

THE CHALLENGES OF THE BRAZILIAN ELECTRIC ENERGY REGULATORY AGENCY ON SUPERVISING DAM SAFETY

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ABSTRACT

On January 25th, 2019 a mining dam collapsed in Brazil and buried 249 people. The tidal wave of mud shocked Brazilians and raised concerns about the safety of all dams in the country. In response to society, The Brazilian Government demanded inspection of all dams, not only in mining dams, but also in dams built for hydropower purpose.

In this scenario, The Brazilian Electric Energy Regulatory Agency (ANEEL), which is responsible for supervising the construction and operation of hydropower plants, has launched a task force to inspect 350 dams across the country. This paper aims to report how ANEEL succeed in complete this task in 8 months and the challenges faced by the Agency on supervising the safety of hydropower dams.

An important challenge that will be presented in this paper concerns to proper risk management. During the task force, ANEEL realized that the major challenge was not only related to the dams maintenance and operation, but also on ensuring that a risk of dam break, even if unlikely, is properly managed. The poor articulation between dam owners and local governments has led ANEEL into actions to improve articulation between all the involved stakeholders.

1. CONTEXT

On January 25th, 2019, a mining dam – Mina do Corrego do Feijao – collapsed in Brumadinho, Brazil and buried 249 people. The tidal wave of mud shocked Brazilians and raised concerns about the safety of all dams in the country.



Figure 1 : Brumadinho Dam Collapse (source NY Times)

After the accident, in response to society, the Brazilian Government published a Resolution¹ demanding inspection of all dams with high hazard potential in case of a dam break and update of all Dam Safety Plans.

1. Resolução nº 1, de 28 de janeiro de 2019 (Source: http://www.in.gov.br/materia/-/asset_publisher/Kujrw0TZC2Mb/content/id/60916868/do1-2019-01-29-resolucao-n-1-de-28-de-janeiro-de-2019-60916784)

In spite of the fact the accident was on a mining dam, the government demand was not only for mining dams but also for all kind of dams, including hydropower dams and multipurpose dams.

According to Law 12,334/2015, which established the National Dam Safety Policy, the Brazilian Electricity Regulatory Agency (ANEEL) is responsible for supervising dam safety from hydropower plants.

2. NATIONAL DAM SAFETY POLICY – LAW 12,334/2015

The National Dam Safety Policy in Brazil was established in September 20th, 2015 through Law 12,334.

The Law enforcement applies to dams with at least one of the following characteristics:

- i. Dams higher than 15 meters;
- ii. Reservoir equal or over 3,000,000 m³;
- iii. Reservoir containing hazardous waste; or
- iv. Significant or high hazard potential.

The principles of the National Dam Safety Policy are:

- I - the safety of a dam must be considered in its planning, design, construction, first filling and first pouring, operation, decommissioning and future use phases;
- II - the population must be informed and encouraged to participate, directly or indirectly, in preventive and emergency actions;
- III - the entrepreneur is legally responsible for the safety of the dam, and is responsible for developing actions to guarantee it;
- IV - the promotion of social participation and control mechanisms;
- V - The safety of a dam directly influences its sustainability and the reach of its potential social and environmental effects.

Regarding the supervision, the Law establishes that, without prejudice to the supervisory actions of the environmental agencies, the inspection of dam safety shall be conducted by:

- I - the entity that granted the right to use water resources, except for hydroelectric purposes;
- II - the entity that granted or authorized the use of hydraulic potential, when it is the predominant use for hydroelectric generation purposes;
- III - the entity granting mining rights for the purpose of final or temporary disposal of tailings;
- IV - the entity that provided the environmental license for installation and operation for the purpose of disposal of industrial waste.

Article 7 defines that dams will be classified by inspectors by risk category, hazard potential and size of the reservoir, based on general criteria established by the National Water Resources Council (CNRH).

The classification by risk category in high, medium or low shall be made according to the technical characteristics, the state of conservation of the dam and compliance with the Dam Safety Plan.

The classification by hazard potential in high, significant or low will be made according to the potential loss of human life and the economic, social and environmental impacts resulting from the dam break.

