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BRAZILIAN LEGISLATION ON THE ENVIRONMENTAL RECOVERY OF MINED AREAS

LEGISLAÇÃO BRASILEIRA DIRECIONADA À RECUPERAÇÃO AMBIENTAL DE ÁREAS DE EXTRAÇÃO MINEIRA

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Abstract

This paper presents a brief survey of the main Brazilian legislation dealing with the obligations of mining enterprises to recover mined areas. The study focuses on legal instruments issued at the federal level by mining and environmental management bodies, beginning with Standard NBR[11] 13.030 of the Brazilian Association of Technical Standards (ABNT[12]), published in 1999, which guides the preparation and presentation of the Degraded Area Recovery Plan (PRAD[13]). It then considers Federal Law No. 9.985/2000, which distinguishes between a "recovered" and a "restored" ecosystem; Decree No. 9.406/2018, which establishes the miner's responsibility for environmental recovery; and ANM[14] Resolution No. 68/2021, which regulates the (PFM[15]). The study also considers the role of environmental management and the concepts of recovery and ecological restoration. The objective is to show how the Brazilian legal framework establishes requirements for the recovery and closure of mined areas and for their return to society in an environmentally appropriate condition.

Keywords: Mining, Environmental Recovery, Environmental Legislation, Mineral Legislation, Environment.

Resumo

Este trabalho apresenta um breve levantamento das principais legislações brasileiras que versam sobre a obrigatoriedade das empresas de mineração em recuperar a área explorada. São apresentados instrumentos legais brasileiros com origem tanto em órgãos gestores da mineração como em órgãos gestores do meio ambiente. O estudo inicia-se em 1999, com a Norma NBR 13.030 da Associação Brasileira de Normas Técnicas (ABNT), que orienta a elaboração e a apresentação do Plano de Recuperação de Área Degradada (PRAD). Em 2000, a Lei Federal nº 9.985 distingue um ecossistema "recuperado" de um "restaurado". Mais recentemente, o Decreto nº 9.406, de 12 de junho de 2018, incorpora a responsabilidade pela recuperação ambiental das áreas degradadas

[11] Brazilian Standards (BRS) – Normas Brasileiras (NBR).
[12] Brazilian Association of Technical Standards (BATS) – Associação Brasileira de Normas Técnicas (ABNT).
[13] Degraded Area Recovery Plan (DARP) – Plano de Recuperação de Áreas Degradadas (PRAD).
[14] National Mining Agency (NMA) – Agência Nacional de Mineração (ANM).
[15] Mine Closure Plan (MCP) – Plano de Fechamento de Mina (PFM).

pela atividade de mineração. A Resolução ANM nº 68, de 2021, regulamenta o Plano de Fechamento de Mina (PFM), introduzindo exigências ambientais específicas a serem observadas pelas empresas de mineração. O trabalho também aborda a gestão ambiental e os conceitos de recuperação e restauração ecológica. Dessa forma, procura-se demonstrar como o quadro legal brasileiro estabelece obrigações para a recuperação e o fechamento de áreas mineradas e para sua devolução à sociedade em condições ambientalmente adequadas.

Palavras-Chave: Mineração, Recuperação Ambiental, Legislação Ambiental, Legislação Mineral, Meio Ambiente.

1 – Introduction

One of the most important activities for the economic development of a region is mining. In Brazil, mining accounts for more than 4% of the Gross Domestic Product, in which the state of Minas Gerais is the main producer, responsible for almost half of the mineral production in the country, which generates jobs, income, as well as taxes and fees for the state, contributing to the socio-economic profile of the society (Brazilian Mining Institute[16], 2015).

However, some of the greatest challenges facing mining is to minimize the impacts resulting from its activities, such as soil contamination, loss of fauna, air pollution, damage to health and the generation of large quantities of tailings. In this way, maintaining environmental balance and preserving the soil, becomes a matter of quality of life for the environment and the population (Santos, 2017).

The environmental agencies and the Brazilian environmental legislation cover several areas of the economy, including mining and exploitation activities. However, there are also environmental protection, mineral legislation and mining management entities, based on the legislation that regulates mining projects in the country.

