

## Legal aspects of water resources management relating to mine water in Brazil

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**Abstract** This paper presents an analysis of the legal aspects referring to the mine water in Brazil and in the State of Minas Gerais, considering the Laws and Decrees at the National level, and the regulations and Normative Deliberations of the National and State Water Resources and Environmental Councils. The main points relate to water ownership, legal authorizations, responsible entities for water use rights and technical aspects. The main results and conclusions are that Brazil has a good legal frame that, however, still needs to be effectively applied and coordinated between the States and the National Water Agency.

**Key Words** legal aspects, water resources management, water rights, licensing, mine water

### Introduction

Clear legal requirements relating to the water resources management in an area where a mining project is going to be implemented is essential for the development of the project and the future mine. Environmental, social, technical and political constraints may ask for different technologies to be used in the mining project. Not knowing the legal frame may result in higher costs of the studies and the implementation of a mine.

Loredo *et al.* (2010) point out that a mining project is an important consumer of water and competes with other water users in the area, particularly with agriculture. This results in the need to implement a proper management of the watershed affecting all parties concerned, such as mining, agriculture, cities, society and public administration. On the other hand, Fernandez-Rubio and Lorca Fernandez (2010) highlight that inflowing water must be abstracted from a mine by wells, pumping stations and galleries. These are examples how water is important to be well dealt with in a mining project.

Brazil is a country with many mining companies and operations, and Minas Gerais is one of the States with great ore resources and mining projects. Consequently, based on the importance of water for mining projects and for the whole country, this paper presents an analysis of legal aspects relating to mine water.

### Methods

This study started with the search for all legal acts in Brazil and in the State of Minas Gerais which concern water resources management in mining projects. In Brazil and in the State, there are different councils for environment and water resources. Despite this separation, there are regulations from the environment councils that relate to water resources, sometimes showing incoherence.

All legal acts were analyzed concerning environmental, social, political and technical topics, aiming to verify their interaction and relation to the implementation and operation of an iron ore project. The legal acts evaluated consisted of:

- Laws and decrees at the National and State level;
- Resolutions from the National Water Resources Council;
- Resolutions from the National Environment Council;
- Norms from the State Water Resources Council;
- Norms from the State Environment Council.

The analysis of the legal acts started with an evaluation of water ownership, followed by an assessment of the legal competency for granting rights for the implementation and operation of mining projects. Then, the responsible entities for the technical part in the authorization process were evaluated, considering their interaction and involving political and social aspects. Finally, technical aspects referring to the legal acts were evaluated, related to the different types of existing authorizations.

### Results

#### *Ownership of Water*

The first legal act relating to the water resources in Brazil was the Water Code (1934). This code discerned public and private water. Public water comprised watercourses, canals, lakes and lagoons that were navigable and the sources for public reservoirs, constructed with public resources. Tributaries of any watercourse that could influence the navigability of another course were also considered public water.

Private water comprised springs and all water

situated on private properties. Synthesizing, the understanding at that time was that public water was that relating to a navigable course or to public structures. Water from non-navigable sources were considered as the property of the owners of the adjoining land.

Public water was divided between municipalities, states and the nation. The water owned by the federal government referred to all courses crossing federal lands or that were limits to neighbor nations or between two or more States. The water was owned by a State when the watercourse served as a limit of two or more municipalities or crossed two or more cities. Municipal water was that from watercourses that crossed only one city. This understanding between different owners was always difficult for any private company to deal with as all watercourses in the same catchment basin are somehow connected and should not have different managing entities. Moreover, public entities could not interfere or manage water situated in private properties. This way, in most of the situations, mining projects were implemented without an effective guarantee of water access. Conflicts of mines with private upstream water owners could not be solved by public authorities.

With the new Brazilian Constitution (1988), private and municipal ownership of water was relinquished. In this document, the Federal Water is defined as any river, lake or watercourse that crosses or borders two or more States. State Waters are defined as all groundwater and surface watercourses that do not cross two States. This way, since 1988, all waters are public in Brazil and are either Federal or State property. This is of great relevance for private companies including mining projects as from this moment control and management of surface and groundwater was a public affair, not to be settled between different water users. However, procedures for cooperation between national and state agencies was not established. This aspect was clarified with the promulgation of the new National Policy for Water Resources (1997), which established that all water resources management has to have the catchment basin as its territorial unit. Accordingly, the State and National authorities together control water use in watersheds with watercourses of different ownership, involving abstractions, effluent discharges or any other interference as dams or dikes. Although this decree is in force for 14 years, State and National agencies are still at different technical stages and without the national support, most of the States have not yet implemented an efficient water resources management policy. There are basins where the National Water Agency manages well the federal watercourses but the State Water Agency does not know the water users established in waters of its domain.

This is a problem for mining projects with a fixed location, as the hydraulic structures for abstraction and discharge have to be as close as possible to the mine. In some situations, the mining company does the State Agency's work, for example collecting data on upstream water use, aiming to secure water for its own demands.