Article 16 establishes that the supervisory institution must:

- I - keep a register of the dams under its jurisdiction, with the identification of the entrepreneurs;
- II - demand from the entrepreneur the register of technical responsibility, by a professional authorized by the System Federal Council of Engineering (Confea) and Regional Council of Engineering (Crea), of studies, plans, projects, construction, supervision and other reports;
- III - require the entrepreneur to comply with the recommendations contained in the inspection reports and periodic safety review;
- IV - articulate with other agencies involved in the implementation and operation of dams within the watershed; and
- V - require the entrepreneur to register and update information regarding the dam.

According to article 17, the dam entrepreneur must:

- I - provide the resources necessary to ensure dam safety;
- II - provide the final project as built;
- III - organize and maintain the information and documentation relating to the project, construction, operation, maintenance, safety and deactivation of the dam;
- IV - inform the respective supervisory body of any alteration that may reduce the discharge capacity of the dam or that may compromise its safety;

- V - maintain a specialized dam safety service, as established in the Dam Safety Plan;
- VI - allow unrestricted access by Sindec's inspection body and members to the dam site and its safety documentation;
- VII - Elaborate the Dam Safety Plan, subject to the inspection recommendations and periodic safety reviews;
- VIII - perform safety inspections;
- IX - perform periodic safety reviews;
- X - elaborate the Emergency Action Plan, when required;
- XI - keep records of reservoir levels, with the corresponding correspondence in stored volume, as well as the chemical and physical characteristics of the stored fluid, as established by the supervisory body;
- XII - keep records of soil and groundwater contamination levels in the reservoir area of influence, as established by the supervisory body;
- XIII - register and keep updated the information related to the dam.

3. DAM SAFETY SPERVISING TASK FORCE

In order to attend the Government resolution, The Brazilian Electricity Regulatory Agency reformulated its priorities and defined the objective of conducting in loco inspection of all hydropower plants with high hazard potential.

Pursuing this objective was a huge challenge for the Superintendence of Inspections for Generation Service, department responsible for dam safety inspections. Considering all the dams related to hydropower plants, the Brazilian Electric Sector has more than 900 dams, of which more than 530 dams have high hazard potential, as shown on Figure 2:

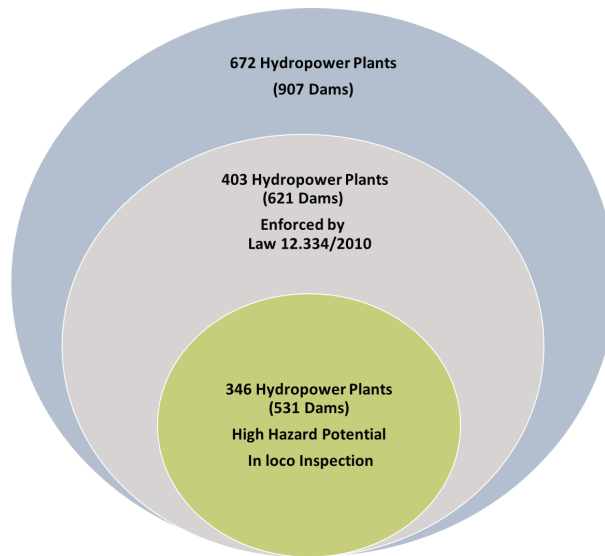


Figure 2 : Electric Sector Dams

The inspection of these projects has been carried out based on Normative Resolution 696/2015, which regulated Law 12334 for the electric sector dams.

According to Resolution 696/2015, the hydropower dams were classified considering the risk category and the hazard potential. Figure 3 presents how the hydropower dams in Brazil are classified.

