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## Environmental Certifications in Mining Exploration Projects

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### **Abstract**

The direct consequence resulting from mining activity when carrying out the exploration or exploitation of a deposit involves changes in the physical environment, ranging from the geoavailability of materials, which can alter the quality of surrounding water and soil, to the emission of noise and fine particle emissions into the atmosphere, which if left uncontrolled can affect the area's environmental quality.

In order to reverse this problem, a number of regulations have been implemented in recent years in Peru, and mainly in the mining sector, such as: National System of Environmental Impact Assessment Law and its regulations, Law on Water Resources, resolution on Discharges in Mining and Metallurgical Activities (MAL), Environmental Quality Standards (EQS) for water, air, noise and soil, regulations governing the process of citizen participation in the mining sub-sector, etc., which, combined with other mandatory legal provisions, such as the closure legislation, allow for a better environmental management in mining.

The environmental and social legislation in force for Peruvian mining aims to ensure the development of sustainable mining projects that contemplate the control of impacts on the environment and surrounding communities, through continuous monitoring programs included in mandatory environmental certifications, such as environmental impact assessments and closure plans, in addition to construction permits and authorizations for water use, dumping, waste management, certificates of non-existence of archaeological remains, and others.

This paper provides a general overview of the environmental legislation involved in the development of a mining project (exploration, exploitation and processing), considering that the mining company makes temporary use of the land, requires start-up environmental certifications (EIS, EIA-sd, EIA-d) to start the project and, once the operation stage is completed, whether it is exploration or exploitation, other environmental certifications are required to proceed with the rehabilitation of the occupied areas (Closure Plan). A descriptive analysis is also made regarding the enforcement of current general, intersectoral and sectoral legislation to be considered in the formulation and development of a mining exploration project, categorized as type-I and type-II projects.

**Keywords:** environmental assessments, exploration, impacts and rehabilitation.

## 1. Introduction

Our constitution considers that it is a right of everyone to live in a healthy environment and that authorities have the obligation of providing these conditions with an adequate legal framework. Therefore, since the 90's, in order to develop sustainable mining projects, a series of regulations have been established to govern mining activity, environmental control and citizen participation in mining projects, both for exploration and exploitation/processing.

In this paper, we will review the legislation that is most relevant to the development of a mining project and conclude with some observations on the scope and limitations of environmental control.

## 2. Environmental Legislation for Mining Projects

Developing a mining project requires a start-up environmental certification and, once the mining activity is completed, other certifications are implemented for the physical rehabilitation stage of the area where mining components were located. In the case of Peru, we have general and specific regulations, both of which are taken into account during the development of the project.

On the one hand, there is the general and intersectoral legislation where the National System of Environmental Impact Assessment Law (Law No. 27446) and its regulations (S.D. No. 019-2009-MINAM), which creates a unified and coordinated system for the identification, prevention, supervision, control and early correction of negative environmental impacts resulting from public and private investment projects involving activities, construction or works that may cause negative environmental impacts. This regulation defines the mandatory nature of environmental certification prior to the start of any project, which must be categorized based on its environmental risk.

Therefore, once the project is classified through a Preliminary Environmental Assessment (PEA), its assessment is

prepared according to the terms of reference (TOR), as follows:

**Category I** comprises projects that have no significant negative impact; they require an Environmental Impact Statement (EIS).

**Category II** comprises projects with moderate environmental impacts that can be eliminated or minimized through easily applicable corrective measures; they require a semi-detailed EIA (EIA-sd).

**Category III** comprises projects whose characteristics, scale and location are likely to produce significant negative environmental impacts; they require a detailed EIA (EIA-d).

On the other hand, there is also specific legislation for the mining sector, both for exploration projects (S.D. No. 042-2017-EM) and for exploitation and processing projects (S.D. No. 040-2014-EM).

