2019 Sustainability Fact Sheet

TAILINGS

Scientist Carla Wytrykush at Syncrude's end-pit lake demonstration project, Base Mine Lake.

Tailings ponds are an integral part of our water management system which help to reduce withdrawals from the Athabasca River. These facilities store the tailings from the bitumen extraction process. As the tailings settle, water is released and then recycled back into plant operations. Over 85 per cent of our water needs are met through these facilities.

Tailings structures are highly engineered and managed for long-term integrity and safety. At the same time, significant resources and expertise are focused toward reducing the volume of tailings and treating them to be used in constructing our reclamation landscape. Based on our current suite of technologies, and in line with regulatory requirements, all Syncrude tailings areas will either have been reclaimed or will be undergoing reclamation within 10 years of the end of mining operations. No untreated fluid tailings will remain in our post-closure landscape.

WHAT ARE TAILINGS?

Tailings is the material that remains after bitumen is extracted from the oil sand. It is a mixture of sand, silt, clay, water and residual hydrocarbon. Tailings are stored in in-pit or out-of-pit tailings placement areas. As it is deposited, the coarser components settle rapidly and are used in the construction of sand beaches or other landforms. The remaining components form fluid fine tailings (FFT). Currently, the surface area of our fluid tailings is approximately 51 square kilometres.

FFT material consolidates to 30 per cent solids by weight within a few years of deposition. However, further consolidation is slow. Therefore we use both mechanical and passive technologies to accelerate this process in order to obtain a soil substrate capable of supporting reclamation activities. In total, 15.9 million m^3 of fluid fine tailings (FFT) were removed from settling basins and processed in 2019.

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SAFETY AND MONITORING

Syncrude's tailings facilities are built according to strict government regulations and are monitored for structural integrity and seepage. The Alberta Energy Regulator (AER) further oversees the safety of our tailings ponds under the Water Act, Water (Ministerial) Regulation - Part 6 Dam and Canal Safety and Alberta Dam and Canal Safety Directive, and performs annual inspections and audits. We are also guided by the Lower Athabasca Region Tailings Management Framework (TMF) and Directive 085: Fluid Tailings Management for Oil Sands Mining Projects which require operators like Syncrude to progressively treat and reclaim tailings.

As required under the Alberta Dam & Canal Safety Directive, the AER conducts a Leading Practices Assessment every three years to assess our tailings management system. For the 2019 review, Syncrude achieved a rating of “Excellent”.

A network of 277 groundwater monitoring wells are located across our operation, of which 219 monitor for tailings seepage. A series of interceptor ditches and sumps ensure any seepage or run-off water from rain or snow falling on the pond embankments is collected and pumped back into the pond. Monitoring results are reported to the AER annually, as required by our operating approval.

Responsible management of our tailings facilities is also a key component of the Mining Association of Canada (MAC) Towards Sustainable Mining (TSM) initiative. As a member, Syncrude follows industry best practices in tailings dam safety and operation. Internal assessments are required annually, with an independent, external verification every three years. An external verification for the 2016 reporting year confirmed Syncrude to have a well-developed tailings management system, with comprehensive monitoring and external technical review practices. (The verification for the 2019 reporting year was scheduled for early 2020 but, due to the COVID-19 pandemic, has been rescheduled for early 2021.)

REDUCING AND RECLAIMING TAILINGS

To reclaim tailings, we've invested over $3 billion over the last decade in three main technologies: centrifuged tails, composite tailings (CT) and end-pit lakes. These technologies are incorporated into our tailings management plans for Mildred Lake and Aurora North. We have consistently met our regulatory commitments and continue to work with Canada's Oil Sands Innovation Alliance, industry partners, academia and the scientific community to develop further solutions.

CENTRIFUGING

Centrifuge technology combines fluid fine tailings (FFT) with gypsum and flocculent, acting as process aids, in vessels (centrifuges) to separate out the water from the FFT. The released water is recycled into plant operations and the dewatered clay material is used in reclamation and landform construction. In our initial placement activities, where material was deposited in thin layers, the clay product was dense and strong enough after about one year, following a freeze-thaw cycle, and is now undergoing reclamation. Placement of centrifuge cake currently occurs in a former mined out area, or in-pit deep deposit at our Mildred Lake site. There are currently 18 centrifuges – each nine metres long and two metres high – in operation. In 2019, 4.7 million m^3 of FFT was treated using this technology. Monitoring and evaluation of deposit performance continues.

COMPOSITE TAILINGS

Composite Tailings (CT) technology combines FFT with gypsum and sand. Upon deposit in mined-out areas, the tailings release water and quickly settle. The area is then capped with sand and soil, enabling the development of landscapes that support forests and wetlands. CT is being used at both the Mildred Lake and Aurora North sites. In 2019, 11.2 million m^3 of FFT was processed using this process.

At Mildred Lake, CT placement is being used to reclaim our former East Mine. We expect sand placement to be complete in 2021 and the area fully reclaimed by the mid-2020s. The 57-hectare Sandhill Fen wetland research watershed was constructed at the northwest end of this area. More information on reclamation of this former mine can be found in the Land fact sheet.

