COSIA, Canada’s Oil Sands Innovation Alliance, is an alliance of oil sands producers focused on accelerating the pace of improvement in environmental performance in Canada’s oil sands through collaborative action and innovation.

Bringing together leading thinkers in Canada and from around the world in industry, government, academia and the public, COSIA has become a leader in open-source innovation. Our made in Canada, proven model of collaboration is achieving major performance improvement in the environmental priority areas of water, greenhouse gases, tailings and land.

Since COSIA began, its members have invested $1.4 billion to develop 1,026 distinct technologies to improve tailings management and reduce industrial impacts on air, land and water. $773 million is currently dedicated to 294 active projects.

Through COSIA, oil sands operators have cut their fresh water use intensity at in situ (non-mining) operations by 42 per cent and reduced their net water use intensity from the Athabasca River mining operations by 18 per cent since 2012.

COSIA innovations have also resulted in an 11 per cent reduction in greenhouse gas (GHG) emission intensity from members’ in situ operations, and a nine per cent reduction in GHG emission intensity from members’ mining operations in the last seven years.

More clean tech innovations like these are forecast to further reduce industry GHGs by 10 per cent to as much as 30 per cent in the next five years, with even greater improvements forecasted for the decade and a half after that.

This year’s Project Portfolio features two projects per Environmental Priority Area (EPA) to illustrate the effectiveness of COSIA’s open source approach to identifying solutions to oil sands innovation opportunities. Those opportunities are also presented according to each EPA in corresponding bubble charts.

Doubling down on innovation and collaboration is making a difference in improving Canada’s oil sands performance. This year’s project numbers reflect the commitment of alliance members to continue to aspire to bigger and creative project ideas that will lead to the next breakthrough technology.
COSIA members have invested $1.4 billion to develop 1,026 technologies to improve environmental performance.

**COSIA ENVIRONMENTAL PRIORITY AREAS**

- **Land**
- **Greenhouse Gases**
- **Water**
- **Tailings**

**IN SITU**

- GHG EMISSIONS INTENSITY: 11%
- FRESH WATER USE INTENSITY: 42%

**MINING**

- GHG EMISSIONS INTENSITY: 9%
- FRESH WATER USE INTENSITY: 18%

* Cumulative from 2012-2018
The discussion of environment and economics is at the forefront for many Canadians right now, as it is for COSIA members. Canada’s oil sands producers, through their membership in COSIA, have proven that this does not need to be an either/or discussion. COSIA’s open innovation approach has seen oil sands producers continually improving environmental performance in ways that enhance the sustainability of their business.

That is why, in 2019, COSIA members elected to “double down” on their work through a new strategic plan which seeks to accelerate COSIA research, technology and innovation work – which has already delivered significant environmental performance improvement. The plan will also see COSIA strive to be a part of the Canadian environmental discussion – through sharing industry’s remarkable story of innovation, collaboration and progress.

As part of our new strategy, we have publicly shared, for the first time, all of our Innovation Opportunities which can benefit from broader, global collaboration. This includes technical opportunities for performance enhancement across all of our Environmental Priority Areas (EPA): Land, GHG, Water and Tailings. Our goal is to broaden the field of creativity for potential and existing innovators alike and push the bounds of what is possible in this exciting and diverse technical arena.

Also, as part of COSIA’s evolution and commitment to this revised strategy, changes to our Associate Member program have reduced barriers to participate in the program for potential innovators, to better align with COSIA’s open-source approach to innovation.

More exciting opportunities exist for partnerships within the broader innovation ecosystem, such as through deepening our existing relationships with organizations like the Clean Resource Innovation Network (CRIN) which, in March of 2019, received a $100 million from the Government of Canada’s Strategic Innovation Fund, partially in recognition of the important role of innovation in oil sands.

COSIA is part of the larger movement in the industry to double down on innovation. Something that is often overlooked is that the Canadian oil and gas sector is by far the largest spender on clean technology in Canada, accounting for 75 per cent of the $1.4 billion spent annually, according to a study from Global Advantage Consulting Group Inc.

Now, more than ever, we need to better tell the story of sector innovation and the resulting improvements to environmental performance. We need to provide comprehensive explanations and clear examples along with transparent and provable results that accurately illustrate the sincere and deeply held conservation values of our own organization and those of our members.