The Environmental Protection Regulations for Mining Exploration Activities, S.D. No. 042-2017-EM, which amended S.D. No. 020-2008-EM, for minor activities considers an Environmental Data Sheet (EDS) as a complementary instrument and for major activities, classifies exploration activities into two categories: I and II. For this, it takes into account the number of exploration platforms, the area to be explored and, if the exploration is carried out using a tunnel, whether the distance considered is greater or less than 100 m. S.D. No. 042-2017-EM and M.R. No. 108-2018-EM, far from relaxing the requirements applied to mining exploration projects, considered to be of lesser significance in terms of environmental impact, make them more demanding.

Therefore, for mining exploration projects, the start-up certification is an EIS for Category I projects and an EIA-sd for Category II projects (see Table 1).

In the case of exploitation projects, the Environmental Protection and Management Regulations (S.D. No. 040 2014-EM) and the Terms of Reference for each category (M.R. No. 116-2015 MEM) classify exploitation projects in Categories III and II.

**Table 1. Classification of Exploration Projects According to S.D. No. 042-2017-EM**

TYPE OF PROJECT	CATEGORY
Exploration projects that include: a) Up to forty (40) drilling platforms. b) An effectively disturbed area of up to ten hectares, including platforms, trenches, auxiliary facilities and accesses. c) The construction of tunnels of up to one hundred meters long in total, which are not located under the projection of fragile ecosystems, water bodies or springs in rainy seasons.	<b>Category I - EIS for projects with minor impacts</b>
Exploration projects that include: a) From forty (40) to seven hundred (700) drilling platforms. b) An effectively disturbed area greater than ten hectares, including platforms, trenches, auxiliary facilities and accesses. The construction of tunnels of more than one hundred meters long in total, which are not located under the projection of fragile ecosystems, water bodies or springs in rainy seasons. c) A pilot plant.	<b>Category II - EIA-sd for projects with moderate impacts</b>

In the case of exploitation projects, the Environmental Protection and Management Regulations (S.D. No. 040 2014-EM) and the Terms of Reference for each category (M.R. No. 116-2015 MEM) classify exploitation projects in Categories III and II.

Category III projects are exploitation and use projects and require a detailed EIA (EIA-d), while service projects can be Category II and III and would require an EIA-sd or EIA-d.

**2.1. Water Regulations in the Peruvian Mining Sector**

The legislation considers as Receiving Bodies any natural water course located upstream of the mining area or any waters flowing in areas near the project that represent the hydrological base of the area and may receive mine discharges and which correspond to lakes, ravines and rivers, whose reference are the EQS measured in total concentrations, while the mine effluents, which are the discharges produced from inside the mining works, also known as contact waters, are referenced with MAL.

Environmental Quality Standards (EQS) are

measures that establish the concentration level or ratio of physical, chemical, and biological elements, substances, or parameters found in water, as a receiving body, that do not pose a significant risk to human health or the environment. They are a mandatory reference in the conception of legal regulations, public policies and the design and implementation of all environmental management instruments. The law establishes that they are mandatory references in environmental certification. Since 2008, when EQS-Water were promulgated (S.D. No. 02-2008-MINAM), they have been amended (S.D. No. 015-2015-MINAM) to the current S.D. No. 004-2017-MINAM.

Maximum Allowable Limits (MAL) are measures of the concentration or ratio of physical, chemical and biological elements, substances or parameters that characterize an effluent or an emission, which when exceeded cause or may cause damage to health, human welfare and to the environment. Its compliance is legally enforceable by the relevant competent authority.

These maximum allowable limits for liquid effluents discharged into the environment by mining and metallurgical units are set forth in S.D. No. 010-2010-MINAM. In practice, each discharge point considered in an environmental certification is referenced with the MAL and for each discharge point to a receiving body, two control points referenced with the EQS-Water must be implemented, located upstream and downstream of the discharge, the latter located at a greater distance from the mixing length.

The metal load contents change from dissolved concentration in M.R. No. 011-1996-EM to total concentration in S.D. No. 010-2010-MINAM, making the effluents quality requirement much more restrictive in case of discharging to a receiving body.

