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## Vale concludes de-characterization of the first of nine upstream dams as announced earlier this year

*Located at Águas Claras mine, in Nova Lima, 8B dam no longer offers any risk of breach*

Vale completed the de-characterization works of the first of the nine upstream dams as announced in January 29. These works for 8B dam – located at Águas Claras mine, in Nova Lima – began in May 17. Our company's goal for the next three years is that all dams will be de-characterized or in accordance with the adequate Factor of Safety, and do not offer any risk to the environment and to the communities and municipalities located below them.

In addition to 8B dam, the de-characterization project includes the following dams: Sul Superior (Barão de Cocais), Vargem Grande (Nova Lima), Fernandinho (Nova Lima), B3/B4 (Nova Lima), Grupo (Ouro Preto), as well as Forquilhas I,

II and III (Ouro Preto). For some of these structures, downstream containment barriers are being built to enhance safety in the event of breach. The de-characterization and containment works are budgeted at R\$8.6 billion.

The de-characterization works carried out at 8B dam consisted of removing the raising structure that contained the sediments and constructing a central rock channel to allow the natural outflow of surface water. All the surface water was pumped out of the reservoir before these works, which created a total of 160 direct jobs. Almost 50 thousand tons of rock have been used to construct the rockfill at the central channel and where containment was located.

According to Carlos Miana, executive manager of the De-Characterization Project, the main challenge faced during these works was the safe transport of a large volume of rocks to 8B dam (located at Águas Claras mine) and the sediments removed from the dam. "A narrow, curvy, and steep downhill 4-km road is between the stockyard and the dam," comments Miana. "Thanks to the constant awareness of drivers and a rigorous safety control, we were able to complete these works – working day and night – without accidents."

The dam area is also being revegetated; it will allow a faster reintegration into the environment. A vegetation blanket was applied in an area of 12,700 square meters, and one thousand seedlings of native species from Mata do Jambreiro were planted – a permanent protection reserve preserved by Vale at the area in which 8B dam was located. The structure had a Declaration of Stability Condition (DCE, Declaração de Condição de Estabilidade) and no alert level was set to it. Then, workers could access this dam without restrictions.

After these works completion, the processes to formalize the de-characterization are being handled with the state agencies and Brazil's National Mining Agency.

#### **Figures about 8B Dam:**

**Start of operation:** 1974

**End of operation:** 2002

**Total capacity:** 300 thousand cubic meters

**Number of jobs created:** 160

**Revegetated area:** 12,700 square meters

**Planted seedlings:** 1,100

**Rockfill height:** 1.5 meter

**Volume of rocks used at the rockfill:** 50 thousand tons

#### **Enhanced Safety**

The other upstream dams are also undergoing preliminary works with the aim of lowering their water level before the de-characterization begins. These interventions consist of channels to divert rainwater and well drilling outside the reservoir area to prevent groundwater inside the dam. They are being carried out outside the risk area for workers.

Workers accessing areas near dams (Sul Superior, B3/B4, Forquilhas I and III) that are set to emergency Level 3, but

outside Self-Rescue Zones (ZAS, Zona de Autossalvamento), are supported by a special safety system (use of satellite tracking device, for example), as well as specific training, immediate response teams, and ambulance support.

Aiming to carry out reinforcement works on containment for dams set to emergency Level 3, Vale is studying alternatives, such as the use of unmanned vehicles (tractors, excavators, trucks, among others) with remote operation to access risk areas.

"Throughout the process, Vale and companies contracted for these works will focus on the safety of all workers involved, the surrounding communities, and protection of the environment as a top priority," comments Carlos Miana, Vale executive manager. "All this is based on continuous dialogue with Government and civil society organizations." According to him, Vale will take all measures required to ensure the safety of workers, as applied to 8B dam.

### **Containment Works**

Aiming to protect communities and reduce the environmental impact in the event of a breach of any upstream dam, Vale is building three containment barriers. By December this year, two barriers located downstream of Sul Superior dam, in Barão de Cocais, and B3/B4 dams, in Macacos (Nova Lima), should be complete. And the containment works for the dams that include Forquilhas I, II and III as well as Grupo – at Fábrica mine in Ouro Preto – should be complete by the end of February 2020.

### **Geotechnical Monitoring Center**

Aiming to improve safety of its dams, Vale installed, at Águas Claras mine and Conceição mine, Geotechnical Monitoring Centers (CMG, Centro de Monitoramento Geotécnico) mainly to monitor their geotechnical structures in real time. These CMGs are provided with advanced technologies that allow the collection of data from geotechnical instrumentation installed at 88 structures – 12 of them with remote monitoring equipment.

Monitoring is done using a variety of instruments, such as video cameras with artificial intelligence, radars that detect millimeter movements, inspection drones, satellite, piezometers (instrument that measures water pressure at shells), and geophones (sensors to measure induced and natural seismic waves). The service is available since February 2019 and by early 2020 it is expected to monitor more than 100 dikes and dams.

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