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Vale invests in technology to reduce the use of dams and increase the safety of operations

Acquired in 2018, New Steel is working to test, on an industrial scale, an innovative technique that enables the dry magnetic concentration of low-grade ore

Vale aims to invest up to US\$100 million to build an industrial plant for dry magnetic concentration of low-grade iron ore. The Brazilian technology, known as FDMS (Fines Dry Magnetic Separation), is unique and has been developed by New Steel - a company acquired in late 2018. The capacity of the plant, which is expected to be installed in Minas Gerais, will be 1.5 million metric tons per year. The project is expected to start up by 2022. Vale estimates that, in 2024, 1% of all the company's production will use this technology, whose patent is already recognized in 59 countries.

With New Steel, Vale estimates that, in 2024, 70% of production will come from dry or natural moisture processing, without adding water to the process and without using tailings dams. Today, the company produces 60% of iron ore using natural moisture processing. However, in 2024, from 30% of the production using wet processing, 16% will have filtered and dry-stacked tailings. Only 14% will continue using the conventional method, with wet concentration and tailings disposal in dams or deactivated extraction sites, as 40% of the current production. Thus, Vale will invest US\$1.8 billion in filtering and dry stacking in the coming years. The first units to use the technique will be Vargem Grande complex (in Nova Lima), Pico, Cauê and Conceição mines (in Itabira), and Brucutu mine (in São Gonçalo do Rio Abaixo).

According to the president of New Steel, Ivan Montenegro, a pilot plant for FDMS will start operating at the Ferrous Metals Technology Center (CTF, Centro de Tecnologia de Ferrosos), in Nova Lima (Minas Gerais) in the second quarter, and the investment amounted almost US\$3 million. The unit will be able to concentrate 30 metric tons of dry ore per hour, using magnetic separation technology with rare earth magnets.

Through this process, New Steel can deliver a concentrate with iron content up to 68%, from poor ore with content up to 40%, depending on its chemical and mineralogical composition. Currently, this concentration is produced by the method known as flotation, which uses water. In flotation, the tailings are usually disposed of in dams. With the dry concentration technology developed by New Steel, the tailings will be stacked. The company is already studying methods to use them as input for the civil construction industry, in addition to other initiatives, such as co-products.

The pilot project at CTF is the second carried out by Vale. Between 2015 and 2017, a similar plant was successfully operated at Fábrica mine in Minas Gerais. The president of New Steel explains that the good results were essential for Vale to see the potential of FDMS. The technology, however, has been tested since 2013. At the time, the equipment allowed a concentration of five metric tons per hour, rising to 15 metric tons in 2015 up to 30 metric tons in 2017. To be aligned with Vale's future projects, the company works on the development of large-capacity magnetic separators up to 100 metric tons per hour.

According to the technical director of New Steel, Mauro Yamamoto, more than 10,000 test samples of ore from the Iron Quadrangle region of Minas Gerais have already been analyzed by the company. Yamamoto points out that today, with technology, 90% of the iron ore from a low-content deposit can be efficiently recovered. Currently, New Steel seeks to reduce operating costs by using industrial microwaves to dry the product. It aims to replace natural gas dryers, thereby reducing energy costs in half. "It is a sustainable process, but we have the challenge of making it more competitive," explains Montenegro.

Dry processing

Our director of Ferrous Metals Value Chain, Vagner Loyola, points out that Vale has been developing technology to increase dry processing for years. Over the last decade, the company invested almost US\$17,8 billion to deploy and expand the dry - or natural moisture - processing of the iron ore produced in Brazil. Over the next five years, we estimate to invest US\$3.1 billion in similar processing facilities to achieve the goal of 70% of dry production.

In Pará, almost 80% of production already uses this technology in the so-called North System. The main plant in Carajás, Plant 1, is being converted to use the natural moisture processing; from its 17 processing lines, 11 already use dry processing and the remaining six wet processing lines will be converted by 2023. The treatment plants at Serra Leste (in Curionópolis) and the S11D complex (in Canaã dos Carajás) do not use water to treat the ore. At S11D complex, for example, the use of the natural moisture processing route allows water consumption to be reduced by 93% when compared to the conventional method of iron ore production. The water saving is equivalent to the annual supply for a city of 400 thousand inhabitants.

In Minas Gerais, dry processing was expanded from 20% in 2016 to 32% in 2019. Today, this type of processing is used by several units, such as Brucutu, Alegria, Fábrica Nova, Fazendão, Abóboras, Mutuca, and Pico. "In Minas Gerais operations, all the units that could be converted to dry processing production are already in operation," explains Loyola. Then, we are using tailings filtering and stacking as well as the dry concentration technology from New Steel to reduce the use of dams."

Dry processing is associated with the quality of the iron ore from the mine face. In Carajás, as the iron content is already high (above 65% iron), the material is only crushed and screened to be classified by size (granulometry). In some mines of Minas Gerais, the average content is 40% iron in rocks known as itabirite. To increase its grade, the ore is concentrated through processing with water, and the tailings are disposed of in dams. Then, the high-grade ore resulting from this process can be transformed into pellets at the pelletizing plants to increase the added value of the product.

The plants that use dry processing in Minas depend on the availability of high-grade ore - around 60% - that can be found in some mines of the state. To achieve the required quality and be included in Vale's product portfolio, this ore must be blended with the ore from Carajás - this blending is carried out at Vale's Distribution Centers in China and Malaysia.

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