

# Reclamation and Environmental Monitoring in Northern Ontario

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**M**IRARCO (Mining Innovation Rehabilitation & Applied Research Corporation) is a not-for-profit corporation that has been developing solutions to mining industry challenges for over 10 years. MIRARCO's mandate is to develop the people and innovative tools needed to plan and design the underground mines and mine waste facilities of the future that conserve environmental integrity and preserve sustainable communities. MIRARCO has expertise in five core research domains: Geohazard Assessment and Risk Mitigation, Ventilation and Production Optimization, Environmental Monitoring and Rehabilitation, Energy, Renewables and Carbon Management and Climate Adaptation and Sustainable Communities. MIRARCO's environmental researchers, in association with Laurentian University professors and graduate students, have had the unique opportunity to participate in a novel reclamation feasibility study entitled Green Mines Green Energy (GMGE). The GMGE study is a nation-wide initiative led by Natural Resources Canada with academic, industry, government and municipal partners. The northern Ontario component of GMGE has been directed and managed by MIRARCO's Environmental Monitoring and Rehabilitation (EMR) team and has demonstrated potential as a sustainable rehabilitation strategy for the mining industry.

The feasibility study is designed to assess the potential to utilize residual organic materials to reclaim mining brownfields while providing a growth medium for biofuel crops. The concept of utilizing one industry's waste to remediate that of another's is in agreement with recycling and sustainability philosophies, offering the mining industry and surrounding communities a multitude of benefits. Residual organic materials are applied as thick covers to tailings

ponds, preventing tailings re-suspension as fugitive dust. The conversion of these barren lands into productive agricultural land provides an alternative to the use of Class 1 agricultural land for the cultivation of non-food crops offering one solution to the "food versus fuel" debate. The introduction of organic matter and plant biomass to mining brownfields immediately increases the carbon sequestration potential of these areas helping mitigate greenhouse gases and possibly generating a new income for the mining industry in Canada's emerging offset system for greenhouse gases. The GMGE research approach for reclamation of mine tailings, a priority for surrounding communities for health and aesthetic reasons has been supported by Vale in Sudbury, Xstrata in Onaping, and Goldcorp in Timmins with varying challenges and successes.

Four half-hectare biosolids covers, approximately one metre in thickness, were constructed at three mine tailings sites in northern Ontario. Two covers were constructed at Vale's Copper Cliff tailings impoundments area, one at Goldcorp's Delnite tailings in Timmins and one at Xstrata tailings in Onaping. The covers at the Vale site have had considerable success, with very successful production of hybrid corn and canola on the cover built using St. Marys pulp and paper biosolids from Sault Ste. Marie in 2008 and 2009.

The Goldcorp experimental site in Timmins, built using Abitibi Consolidated pulp and paper biosolids, has also produced healthy canola crops, with the 2008 corn seedlings were eaten by crows. The lush and healthy canola yielded greater than the northern Ontario agricultural norm. In 2009, corn was substituted with switchgrass, a common biomass crop, and canola was sown. Both crops thrived and yields demonstrated the potential of the reclamation model. The cover at the Goldcorp site also created an effective hydraulic



Corn grown on the St. Marys biosolids cover at the Vale experimental site in Copper Cliff. The Vale iron and sulphur rich tailings can be seen in the background (Photo courtesy of Tamara Posadowski).



Canola grown at Xstrata experimental site in 2010 after deep ripping (50 cm) and fertility treatment (Photo courtesy of Samantha Smith).



Harvesting crops on the St. Marys Vale experimental plot (Mike Soenens pictured; Photo courtesy of Graeme Spiers).

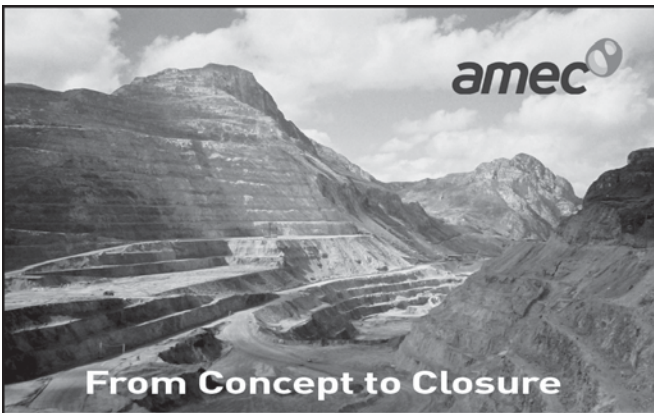
barrier, limiting water infiltration into the tailings below reducing metal movement into groundwater.

Municipal compost from southern Ontario was used to construct the cover at the Xstrata experimental site in Onaping. With appropriate cultivation and fertility treatments the cover produced high yields of corn, canola, and switchgrass crops in 2010, with which were comparable to regional agricultural averages.

Greater biological biodiversity was observed at all sites, with the barren tailings areas becoming a habitat for a variety of insects including butterflies and bees, as well as small rodents and frogs. Future directions of the reclamation approach may incorporate wide-spread use of perennial crops

which require less maintenance, produce large quantities of biomass, and store a carbon as root mass and root degradation products below-ground to enhance the carbon sequestration potential of the sites. The ultimate goal is to create productive agro-forestry sites on brownfields in Canada, in turn creating a profitable industry post mining for surrounding communities. However, to achieve this goal continued monitoring and research is required to ensure safe and sustainable long-term implementation of this reclamation strategy.

Researchers in the EMR division of MIRARCO are completing other on-going environmental studies in northern Ontario. For example, air-borne anthropogenic aerosolic contamination in northern Ontario is being mapped by analyzing moss composition, with samples collected from across northeastern Ontario. The EMR/Laurentian University graduate student research team is also examining the composition, speciation and provenance of regional aerosols with research support from both government and industry sources. Alternative approaches to resource extraction from low grade ores are being examined through development of microcosm studies to monitor microbiogeochemical release of iron and sulphur and associated uranium and rare earth elements using indigenous microflora with nutrient supplied as needed. The goal is to develop a 'walk-away solution' closure solution for uranium mining, with the possibility to extend the approach to both base metal and gold applications. MIRARCO is dedicated to helping develop safe and sustainable mining techniques ensuring a healthy and thriving environment. M



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