Senior Scientist Helena Wessman-Jääskeläinen is performing research to elucidate the main challenges the mining industry in Finland is facing and providing green solutions to these problems.

Water use and quality. In the 1980s, the forest industry carried out research focused on local water emissions and it significantly improved wastewater purification together with changes in the core process technology. It found ways to enhance environmental research and assessment tools simultaneously.

Water availability and quality is again in focus, and globally the mining industry is facing similar types of environmental challenges that the forest industry faced a few decades earlier. To understand the impacts of water availability and quality through the whole value chain, this industry also needs to combine environmental research with new technologies that utilise tools based on life cycle thinking.

As part of the ‘Sustainable Acceptable Mining’ (SAM) project, you have investigated the water usage in the production of copper concentrate at the Pyhäsalmi mine – the deepest metal mine in Europe. What were your goals?

Our aim for SAM was to develop a water footprint approach for use in Finnish mining industry, based on the recently accepted ISO standard 14046 and existing impact assessment methodologies – a goal that we achieved. We started with case studies like the Pyhäsalmi mine to improve our understanding of the various direct and indirect water flows and impacts on water use.

Are the conclusions that you have drawn from your examination of the Pyhäsalmi mine applicable to other mines or aspects of the mining industry?

Water footprint methodology was found applicable for mines and mine products and could be a part of environmental sustainability indicator set for any water intensive process industry. However, it is important to understand that the water footprint is a local indicator, and the impacts caused by mining processes can vary depending on the specific site and its hydrology, climate or geology. Thus, it is necessary to consider each location separately.

You are also finding ways of promoting sustainable change among multiple stakeholders. How does this relate to your work with the mining industry?

The aim of our research is to use lessons learned from our investigations to create a new Finnish mining industry that works harmoniously with the stakeholders, including mining companies, NGOs and authorities, among others. This is a change that is needed, exemplified in the preliminary results of SAM, as the main challenges in the Finnish mining industry relate to activities of the authorities, company culture, communication and life cycle thinking.

Elaborating on these results, we found that the lack of collaboration of the authorities in different sectors hinders the development of sustainability. Moreover, the company culture does not always follow the current demands of the stakeholders, such as social and cultural responsibility aspects. Also, communication processes are not always tailored to the stakeholder needs, and challenges of new business potentials after mine closure have not been properly considered. These results have served as a red line when specifying the goals of SAM.

How would you like to see this work progress in the future?

Sustainability research in the mining sectors needs the combination of social, environmental and technical knowledge. Mining is a local issue and the local industry, authorities and stakeholders should be involved in the decision making. Water management and tools to assess water use and quality should be taken into account more effectively.

SAM is a good start to give specific environmental and societal tools for companies to identify the major environmental impacts and their mitigation potential. It is also a good example of national and international cooperation, and should be applied globally.
Not mine, but ours

Scientists at VTT Technical Research Centre of Finland are creating breakthroughs in green mining, applying new tools that measure water footprint and working to help mines gain a social licence to operate

UNBEATABLE GEOLOGICAL POSSIBILITIES, excellent infrastructure and optimistic outlooks make Finland one of the top areas for mining investment in the world. The country has a long history of mining activity, with iron ore mining commencing in the middle of the 16th Century. Since then, many metal mines have opened and exploited iron, copper, nickel, zinc, cobalt, gold and other metals. Industrial minerals such as talc, carbonates and apatite have also been mined.

Due to the worldwide increase in demand for metals and industrial minerals, the Finnish mining industry has expanded significantly over the last six years, with more than 30,000 people making a living in the country’s mining sector. The direct positive consequences of this with regard to employment and the economy are obvious, and opportunities for technology and service companies have also been created along the value chain.

However, the industry is facing a turbulent time in terms of insistent negative publicity concerning its environmental and social impacts, along with its effect on other industries, such as tourism, forestry, agriculture and reindeer herding. And, although Finland is one of the leading suppliers of mine-related technology, the mining systems, routines, and communication and interaction with the public have remained relatively unchanged since the 1960s.

THE GREEN MINING CONCEPT

To mitigate these issues, the Finnish Government funded the Green Mining Research Programme. The ‘green mining’ concept calls for the integration and minimisation of environmental and social issues affecting communities, improvements to safety standards and the guarantee that land will be used sustainably when mining activities end. Researchers at VTT Technical Research Centre in Finland have embarked on a joint three-year ‘Sustainable Acceptable Mining’ (SAM) project in 2013 with Geological Survey of Finland, Finnish Environment Institute and Helsinki University. Within this frame and together with the mining industry, the researchers are focusing their attention on sustainability, both in terms of water usage and quality, and business and service actions.

Dr Helena Wessman-Jääskeläinen is Senior Scientist at VTT and is also coordinator of SAM. Her expertise in water conservation and previous experience working with the forest industry’s environmental indicators has been important to the project’s current success.

WATER MANAGEMENT

For any mining project, water is critical in terms of environmental impact. This is especially true for mines in Finland, as more than 50 per cent of reported environmental cases between 2006 and 2012 concerned water. “Changes in the quality of water not only have an impact on wellbeing, health and the quality of life, but they also have ecological, cultural and economic consequences,” Wessman-Jääskeläinen highlights.

