, abandonment, restoration and reclamation of mines activities and also promoting the environmental self-assessment through the utilisation of environmental management systems.

Finally, one of the main objectives of the present work is to present the current work of the Ministry of Mining regarding the scope of the proposal of closure, abandonment, restoration and reclamation of mines activities.

¹ They are mainly foreign investments

2.0 The mining Sector in Chile

During 1996, mining exports represents approximately 50% of total exports, with an average annual value slightly below U.S.\$ 8 billions². The sector has collected investments amounting to some US\$ 7 billion between 1990 and 1996, approximately the 75 % of these investments are from foreign countries. Therefore, an adequate management of the environmental issues in the mining sector, allow a sustained development in Chile.

Additionally, the country holds a significant share of the world reserves of various metallic and non metallic minerals (copper, rhenium, selenium, lithium, molybdenum, etc.) and it is the world's first primary copper producer.

The high level of foreign investment in the mining it is possible due to the country shows many comparative advantages for mining such as the number and grade of the orebodies, the geographical location of mineral deposits, the availability of qualified human resources, a adequate infrastructure, up to day communication and financial services, political stability and the existence of stable and clear regulations regarding foreign investment and mining property rights.

Historically, mining activities have been classified into three categories according with their size, small, medium and large scale mining. Another feature of the Chilean mining industry is the existence of state and privates companies.

Large scale mining was the privilege of state owned CODELCO until Minera Escondida began operations in 1991. Due to the start of new projects , the copper output from private companies will increase from the present 25% to 50 % of total production in 1995.

CODELCO, with four mines and three smelters, is the largest copper producer in the world. There is also ENAMI. a state owned company which provides a market for small miners and does mineral processing and custom smelting for small and medium size producers in its four plants and two smelters.

Private mining is represented by Shell, Exxon, Outokumpu, Cominco, BHP, Placer Dome, Phelps Dodge, American Barrick, Coeur d'Alène Mines, RTZ Corporation, Cyprus/AMAX, etc. and by many medium and small scale national producers.

In brief, mining is important to Chileans because it is the main source of foreign currency, it attracts capital through foreign investment in projects, and it is an important source of income to the state through taxes and the profits of CODELCO and ENAMI. Moreover, mining creates a strong demand for goods and services, and therefore, has a direct local impact on local socio-economic development.

² Source: Chilean Copper Comissin (1996)

3.0 The Environmental Regulations in Chile

There are several environmental regulations in Chile, according to a survey of the National Commission on the Environment (CONAMA) in 1992, approximately 1500 regulations were identified such environmental regulations. However, those regulations are dispersed all along the different statutes creating a complex administration in the environmental field. In fact, that situation encouraged the development of the Chilean Environmental Law, that was published in March of 1994.

One of the main objectives of the Environmental Law is to co-ordinate the application of the all other environmental regulation in Chile, regarding the environmental impact assessment system, Clean-up plans, elaboration of environmental quality and end of pipe standards.

The application of the Environment Law, it affects almost every sector of the Chilean economy, particularly the mining sector. It is expected that the existence of the Environment Law will have strong implications in the development of the future mining investment projects.

The Environmental Law, is the framework to co-ordinate the application of the specific environmental regulations, however it is possible to identify three principal issues in this Law, namely:

- a) Environmental Impact Assessment System
- b) Elaboration of Environmental Quality and end of pipe Standards
- c) Clean-up Plans

3.1 Environmental Impact Assessment System (EIAS)

The Environmental Law established the Environmental Impact Assessment System (EIAS) as an essential element of the environmental management, with emphasis on its preventive character. The EIAS establishes the type of projects requiring an evaluation of its environmental impacts, the way they will propose the qualification procedure to which they will be subjected.

The EIAS covers the required environmental permits that operate under Environmental Law, as well as the criteria to be used in carrying out Environmental Impact Studies (EI) or Environmental Impact Statements (EIS) for different investment projects. As a result of the approval of the Environmental EI or EIS, the State will request that all productive projects -private or public, from their start to closure -, should comply with environmental standards, establishing certain investment commitments to mitigate or compensate environmental damages

Conceptually, an Environmental Impact Assessment is the methodology by which a project designs its activities, from the stage of construction to abandonment to minimise the associated environmental risks, prevent pollution and all adverse effects.

The Environmental Law defines EIAS as the procedure that, based on a EI or EIS, determines whether the impacts are adjusted to the existing environmental regulations. The National Environmental Commission (CONAMA) is the organisation responsible to co-ordinate the EIAS process when the impacts affect more than one Region of the country, otherwise the corresponding Regional Environmental Commission (COREMA) when the impacts are limited to the respective Region . In the mining sector, the EI and EIS are not a new subject. Several years before the enactment of the Environmental Law, foreign mining companies carried out internal Environmental Impact Studies, as part of corporative policies demanded by their shareholders.

3.2 Elaboration of Environmental Quality and End of Pipes Standards

The elaboration of environmental quality and end of pipe standards (EQEPS) is a new issue in Chile, before this Law. In this field the first goals for the Chilean government is to compile, systematise, and review the existing environmental standards in this field; and to establish a ranking of elements and substances in order to develop new environmental standards or modify the wrongs.

