

RESEARCH AND DEVELOPMENT

Performance Overview

- Recognized as one of Canada's top spenders on R&D
- Cofounded Oil Sands Tailings Consortium to advance tailings management technologies
- Study to evaluate using coke to remediate tailings water approved for field pilot
- Two new research chairs sponsored at the University of Alberta

Innovation enabled by research and development is key to Syncrude's sustainability efforts. For 48 years, we have been a technology leader in the oil sands industry, developing and implementing many innovations that have established an operating platform, lowered costs, improved reliability and reduced environmental impact.

Syncrude operates the oil sands industry's only dedicated research and development centre, and invests more than \$60 million per year to improve knowledge and develop better ways. We are among Canada's top 50 R&D spenders.

About 100 scientists and technologists work at the R&D Centre, including a growing team of experts dedicated to improving environmental performance; their efforts are supplemented by a rotating complement of more than 20 graduate students who become the next generation of oil sands scientists.

While new production technologies are patented and licensed, Syncrude technologies related to tailings management and reclamation are published and shared through collaborative industry groups like the [Oil Sands Tailings Consortium \(OSTC\)](#) and the [Canadian Oilsands Network for Research and Development \(CONRAD\)](#), which will be managed under the newly formed [Canadian Oil Sands Innovation Alliance \(COSIA\)](#).

Syncrude stewards to an annual Technology Development Plan. This plan constitutes the planning base for maintaining an appropriate level of investment in R&D for continuous improvement in current plant operations, as well as progressing new and emerging technologies in the mining, extraction, utilities, upgrading and environmental areas. Syncrude is continuously challenged to develop new technology to solve current and future operating problems.

Research Chairs supported by Syncrude:

- [University of Alberta/NSERC Chair in Oil Sands Engineering](#)
- [Alberta Chamber of Resources/University of Alberta Mining Industry Chair in Geo Statistics](#)
- [University of Alberta/NSERC Chair in Forest Reclamation](#)
- [University of Alberta Chair in Integrated Landscape Management](#)
- [University of Alberta/NSERC Chair in Pipeline Transport](#)
- [University of Alberta/NSERC Chair in Oil Sands Tailings Water Treatment](#)
- [University of Alberta/NSERC Chair in Control of Oil Sands Processes](#)
- [Canadian Centre for Welding and Joining](#)

Syncrude Helps Found Tailings Research Consortium

Syncrude was among six companies joining forces in December 2010 to create the [Oil Sands Tailings Consortium](#). Its mandate is to advance tailings management solutions through collaboration and sharing of intellectual property. Each company has pledged to share its existing tailings research and technology and to remove barriers to collaborating on future tailings R&D.

The group established a budget of \$90 million for 2011 and mapped out the initial consortium field projects for that year. Syncrude took the lead on MFT Centrifuging and polymer mixing techniques (see [Fluid Fine Tailings](#) discussion). Other operators are focused on alternative polymers and the commercial feasibility of thin-lift drying.

The consortium also executed a \$1.4 million tailings road map study to identify all possible and potential technologies to remediate oil sand tailings. Over 450 submissions were received, and 135 will be examined as potential solutions. The most promising of these will be further evaluated.

Filtration of Tailings Water Studied as Remediation Treatment

A multi-year Syncrude project to study the effectiveness of using petroleum coke, an oil sands by-product, to filter harmful substances, such as naphthenic acids, out of tailings water has proven sufficiently promising that a field pilot will be conducted in 2012. The pilot will aim to determine the field conditions needed to ensure the process is operated in the most efficient manner possible. The experiment is being led by two Syncrude researchers with a combined 30 years experience in water treatment. The technology has received patents in Canada and the United States.



Fish tank trial helps prove water remediation technology: A demonstration project at Syncrude's R&D Centre involving koi living in treated tailings water has shown the viability of treating the water with petroleum coke to support aquatic life. The koi have been living in the water since May 2010.

Rough Mulching Aids Reclamation Efforts

Syncrude research to study the effects of using roughly mulched woody debris as a soil cover on reclamation landscapes has proven effective in improving plant growth and productivity on these sites. Syncrude has been using the debris on all of its reclamation sites since 2009. The material from tree tops and stumps was formerly considered as waste, and past practice was to burn it when land is being cleared for mining.

A 2009 directive from Alberta Sustainable Resource Development on the [Management of Wood Chips on Public Land](#) reaffirmed the benefits of using coarse woody debris over wood chips. Chips have the negative effect of interfering with plant growth and depleting soil nitrogen. A rougher mulch, which contains wood slivers and pieces as large as six feet long, acts differently and breaks down more slowly than wood chips, thereby mimicking natural processes. It also creates habitat for small animals, provides areas for water to collect, promotes growth of natural vegetation and minimizes soil erosion. Other resource developers are now incorporating rough mulch in their reclamation landscapes.



Rough mulching of woody debris provides habitat for small animals, improves water retention and minimizes soil erosion on reclaimed landscapes.

Pilot Plant Addresses Reliability Issues

An oil sand extraction froth treatment pilot plant, operating since 2009 at Syncrude's Edmonton R&D Centre, has helped reveal ways to remove chloride-laden water and clay solids from bitumen froth; both cause reliability problems in bitumen processing equipment. The pilot test also aims to improve environmental performance by reducing the amount of bitumen lost to tailings. A patent for the novel froth treatment process demonstrated at the pilot plant is underway and scale-up plans are being developed.

Support for University Research

Two new research chairs created at the University of Alberta in 2011 brought to nine the total number of chairs at the University supported by Syncrude. [Dr. Mohamed Gamal El-Din](#) is studying processes to clean oil sand tailings water so that it can be recycled or safely discharged into the environment. [Dr. Biao Huang](#) is studying technology-control methods used to monitor oil sand extraction and upgrading facilities. Syncrude is providing more than \$6 million in total for research at the University, including the nine chairs, 14 joint industry research programs and directly-commissioned research involving 19 different projects. The research is expected to lead to ways to reduce environmental impacts, improve reliability and reduce costs.



Professor Mohamed Gamal El-Din (right) discusses the next batch of samples for the "Waters" UPLC – HDMS (Ultra Pressure Liquid Chromatography) – (High Definition Mass Spectroscopy) equipment with PhD Candidate Parastoo Pourrezaei and Postdoctorate Leo Perez at the University of Alberta.

Sulphur Effects in Reclaimed Landscapes Studied

Syncrude has commissioned scientists from McMaster University to study bacterial sulphur reactions occurring in a reclamation landscape where composite tailings have been used as a substrate. Composite tailings are a mix of fluid fine tailings and gypsum (calcium sulphate); the material is alkaline and saline, and has little organic matter. The area being studied is being reclaimed as a fen wetland and the research aims to determine if bacterial sulphur is having an effect, whether good or bad, on the fen's development. The [\\$2.2 million project](#) is supported by Syncrude along with the Natural Sciences and Engineering Research Council of Canada.

Reclamation Research

In 2011, Syncrude continued working with our CONRAD (Canadian Oilsands Network for Research and Development) partners to support a broad range of reclamation and environmental research. This research is summarized in the CONRAD ERRG (environmental & reclamation research group) Annual Update released each year and posted on their website. It provides a brief description of the objectives of each program, a brief summary of results to date and a list of the peer reviewed journal publications published that year. View the 2011 ERRG Update at: www.canadianoilsandsnetwork.ca.