COSIA’s collaborative approach to innovation is generating real progress with tangible results, including active facilities and programs with many promising projects in development – a few of which are highlighted in the coming pages. These projects represent our ongoing commitment to using the considerable power of combined scientific and technological expertise to accelerate environmental innovation, enabling this important industry to perform even better for the environment and for the future.

Wes Jickling
Chief Executive

Chief Executive of COSIA, Wes Jickling

Speaking up for collaborative innovation in oil sands

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Wes Jickling
Chief Executive
COSIA’s Land Environmental Priority Area (EPA) is focused on being world leaders in land management, restoring the land and preserving biodiversity of plants and animals.

Land Director: Jack O’Neill

COSIA’s Land EPA is focused on reducing the footprint intensity and impact of oil sands mining and in situ operations on the land and wildlife of northern Alberta. Oil sands mining operations over the past 50 years have disturbed just 0.03 per cent of Canada’s vast boreal forest (sources: AER and NRCan, 2018). Wildlife use of uplands and wetlands habitats in Canada’s oil sands region is generally well understood, and to add to the existing science, more study of how (and how well) returning wildlife adapts to reclaimed areas is being undertaken through the Early Successional Wildlife Dynamics Program (ESWD). COSIA members have synthesized their extensive learnings from various forest restoration related applied research programs and have shared them in the Forest Restoration: 360 Virtual Tours and Silviculture Toolkit. The Toolkit work was completed in collaboration with the Canadian Forest Service.

COSIA members are committed to funding and sharing learnings from adaptive research programs which aligns with the focus of the Land EPA.

![Costs Diagram]

**ENVIRONMENTAL PRIORITY AREA**

**Land Projects**

- **$154** Million Technology Development Costs
- **415** Contributed Technologies
- **95** Active Projects
- **$79** Million Cost of Active Projects

* Cumulative from 2012-2018
COSIA’s Innovation Opportunities, displayed here along with Land’s Aspiration in the centre, provide focused, actionable descriptions of the current state of opportunities related to environmental processes and impacts of the oil sands industry. If you’re an innovator interested in submitting an idea, sign up for our email list, follow our social media channels, submit an idea through our E-TAP system and check our website at cosia.ca regularly for more information.

COSIA EPA members will strive to be world leaders in land management, restoring the land and improving biodiversity of plant and animals.

* COSIA is looking for new innovative ideas and/or technologies that can be used to monitor various biophysical parameters across our Land EPA focus areas.
Forest Restoration: 360° Virtual Tours and Silviculture Toolkit

Online library of forest restoration techniques and science

Overview
The virtual tours and silviculture toolkit portal were created to provide a go-to location for information about forest restoration in the oil sands region.

Showcasing a suite of guided, 360-degree virtual tours with pictures and commentary presented with a series of videos, fact sheets and guidebooks, the project uniquely illustrates progressive restoration techniques. This new site and the toolkit materials will help build capacity among operators and managers, leading to better outcomes for boreal forest restoration.

The Technology
The site’s interactive 360-degree pictures can be clicked and dragged by the viewer to see the imagery from different perspectives. Combined with voice-over and text information and backed up by several videos, fact sheets and guidebooks, the virtual tours and toolkit website offers a wide breadth of detailed virtual reality that takes online learning in the sector to the next level. The site helps bring silviculture to life, which is the science of controlling the establishment, growth and health of a wooded area.

Objective
To provide a go-to, continually updated and refreshed location from which to access an extensive information cache about forest restoration.

Potential/Actual Environmental Benefits
- Global access to high-quality Canadian forest restoration and land reclamation knowledge.
- Provide instruction that will help build capacity among operators and managers, and lead to better outcomes on disturbed land sites – here and anywhere in Canada’s boreal forest.
- Feature examples of challenging sites and how restoration techniques have helped solve underlying site-limiting factors.
- Show visual evidence of sites 7-10 years after treatment so the viewer can see how sound decisions produce positive outcomes in the long term.