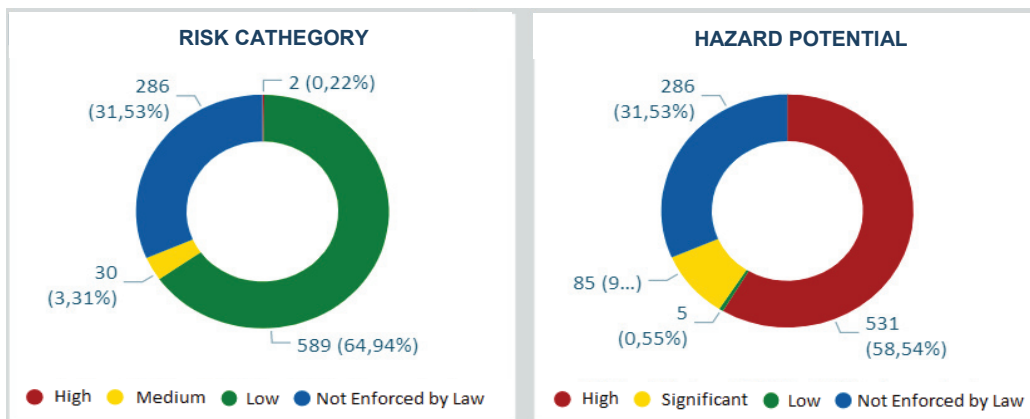


Figure 3 : Brazilian Hydropower Dams Classification

The task force coordinated by ANEEL in order to inspect the 531 dams with hazard potential counted on 21 public servants working on the Inspection Department, assistance of specialized companies contracted by ANEEL for technical support, and some Regulatory State Agencies (AE), with which ANEEL has a cooperation agreement.

ANEEL has cooperation agreement with ten regulatory state agencies and for this task force five agencies had performed inspections.

Figure 4 Presents the distribution of the supervised dams by state, indicating states where the regulatory state agencies also have performed inspections.