There are many reasons Finland is particularly affected in terms of water use and quality. Heavy rainfall and melting snow means excess water at the mining sites makes water risks higher than average. Moreover, the ice cover in Nordic conditions can cause a lack of oxygenation in aquatic systems, inhibiting degradation of pollutants. Therefore, water management has to be considered at each individual mining location, as hydrology, climate or geology can vary dramatically. Furthermore, all technology must be evaluated in a complete start-to-finish process, as the quality and use of water varies considerably throughout the planning, production and closing phases of a mine; this is where VTT has played a large role. “VTT is a strong actor in water related environmental management, because of our ability to connect different technological and assessment approaches to solve complex and large-scale problems,” Wessman-Jääskeläinen explains.

WATER FOOTPRINTS

In 1997, the Global Reporting Initiative created guidelines for water disclosure, in order to support these guidelines in terms of water use impacts, additional environmental tools – such as water footprint, risk assessment and eco-efficiency – have had to be developed to fulfill stakeholder expectations. VTT researchers have been at the forefront of creating and improving these assessment protocols for years.

In the 1980s, the forest industry faced a similar situation to the one facing the mining industry now – a bad environmental image especially with water emissions and low societal acceptance. In fact, the pilot studies that took place as part of Finnish forest companies’ drive to improve water sustainability led to the development of the water footprint methodology in 2009 and has in essence laid the groundwork the team’s current work.

Water footprint is a local environmental indicator that examines the impacts of water intensive industry. Interestingly, instead of...
GREEN MINING

OBJECTIVES
• To create new concepts for environmental water monitoring
• To make tools that combine social aspects and policy recommendations to create a roadmap for the Finnish mining sector that will lead it to be sustainable and socially accepted

KEY COLLABORATORS
Coordinator of the Green Mining Programme
Harry Sandström, Spinverse, Finland
Professor Olli Salmi; Dr Johanna Kohl;
Dr Nina Wessberg; Senior Scientist Elina Saarivuo, VTT, Finland

PARTNERS
Finnish Environment Institute, Finland
Geological Survey of Finland · Helsinki University, Environmental Economics, Finland
First Quantum Minerals, Pyhäsalmi Mine, Finland · Anglo American, Finland · Agnico Eagle, Kittilä Mine, Finland · Northland Mines, Finland · Sandvik Mining, Finland · FinnMin, Finland · Metsähallitus, Finland · City of Kuusamo, Finland · Fundación Chile, Chile
Commonwealth Scientific and Industrial Research Organisation, Australia

FUNDING
Tekes – Finnish Funding Agency for Innovation

CONTACT
Senior Scientist Helena Wessman-Jääskeläinen
Leader of the Sustainable Acceptable Mining project
VTT Technical Research Centre of Finland
PO Box 1000
FI-02044 VTT
Finland
T +358 405 227 253
E helena.wessman@vtt.fi

PYHÄSALMI MINE
Earlier this year, Wessman-Jääskeläinen and her team put their water footprint assessments to the test in Finland’s Pyhäsalmi mine. In a move to assess the impacts of water use associated with production of copper concentrate, the group examined the input and output of the site. The researchers found that for each tonne of copper anode that the mine produced, it deprived other water users of 240 litres H2O eq. “The importance of understanding the local conditions, accounting for the whole value chain and the challenges in data collection were highlighted in our study,” Wessman-Jääskeläinen expands. “Traditionally, very little recognition to supply chain water use has been given, but the Pyhäsalmi mine showed that 56 per cent of the water impacts were generated at the mine site, and the rest in raw material, chemical production and copper refining.”

SOCIAL ACCEPTANCE
The Pyhälammi mine also exemplified how nearby communities and other stakeholders are affected by mining actions and thus expect to be involved in decision making, as well as sharing the economic and social benefits generated. Through a detailed examination, Wessman-Jääskeläinen and the VTT researchers discovered that common causes of social conflict in the industry include insufficient consultation, lack of public participation, lack of education, environmental concerns and opposing expectancies of social and economic prospects. However, the biggest challenge is creating and working towards a common goal among multiple stakeholders. To address this problem, SAM has been promoting public debates and communication.

SAM researchers have also been using a multi-level perspective as an analytical tool to better understand the dynamics of system innovations and it considers different levels – the landscape pressures, niche experiments and regime developments. Additionally, the researchers are integrating foresight procedures with societal embedding practices by hosting industrial and stakeholder workshops that relied on so-called PESTEV-themes – policy, economy/markets, society, technology, environment and values. From this, they identified future paths and development needs to create a shared vision and roadmap of the sustainable and acceptable mining industry in Finland.

Sustainable Acceptable Mining (SAM) is creating and working towards a common goal among multiple stakeholders. To address this problem, SAM has been promoting public debates and communication.

UNITED FOR GREEN MINING
Turning to the new year, Wessman-Jääskeläinen and colleagues plan to focus on ‘social licence to operate’ and specify the tools with which this can be accomplished. Fortunately, organisations involved in the Finnish mining industry greatly complement each other, thus VTT might just be the driving force to bring them closer together.

Finland is fighting to turn mining’s image around and companies are investing heavily in developing sustainable, safe and acceptable mining activities.