Outcomes
The wide selection of interactive 360-degree images and videos, fact sheets and guidebooks address subjects such as linear restoration, site preparation techniques (e.g. mixing and scalping, soil salvage, mounding, vegetation management), soil decompaction, chemical and biological vegetation control, restoring forest cover, planting trees on oil sands exploration sites, and more.

Collaboration
This initiative was carried out by COSIA member companies led by Cenovus Energy Inc., in collaboration with Natural Resources Canada.
Early Successional Wildlife Dynamics Program

Research to facilitate wildlife return to reclaimed habitats

Overview

Wildlife use of upland and wetland habitat in Canada’s oil sands region has been extensively studied and is generally well understood, but the ability for reclaimed upland habitats to promote the return to and use of previously disturbed habitats remains under-studied. Further study of how (and how well) returning wildlife adapts to reclaimed areas is being undertaken by the Early Successional Wildlife Dynamics Program (ESWD).

For COSIA producers, the research aligns with their goal of being world leaders in land management, reclamation and the preserving of plant and animal biodiversity.

The ESWD is a detailed, ongoing five-year (2015-2020), multi-species surveying, and sampling program being carried out across five upstream oil sands extraction operations.

The Technology

Qualified biologists observe, sample and carefully document a wide spectrum of site flora and fauna. Examples include: songbird species occurrence and distribution, vegetation species composition, cover, and height at all sample sites, and making reliable observations of wildlife species throughout the seasons.

Autonomous passive recording devices such as Wildlife Acoustics Song Meters are used for bats, amphibians, and some species of birds.

Wildlife cameras are deployed throughout each lease to track the presence and distribution of medium and large-sized mammals. All data is collected in a standardized manner so that statistical tests can be applied.

Objectives

• Evaluating wildlife use of reclaimed habitats and areas adjacent to development.
• Assessing the return and re-establishment of wildlife on reclamation areas.
• Evaluating the effectiveness of practices and principles applied in reclamation areas to improve biodiversity.
• Addressing reclamation certification requirements.
Outcomes
In 2018, field surveys were completed at 38 sites and included the following:
• 19 on Canadian Natural’s Oil Sands project sites;
• 11 on Suncor Energy’s Base Lease;
• Four at Suncor’s Fort Hills; and
• Four on Imperial’s Kearl Oil Sands operation.
Surveys and data gathering were distributed among six main habitat types: reclaimed sites, compensation lake sites, cleared areas, logged sites planted with tree species, forest fire sites and mature forest sites (controls) that emulate representative ecosystems for upland reclamation sites.

Potential/Actual Environmental Benefit
Current results indicate that wildlife is returning to and using reclaimed upland habitat with the return being a function of: time since reclamation, proximity to intact mature forest, and vegetation composition of the reclaimed habitats. 2018 was the fourth year of the five-year ESWD research initiative.
More perspective on the full five years worth of data will be available once the program is completed in 2020.

Collaboration
LGL Limited Environmental Research Associates, with Canadian Natural as the industry champion and collaboration with Suncor and Imperial.
COSIA’s Greenhouse Gasses Environmental Priority Area (EPA) is focused on producing oil from the oil sands with lower greenhouse gas emissions than other sources of oil.

Reducing Greenhouse Gases (GHG) in the oil sands is a top priority for COSIA members, the province, and the country. COSIA is making tremendous strides through its collaborative model to identify and advance a wide range of technologies that will have a material GHG impact. The two technologies highlighted in this report exemplify the range of opportunities being advanced: From energy efficiency approaches such as Vacuum Insulated Tubing that, when deployed across the industry, can have significant GHG benefits, to capturing CO2 through a Molten Carbonate Fuel Cell while producing valuable co-products such as heat, power, and water. These projects are exciting examples of COSIA member’s focus on collectively reducing GHGs.

GHG Director: Matt McCulloch

ENVIRONMENTAL PRIORITY AREA

Greenhouse Gas Projects

$217* Million Technology Development Costs

165* Contributed Technologies

27 Active Projects

$32 Million Cost of Active Projects

* Cumulative from 2012-2018
GHG: Innovation Opportunities

Each bubble represents a possibility that, if realized, would contribute towards the achievement of GHG’s Aspiration, which is stated in the centre bubble. If you’re an academic, researcher, innovator, inventor, entrepreneur, large company, or really anyone with an idea or potential innovation – we want to hear from you.
Overview

This project explores Molten Carbonate Fuel Cells (MCFC) used to capture CO₂ from natural gas-fired processing units while generating low GHG-intensive electricity. The innovation being investigated is to combine MCFCs and once-through steam generators (OTSGs) to cogenerate steam and electricity at oil sands in situ facilities. OTSGs burn natural gas to boil water, producing steam that is injected into the ground to soften bitumen for extraction and processing.