The methodological model employed in this work was to undertake bibliographical research on the Brazilian mineral and environmental legislation, highlighting some of the laws, regulations, ordinances and resolutions in force in Brazil, which have as their main focus the environmental recovery of mining areas, as well as the promotion of mining activity in a sustainable manner.

2 - Environmental Management

The use of natural resources must follow pre-established criteria, so that environmental pollution doesn't spread and affect the entire population, which is why environmental management is necessary. In fact, environmental management is the set of operational and administrative decisions made by a company in order to reduce and eliminate impacts on the environment from human activities (Borges, 2009).

The companies that practice environmental management, reduce direct costs and receive recognition for respecting society through an ethical stance, as well as preserving natural resources and the health of the population (Vieira, 2010).

[16] Brazilian Mining Institute (BMI) – Instituto Brasileiro de Mineração (IBRAM).

The state carries out environmental management and it is responsible for overseeing practices related to natural resources, making changes to the plans devised by the entrepreneur when necessary (Lemos, 2016).

Recovery, restoration or rehabilitation techniques, can be used in the process of recovering an ecosystem which has been disturbed naturally or by direct human action (Rogalski et. al., 2009). Environmental recovery involves various natural aspects, including soil, landscape, fauna and flora (Brum, 2000). In fact, the environmental recovery is the reconstruction of an environment that has suffered alterations, with or without human intervention, aiming to reactivate the natural dynamics of the local community, similar to the pre-existing one. In environments where there is a high degree of degradation, where the conditions of the soil and other natural elements have surpassed the limit of their capacity for self-recovery, human intervention is necessary for their recovery, since in these conditions it is not conducive to the emergence of new vegetation (Fonseca et al., 2001).

According to the Environment Ministry[17] (EM), environmental recovery is directly linked to the science of ecological restoration, which is the process of aiding the re-establishment of a degraded, destroyed or damaged ecosystem. When an ecosystem contains sufficient abiotic and biotic resources to continue its development without additional aid or subsidies, it is considered recovered.

2.1 - Environmental legislation

This section presents the main environmental legal instruments selected for the analysis. The selection begins with the legal distinction between recovery and restoration established by Federal Law No. 9.985/2000, and then considers the state-level framework applicable in Rio de Janeiro and the Forest Code. These instruments were highlighted because they establish concepts and procedures directly related to the recovery of degraded areas and environmental protection.

The Federal Law No. 9985, of July 18, 2000, in its Article 2, distinguishes, for its purposes, a recovered ecosystem from a restored one as follows:

> *"Art. 2, for the purposes of this law, it is understood as: [...]*
> *XIII - recovery: restitution of a degraded ecosystem or wild population to an undegraded condition, which may be different from its original condition;*
> *XIV - restoration: restitution of a degraded ecosystem or wild population as close as possible to its original condition;"*

The State Environmental Institute of the State of Rio de Janeiro - INEA[18] in its resolution No. 143 from June 14, 2017, states:

> *The "Article 3rd - For the purposes of this Resolution, it is understood that:*
> *Forest restoration: the process of helping to re-establish an ecosystem that was degraded, damaged or destroyed, consisting of an intentional activity, which triggers or accelerates the ecological integrity recovery of an ecosystem, in a natural or assisted form, including a*

[17] Environment Ministry (EM) – Ministério do Meio Ambiente (MMA)
[18] State Environmental Institute of the State of Rio de Janeiro – Instituto Estadual Ambiente do Estado do Rio de Janeiro (INEA)

> *minimum level of biodiversity, variability in the structure and functioning of ecological processes, considering its ecological, environmental and social values*"; (INEA, 2017)

On the other hand, the Brazilian Association of Technical Standards NBR 13.030/99 defines recovery as "a set of procedures through which the degraded area is recomposed in order to establish the original function of the ecosystem" (ABNT, 1999). The aim of recovering or rehabilitating degraded areas from mining is to establish a new way of using the mined area, based on a pre-established plan for land use and with a view to achieving environmental stability, thus resulting in the technical solution required by the competent public body (Souza, 2003).

The recovery is directly linked to implementing a methodology aimed at restoring tree cover, guaranteeing the harmony of the landscape. These are measures designed to mitigate the visual impact resulting from mining activities (Lemos, 2016).