Three goals that may be considered in the EQEPS are: i) to protect human health, ii) to protect any environmental component from pollution, and iii) to protect one or more natural resources or some cultural historical patrimony. That is to say, that any standard to be proposed should provide an adequate protection of a specific environmental component, its measure being the limit of what society accepts. The argument about standards' acceptance must include all aspects (ethical, technical, economical, etc.). All these must be supported by the best scientific knowledge.

Standards must be reasonable and reachable for companies. It makes no sense to set up standards with no scientific base, or very difficult to comply with, since they weaken the possibility to protects the environment, generating uncertainty in the companies and favouring the no compliance with environmental standards.

A reasonable standard does not mean a rule favouring or granting "special licenses" for polluting to fast growing economic sectors, like mining. A good environmental quality standard could benefit both the environment and the economy. On the contrary, a bad one could negatively affect both. Well designed standards will push companies to develop efficient technologies and to keep control on their processes, and even to compete internationally with their products.

In the mining sector, the generation of adequate environmental standards is a priority. This is important, because commitment exists related to environmental demands of Chilean

society, and a growing pressure from industrial countries about the environmental behaviour of the developing countries.

3.3 Clean-up Plans

The Clean-up Plan is the legal instrument for the industries in operation do not comply with the environmental standard (air, water, soil, etc.) . The government should authorise Clean-up Plans whose aim should be to comply with the environmental standards within a reasonable time scale.

The mining sector experience in the development and approval of clean-up plans, that were long and complex, indicates the conveniences to avoids them become an excessive burden for the State. To do so, the by-laws' rules must place responsibilities on the polluter, assuring the "polluter pay" principle. In the case of clearly identified emission sources, it must be necessary to ask the company for the information involved. The company should give the adequate information to ensure a clean-up plan according to its financial and technical capability. In case of several emission sources, it will be more efficient to design regulation instruments like the trade emission permits

4.0 Current Chilean regulation of closure, abandonment, restoration and reclamation of mining activities

In general terms, there are some regulations that indirectly control the closure and abandonment of mining activities in Chile. Those regulations were developed regarding other aspects different to closure and abandonment of mines. For example the Environmental Law, establishes a procedure that it is compulsory to introduce into the environmental impact study a closure stage of the project in order to assess its impact on the environment and the management programme to control environmental impacts during the closure stage. In particular it is possible to highlight the following regulations regarding mine closure:

- Environmental Law (Law N° 19300, 1994)
- Health and Safety Code for Mines in Chile (Supreme Decree N° 72, Ministry of Mining, 1985)
- Sanitary Code (Supreme Decree N° 553, 1990, Ministry of Health)

However, the majority of the environmental impact studies of mining projects present a chapter relates to closure and abandonment of the mines that are quite generals, such a general guidelines about the principles to follow in the closure of the mining project, and the intention of the mining company to elaborate a future plan of closing, abandonment and rehabilitation of the mining project. The environmental impact study have to be presented to the CONAMA or COREMA agencies depending of the location of the projects.

For that reason is the urgency to elaborate a specific regulation regarding the closure, abandonment, restoration and reclamation of mining projects in order to establish a framework of action and clear rules about those aspects. On the other hand, it is duty of the State through the Ministry of Mining the elaboration of policies and regulations regarding the subjects of closure of mines.

Additionally it is essential to elaborate in the short term that regulations in order to introduce the cost of closure and restoration at the beginning of a mine project. Those aspects are essential to assess the economic feasibility of a new mining project in Chile, despite the closure, abandonment, restoration and reclamation are not new for medium and large mining companies in the world. Also, those aspects are important for the current mining projects operating at the moment in order that they can adapt their operations to the future demands in a frame of gradually that permit mining growth and an appropriate protection of the environment

Currently, The Ministry of Mining is elaborating a proposal of regulation of closure, abandonment, restoration and reclamation of mining activities in Chile through their Environmental Unit. In the development of the regulation the Ministry of Mining is introducing the participation and opinion of mines companies, state agencies, universities, research centres, mining experts, and public in general in order to elaborate a realistic regulation regarding the specific characteristic of the Chilean mining sector.

5.0 Key issues regarding the proposal of regulation of closure, abandonment, restoration and reclamation

At the moment the Government through the Ministry of Mining is working on the elaboration of a regulation of closure, abandonment and reclamation of mining activities. In this context, it is important to highlight the willingness of the Ministry of Mining to receive comments and proposals from all sectors. For instance, it is contemplated the development of a series of workshops in order to receive the opinion of the actors previously mentioned at different stages of the development of the regulation.

There is a lot of uncertainty what to consider in the scope of the regulation, however the objective of this paper it is not to establish the scope of the regulation on the contrary, the objective regarding that aspect is to display specific issues that will be matter of debate, for example:

- Scope of the regulation, (Who will be affected by the regulation ?).
- Establishment of the legal status of the regulation (Law, Supreme Decree, etc.)
- Application of the regulation (How the regulation will be applied?).
- Establishment of the Criteria to define the mining projects that will be regulated (What sort of projects will be affected by the regulation related to their dimension, location, date of beginning, etc.).

