TURNING TAILINGS INTO GOLD

Case Highlight: NVRO Metals

A 21st century gold rush is under way, as governments and industry move to secure supplies of the critical metals and minerals that make modern technology possible.

NVRO Metals Limited has hit on a way to fulfil that demand without the environmental challenges involved in opening new mines. The opposite, in fact: the cleantech company's proprietary NVRO Process™ actually cleans up environmental pollution from past mining operations. Thanks to digital process optimization by ANDRITZ, NVRO Metals has improved both the economics and environmental performance of its tailings recovery operation.

TRASH OR TREASURE?

The organizations joining the new gold rush do so with their eyes wide open to the cost of new mining operations. If decades of institutional experience weren't evidence enough, then the 30,000 tailings storage facilities around the world, filled with toxic byproducts of traditional mining techniques, serve as stark reminders of the legacy a mine can leave behind. But while many might see the global tailings stockpile purely as a cautionary tale, NVRO Metals saw an opportunity. Because mine tailings are not pure waste: they contain an estimated USD 3 trillion in unrecoverable precious, strategic, and critical metals. Unrecoverable – until now.

The technology solves two problems at once, extracting these in-demand resources from stored tailings while neutralizing much of the toxicity that makes this waste a threat to the environment. When a 2023 internal study identified opportunties for further optimization, the company turned to ANDRITZ to help access it.

SIMULATION HELPS TURN POTENTIAL INTO PROFIT

The NVRO Process™ subjects mine tailings to a low-temperature hydrometallurgical process. As well as recovering precious, base and critical metals from the tailings, the process removes sulfides, reduces the potential for acid mine drainage, reduces heavy metal content, and stabilizes arsenic to prevent it leaching out into the surrounding soil. Following the process, the tailings no longer need to be stockpiled in specialized facilities; the remaining waste can be used to backfill the mine it came from, with greatly reduced risk of contaminating local groundwater.

NVRO Metals' 2023 pre-feasibility study indicated that the process could be more efficient. In theory it was possible to reduce operating costs while improving the quality of the end product: the metal concentrates. To turn theory into practice and potential into profit, ANDRITZ built a simulation of the NVRO Process™ in IDEAS, the world's leading industrial process simulator. By creating high-fidelity virtual models of industrial processes, IDEAS makes it possible to test the effects of proposed process changes without risky and costly real-world trial and error.

Using IDEAS, ANDRITZ identified even bigger improvements than in NVRO Metals' own study. The simulation indicated it was possible to increase the concentrate grade of extracted gold by 286 % more than the company had thought, and of silver by 450 % more.

MINOR MODIFICATIONS, SIGNIFICANT IMPROVEMENTS

Rather than requiring a major plant overhaul, the improvements were achieved through targeted, low-cost process modifications. The result was a more efficient operation that processes less unnecessary material, consumes fewer resources, and generates lower emissions.

At the same time, NVRO Metals increased the recovery of valuable minerals and improved concentrate quality, demonstrating how smart process optimization can deliver both economic and environmental benefits.



Digital gold rush
Using the ANDRITZ IDEAS process simulator, NVRO Metals identified major optimization opportunities before making any physical changes. The simulation revealed the potential to increase gold concentrate grade by 286 % and silver by 450 %.

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Cleaner and more profitable
Small process adjustments delivered big results: higher-value metal concentrates, lower operating costs, reduced resource consumption, and safer tailings that can be returned to former mine sites instead of stored in specialized facilities.

Using digital optimization to recover more critical metals from mining waste while reducing environmental impact.

"The ANDRITZ IDEAS simulation identified an additional USD 232 million in pre-tax, life-of-mine cash flows. This is just one example of the outstanding optimization outcomes achieved to date with only minor plant tweaks," said Grant Freeman, CEO, NVRO Metals.

The simulated process improvements were independently laboratory tested by ALS Global, to validate the results before NVRO Metals committed to full implementation.

The company then partnered with ANDRITZ and Hatch Pty Ltd to make the minor modifications needed to optimize its process. The more critical metals that can be recovered from existing mine tailings, the less governments and industry need to rely on new mining operations to keep up with demand. By helping NVRO Metals optimize its process, ANDRITZ IDEAS has helped both to clean up toxic byproducts and to limit future environmental impact – all while boosting technological progress.

Steve Royan, Director Sales & Business Development, Automation & Digitalization at Separation, ANDRITZ, summarizes the project: "ANDRITZ's industry-leading IDEAS simulation software accelerated the optimization of the propriety NVRO Process™, helping to shape a more sustainable future for the mining and metals industry."

THE NVRO PROCESS™ IN BRIEF:

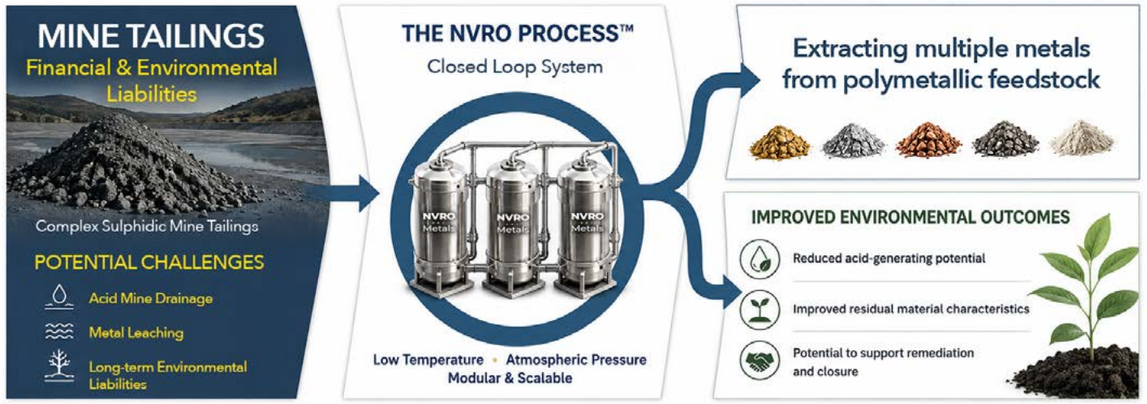
Recovering value and improving environmental outcomes

Step 1: Feed material
Mine waste, tailings and selected sulfidic materials.

Step 2: Metal recovery
Concentrate and recover valuable metals through a low-temperature hydro-metallurgical process.

Step 3: Valuable products
Production of metal-rich concentrates and recoverable products.

Step 4: Environmental outcomes
Reduced sulfide content and stabilization of environmental liabilities.



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THE OPPORTUNITY

30,000
tailings storage facilities worldwide

USD 3 trillion
of previously unrecoverable metals



PROCESS OPTIMIZATION

+ USD 232 million
cash flow, including **USD 15.3 million** saving on logistics costs by reducing concentrate volume

67 % reduction
in annual concentrate volume

35 % less
material sent to the leaching circuit

ANDRITZ EXPERT:

→ **Steve Royan,** Director Sales & Business Development, Automation & Digitalization, Separation

Compared to NVRO Metals' pre-feasibility study:

286 % higher
gold concentrate grade

450 % higher
silver concentrate grade

82 %
gold recovery in preconcentration (validated by ALS Global)

96.3 %
oxidation efficiency