2.2 - Forest Code and forest restoration

In addition to the general environmental rules described above, the Brazilian Forest Code is particularly relevant to the protection and recovery of vegetation. This is especially important in the context of Rio de Janeiro, where forest protection and restoration are part of the broader environmental framework. Law No. 12.651, of May 25, 2012, in its Article 51, provides that the competent environmental agency may embargo works or activities associated with deforestation that violates the law, with the objective of preventing continued environmental damage and promoting environmental regeneration and recovery of degraded areas.

> *"The competent environmental agency, upon becoming aware of deforestation in disagreement with the provisions of this Law, shall place an embargo on the work or activity that caused the alternative use of the land, as an administrative measure aimed at preventing the continuation of environmental damage, fostering the regeneration of the environment and providing viability for the recovery of the degraded area".*
>
> *§ 1st The embargo is restricted to the places where the illegal deforestation actually took place, and does not affect subsistence activities or other activities carried out on the property that are not related to the infraction.*
>
> *§ 2nd - The responsible environmental agency must make information on the impounded property publicly available, including through the World Wide Web, safeguarding data protected by specific legislation, characterizing the exact location of the impounded area and informing at what stage the respective administrative procedure is.*
>
> *§ 3rd At the request of the interested party, the environmental organization responsible will issue a certificate stating the activity, the work and the part of the area of the property that is the object of the embargo, as the case may be". (Environment Ministry, 2012)*

As an example of practical application, the provision cited above connects enforcement with environmental recovery: when illegal deforestation is identified, the embargo is intended not only to stop the activity but also to create conditions for environmental regeneration. This illustrates how legal

protection and recovery measures can operate together. The present study, however, is bibliographical and does not evaluate individual enforcement cases or the response of companies and local populations.

3 – Mining Management



Figure 1: Headquarters of the National Mining Agency, Brasília-DF. (Source: ANM)

The following section examines the principal mining-management instruments identified in the literature, with emphasis on the requirements concerning mine operation, recovery and closure.

According to Mining Regulatory Standard (MRS)[6] No. 20, of January 2002, upon completion of the activities conducted, the company must formulate a justification requirement to the Honorable Minister of Mines and Energy, accompanied by a technical report containing the following items:

- Report on the work performed;
- A demobilization plan for the installations and equipment that comprise the infrastructure of the mining project, indicating the destination to be assigned;
- Characterization of the remaining reserves, if any;
- Update of all topographical surveys of the mine;
- Mine plan showing recovered mined areas, recovered and unrecovered degraded areas, soil disposal areas, organic soil disposal areas, sterile, ores and tailings, dams, access roads and other civil work or - structures;
- Soil, atmosphere and water resources pollution control plan, with characterization of controlling parameters;
- Monitoring and follow-up program relating to: dams; slopes in general; behavior of the

water table; water drainage;

- Effluent discharge control plan with characterization of controlling parameters;
- Measures to prevent outsiders from accessing the mine and barriers to access dangerous areas;
- It contains all the data inherent to the operational exploitation activity, the mitigation measures imposed and their success, and the final conformation of the mining area and its recovery.

3.1 - Degraded Area Recovery Plan (DARP)

The Degraded Area Recovery Plan (DARP) is a study that the environmental agency requests at the moment of licensing mining projects. The DARP can be altered and revised subsequently to its approval, with the aim of incorporating technological innovations or more suitable alternatives due to the development of the exploitation work (LEMOS, 2016).

The Brazilian Association of Technical Standards issued Standard NBR 13.030 in June 1999 to guide the preparation and presentation of the Degraded Area Recovery Plan. It defines the items that should be included in the Degraded Area Recovery Plan (ABNT, 1999), which are:

- A general description of the project, containing information on the company, the resource explored, the exploitation plan and the beneficiation processes;
- Environmental diagnosis containing the definition of the direct and indirect areas of influence, diagnosis of the physical environment, biotic and anthropic environment, as well as the ecological physiognomy of the region; assessment and description of environmental impacts;
- Intention and suitability for future use of the area;
- Topographical and landscape conformation;
- Emergency actions for risks of environmental accidents;
- Renunciation of the mining title;
- Monitoring and follow-up program;
- Planning and execution flowchart;
- Technical team responsible; chronogram; bibliographical references and annexes (maps, spreadsheets, drawings, etc.).