- Establishment of a procedure of closure, abandonment, restoration and reclamation of new projects.
- Establishment of a procedure of closure, abandonment, restoration and reclamation of projects in operation currently.
- Establishment of procedure of restoration and rehabilitation of abandoned mines activities and also define who will be liable to do that.
- Establishment of technical aspects to consider in the closure, abandonment, restoration and reclamation plans.
- Establishment of environmental liability of mining companies about the regulation
- Establishment of a system regarding financial guarantees (What sort of guarantees will be required and in what form?).
- Establishment of the amount of financial guarantees (How the financial guarantees will be determined?, could the costs of abandonment in the period in which does the company declare profits be tried like financial costs,?).
- Establishment of a monitoring Plan of the closure, abandonment, restoration and reclamation of mining activities
- Establish a mechanisms of public participation.
- Establishment of follow up measures of the regulation (How will be assessed the success of the regulation in terms to avoid the environmental risk)

The merely fact of the elaboration of an efficient and modern regulation of closure, abandonment, restoration and reclamation of mining activities does not assure the success of the control of pollution and diminishing of the environmental risk of the mining activities in Chile. The real point is to develop a realistic regulation in which the mining companies, state agencies, and the general public see an opportunity to contribute to the sustainable development of Chile, in order to those groups will be really committed to comply with the new regulation. Additionally, the application of a regulation of this nature, it is not a fast process, conversely needs time, during which technical capabilities regarding closure and rehabilitation of mines will be developed in Chile.

Likewise, it is important to consider that the elaboration of this normative will introduce new tasks to do by the government, specifically in those institutions relate to the mining sector such as the Ministry of Mining and the National Service of Geology and Mining. Therefore, those institutions will have to develop training programmes regarding closure and rehabilitation of mines for the private and public sectors, in order to face the challenge of the implementation of a system of closure and rehabilitation of mining sites in a successful form.

6.0 Technical Aspects Regarding the Regulation

Within the main environmental impacts generated by the closure and abandonment of mine activities, it is possible to highlight some of those, for instance the following:

- Pollution in rivers and aquifers from acid mine drainage

- Pollution in rivers by the not adequate disposal of toxic materials
- Pollution of the air by tailing ponds abandoned and toxic material leave in an inadequate form
- Soil contamination from treatment residues and spillage of chemicals leave in an inadequate form
- Physical risk at the plant on site leave in an inadequate form
- Erosion of the soil
- Poor visibility
- Landscape impact
- Destruction of the vegetation near to the abandoned mine
- Danger from failure of structure and dams
- Land instability and subsidence
- Sediment runoff from abandoned mining sites
- Accidents caused by an inadequate mine closure

However, those impact can be minimised through the choice of an appropriate methodology of abandonment and rehabilitation and the application at the beginning of the project of a program of the closure of the mines. In this respect the working plan for a large or medium mines should choice technological options that lead to minimum ground disturbance and avoid excessive runoff of water. Processing technologies that do not discharge polluting emissions or waste should be chosen if available. Water may be recycled in the plant or treated prior to release. Safe methods of handling of chemical should be adopted. Mine waste disposal should follow ecological and safety criteria, with progressive rehabilitation of the site during the active life of a mine. Therefore, the introduction of the closure programme within the environmental management system of the site it is vital, in case that the mining company is running an environmental management system.

Additionally, at the moment it is recognised for the society the responsibility of the mining companies regarding to prevent the impact on the environment during the whole life of the project, including the closure stage. Therefore, that cost have to be consider at the feasibility of the project.

For that reason, the majority of developed countries have developed extensive regulation at national or province level regarding closure, abandonment, restoration and reclamation of mining activities from the 1970's, that is the case of Canada, United States, United Kingdom, Sweden, Germany, etc. That regulations include aspects regarding safety issues, environmental issues and reclamation issues in order to analyse the feasibility to reutilised the land disturbed by the mining project or restore the natural or similar conditions before the operation of mining activity.

Additionally, it is important to highlight that each closure and rehabilitation plan is different due to the specific physical, chemical, climate, economic and social conditions of the mine site.

For instance, in Chile the mining operations are distributed through the whole country that have totally different climate, however the majority of the mining activities are located in the north of Chile that has a quite dry climate with a very low level of precipitation, the main problems are regarding the disposal of mining residues, safety aspects, the pollution of air and social problems after stop the operations.

7.0 Conclusions

It is important to recognise that the Chilean government, mining companies and public in general shares an important number of topics, for example; the improvement of the Chileans life quality within a framework of sustainable development.

Additionally, the new regulation of closure, abandonment, restoration and reclamation of mining operations have to be elaborated accordingly to the specific characteristic of the Chilean mining sector, taking in consideration the mistakes of the developed countries regarding those aspects. From this point of view Chile has a real opportunity to develop a real modern and efficient regulation.

Finally, the opportunity to analyse the experience of closure and reclamation of mining activities in this international symposium will be quite important in the development of the regulation of closure of mines..