



### **D37 Technical Guiding Elements for Forensic Analysis of Tailings Dam Breaks: A Case Study From the Brazilian Federal Police**

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After attending this presentation, attendees will better understand current efforts being made regarding a forensic science subject that is less developed, particularly in Brazil.

This presentation will impact the forensic science community by presenting the singularities of a catastrophic event that occurred in Brazil, revealing the main points of interest for future investigations of similar cases.

Currently, the economic viability of global mining necessarily implies a cost reduction in tailings dams. In such a context, upstream raising techniques are often taken as a recurrent solution, in spite of being a riskier one, almost always demanding the adoption of quality-controlled operations and more rigid and conservative security protocols.

In the interest of criminal inquiry led by the Brazilian Federal Police (BFP), forensic science experts were asked to take part in the case of a recent catastrophic event related to a massive-scale tailings dam failure that occurred in Brazil last year (November 5) the outcome of which was drawn the attention of the international press. After strenuous work, the forensic Brazilian experts group developed new technical guiding elements to drive the initial work of similar cases. Such elements would comprise various dam stages (project, construction, operation, and deactivation) and would consider, among other points: the general characterization of the damming structures and their internal and external draining devices; the presence of spare safety structures; the establishment of technical premises for keeping good permeability conditions at the tailings according to its properties and its disposal techniques; the use of separated and independent reservoirs according to different types of tailings; the potential disruptions in the structural security throughout its working life; excessive raising of rates; proneness to liquefaction at valve-controlled tailings according to scientifically approved testing methods; occasional modifications in geotechnical properties of soil used in stability analysis, in accordance with on-site inspection; a periodic review of dynamic loads and instrumentation gauges on the basis of the dam functioning.

The failure that took place at the “Fundão” dam, located in Brazil in the city of Mariana, state of Minas Gerais, also caused a stir in the scientific community, revealing the urgent need for improvements in the local protocols devoted to environmental licensing, together with revisions of Brazilian technical standards so as to ensure greater security levels in this raising type of dam. The disaster occurred in the area surrounding the district of Bento Rodrigues, near the so-called “Germano” mine, an open-cast ore mine controlled by the Samarco Company, which belongs to a joint venture from VALE S.A. (a Brazilian company) and BHP Billiton Limited Plc (an Anglo-Australian company) and was created to explore low iron content material in that site. The disaster result in nearly 20 casualties, including not only dam workers, but also towns people residing immediately downstream, in addition to causing extensive harmful environmental effects related to the slurry wave that flowed more than 600km along streams and river basins, surpassing the state limits, and reaching the Atlantic Ocean.

It was concluded that the accident was caused by not only one factor, but a combination of the previously referred to factors, which were maximized by the absence of an in-depth approach in the Brazilian standards, as well as by the lack of a governmental well-prepared supervisory body, in compliance with the current increasing demands for tailing dams in this country.

#### **Tailing Dam, Break, Analysis**

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