3.2 - New Regulation of the Mining Code

Decree No. 9.406, of June 12, 2018, known as the New Regulation of the Mining Code, introduced clearer rules concerning the scope of mining activity and the responsibilities associated with it. Its provisions are relevant to environmental recovery because they connect mining activity, mine closure and the future use of the affected area.

For example, in Article 5th, there is a new, clearer and more objective definition of what is legally understood as a mining activity, including peripheral works within this definition. Thus, in the eyes of the legislation, mining activity ranges from the research and development of the mine, passing through the areas of beneficiation and reutilization of tailings and steriles, up to the sale of the mineral product and the closure of the mine.

> *"Art. 5 The mining activity encompasses research, the exploitation, mine development, the beneficiation, the commercialization of ores, the reutilization of tailings and steriles and the deactivation of the mine.*
>
> *§ 1st. Independent of a concession, the reutilization of manifested and registered mines, which are subject to the conditions established by Decree-Law No. 227 of 1967 - the Mining Code, this Decree and correlated legislation establish for the exploitation, taxation and the inspection of concessioned mines".*

The second paragraph expressly states that it is the total responsibility of the concession holder to rehabilitate the area and treats these procedures as an inevitable consequence of the mining activity.

> *"§ 2nd The exercise of mining activity implies the responsibility of the miner for the environmental recovery of degraded areas."*

The third paragraph includes mine closure for the first time in the form of a Decree as a stage of mineral activity, requiring the miner to foresee the future suitability of the area as part of the mine closure process, as well as dismantling the facilities and monitoring the aquifers and tailings.

> *"§ 3rd The closure of the mine may include, among other aspects, the following:*
>
> *I - the environmental recovery of the degraded area;*
>
> *II - the demobilization of the installations and the equipment comprising the infrastructure of the endeavor III - the suitability and purpose for future use of the area; and*
>
> *IV - the monitoring and follow-up of the tailings and sterile disposal systems, geotechnical stability of the mined areas and servitude areas, behavior of the aquifer and water drainage".*

In practice, all the installations of the mine are contemplated by the Code, including the sectors of transportation, storage and beneficiation of the ore, as well as the points of tailings allocation, for example, the dams.

This means that all mining impact areas are subject to the responsibilities and obligations of the Code, among them, the development of ecological impact reduction plans, the acquisition of all licenses from the environmental and mining authorities as well as the liability to fines and civil responsibilities.

From the authors' perspective, the main contribution of this regulation is that environmental recovery is treated as a responsibility connected to the mining activity and to its closure. The legal text establishes the obligations that companies must observe; however, because this research is bibliographical, it does not provide empirical evidence about the degree of acceptance or compliance by individual companies.

3.3 - Mine Closure Plan - MCP

On April 30, 2021, the National Mining Agency published Resolution 68, which establishes the guidelines for drawing up the Mine Closure Plan.

A Mine Closure Plan was already required in 2001 by Ordinance 237 of the then National Department of Mineral Production (NDMP)[19], and had to be submitted as part of the Economic Improvement Plan (EIP)[20]. In 2018, this requirement was transformed into a Decree by the reform of the Mining Code, and the Mine Closure Plan became mandatory as a second report, which must be submitted together with the EIP. Finally, in 2021, a specific National Mining Agency resolution was published to detail the preparation of the Mine Closure Plan and adapt it to safety and sustainability demands. It also maintains the obligation for the closing costs of the mine to already be foreseen and accounted for in the finances of the company, in such a way that the profits obtained from operating the project are able to cover the cost of decommissioning it.

Among the updates undertaken are its 24 articles, which establish how the Mine Closure Plan should be developed:

Article 1 (III) provides a definition of what a Mine Closure Plan is and a summary of what it should contain. It should be noted that this definition includes the concepts already defined by previous regulations, such as forecasting future use of the area, continuous monitoring of what is suitable for dismantling of the structures, and rehabilitation of the area. The concepts of physical chemistry are introduced by sections VII and VIII, defined individually, the former linked to geomechanical and morphological stability, and the latter to the chemical and mechanical balance of the site.