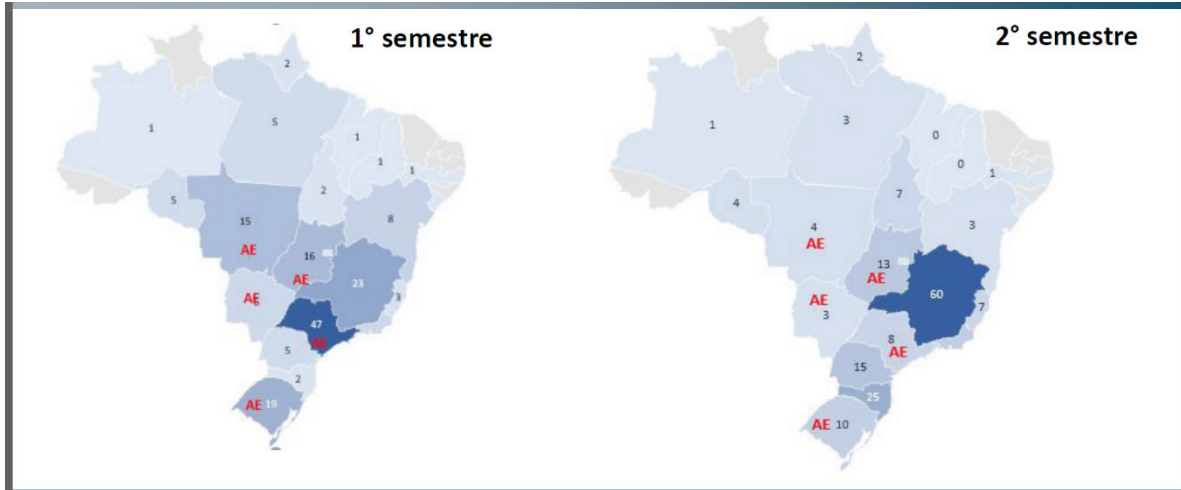


Figure 4 : Dams supervised by state

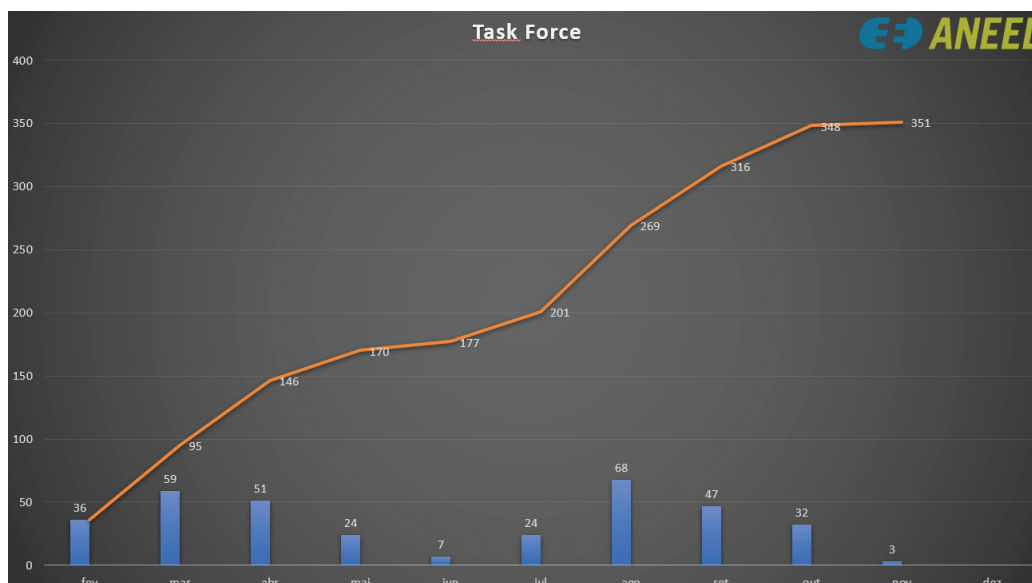
The dam safety inspection process focused on assessing the entrepreneur regulatory compliance. Therefore, on the field, it was verified: the minimum content of the Dam Safety Plan and the Emergency Action Plan and if the documents were elaborated by a licensed professional; the Safety Inspections Report and if the company was attending all the recommendations point out in the document; also, the dam general state of conservation.

Along of the task force development, we also incorporated a new dimension in our inspections – the articulation between entrepreneur, the cities government and the local civil defense body.

In the beginning of the task force, we had a lack of knowledge about how the civil defense bodies on local, state and federal level are organized. After having a better understand of the emergency management arrangements, ANEEL realized the importance of promoting a better engagement with all the stakeholders.

Thus, we included in field inspections a meeting involving the entrepreneur, the city authorities and local civil defense. Those meeting aimed to improve the articulation between entrepreneur and local government in order to develop a risk management plan in case of dam break.

We began the task force in February and by the end of November ANEEL concluded in loco inspection in 351 hydropower plants with more than 500 dams.



4. MOST IMPORTANT FINDINGS

After inspecting all the 351 hydropower plants, the vast majority of the dams presented a good conservation and operation status; therefore, the most important findings were related to:

- Dam Safety Plans and Emergency Action Plans outdated
- Technical documents without register of technical responsibilities from Regional Council of Engineering
- Flood Map outdated
- Irregular occupation on dam's downstream; and
- Lack of articulation between entrepreneurs, local civil defense and local community.

