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Mining disasters and public health in Brazil: lessons (not) learned

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By publishing a *Thematic Section* on the Vale tailing dam disaster in Brumadinho, Minas Gerais State, Brazil, *Cadernos de Saúde Pública* is honoring an important mission by calling on the academic community to reflect on the worst social and environmental disaster in Brazil's history and one of the most serious in the world. In three articles, the journal's readers will have the opportunity to examine current knowledge on the disaster's causes and effects. With well-crafted reporting based on the available evidence soon after the disaster, Milanez et al. [1] unveil the dynamics of the state's hijacking by the mining industry and corporate tentacles in environmental policy. Freitas et al. [2] focus on public health and the organization of services to examine the links between the Samarco and Vale disasters. Noal et al. [3] address the relevant issue of the disaster's impacts on the mental health of a large contingent of victims and the psychosocial care mobilized in the initial phase of the response.

From the onset, we should emphasize that the tragedy in Brumadinho is inacceptable and unjustifiable, considering the consternation, outrage, and revolt among the victims themselves and all of us who still adhere to basic civilized values. However, perhaps the most worrisome feeling is that of powerlessness: how could the Feijão dam have collapsed just over three years after the Fundão dam burst in Mariana, Minas Gerais State? Even more so when the most recent tragedy amplified the order of magnitude of deaths from dozens to hundreds, and of victims (depending on how the latter are defined).

"*Neither God nor Newton are to blame*" [4], i.e., the mining disasters have individual and institutional culprits: persons, companies, and government agencies. Agents that cause crimes and violate numerous human rights of a huge population contingent.

In one's state of bewilderment provoked by the Vale disaster, the first and obvious question is: How could Feijão have happened after Fundão? Several other questions stem from the first; they may seem obvious, but they need to be repeated, since they point to lessons only partially learned – and not turned into public policies – and even to other questions still unanswered. Some of these are:

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Why was the same hazardous technology still used to dispose of tailings in dams?

One does not have to be an expert in geotechnical engineering to realize that the upstream heightening technique to dispose of tailings, in which the dam is partially laid on unstable tailings in the reservoir, is clearly less safe, although cheaper than other techniques. The additional risk has been extensively documented by the technical community [5] and had already been explicitly contraindicated in a Brazilian ruling ("*The upstream dam heightening method is not recommended*") [6].

The more contemporary discussion concerns the use of any form of tailing dams: "*The new and safer dam-building technology* (sic) *provides for the disposal of tailings, after dried and compacted in piles, thereby eliminating slurry dams. The cost is higher for the mining companies, but definitely hundreds of times less than the billions in damages awarded after Mariana and predicted for Brumadinho*" [7]. The existence of different alternatives for disposing of tailings is reported in the technical literature and is even publicly acknowledged by the Brazilian Mining Institute (IBRAM), which was already warning in 2016 that "*although upstream heightening is the technique most widely used by mining companies, it involves low dam-building control and becomes critical, especially in relation to safety*" (Araújo, 2006, *apud* Brazilian Mining Institute [8], p. 19).

The obvious question is: what is the companies' rationale in adopting a technique for disposing of tailings that is clearly hazardous and that leads to economic losses when the dam collapses? Even the most rudimentary rationale in profit optimization does little to explain the corporate blind eye to economic losses from countless pressure and damages, not to mention the losses from the deterioration of the company's image.

As a spinoff of this obvious paradox, important strides were made, fortunately, after the Feijão dam collapsed in Brumadinho. The Brazilian National Mining Agency issued a nationwide ban on "*the use of the so-called 'upstream' dam heightening technique*" [9], and the same ban was issued by state legislation in Minas Gerais State (*Law n. 23,291/2019*), as discussed by Milanez et al. [1].

Why was the notoriously incorrect classification of dam risks maintained?

Resolution n. 143/2012 [10] establishes criteria for classifying dams according to the variables of risk category and potential harm. For both classifications, the criteria are based on a scoring system with the sum of the dam's characteristics, which are assigned values, such as height and length, the existence of a safety plan, and the dam's state of conservation. The score classifies the dam as high, medium, or low risk or harm.

Both dams, Fundão in Mariana and Feijão in Brumadinho, had been classified in the lowest risk category. These two cases alone suffice to demonstrate the criteria's absolute inadequacy. The technocratic criterion that assigns quantitative scores to different dam characteristics is unable to truly capture the risks of collapse, since it overlooks the fact that in some cases a single factor, which can predominate and suffice to condemn the structure, is diluted by other less significant factors.

If this methodology was not altered after the Samarco tragedy in Mariana, thus failing to call attention to the dire risk of the existing dams, like the one in Brumadinho, the hope is for an urgent review of these procedures, which was emphasized by United Nations humans rights experts: "*We call upon the Brazilian Government to prioritize the safety evaluations*

of existing dams and rectify current licensing and safety inspection processes to avoid the recurrence of this tragic incident. We further call upon the Government not to authorize any new tailing dams nor allow any activities that would affect the integrity of existing ones until safety is ensured" [11].

Why is the environmental licensing process for industries still so permissive, and why are the licensing bodies so heavily influenced by corporations?

