



Nornickel is making a comprehensive, long-term effort in monitoring assets to assess the impact of permafrost thawing in the Norilsk region

Materials



Norilsk Nickel Great Norilsk Expedition

2.5 Mb

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To manage this risk, the Company:

- Regularly monitors the condition of foundations underneath buildings and structures built on permafrost
- Performs geodetic monitoring of the movement of buildings
- Monitors soil temperature in buildings' foundations

- Monitors the compliance of its facilities with operational requirements for crawl spaces
- Develops recommendations and corrective action plans to ensure safe operating conditions for buildings and structures

Roll-out of permafrost thawing monitoring:

- An agreement with Sovzond, the leading Russian space monitoring company, for monitoring of permafrost-based structures using satellite images and early detection of any possible deformations
- Evaluation of supporting posts deformation and soil temperature by means of confirmative geological drilling
- Installation of strain gauges and temperature sensors
- Upgrade of the Diagnostic Center of Polar Division and Permafrost laboratory

Systematic analysis of the impact of permafrost thawing on foundations:

- Interferometric analysis of satellite images to identify both vertical and horizontal changes in foundation structures
- Geological drilling to secure real-time thermometric monitoring of foundations. Comparison of historical permafrost/soil temperature diagrams with up-to-date data sets
- Seismoacoustic methods of piles condition analysis and early detection of potential structural deformations and rusting
- Geodesic surveying of buildings structural parts

Satellite monitoring of permafrost-based industrial structures:

- Real life monitoring of permafrost-based structures using satellite images
- Images taken every 48 hours with 1cm precision
- Precision to improve to 1mm by mid-2021
- Side-by-side analysis of images should help to detect any possible deformations of structures at an early stage

The Great Norilsk Expedition — Permafrost Study:

- 30 scientists from 14 research institutes of the Russian Academy of Sciences' Siberian Branch supervised by Valentin Parmon, Chairman of the Siberian Branch of the Russian Academy of Sciences
- The samples from Pyasino Lake collected at a 7-8m depths measuring permafrost temperatures at a 15m depth

Geophysical Research Focus:

- Study of the structure and conditions of the cryolithic zone as a basis for recommendations on the reduction of current environmental impact and remediation of previous industrial activities
- An assessment of the depth of permafrost roofing in undisturbed conditions and within infrastructure facilities
- Delineation of anthropogenic rims across production facilities
- Identification of technological options for filtering of polluted waters and petroleum products from the facilities
- Assessment of the capacity of loose sediments within the infrastructure

Geocryological Research Focus:

- Assessment of the current cryolithosone status and historical trends in the Norilsk region
- Analysis of the distribution and peculiarities of permafrost sequences
- Assessment of the boundaries of distribution, the degree of intensity of development of cryogenic processes and formations

- Description of the degree of surface contamination by these processes and formations
- Estimation of depth and dynamics of seasonal ground thawing and freezing depending on surface conditions
- Calculation of the normal depth of seasonal thawing and freezing
- Assessment of the distribution, character of manifestation, genesis of taliks (if any) (based on materials of engineering surveys and drilling data)
- Forecast of changes in geocryological conditions