The Article 2, in turn, reaffirms the obligatoriness of every mine to have a Mine Closure Plan. In fact, the Article 5 details the minimum information that must be presented by developments still at the requirement stage of applying for a exploitation title. That said, it is important that the responsible organization monitors the financial capacity of the development to afford closure interventions. Until then, this guarantee was made by means of the Economic Improvement Plan - which, since the entry into force of item VII of article 5, has deepened this determination. It now requires a financial detailing of the interventions in 3 parts: pre-closure, during closure and post-closure.

The Article 6, embraces mines that are undergoing decommissioning due to exhaustion, adding some information that must be included in the Mine Closure Plan for this type of project. The entire article includes various mapping reports of the project area, including topographical information, which needs to be updated periodically, as well as the locations of the facility and the roads leading to the development.

From a more strictly environmental point of view, 4 sections can be highlighted, namely: II, IV, VI and VII.

[19] National Department of Mineral Production (NDMP) – Departamento Nacional de Produção Mineral (DNPM)
[20] Economic Improvement Plan (EIP) – Plano de Aproveitamento Econômico (PAE)

Art. 6 The Mine Closure Plan for mines being closed due to exhaustion, in addition to the elements in art. 5, must contain:

II - Assessment of the risks arising from the closure of the enterprise and ways of mitigating any damage resulting from the activity;

IV - A plan for the physical and chemical stabilization of the remaining structures;

VI - Maintenance and monitoring actions for the remaining structures after the closure of the enterprise; and

VII - Guidelines for adapting the area to the planned future use."

Another article worth highlighting is Article 17, which makes it an obligation to present a report proving the works that should have been carried out were actually executed in accordance with the provisions of the Mine Closure Plan. This measure prevents the Plan from not being implemented and that there are no environmental consequences caused by the company, therefore no failure to comply with the regulations

The analysis of Resolution No. 68 shows that mine closure is associated with environmental, technical and financial planning. This reinforces the preventive character of the legislation, since the future condition and use of the area must be considered before closure is completed. No field interviews or surveys were conducted in this study, so conclusions about the receptivity of companies or populations cannot be drawn from the available material.

4 - Conclusion

The period of operation of a mining project is directly linked to the availability and economic feasibility of the mineral resource targeted by the entrepreneur. Consequently, at some point the project will need to be decommissioned, either because the resource has been exhausted or because continuing the activity is no longer economically feasible. It is therefore important to plan, from the beginning, the future use of the site after mine closure.

This research highlights the concern for environmental protection expressed in the Brazilian legal framework governing mining and environmental management. The legislation analyzed establishes responsibilities for environmental recovery, mine closure, monitoring and future use of mined areas. In particular, the instruments discussed show a progressive structuring of requirements, from the preparation of recovery plans to the planning and verification of mine closure.

The bibliographical analysis therefore indicates that Brazilian mineral and environmental legislation has established a legal framework intended to allow mining activity to be carried out while maintaining environmental responsibilities. The study does not include interviews with companies or surveys of populations, so it cannot establish their receptivity or the practical level of compliance beyond what is provided in the legal and bibliographical sources analyzed. Such an assessment would require empirical research in specific mining areas.

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List of Acronyms:

1. Brazilian Standards (BRS)
   Normas Brasileiras (NBR)

2. Brazilian Association of Technical Standards (BATS)[1]
   Associação Brasileira de Normas Técnicas (ABNT)

3. Degraded Area Recovery Plan (DARP)[2]
   Plano de Recuperação de Área Degradada (PRAD)

4. National Mining Agency (NMA)[3]
   Agência Nacional de Mineração (ANM)

5. Mine Closure Plan (MCP)[4]
   Plano de Fechamento de Mina (PFM)

6. Environment Ministry (EM)[5]
   Ministério de Meio Ambiente (MMA)

7. Mining Regulatory Standard (MRS)[6]
   Norma Regulamentadora da Mineração (NRM)

8. State Environmental Institute of the State of Rio de Janeiro
   Instituto Estadual Ambiente do Estado do Rio de Janeiro (INEA)

9. National Department of Mineral Production (NDMP)[8]
   Departamento Nacional de Produção Mineral (DNPM)

10. Economic Improvement Plan (EIP)[7]
    Plano de Aproveitamento Econômico (PAE)