The study concluded that using MCFCs would potentially be far less energy-intensive and more cost effective than conventional post-combustion carbon capture methods.

Cenovus Energy, Shell, Alberta Innovates and the University of Calgary also carried out a preliminary design. Following these initiatives, with increased interest from other partners and government, the membership conducted a larger scale design plan to evaluate the preliminary cost of piloting a 1.4 megawatt power generation project at the Scotford Upgrader, part of the Athabasca Oil Sands Project (AOSP).

The Technology

A fuel cell converts chemical energy from a fuel into heat and electricity through an electrochemical process that uses CO₂. MCFCs are one type of fuel cell that operate at high temperatures to produce electricity, heat and water. They contain an anode, a cathode and a molten electrolyte salt layer. MCFCs have been used in commercial power generation since the 1990s and can be adapted to capture CO₂.

Objective

To cost out and ultimately develop a demonstration scale pilot to capture CO₂ from a natural gas-fired plant’s flue gas supply (exhaust or stack gasses from combustion) and to produce close to zero GHG-intensive electricity by using MCFC technology.

Potential/Actual Environmental Benefit

- Significantly reduce the greenhouse gas intensity of in situ steam generation from this method of oil sands production and provide a close to zero GHG emissions energy to the Alberta power grid while capturing CO₂ from an existing exhaust stack. This technology could also be applied to production using heaters that are fuel-fired (mining and upgrading).
- Offset the costs associated with carbon capture in two ways: (1) with revenues from electricity production and sale, and (2) by earning potential carbon credits from having a close to zero GHG-intensive electricity output.
- Water that is generated from reactions within the fuel cell can be captured and used at oil sands facilities, displacing other make-up water sources.

Outcomes

Combining MCFC technology with carbon capture is transformative because it may reduce the cost of carbon capture, making it a more environmentally viable solution that may produce economic benefits as well.

Collaboration

The project was initially undertaken by COSIA members Cenovus Energy, BP Canada, Canadian Natural, and Suncor, and Alberta Innovates. Other non-COSIA participants are MEG Energy and Husky Energy. Canadian Natural (majority owner of the AOSP) and Shell Canada are currently looking for additional participants for the 1.4MW unit to pilot. The project will be partially funded by Emissions Reduction Alberta.
Overview

In SAGD operations, steam is injected into the ground through an injector well to heat bitumen to make it more fluid (less viscous) so it can be extracted through a producer well.

In order to achieve this fluidity both wells must be pre-heated – sometimes a three to four-month process or more. The injected steam loses heat as it travels down the well. Additional steam is typically injected to make up the heat loss. Vacuum Insulating Tubing (VIT) technology reduces the need for additional steam by allowing the originally injected steam to maintain its heating properties for a longer duration.

The Technology

VIT consists of two strings of concentric tubing. The air between the tubing is removed, creating a vacuum layer that is difficult for heat to move across. As a result, vacuum insulated tubing greatly reduces the amount of heat that a well loses to its surroundings above the bitumen-bearing zone.

Objectives

- Reduce GHG emissions and costs by improving SAGD well efficiencies and minimizing the quantity of natural gas combusted, while producing the same amount of bitumen.
- Develop a common, fully adopted Industry Recommended Practice for determining the VIT heat transfer coefficient for use by industry and VIT manufacturers.

Potential/Actual Environmental Benefit

Vacuum Insulating Tubing (VIT) decreases GHG emissions by reducing steam heat loss, maintaining steam quality, decreasing well casing deformation and protecting the cemented casing of the well. It saves energy, reduces water consumption and shortens the steam cycle all of which reduce the impacts to the environment.

Outcomes

Tests to date suggest wells equipped with vacuum insulated tubing may need as little as 75 days of pre-heating, reducing the time, fuel and water required for wells to start producing bitumen. Further heat losses are avoided throughout the life of the well.