#### *Legal Authorizations*

In Brazil, the implementation of a mining project requires environmental licenses and authorizations referring to water resources. The environmental licenses are issued in three subsequent steps:

- Provisional License (LP): this license is granted in the preliminary phase of planning the project or activity and approves its location and conception, attesting the environmental feasibility and establishing the basic requirements and conditions to be met in the next phases of its implementation;
- Implementation License (LI): this license authorizes the implementation of the project or activity according to the specifications of the approved plans, programs and projects and stipulates the measures for environmental control;
- Operation License (LO): this license authorizes the operation of the activity or project, after the verification of the effective fulfillment of the conditions derived from the other licenses, including the measures for environmental control.

The three steps of the environmental licensing are defined in a Federal Law, valid for the whole country. This aspect is relevant as all States must follow the same legal rules and act according to the same methodology. For water resources, however, there are some differences due to the Federal Law 9433/1997 that regulates the allocation of water use rights for the following activities:

- Abstraction of surface water;
- Exploitation of groundwater;
- Effluent discharge;
- Hydroelectric power plants;
- Other water uses or interferences that alter quantity, quality or the existing regime in a watercourse.

Concerning water use rights, however, there is no nation-wide stepped procedure, unlike the environmental licenses. Each State has its own rules and only part of them has a possibility of provisional water use authorization, before awarding full water use rights. The provisional water use authorization is important for large projects as it se-

cures a reserve of water during the planning period of the project, which can take several years. Usually, the provisional water use rights are valid for two years, which is inadequate for large projects. This aspect has been criticized as there are projects that have to renew their water use rights without actually realizing any abstraction or even before concluding the construction works. This point should be solved by institutionalization of provisional water use authorization at the national level, with a validity of three years, which would give companies time to work out its plans for implementation and also to obtain other necessary legal acts in order to accomplish all requirements.

At the national level, a clear procedure is in force for mining projects that require water use rights. The Resolution 29 (2002) from the National Water Resources Council established an effective instrument to obtain the authorization. PUA, which means “Water Plan for Mining” is the only report that companies have to submit concerning all water uses of a mine. The Resolution provides a list of uses or interferences of mining with water resources which are subject to reporting:

- Abstraction of surface or groundwater as an input to the production process;
- Discharge of industrial effluents into water-courses;
- Exploitation of groundwater with the aim of dewatering;
- Diversion, straightening and channelization of streams required for prospecting and mining;
- Construction of dams for retention of sediments and fine particles;
- Construction of dams for the regularization of flow;
- Systems for tailings and waste disposal;
- Exploitation of minerals in water bodies;
- Water abstraction and effluent discharge for the transport of mining products (sludge pipelines).

Regulation at the national level was very beneficial as all mining projects in the country are subject to the same methodology to obtain authorizations relating to water resources. PUA requires that the whole water balance of a project is integrated in only one report, considering impact on quantity and quality of surface and groundwater. However, even being established in 2002, most of the States have not yet adjusted their technical, political and administrative structure for implementation of Resolution 29. So, if Brazil now has an adequate legal mechanism to evaluate the interferences of mining projects with water resources, this is still not applied in the whole country. Even Minas Gerais, the State where most of

the important mining projects are localized, is yet to implement the Resolution.

#### *Responsible entities for water use rights*

The definition of the entities responsible for the technical analysis and for granting legal authorizations should be a simple task, considering objective criteria. At the national level, the National Water Agency is responsible for the technical analysis and issues water use rights for Federal Waters. However, at the state level in Minas Gerais, some definitions are diffuse even for the technicians of government agencies. In the State, there are three possible situations:

- Water use rights for projects that are not subject to environmental licenses: requests are directly submitted to the State Water Agency – IGAM;
- Water use rights for projects that require environmental licensing: demands are considered within the environmental assessment and are evaluated by the Environmental Agency in an integrated process;
- Water use rights for large projects: regardless of whether or not they are subject to environmental licensing, applications must be decided by Water Basin Committees or the State Water Resources Council.

Two comments concerning these points are important. First, the competency of State Water Agency or Environmental Agency is not always easily established. Although the definition of projects that are subjected to environmental licenses is clear, the definition of the entity that evaluates the water use rights is not. This occurs when the studies to define the interferences with water resources are not carried out at the same time as the environmental studies and the water use rights are applied for at a different time from the environmental licensing process. Sometimes in this situation, the environmental authorities understand the water use rights as separate from an environmental license, to be investigated with a different analysis and a different focus. The ensuing duplication of work may cause a considerable loss of time.

Secondly, the definition of large projects is vague although there is a Normative Deliberation from the State Water Resources Council establishing the criteria. Unfortunately, the deliberation uses some very subjective terms, leaving the decision to the technicians whether the application is submitted to the Water Basin Committee or the State Water Resources Council. In doubt, most of the mining projects are considered as large ones and this has led to much concern in the mining industry because the Committee and Council

Table 1 Parameters and legal limits for effluent discharge.