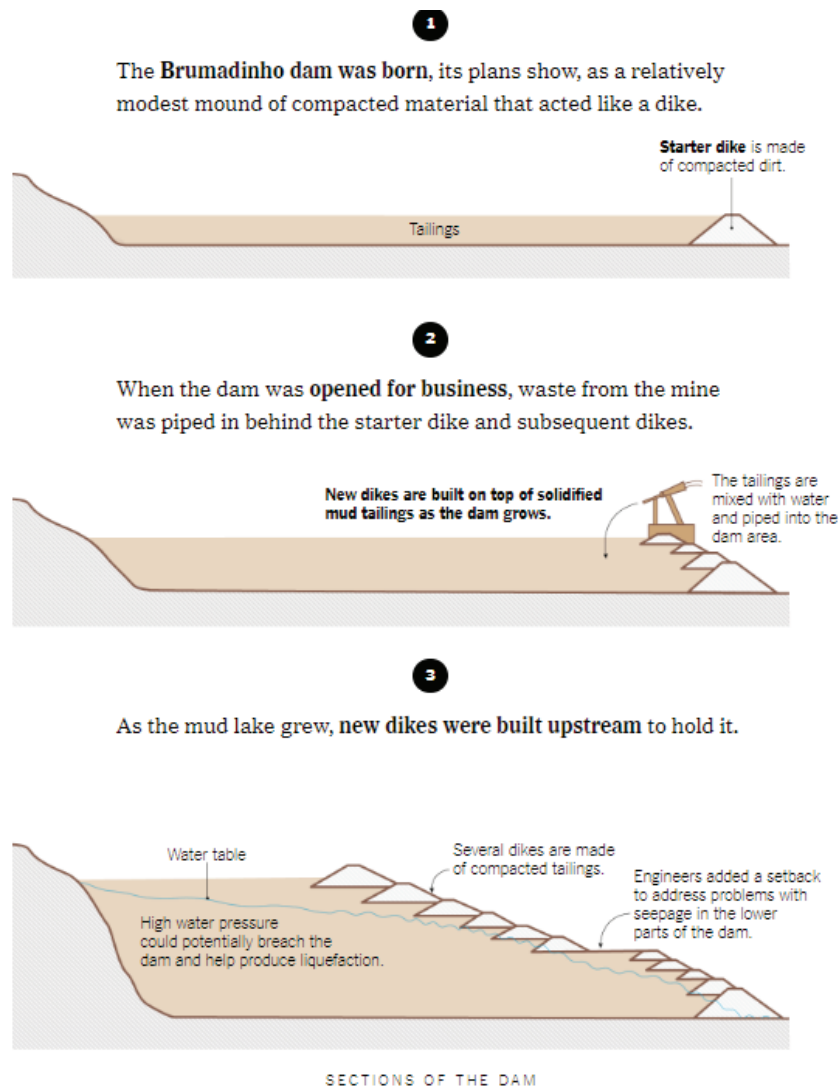
5. CHALLENGES

Along the task force an important challenge was to make the proper difference between a mining dam and hydropower dam.

Following Brumadinho tragedy, a misperception has arisen in the population that all dams are at imminent risk. Thus, in addition to leading the task force, ANEEL took time to explain the construction and risk differences between a mining dam and a hydropower dam.

Citing a New York Times article about the tragedy, dams like the one that collapsed in Brumadinho are, in essence, lakes of thick, semi-hardened mud consisting of water and the solid byproducts of ore mining, which are known as tailings.

The structure at Brumadinho strained the very definition of “dam.” On the opposite to a hydropower dam, It had no separate concrete or metal wall to hold back its contents. Instead, the structure, known as an upstream tailings dam, relied on the lake of mud to remain solid enough to contain itself.



The New York Times | Note: Diagram is based on a 2010 master's thesis by Washington Pirete and a 2018 report by Tüv Süd.

Figure 5 : Mining Dam Construction Method (source: (NYT))

Another challenge was to strengthen the risk management culture in small hydropower plants. The Brazilian electricity matrix shows that 60% of the hydropower plants has less than 30 MW of installed capacity. The small hydropower plants (SHP) usually belong to small entrepreneurs with no electric sector experience. Therefore, ANEEL needs to reinforce the legal and regulatory requirements and the importance of developing appropriate risk management.

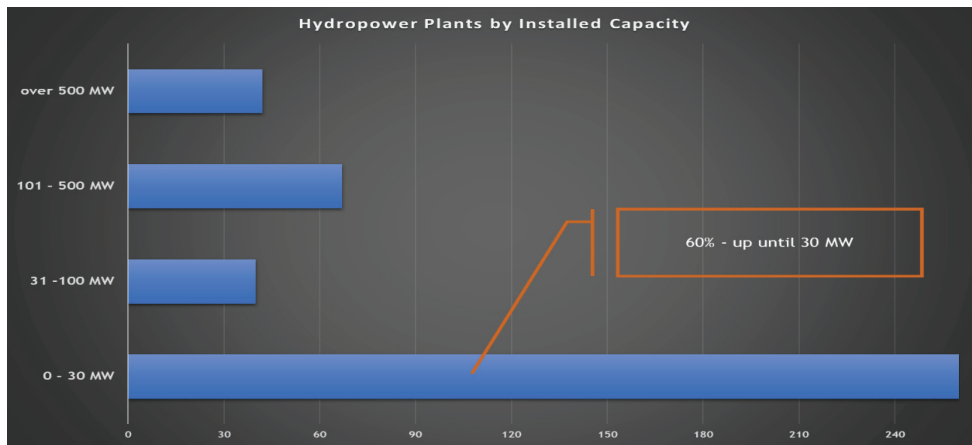


Figure 6 : Hydropower Plants enforced by Law 12,334/2015 by Installed Capacity

For the Brazilian Electric Sector another challenge is for Dam Safety Plans and Emergency Action Plans to consider the effects of upstream and downstream dams in the same watershed. For this, entrepreneurs should articulate and share the studies in order to manage risk considering the effects of other dams.