**Table 2. MAL for Effluents from Mining and Metallurgical Units S.D. No. 010-2010-MINAM**

Parameter	Unit	New units	
		At any time	Annual average
pH	u.e.	6-9	6-9
TSS	mg/l	50	25
Oil/Grease	mg/l	20	16
Cyanide (t)	mg/l	1.0	0.8
Arsenic (t)	mg/l	0.1	0.08
Cadmium (t)	mg/l	0.05	0.04
Chromium (t)	mg/l	0.1	0.08
Copper (t)	mg/l	0.5	0.4
Iron (d)	mg/l	2.0	1.6
Lead (t)	mg/l	0.2	0.16
Mercury (t)	mg/l	0.002	0.0016
Zinc (t)	mg/l	1.5	1.2

Note:(t)= total concentration; (d)= dissolved concentration.

The metal load contents change from dissolved concentration in M.R. No. 011-1996-EM to total concentration in S.D. No. 010-2010-MINAM, making the effluent quality requirement much more restrictive in case of discharging into a receiving body.

**2.2. Regulations on Noise**

Noise control in the Peruvian mining industry is based on the EQS and MAL established in the Occupational Safety and Health Regulations, which make it possible to assess whether or not the environment and workers' health are deteriorating.

For the environmental noise quality assessment, the mandatory reference is EQS-Noise. Table 3 shows the maximum levels of noise for external environments that were included in the National Environmental Noise Quality Standards (S.D. No. 085-2003-PCM), which must not be exceeded in order to protect human health. The noise limit values are grouped by application areas (industrial, commercial,

residential and special) and by daytime or night-time hours.

When industrial environmental noise is emitted from more than one source and the combined effect of sound pressure levels from single sources needs to be calculated, naturally, as the decibel is a logarithmic expression, decibels cannot be added arithmetically, for example: 50 dB and 70 dB are not 120 dB.

**Table 3. Environmental Noise Standards**

Application areas	Values expressed in LeqT	
	Daytime From 7:01 AM to 10:00 PM	Night-time From 10:01 PM to 7:00 AM
Special protection	50	40
Residential	60	50
Commercial	70	60
Industrial	80	70

For an environmental assessment in case of eight noise sources having sound pressure levels  $L_p$  of 73, 75, 88, 82, 85, 88, 85 and 86 dB, respectively. The overall equivalent noise level is 83.9 dB.

**2.3. Regulations on Air**

The legislation on gases emitted into the atmosphere by the mining sector in Peru can be grouped into environmental air quality in mining areas and air quality from an occupational health point of view.

In order to know the state of the atmosphere and its possible effects on human health, measurements are taken at very different scales, ranging from "personal" measurements using portable devices, to discrete specific control monitoring devices to obtain filtered or sedimented samples. Continuous measuring equipment is also often used, which can even transfer the relevant information to a control center.

National Alert State Levels for Air Pollutants were regulated by S.D. No. 009-2003-SA. This standard defines the different states

of alert for air pollutants based on critical concentrations (PM<sub>10</sub>, SO<sub>2</sub>, CO and H<sub>2</sub>S). These states of alert have been grouped as: caution, hazard and emergency.

The control of emissions into the atmosphere is legally regulated, so that certain gases or amounts of particles cannot be emitted if they exceed certain established margins, in order to avoid or minimize as much as possible the risks resulting from their presence in the air we breathe. Through M.R. No. 315-96-EM/VMM, the Maximum Permissible Levels of Sulfur Dioxide, Particles, Lead and Arsenic present in gaseous emissions from mining and metallurgical units were approved.

This means that any particles smaller than 3 microns are breathable and therefore harmful to health as they cannot be expelled through the respiratory process. Substances and particles larger than 3-10 microns are inhalable, which means that they remain in the nasal villi and do not enter the respiratory system. To determine air quality and develop environmental monitoring programs for mining, a series of regulations on air are referred to, as shown in Table 5, which includes the following: M.R. No. 315-96-EM/VMM; S.D. No. 074-2001-PCM, later amended by S.D. No. 069-2003-PCM and S.D. No. 003-2008-MINAM, which establish the values of the National Environmental Air Quality Standards (EQS-Air) which are of obligatory reference and condition environmental quality.