Parameter	BOD (mg/L)	COD (mg/L)	pH	Temperature	Suspended solids (mg/L)
Limit Value	60	180	6.0 – 9.0	40°C	100

members are equally elected from NGOs, water users and representatives of municipalities and state or public entities. The result is that large mining projects by firms such as Anglo American, Vale and Samarco depend on the approval of NGOs and municipalities, while technical analysis is losing influence. This way, the approval of the right to abstract water from a watercourse is decided based on social or political aspects with participation from local residents or politicians representing municipalities.

**Technical aspects**

Another relevant point concerns the technical criteria for water use in Brazil and specifically in the State of Minas Gerais. As discussed before, the main water uses in a mining project are generally abstraction from rivers or reservoirs, effluent discharge and the exploitation of groundwater, mainly for dewatering a pit.

For the abstraction of river water, there is not yet a hard criterion set to be used in a catchment basin. In the watersheds of Minas Gerais the National Water Agency limits use to 70% of the Q<sub>95</sub> (95 percentile discharge), while the State Agency authorizes use to 30% of Q<sub>7,10</sub> (seven-day minimum discharge with a return period of one in ten years). The State of Minas Gerais also defined the criterion that with a regularization dam, the water user can abstract more than 30% of Q<sub>7,10</sub> if a remaining discharge of 70% of Q<sub>7,10</sub> is ensured at all times. Considering that Q<sub>95</sub> is usually greater than Q<sub>7,10</sub> and the percentage permitted by the National Agency is 70% against 30% from the State, most of the catchment basins have water resources under state jurisdiction that are inaccessible but would be granted by the National Agency. In some cases this causes great costs to companies as they have to install abstraction systems far from the mine and beneficiation plant, and long pipelines in a situation of water availability near the project.

The criterion for groundwater considers two different situations. The first concerns the abstraction by wells for supply of a project or part of it. In this case the analysis requires a pumping test of only 24h, including the recovery time. This may be problematic in situations where there are interfering wells, which are not evaluated together. Then, when the company needs effectively to exploit the well, the aquifer cannot support the demand, as there are other users already drawing

from the same resource. The second situation occurs in projects that need wells for dewatering a pit. In this case, we can consider that the analysis is realized in an adequate way, requiring prolonged pumping tests, study of conceptual and numeric models and also the registration of all springs in the surrounding area and water users from downstream communities. Considering that the process of dewatering a pit can result in reduction of flow from springs and wells, the exploitation of the groundwater is done with all precaution in Brazil, more specifically in the State of Minas Gerais.

Finally, the effluent discharge analysis follows two different methodologies. The first considers the quality of the effluent discharged and the second evaluates the availability for dilution in the receiving body. The effluent that will be discharged has to comply with legal norms in terms of BOD (biochemical oxygen demand), pH, temperature, suspended solids and COD (chemical oxygen demand), as presented in Table 1. The values do not depend on the water quality of the receiving body.

The second methodology considers the ability of the receiving body to dilute the effluent. This is calculated with the mixing equation (1) as presented by Kelman (1997).

$$Q_{dil} = Q_{eff} \cdot \frac{(C_{eff} - C_{perm\_man})}{(C_{perm\_man} - C_{man\_nat})} \tag{1}$$

Where:

Q<sub>dil</sub> = Necessary flow to dilute the effluent in order to maintain the receiving body in the same quality class (m<sup>3</sup>/s);

Q<sub>eff</sub> = Flow of the effluent that will be discharged to the receiving body (m<sup>3</sup>/s);

C<sub>eff</sub> = Concentration of the pollutant considered in the evaluation of the effluent that will be discharged (mg/L);

C<sub>perm\_man</sub> = Permitted concentration of the pollutant in the receiving body, as per its class of quality (mg/L).

C<sub>man\_nat</sub> = Natural concentration of the pollutant in the receiving water body (mg/L).

Watercourses in Brazil are divided into 5 quality classes which are called special, 1, 2, 3 and 4. For each class, there are different limits for pollutants due to mining activities. The resulting mixture in the receiving body must maintain the same class

of quality it was assigned before. The parameters to be considered are presented in a Resolution from the National Environment Council (Res. CONAMA n° 357/2005 – available: [www.mma.gov.br/port/conama/legiano1.cfm?codlegitipo=3&ano=2005](http://www.mma.gov.br/port/conama/legiano1.cfm?codlegitipo=3&ano=2005)).

### Conclusions

This paper presents an analysis of the Brazilian water resources legislation, focusing on water use for a mining project. The main evaluated points relate to water ownership, legal authorizations, responsible entities for water use rights and technical aspects. Generally, it can be concluded that the country has a good legal and normative frame that, however, still needs more effective application and coordination between the States and the National Agency.

Divided water ownership is still a weakness of the licensing process, causing a lack of coordination between the States and the National Agency. Main concerns are the missing integration between databases, resulting in companies doing some jobs which should be the administration's responsibility. The legal framework at national level supports efficient licensing by the National Water Agency. Both the law and its execution are less perfected at state level and State Agencies

struggle with effective application. Responsibility for water use authorization is shared by several entities and the mining industry has to deal with many interests. Somewhat contradictory regulations of the National and State Agencies, e.g. aspects related to the abstraction of river water or concerning dams should be resolved.

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