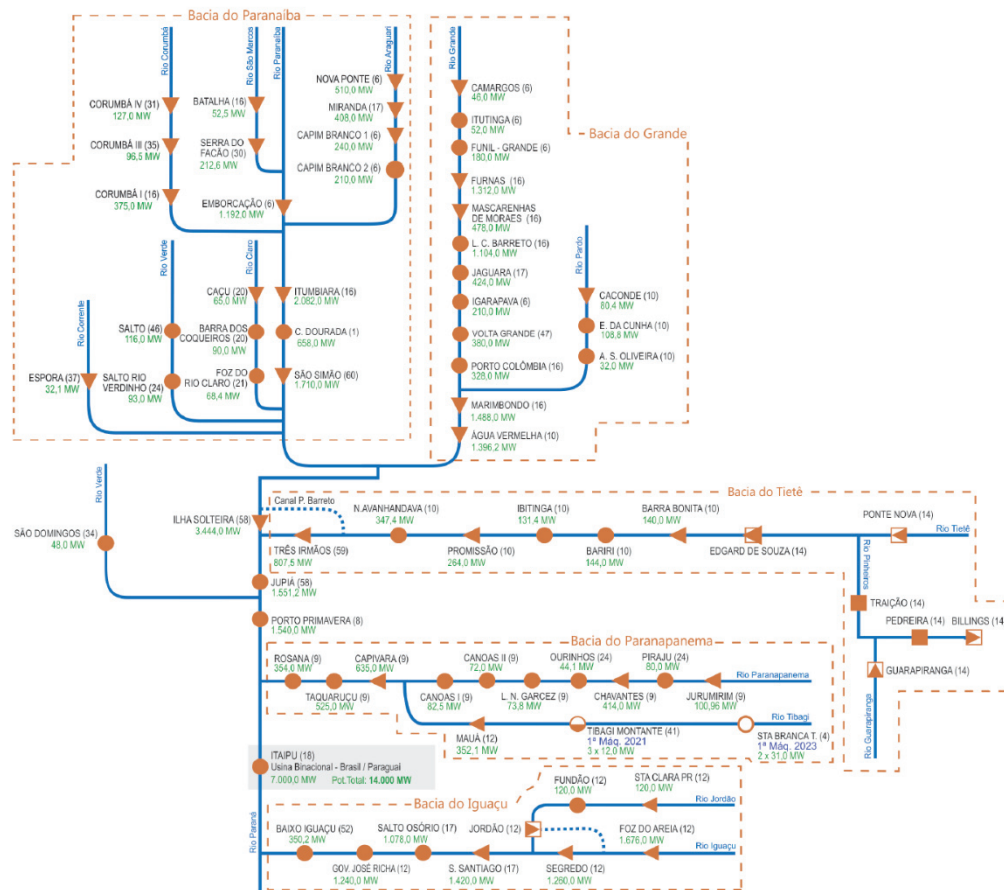


Figure 7 : Hydropower Plants in Parana river watershed

Finally, the supervision of hydroelectric dams poses the challenge of having the Emergency Action Plans effectively implemented in local communities. As a regulatory agency responsible for implementing Dam Safety National Policy, we realized that an Emergency Action Plan must be more than a document in a shelf, it should be an efficient document that support municipalities contingency plans.

However, after visiting 398 cities, we note, in many cities, the lack of local infrastructure needed to implement emergency measures. In some cities, there is not even a local civil defense.

To change this situation, ANEEL has been articulating with Federal and State Civil Defense reinforcing the importance of local authorities and entrepreneurs working together to implement the Emergency Action Plans.

6. CONCLUSION

After successfully completing the objective of inspecting all high-risk dams, the challenges ANEEL has faced throughout 2019 should continue to be addressed throughout 2020.

We need to continue strengthening the articulation with civil defense bodies, to monitor the implementation of Emergency Action Plans; ensure that companies carry out recommendations and determinations of Dam Safety Inspections and comply with regulatory requirements.