Case Study

TACKLING EMISSIONS THROUGH SULPHUR DIOXIDE CAPTURE
NEW SOLUTIONS TO AN OLD CHALLENGE: NORNICKEL'S SULPHUR PROJECT

Industrial sulphur emissions remain a significant environmental and public health challenge, contributing to acid rain, air pollution, and ecosystem degradation – making their reduction a critical focus for effective ESG (Environmental, Social, and Governance) strategies. Sulphur dioxide (SO_2) emissions have been a challenge in the context of the extraction and processing of nickel and copper and related PGM production in Russia. Hence, mitigating risks to both local communities and the environment are a key strategic priority for PGM, nickel, copper and other base and precious metals producer Nornickel.

Sulphur Project is Nornickel's comprehensive environmental initiative aimed at achieving world-class performance in sulphur dioxide utilisation and drastically reducing SO_2 emissions, with the broader goal of significantly improving the environmental conditions in the surrounding area.

The Sulphur Project. October 2023

The technology behind the *Sulphur Project* involves intermediate production of sulphuric acid at high sulphur dioxide recovery rates (up to 99.5%), with the acid subsequently neutralised with limestone and converted into a neutral by-product – gypsum.

Gypsum sample

This initiative is by far not Nornickel's first effort to tackle the challenges posed by high sulphur content in the ore. In fact, the origins of the *Sulphur Project* trace back to the early days of the company's metallurgical operations, when capturing sulphur dioxide gas was an integral part of production, originally aimed at generating commercially valuable sulphuric acid.

The launch of the Sulphur Project

For decades, finding a viable solution to this formidable engineering problem proved elusive. The difficulty lies in a unique combination of factors: unlike any other industrial enterprise worldwide, Norilsk faces the task of recovering sulphur from exceptionally large volumes of off-gases generated in a continuous metallurgical production cycle. This challenge is further compounded by the region's geographical isolation and the remoteness of potential markets, making conventional approaches economically and logistically unprofitable.

Finding a customized, large-scale solution for sulphur dioxide capture

There were no ready-to-implement technical solutions available globally, as only isolated elements of the required technology existed. A solution was needed to recover at least 95% of sulphur dioxide from off-gases while maintaining uninterrupted production. To meet regulatory requirements, this called for the development of a unique, enhanced technology. Extensive work on selecting the best available technologies for sulphur dioxide capture, along with a study of global best practices in light of updated Russian environmental legislation, enabled the company to gain unique expertise, identify the shortcomings of various technologies, define technical requirements for future sulphur production, and assess staffing needs.

The selected technologies fully account for the availability of raw materials and resources needed for large-scale recovery, as well as the logistical constraints of the Norilsk Industrial District, including the lack of rail access to external networks, a short shipping period on the Yenisei River with periods of air-only access, and challenging navigation along the Northern Sea Route.

With the adopted solutions, sulphur recovery has become nearly harmless to both humans and the environment. After the completion of the project on the Kola Peninsula, sulphur dioxide emissions went down 90% in 2022 compared to the 2015 baseline. In October 2023, the project was extended to the Norilsk Division. When the project reaches full capacity in 2025–2026, emissions at the Polar Division will be reduced by 45% compared to the 2015 baseline. This achievement aligns with the objectives of the Clean Air federal project and the Russian President's Executive Order No. 204, On National Goals and Strategic Objectives of the Russian Federation Through to 2024, dated 7 May 2018.


Training of operating personnel for the Sulphur Project

In total, there are about 900 units of technological equipment in the shops of the *Sulphur Project* at Nadezhda Metallurgical Plant, not counting the auxiliary equipment. The bulk of this equipment is concentrated at the principal sulphuric acid production section of the *Sulphur Project*.

The *Sulphur Project* is a complex and high-cost initiative, with approximately RUB 200 billion (approx. €2.1 billion EUR) in non-recoverable

The Sulphur Project

investment and a new production facility employing over 1,000 skilled professionals. The construction of the *Sulphur Project* facilities at Nadezhda Metallurgical Plant involved four general contractors and multiple subcontractors from across Russia, all with experience in building technologically demanding industrial facilities in diverse climatic conditions. This involved reconfiguring metallurgical capacities, significantly upgrading the company's production assets, shutting down critically outdated facilities, and transferring parts of the production chain between different company sites.

The *Sulphur Project* in the Norilsk Industrial District is just one component of Norilsk's comprehensive development programme extending through 2035. The programme includes the remediation of legacy pollution, land cleanup, rehabilitation of tailings storage facilities and dumps, mineralisation of tailings, and the construction of treatment facilities for both mine water and domestic wastewater.

The Norilsk Nickel Group ("Nornickel", the "Group", the "Nornickel Group", or the "Company") is a diversified metals and mining holding company, the world's largest producer of palladium and metal nickel, and one of the leading global producers of platinum, copper, rhodium, and cobalt. Nornickel's key competitive advantages include a vertically integrated production chain that spans a unique mineral resource base and a full production cycle, from ore mining to refining, along with its own energy, logistics, and infrastructure assets. The Group's production facilities are located in Russia, including in the Norilsk Industrial District, on the Kola Peninsula, in the Trans-Baikal Territory, and in Finland. The Head Office of PJSC MMC NORILSK NICKEL (the Group's parent company) is based in Moscow.

Nornickel holds leading positions among industrial companies operating in the Russian Arctic. The Company's enterprises play a vital role in the development of Norilsk, Dudinka, Monchegorsk, and Zapolyarny, contributing to the social and economic development and stability of these cities.

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