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Finnish Green Mining program starts research on utilization of tailings and reduction of wastes
by Min-Novation Project Manager Hanna Repo, Kainuun Etu Ltd

Structure and Depth of the Green Mining Program

TEKES, the Finnish Funding Agency for Technology and Innovation, launched the Finnish Green Mining program (GM) in 2011 in order to position Finland as a leader in sustainable mining. Key action areas and the Finnish concept for "green mining" are illustrated as follows:

- Promotes materials and energy efficiency
  - Less energy used in process
  - Renewable energy utilized
  - Less side rock and wastes
  - Less water used and discharged

- Ensures availability of mineral resources for future needs
  - New ore reserves
  - Advanced exploration techniques
  - Mineral processing for low grades

- Minimizes adverse environmental and social impacts
  - Reduce of environmental footprint and emissions
  - Maximize positive social impacts
  - Considering of stakeholder interests

- Improves work and organisational practices
  - Culture of continuous improvement of safety, quality and environmental performance of the companies

- Ensures sustainable land use following mine closure
  - Mine closure plan is started simultaneously with mine planning and is updated regularly during the whole life time of the mine

Source: Tekes – the Finnish Funding Agency for Technology and Innovation

Program Coordinator Harry Sandström reports that after running for two years, the program has around 50 ongoing projects with an overall budget of 40 M€. The research and development covers the entire value chain of mine development and operation, from exploration to mine closure.

Green Mining Through Separation Technology – The TREWA Project

A key issue in material efficiency facing many a mining company is the reduction and better utilization of mine wastes, including waste rock and tailings.

The generation of tailings is a significant environmental concern in the mining industry as the production of tailings can exceed the production of the concentrate by several times. Currently, tailings are disposed of through dry stacking or stored in holding ponds which are later on landscaped. The management of tailings results in significant costs as dry stacking requires high capital input in dewatering technologies and the construction and management of holding ponds is becoming increasingly expensive. In addition, tailings ponds can cover more than half of the whole mine district.

In addition to being environmentally less attractive to store tailings in ponds, valuable resources might be lost in tailings. Metals could be recovered through the treatment of tailings and thus form a more environmentally benign waste. However, the treatment of tailings is not without its challenges. These challenges are now tackled in the GM-funded
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Source: Tekes – the Finnish Funding Agency for Technology and Innovation

- The goal of TREWA is to provide an economically and technologically feasible treatment process for tailings to decrease the quantity of waste and produce value-added products during the treatment. At the heart of this development lie various separation techniques. Large scale dewatering and fractionation, selective leaching, solution purification and solvent recovery need to be considered to produce a viable process, Research Professor Riina Salmimies of Lappeenranta University of Technology explains.

Advances in the treatment of tailings would make a significant contribution to the sustainability of the Finnish mining industry and would help mining companies in dealing with challenges in acquiring and maintaining their social license, Riina Salmimies concludes.

The 3-year project, which officially kicked off in January of this year, is a joint venture between Lappeenranta University of Technology (LUT) and VTT, who have set out to build Finland's largest research cluster in separation technology in Lappeenranta. The majority of the work will be executed at LUT in the solid/liquid separation research group led by professor Antti Häkkinen. The project also utilizes the expertise and input of international partners. Three universities: The Norwegian University of Science & Technology from Norway, TU Bergakademie from Germany and St. Petersburg State Mining Institute from Russia are involved in the project. The project is partially financed and implemented in close co-operation with several technology companies: Outotec and Weir Minerals as well as FQM Kevitsa Mining. The variety of partners ensures that several aspects of feasibility will be addressed during the project.

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Additional information is available about:

**Green Mining Program:**
- Program Coordinator Harry Sandström, TEKES/Spinverse Ltd, harry.sandstrom@spinverse.com

**Green Mining projects:**

**TREWA:**
- Riina Salmimies, Project Manager and Research Professor, Lappeenranta University of Technology, riina.salmimies@lut.fi
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Oulu Mining School – A Northern Network of Knowledge

Oulu Mining School (OMS) is the University of Oulu-based educational and research network that has been operating in the field of mining and mineral processing since 2007. Its core partners are the Department of Process and Environmental Engineering, the Department of Geosciences and the Extension School.

The key function of OMS is educating Masters in mining and mineral processing as well as geosciences. This is done in cooperation with Aalto University in Helsinki and Luleå University of Technology in Sweden. The Oulu Mining School works closely on various research topics with the Geological Survey of Finland, the Finnish Institute of Occupational Health, as well as the Pyhäsalmi, Agnico-Eagle Kittilä, Talvivaara and Outokumpu Chrome mines.

"The OMS innovation environment attracts great interest. We have had a continuous line of visitors knocking on our door every day ever since the December opening ceremonies of the mini-pilot. Obviously our strategic choices have been correct. The mini-pilot beneficiation plant helps us further strengthen our networks," comments Professor Hannu Kuopanportti of the University of Oulu.

Mini-Pilot Beneficiation Plant – Innovation Environment for Mineral Processing

The continuous mini-pilot beneficiation plant of the Oulu Mining School is a unique, university-based research platform for sustainable mining and mineral engineering. The recently set up 14 metre-long process line covers the whole beneficiation chain typical in most Finnish mines.

The mini-pilot plant both optimizes the use of resources, and minimizes production costs as well as overall impacts on the environment. The innovation environment is used for education and research functions of the University of Oulu. Mining companies are a key target audience for the plant. Access to this resource gives them a great opportunity to optimize their material flows and structures at an affordable cost.

The beneficiation plant may be used for sulphide ore studies and education. However, the plant has great potential for a variety of different applications. "We are just beginning to realize the whole potential of the investment," says Project Manager Ilkka Hynynen of OMS. "After some small additional investments such as spirals and magnetic separators we will have no problems to enlarge our territory and offer our services in ore research across Fennoscandinavia!"

The minipilot investment was funded by the University of Oulu and the Council of Oulu Region (from the European Regional Development Fund). Main partners participating in the planning and technical part of the project were the Geological Survey of Finland, Outotec, Siemens Electric and PANalytical.

For more information on OMS and the mini-pilot please write to: hannu.kuopanportti@oulu.fi

COMING UP IN THE NEXT NEWSLETTER:
THE 1ST ARTICLE OF A 4-PART SERIES ON THE SUBJECT OF MIN-NOVATION’S PILOT INVESTMENTS