This COSIA project will consolidate vendor practices to establish industry-consistent results and SAGD well performance measurement.

Collaboration

VIT trials were completed through the Surmont joint venture project between ConocoPhillips Canada and Total E&P Canada. Imperial has led work on consolidating vendor practices.
COSIA’s Water Environmental Priority Area (EPA) is focused on being world leaders in water management, producing Canadian energy with no adverse impact on water.

COSIA members work relentlessly to improve their water management practices, and the data shows they are succeeding. The Water Technology Development Centre, an in situ test facility connected directly to Suncor’s Firebag oil sands facility, allows testing of technology with hot fluids under pressure, which will reduce new technology development time by years, accelerating more efficient technology commercialization. For the mining sector, Lake Miwasin is a large pit lake pilot demonstrating the effectiveness of the PASS tailings treatment technology, safely sequestering tailings in a pit lake while ensuring excellent water quality, for return to the environment further decreasing net intensity.

Water Director: John Brogley

**ENVIRONMENTAL PRIORITY AREA**

**Water Projects**

- **$273*** Million
  - Technology Development Costs
- **257*** Contributed Technologies
- **95** Active Projects
- **$402** Million
  - Cost of Active Projects

* Cumulative from 2012-2018
There are more than 60 Innovation Opportunities in total, categorized by COSIA’s Environmental Priority Areas (EPAs). Below are the opportunities available for the Water EPA, with the Aspiration they work to contribute to in the centre. Watch for further communication from COSIA about these opportunities.
Overview

Two main methods are used to recover oil sands resources: (1) in situ (‘in place’) drilling and (2) mining. Of all oil sands reserves, 80 per cent are too deep to be mined. In situ extraction technology is used to reach those reserves by injecting high-temperature steam into the reservoir to melt the bitumen. The warm bitumen flows into the lower well and is pumped to the surface.

The cooled steam turns back into water and is pumped to the surface with the bitumen. The water is then separated and processed through water treatment facilities. The water is recycled after it has been extracted and used to produce steam many times over.

In situ operators continuously pursue innovative ways to improve processes. They look for energy use efficiencies to further reduce GHG emissions, for example, recycling technology reliability enhancements, water use minimizations and water treatment cost reductions.

These shared goals led to COSIA members putting together the Water Technology Development Centre (WTDC) concept. Attached to Suncor’s Firebag Steam-Assisted Gravity Drainage (SAGD) in situ operation, the $165 million WTDC facility was put into operation in summer of 2019.

The Technology

Attaching the WTDC to Firebag’s SAGD systems streamlines testing of new technologies on fluids that have the same physical/chemical characteristics and elevated temperatures and pressures that occur at commercial SAGD in situ operations.

The facility also simulates the dynamic process changes that occur at SAGD facilities, allowing the process upsets that come with new technology to be evaluated accurately and efficiently.

Objectives

Create a jointly-funded, shared SAGD testing and research facility that enables operators – on an ongoing basis – to find the following:

- Energy use efficiencies that further reduce GHG emissions.
- Recycling technology reliability enhancements.
- Water use minimizations.
- Water treatment cost reductions.

Potential/Actual Environmental Benefits

- Accelerated testing, development and implementation of better water recycling and treatment technologies.
- Water use footprint reductions.
- Energy use efficiencies that reduce GHGs.

Outcomes

- Dedicated test facility that overcomes the many barriers of conducting field tests at commercial production facilities.
- Large-scale live-process fluid lab that enables operators to prototype and “test drive” more technologies than each could on their own, while sharing knowledge, risks and costs.
- Enhanced ability to develop and implement new water treatment technologies.
- Decreased time frame for field testing technologies and moving them to commercial application, also speeding up return on investment.