Highly symbolic in this regard is the vote on authorization for decommissioning the B1 dam of the Córrego do Feijão mine by the Minas Gerais State Council for Environmental Policy (COPAM) on December 11, 2018. The authorization was approved by eight votes (Secretariat for Economic Development, Science, Technology and Higher Education – SEDECTES, Regional Board of Engineering and Agronomy – CREA, Minas Gerais Syndicate of Mining Industries – SINDIEXTRA, IBRAM, Minas Gerais Economic Development Company – CODEMIG, State Secretariat of the Chief of Staff and Institutional Relations – SECCRI, Minas Gerais State Federation of Thade and Business Associations – FEDERAMINAS, and State Goverbment Secretariat – SeGov, i.e., state government agencies, business associations, and the engineering association), with two abstentions (Brazilian Institute of the Environment and Renewable Natural Resources – IBAMA and Minas Gerais Federal Center for Technological Education – CEFET), and one contrary vote (FONASC, the National Civil Society Forum in the Committees on River Basins). In her explanation of vote, the FONASC representative stated, *"It is extremely violent to continue to witness this situation of irresponsibility, of insanity in environmental decisions"*, and that *"what happened here with this vote is all wrong and extremely serious"* [12].

This type of weakness in the environmental licensing process, the control over decision-making bodies by companies with vested interests, and the state's hijacking by these interests have been the object of numerous observations and exposés, as documented in the article by Milanez et al. [1] and in other academic study [13].

Another angle that deserve mention is the lack of accountability on the part of collegiate body members, both from the point of view of representation and legitimacy and the responsibility for the decisions made.

Why are the mining companies allowed to monitor themselves?

The fact that self-monitoring is taken for granted, especially by mining companies, is another facet of the licensing process with no impartiality or autonomy. Adopted on the questionable grounds of transferring the costs of monitoring to the potential polluter, self-monitoring without government oversight is based on the assumption that all the agents in the process genuinely and exclusively intend to watch over environmental quality and human health. This is obviously not the case in a competitive economic environment based on maximizing profits, proper to these corporate sectors.

A study on water quality monitoring in the Rio Itabirito basin revealed weaknesses in this process, especially in the action by the environmental agency and in the results' credibility. Undersized infrastructure and loss of qualification of state agencies have also prevented adequate assessment of the reports [14].

The same principle, but even more serious, applies to self-monitoring of dam safety. The inquiry by the Office of the Minas Gerais State Public Prosecutor into the collapse

of the Vale dam in Brumadinho identified e-mails between the company's employees and the German consulting firm responsible for issuing the dam's stability reports, *"in which employees of TÜV SÜD explicitly mentioned a kind of blackmailing by Vale for them to attest to the tailing dam's safety, despite what the numbers identified by the inspection pointed to"* [15].

Therefore, in addition to a situation that undermines inspection and control (typical government activities) and transfer of the job of monitoring to the vested interests themselves, a pervasive institutional environment allows the companies to issue or induce the production of fraudulent reports on the dams' risks.

Why does time hurt the victims and benefit the companies? Why don't the institutional arrangements to address the effects of the disasters favor the victims?

The negotiations over reparations for damages from the Samarco disaster, including compensation and fines, involved countless stakeholders and stages, resulting in a dubious outcome. *"The tactic of using time to erase the tragedy's tracks"* [16] (p. 81) has been widely identified.

Meanwhile, the institutional solution to deal with the reparations – the creation of the Renova Foundation – contradicted the initial proposal of creating a public foundation under private law, which would have ensured its public management without losing the agility needed to receive funds and make expenditures. The solution that was finally adopted meant that the funds remained *"under the company's total control"* [17] and with *"a deplorable lack of transparency and of the victims' participation in the negotiations"* [18]. It also gave the company autonomy in settling out of court and of determining those who were (and were not) "affected" by the dam's collapse, as emphasized by Milanez et al. [1].

Thus, the obsession with cutting costs has proceeded unabated after the disasters, often with the state's blessing.

Which workers' health policy authorizes installing a dining hall and administrative building downstream from dams with high risk of collapsing? Why did the sirens fail in both tragedies?

These are obviously questions without answers, since the situations are so absurd. There is a clear criminal liability: *"When you do something knowing that it can produce a risk, that act is criminally liable and involves the same severity as when a drunk driver runs over a pedestrian"* (testimony by Flávio Batista, University of São Paulo) [19]. However, the trial and conviction of the guilty parties continue at a snail's pace.

What are the effects of the mining disasters on health?

Disasters of such magnitude result in complex effects, difficult to identify and measure, and that change over time. Freitas et al. [2] and Noal et al. [3] point appropriately to a set of potential effects, both on the mental health of the direct victims, and from the results of mobilization of the tailings after the dams' collapse, affecting water, soil, air, and ecosystems, including the vector, host, and reservoir cycle. But while we researchers have an idea of the potential risks, we appear to lack adequate answers on how such risks have been expressed in reality, nor do we have sufficient means to communicate the risks to populations and social movements.

An emblematic issue in this sense is the result of the deterioration of water quality on the health of people living near the water basins and of those whose public water supply depends on the waters affected by such risks. Water monitoring along the Rio Doce, for example, still shows high concentrations of various hazardous substances, even three years after the Samarco disaster, involving various metals and other solids [20]. Little is known about the chronic effects of exposure to high levels of harmful chemical substances, while the limits to substances in water are established on the basis of lifetime consumption. In this regard, the scientific community still needs to provide the affected communities with better answers.

The prediction of the effects from the Brumadinho tragedy can obviously benefit from studies already developed on the Rio Doce, but they should take its specificities into account, such as the tailings' downstream movement, the different capacity for dilution in the Rio Paraopeba, the effect of the Três Marias dam on attenuating the pollution, and the uncertainties concerning the downstream impact on the Rio São Francisco.

By way of conclusion, while this text raises a series of questions that are still hovering in the air concerning the context of Brazilian mining and the consequences of the more recent disasters, there is something extremely serious in this field that should be translated into a collective agenda committed to the health and wellbeing of populations threatened by mining operations in Brazil.

Additional information

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