

Case Study

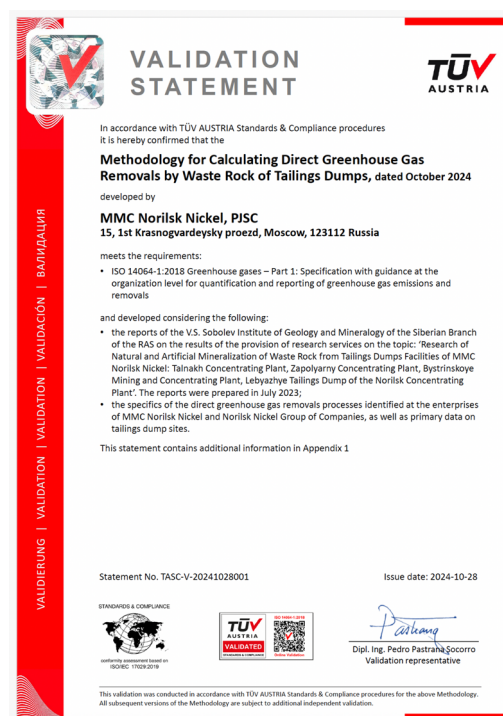
13 CLIMATE
ACTION

DECARBONIZATION PROJECTS: ASSESSMENT OF THE ABSORPTION CAPACITY OF MINING WASTE

Nornickel has assessed the capacity of rocks at the tailings storage facilities in Norilsk to absorb carbon dioxide (CO₂). Extracting materials from mines and bringing them to the surface creates conditions for mineralisation, which is a natural carbon dioxide absorption process. Nornickel's ores have a unique composition. During mineralisation, minerals contained in mining waste react with carbon dioxide to form stable secondary carbonates, which remain in the tailings storage facility.

Research into the mineral sequestration of carbon dioxide has been under way since the late 20th century due to the global search for safe, environmentally sound, and long-term solutions for CO₂ disposal. The CO₂ mineralisation process implies the reaction of carbon dioxide with various minerals – such as olivine, serpentine, and other silicates containing calcium, magnesium, and iron. During the reaction, a carbon dioxide molecule binds with the positively charged ions of these elements in the presence of water to form carbonates, thereby converting into a solid phase.

In 2024, TÜV AUSTRIA validated Nornickel's methodology for calculating direct GHG absorption through gangue mineralisation in tailings storage facilities to ISO 14064-1-2021 Greenhouse gases. Part 1. Specification with guidance at the organisation level for quantification and reporting of greenhouse gas emissions and removals. This methodology is unique in Russian practice.



The methodology provides for measuring CO₂ absorption through passive (non-anthropogenic) carbonation of certain minerals in the tailings stored at the Company's tailings storage facilities. The rate of passive carbonation depends on the mineral composition of the parent ore, particle size, climatic conditions, and the chemistry of pore water in the rock mass. One of the key factors influencing the efficiency of the mineralisation process is the acid-alkaline balance of the solution in which the reaction occurs. To estimate the amount of CO₂ absorbed, analytical methods are used, including infrared (IR) spectroscopy,

Case Study

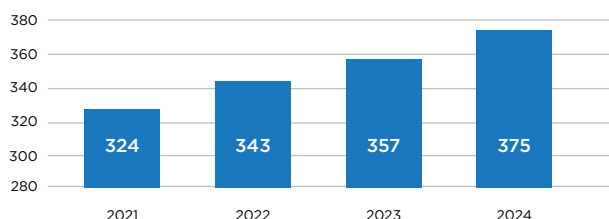


Lebyazhye Tailings Storage

X-ray diffractometry, and CHNS (CN) elemental analysis, which determines the carbon content in the pulp and tailings.

The amount of direct CO₂ absorption depends on the volume of waste rock disposed of at the Company's tailings storage facilities in the reporting period. The amount of actual removals for 2021–2024 was measured in the Company's four tailings storage facilities located in the Norilsk Industrial District and then verified by TÜV AUSTRIA.

Direct absorption of greenhouse gases by waste materials in four tailings storage facilities in the Norilsk Industrial District, kt of CO₂ equivalent



The 2024 emissions and removals report already includes the absorption capacity of the Company's tailings storage facilities. This unique measure helps offset the product carbon footprint.

Nornickel plans to further develop this project, with studies of artificial and active gangue mineralisa-

tion in tailings storage facilities scheduled to start as early as 2025. These approaches have greater potential for greenhouse gas capture compared to natural mineralisation.



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.