Collaboration

Suncor is leading the WTDC initiative, with participant companies Canadian Natural and non-COSIA members Husky Energy and Shell Canada.
Lake Miwasin Permanent Aquatic Storage Structure (PASS)

Advancing development of lakes in reclamation closure landscapes

Overview

Lake Miwasin is a scaled down demonstration of Suncor’s commercial scale pit lake at Dedicated Disposal Area 3 (DDA3, the future Upper Pit Lake (UPL)). Suncor uses the Permanent Aquatic Storage Structure (PASS) process, an inline tailings treatment process of coagulant addition followed by flocculant addition. The PASS process enables:

- more rapid reclamation of the treated fluid tailings (FT) into a freshwater lake environment;
- integration of the lake into the surrounding watershed; and
- mitigation of potential adverse environmental effects.

The goal of the Lake Miwasin pilot study is to monitor and evaluate if the PASS process, when combined with the watershed design for the pilot pit lake, will lead to a self-sustaining boreal lake ecosystem.
The Technology

The PASS technology combines Suncor’s Tailings Reduction Operations (TROTM) process with the addition of a coagulant to improve the quality of the water expressed from the treated fluid tailings. The treatment process rapidly dewater the fluid tailings as the clay particles adhere to coagulant, safely expressing most of the trapped water and providing an effective means for creating a lake and in an accelerated timeline. To validate this closure concept, Suncor has constructed a demonstration pit lake called Lake Miwasin (Cree for ‘beautiful’), that contains PASS-treated fluid tailings and has an aquatic cover established in 2018. The lake will be monitored and adaptively managed for the next 15 years.

Pit lakes are a necessary part of successful closure and reclamation plans and are considered a best practice in mining industries around the world. There are a number of pit lakes in Alberta created from former coal mine pits and are now used for recreational fishing, and swimming. They continue to demonstrate naturally colonized fish and staging areas for migratory birds.

Objectives

• Accelerate surface mine tailings dewatering and treatment while reducing the amounts of some metals and hydrocarbon contaminants to levels that meet federal and provincial guidelines for freshwater lakes.
• Accelerate the creation of a boreal forest lake that supports a vibrant aquatic ecosystem after the mine closes.

Potential/Actual Environmental Benefit

• More rapid and effective tailings dewatering and treatment, so that secured tailings support a natural boreal forest lake while speeding up land reclamation (get the land back to normal sooner).
• Significantly increase the amount of fluid tailings that can be treated and in a more sustainable manner.

Outcomes

The treatment process that is anticipated to achieve mine closure in less time and leaving a fresh water-capped lake that supports a vibrant aquatic system.

• To validate this closure concept, Suncor has constructed a demonstration pit lake, called Lake Miwasin, that contains PASS treated fluid tailings process with the lake’s aquatic cover completed in 2018.
• Lake Miwasin will be monitored and adaptively managed for 15 years (to the end of 2032) with the potential for water return to the Athabasca River in the future.
• Development of an innovative method for mine tailings dewatering and treatment that can be shared as a best practice with other mine operators.

Collaboration

Suncor is leading Lake Miwasin and PASS. Other participants: Syncrude; Canadian Natural Resources; Alberta Innovates; Athabasca University; University of Alberta (two research groups), University of Saskatchewan, University of Waterloo.
COSIA’s Tailings Environmental Priority Area (EPA) is focused on transforming tailings from waste into a resource that speeds land and water reclamation.

Tailings Director: Dave Corriiveau

Working with universities, government and research institutes, other companies and partners, the Tailings EPA is bringing together the shared experience, expertise and financial commitment of oil sands mining companies to find new technologies and solutions to tailings. These two projects focus on commercial scale treatments employing innovative methodologies for dewatering and recovery facilities that continue to build on past successes achieved in the laboratory. Enabling effective scale-up to the field helps ensure member companies will be able to meet and exceed federal and provincial guidelines for the protection of aquatic life, remediation and the safe return of treated water to the watershed. These project sponsors, leaders and participants are all key players in collaborating for solutions in tailings to improve the environmental performance of these terrestrial and aquatic formations.

**Tailings Projects**

- **$755* Million** Technology Development Costs
- **189*** Contributed Technologies
- **77** Active Projects
- **$260 Million** Cost of Active Projects

* Cumulative from 2012-2018
Innovation Opportunities include research and technology opportunities, from incremental - because the small things add up - through to the game-changers with the potential to propel industry forward. Below are the Innovation Opportunities available for Tailings, with their Aspiration in the centre.
Pressure Filtration for Fluid Fine Tailings Treatment

Accelerating tailings and land reclamation

Overview

The filter press is a well-known technology to recover water from fine clay materials. However, clogging of filters over time by fines and residual bitumen has prevented adoption of the technology for treating oil sands mine fluid fine tailings (FFT). The added step of chemically treating the tailings before mechanical filtration gave promising results at a laboratory scale.