Usually, a high volume sampler is used for PM<sub>10</sub>, PM<sub>2.5</sub>, Pb, As, Cu, plus dynamic sampling trains for the capture of CO, NO<sub>2</sub> and SO<sub>2</sub> gases. The results of the parameters analyzed are expressed in micrograms per cubic meter of air (µg/m<sup>3</sup>), at standard temperature and pressure conditions, i.e. at 25 °C and 760 mmHg.

### 3. Closure Certifications

Once the mining cycle is completed, the areas occupied by the components and facilities of the mining project must be rehabilitated. For this closure and post-closure stage, another environmental certification is required, known as Closure Plan, which includes specific legislation such as the Mine Closure Law, Law No. 28090 and its amendment (Law No. 28507) and the Mine Closure Regulations, S.D. No. 033-2005-EM and its amendments; S.D. No. 035-2006 and S.D. No. 045-2006-EM, which require the development of closure activities for exploration projects and the preparation of a closure plan with budget and guarantee for exploitation and processing projects.

According to the current legislation for exploration projects (S.D. No. 042-2017-EM), once their operating life is over, closure activities are carried out to rehabilitate the altered areas, unlike exploitation and processing projects in type-I and type-II exploration projects, a closure plan involving the imposition of a bond or guarantee is not used.

There are exceptions where type-II exploration projects with EIA-sd must have a closure plan that includes the imposition of a bond similar to a type-III exploitation project. This occurs when exploration projects involve the construction of exploration tunnels of over 100 m from which significant volumes of excavated material considered as mining waste are extracted and disposed of on the surface, and this amount of material to be dumped exceeds 2,000 t of PAG material or over 10,000 t of non-PAG material.

When exploration projects move to exploitation, the closure of some components can be deferred (not closed) as their closure is budgeted in the closure plan of the type-III project at the end of its life.

### 4. Certification Bodies

In view of the current mining and environmental legislation applicable to mining projects, there are two entities in charge of issuing the certifications

required to start and conclude mining activities. Type-I and type-II exploration mining projects are managed by the Ministry of Energy and Mines (Minem), while start-up certifications for exploitation and processing projects (type-II and type-III) are requested to the National Service of Environmental Certification for Sustainable Investments (Senace), which is an autonomous agency attached to the Ministry of the Environment (Minam), in charge of reviewing, monitoring and approving all Environmental Impact Assessments (EIA-sd and EIA-d). This means that the start-up certifications for exploitation projects are only handled by the environmental authority (Senace), without the participation of the specific authority (sectoral), a situation that makes start-up certifications a mainly environmental assessment.

**Table 4. Entities that Evaluate and Manage Certifications for the Mining Sector**

Environmental Certifications for the Start-up of Mining Projects: Exploration and Exploitation/Processing			Certifications for the Completion of the Operation
General and Intersectoral Legislation	Sectoral or Specific Legislation: Regulations and TOR		Closure Law and Regulations + Amendments
Law No. 27446 Regulations S.D.19-2009 Minam <b>Evaluated by: Senace</b>	Exploration S.D.42-2017- EM; <b>Evaluated by: Minem</b>	Exploitation and Processing S.D. 40-2014- Minam <b>Evaluated by: SENACE</b>	S.D. 42-2017-EM Closure Law No. 28090 S.D. 033-2005 EM <b>Evaluated by: Minem</b>
PEA	EDS		Closure Activities
Type-I EIS	Type-I EIS		
Type-II EIA-sd	Type-II EIA-sd	Type-II EIA-sd	CP + Bond
Type-III EIA-d		Type-II EIA-d	CP + Bond

**5. Final Considerations on Sectoral and General Legislation**

Assuming that the environmental legislation

applied to the mining sector should facilitate the sustainable use of natural resources, it ensures the environmental protection of the physical environment and biological diversity, prevents damage to human health, and promotes villages and cities that are sustainable with a better quality of life.