The Sandhill Fen wetland was constructed using Composite Tailings.

END-PIT LAKES

End-pit lakes are a common and successful closure practice in the global mining industry. At Syncrude, one example involves adding a layer of water over FFT to physically isolate the tailings and create a lake. Syncrude has invested over 40 years of research to study this technology, with the industry's first commercial-scale end-pit lake demonstration now underway in our former West Mine.

Focus areas for research and monitoring include water quality, impacts of the underlying FFT layer, consolidation of the tailings, development of the shoreline, and the establishment of plants and insects. A number of universities have assisted in the research, including the University of Toronto, McMaster University, University of Alberta, University of Calgary, University of British Columbia and the University of Saskatchewan.

An adaptive management approach is being used to actively steward the lake towards achieving our closure objectives. To date, monitoring and research indicates that the fines are physically isolated beneath the water cap, and the water quality is improving. FFT consolidation is progressing as expected, with approximately 1 metre of settlement per year since 2013 and a water cap of up to 12 metres deep. In addition, there is oxygen in the water, water quality is improving, and naphthenic acids have declined in concentration. A variety of biological communities are also developing, including algae, aquatic plants, zooplankton and macroinvertebrates. Skimming, dredging and shoreline cleaning are underway to address the presence of residual bitumen. In addition, waterfowl deterrents continue to be in place throughout this demonstration period.

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TAILINGS TECHNOLOGY DEVELOPMENT

We are currently researching additional technologies that could be used to supplement existing tailings remediation methods. These include:

ACCELERATED DEWATERING

Accelerated dewatering is based on methods successfully used in the Florida phosphate industry where it is known as rim ditching. This technology mixes FFT with an organic flocculent, which is then placed in deep deposits. The flocculent is the same material used by municipal water treatment systems. Flocculent molecules wrap around the clay mineral particles in the FFT, forcing them to settle faster.

Initial tests of this technology showed a reduction in FFT volume by 50 per cent in three to five years. Further research and field tests significantly improved the process, resulting in increased initial water release, higher initial solids content of the treated FFT, lower solids content in the released water, and more ultra-fines sequestered in the deposit. Monitoring is ongoing to provide a more complete picture of the deposit performance over time.

We anticipate that accelerated dewatering could be an energy- and cost-efficient addition to our tailings reclamation activities.

OVERBURDEN MIXING

This method, studied since the late 1980s, mixes FFT with overburden (from mining operations) to create a fully functional surface that can be walked or driven upon, and used for terrestrial reclamation. A small-scale demonstration pilot plant operated in 2014 and 2015, with a field prototype in operation in 2018. Results are promising and we are evaluating opportunities for a commercial demonstration.

FFT CLAY TREATMENT

As it consolidates, FFT releases water at a very slow rate due to the strong affinity between clay surfaces and water. Lab-scale demonstrations in our research centre however have successfully enlarged the size of the clay particles and treated them so they repel – instead of attract – water. This could potentially provide an additional tailings treatment process. A field trial is underway.

TAILINGS CO-DEPOSITION

Tailings co-deposition places two or more tailings products in a mined-out pit with limited to no intentional mixing. We have performed laboratory scale tests to study several different combinations and, based on the positive results so far, we are evaluating opportunities to implement co-deposition at a larger scale. With continued demonstrated success, the technology could add an alternative fluid tailings treatment technology that may accelerate reclamation and closure activities.

TAILINGS TREATMENT PROCESS AID

Gypsum is currently used as a treatment aid to accelerate FFT consolidation and dewatering in CT and centrifuge tailings operations. Research however has demonstrated the potential to replace gypsum with a waste byproduct from a process in our upgrader which uses lime and calcium oxide to help capture sulphur dioxide gas and minimize air emissions. This solid byproduct, containing calcium sulphite and residual lime, has so far proven to be an effective tailings treatment aid which could help to improve our reclamation outcomes. Planning for further field studies are underway.

COLLABORATIVE RESEARCH EFFORTS

We operate one of the largest private sector research facilities in Western Canada and participate in Canada's Oil Sands Innovation Alliance (COSIA). COSIA coordinates collaborative industry research and knowledge exchange among its members. Research work includes literature reviews, laboratory projects, pilot trials and large, field scale demonstration and commercialization programs.

Tailings Management Performance Data

Mildred Lake	2015	2016	2017	2018	2019
Fluid Tailings volumes[1] (million m^3)	476.3	501.2	502.1	514.6	525.5
Centrifuge Cake volume[2] (million m^3)	3.5	5.3	6.7	6.4	3.8
CT Beach deposit[3] (million m^3)	11.0	1.1	2.36	2.11	1.2
Aurora North	**2015**	**2016**	**2017**	**2018**	**2019**
Fluid Tailings volumes (million m^3)	127.9	131.2	136.8	133.3	137.0
CT Beach deposit[2] (million m^3)	21.7	25.1	5.1	5.9	16.7

1 Treated and untreated volumes as measured (mid-year).
2 Volume of reclaimable treated fluid fine tailings (cake) material produced from centrifuge process, calculated using a combination of instrumentation and sampling data.