This project is a commercial scale demonstration study that builds on the success of the previous laboratory scale test results, which identified important parameters such as operating pressure and the most effective chemical amendments.

The Technology

The method mechanically presses water out of fine clay materials to form a dense clay-like cake suitable for transport to a reclamation area.

Objectives

• To deliver more than 70 per cent solids by weight in the pressed product (cake).
• Evaluate the technology with alternative treatment technologies and develop all the necessary information for a future commercial operations design.

Potential/Actual Environmental Benefit

Based on the results achieved during the laboratory-scale study, filter presses appear to be a competitive technology for producing a sufficiently dense product from FFT that is suitable for rapid terrestrial reclamation (and creating a dry landform).

Outcomes

The commercial scale demonstration plant will consist of a feed conditioning system and two filter presses of different design. Plant engineering was completed in 2018. Construction commenced in 2018 with completion and operation taking place in 2019. Results are expected late in 2019.

Collaboration

Led by Canadian Natural with research partners Teck Resources Limited and Ledcor Nalco Services.
Overview

The Permanent Aquatic Storage Structure (PASS) project focuses on the treatment of fluid fine tailings (FFT) prior to placement in an end pit lake (boreal forest reclamation lake). Tailings are composed of a mixture of water, sand, clay, fine solids, residual hydrocarbon and salts – all of which are naturally found in oil sands deposits. End pit lakes are temporary aquatic post-mining closure landforms used by the mining industry around the world to manage and treat tailings.

The PASS project is a multi-year, multi-stage project that began with laboratory and bench scale testing. It is currently in the third year of a five-year project schedule. The next stage includes a field prototype.

The Technology

The PASS technology combines Suncor’s Tailings Reduction Operations (TRO) process with the addition of a coagulant (called “flocculant”, it is an agent used in the water treatment processes to improve the sedimentation or filterability of small particles) to improve the quality of the water taken out of the treated tailings.

The treatment is a two-step process. The first is to use coagulant agents to reduce the mobility of the contaminants (small amounts of some metals and hydrocarbons) to levels that meet federal and provincial guidelines for freshwater lakes. This step ensures that materials of concern are permanently isolated within the mineral matrix of the tailings and therefore is easier to filter out.

This is followed by the addition of a coagulant agent that aids in releasing water from the treated tailings. Water is released as the fine particles form larger particle masses or “flocs”.

A bench-scale geotechnical centrifuge for simulation of treated tailings settlement in a deep deposit was also developed for the PASS project. The centrifuge could also be used in other applications as a process monitoring tool to ensure that tailings settlement targets are achieved. In the usual settling process, water rises to the top of the tailings pond and is then reused in the bitumen extraction process. Even with existing methods, more than 85 per cent of the water is recycled from settling basins.

Objectives

- Identifying the materials of potential concern that might impede the geochemical and geotechnical stability of a freshwater lake.
- Developing FFT (tailings) treatment solutions to bring the parameters to levels that meet federal and provincial guidelines for freshwater lakes.
Potential/Actual Environmental Benefit

The combination coagulant-flocculant treatment process ensures that the mixture of the pore water and the fresh water cap meets federal and provincial guidelines for the protection of aquatic life and can be safely released to the surrounding watershed. This will enable (and accelerate) reclamation to an aquatic closure landform (boreal forest lake) shortly after tailings settling is complete.

Outcomes

- Treated tailings are analogous to lake sediment settling over long periods of time.
- The treatment process achieves mine closure plan compliance in a shorter period and leaves a water-capped lake that supports a vibrant aquatic system.
- Development of an innovative methodology for mine tailings dewatering and treatment that can be shared as a best practice with other mine operators.

Collaboration

Suncor is leading the PASS initiative. Other participants: Teck Resources Limited, Coanda Research and Development Corporation, SRK Consulting (Canada) Inc., University of Alberta, University of Saskatchewan, University of Waterloo.