Therefore, below are some examples of the strengths and weaknesses or gaps in the current legislation for the development of mining activity, including exploration projects.

Environmental regulations for the mining sector have been progressively consolidated as the development of environmental issues has taken on a broader dimension, and also due to increasing promotion of concepts linked to corporate social responsibility, which promotes a type of mining development that is respectful not only from an environmental point of view but also from a social perspective. In addition to this, we have the activism of organized civil society, especially the participation of local communities, whose social license often ends up conditioning the development and successful progress of mining projects, both for exploration and exploitation/processing.

Having an appropriate legislation in the sector contributes to improve the relations with populations neighboring the mining facilities. Continuous monitoring programs for environmental quality of water, air, noise, soil and others, allow to correct any deviation and improve the conditions of the mining operation environment.

The start-up (EIS, EIA-sd, EIA-d) and project closure (closure plan) environmental certifications, combined with the EQS and MAL values, constitute environmental management tools that can help develop sustainable mining projects with greater environmental control and worker protection.

On the other hand, although it is true that mining activity in Peru has more legal provisions compared to other countries in the region, we also find a number of inconsistencies and gaps in some regulations that require amendment and/or adaptation to really contribute to the development of sustainable mining projects, among which we can mention:

- In general, environmental legislation does not consider the assessment of environmental risk. This means that, in many cases, assessment authorities with poor technical experience, and who issue certifications, can consider the same level of information and control measures requirements for a component with low or accepted impact level and for another component with a critical impact level. With an accurate identification of environmental risks in mining project's components, both the authority and the applicant would dedicate more efforts and energy to control measures for high-risk components, which would reduce the time required to evaluate and issue environmental certifications, among other things.
- Many regulations have been issued, such as laws that are poorly correlated with their regulations or terms of reference, which in many cases lead to their modification only to change the dates until their regulations or legal provisions are issued. However, before these periods of adaptation or implementation are met, new legal provisions on the same subject are issued, as in the case of the 2008 EQS-Water which, considering all the date changes, should have been completed on December 19, 2015; on that same day, a new Supreme Decree was issued with the 2015 EQS-Water where a new implementation period was given, and later, in 2017, another provision was issued for the EQS on surface water. This makes the issuance of regulations by the relevant authorities rather irresponsible and creates confusion among the applicants.
- In the case of maximum allowable limits (MAL) for liquid effluents discharged into the environment by mining and metallurgical units, since 1996, mine discharges have been controlled through M.R. No. 011-1996 EM, although few

of the parameters referenced were in dissolved concentrations; in 2010, with S.D. No. 010-2010-MINAM, they change to total concentrations. This makes effluent regulations much more restrictive but, in terms of contamination, it becomes less effective, because if one wants to determine the contaminating fraction found in the effluent, one must look for a fraction below the dissolved one, which will be the bioavailable portion, which is in fact the toxic fraction.

- The same applies to EQS-Soil, which, based on the method of quantification by leaching, ends up considering the whole (stable and dissolved part) as a contaminant load.

## 6. Author's Background

The undersigned has participated in the preparation of technical-economic projects and environmental assessments for mining operations between 1991 and 2000 at *Escuela de Minas de Madrid* and EPM consulting company, between 2001 and 2007, at the Geological and Mining Institute of Spain; in addition to developing research projects on acidic waters, he has reviewed Mine Closure and Mining Basin Rehabilitation Plans. Over the last 10 years, at SRK Peru, he has prepared several environmental impact assessments and closure plans for various mining companies. When comparing the current environmental legislation for the Peruvian mining sector with legislations from other regions, Peruvian legislation for both start-up certifications (EIA) and completion certifications (Closure Plan) does not contemplate assessing environmental risk, which may lead to the allocation of the same resources or energy without prioritizing needs.