Collaborating on Oil Sands Tailings Innovation

Establishing the Oil Sands Tailings Consortium (OSTC)

Tailings and Mine Waste 2011

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Formation of the Oil Sands Tailings Consortium – OSTC December 2010

Oil Sands Tailings Consortium

Develop and deploy Tailings solutions faster
## Active Tailings Development & Commitments Today

Separate company funding, work-streams, resources and activity

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2009 - D074: Increased expectations for the pace of fines management
~ 30 years ago…the Oil Sands were viewed as a technical and economic curiosity
Today...the Oil Sands are a globally significant resource
The Resource

- 170 Billion barrels of oil resource
- Oil Sands underlie 140,200 km² of Boreal Forest
  - 0.1% of Canada’s total Boreal Forest
- Only 20% are shallow enough for surface mining
- 80% will require in situ techniques for extraction
- Most of the reclamation research and planning is focused on mining operations
Oil Sands Processing

If the process is this simple, what’s the problem?

River water

Water (85% Recycled Water)

Oil Sands

Sand

Clay

Water

Water

Clay

Water

Water

Clay

Bitumen

Water

Bitumen

(Product)

Tailings

Sand

Clay

Water

Water

Water (Reuse)

Tailings and Mine Waste Conference - Vancouver - November 6-9, 2011
Tailings – what are they?

- Mixture of remaining water and solids following bitumen extraction process
- Composed of water, sand, silt, clay, small amounts of hydrocarbon (bitumen, solvent, and asphaltenes)
- A necessary part of production in excavation of oil sands and removal of bitumen
Tailings Challenges

- Surface area impact
- Reclamation confidence and pace
- Water quality
- Groundwater protection
- Wildlife protection

**Overall Challenge:** Finding solutions that effectively optimize both environmental and cost performance:
- Dewatering the fluid fine tailings
- Treatment of the remaining process-affected water
- Reclamation of the tailings disposal areas (both terrestrial and aquatic)
The Creation of an Oil Sands Tailings Consortium (OSTC) is a Ground-breaking Move – Principles for Collaboration

Co-ordination among industry players now critical = Finding solutions to accelerate the pace of reclamation

Tailings information is organized, verified through peer review, kept current and broadly available to industry and collaboration partners

Bias to publish to support more rapid and efficient deployment of novel tailings technologies

Improved coordination and efficiency of industry, governmental, academic and entrepreneurial efforts

All members will contribute equitably to ensure the successful development of innovative Tailings Technologies

Tailings Consortium

Share knowledge broadly

Collaborate on R&D

Eliminate monetary & IP barriers

Equitable cost sharing
OSTC Progress to date

• OSTC Agreement finalized in April 2011
• OSTC Executive Director hired effective July 1, 2011
• Five workshops, along with an initial retreat, have been held in order to share information and coordinate field work
• Several field programs are underway in order to progress the development of various tailings technologies
• The OSTC is participating in the Tailings Roadmap Study (along with several other G of A and Federal Government agencies)
• Agreed to fund the Oil Sand Tailings Research Test Facility for another 5 years
• Hosted several media, from across Canada, for a 2 day tour of the four operating oil sands plants tailings facilities
• Combined total (among OSTC member companies) of > $90M to be spent on oil sand tailings R&D in 2011
The Regulators

• Alberta Environment
  – Air, land, water, reclamation

• Alberta Sustainable Resource Development
  – Surface access, timber harvest, wildlife management

• Energy Resource Conservation Board
  – Carries out public interest test – ‘reclaimability’ key to passing the test with a particular focus on tailings

Reclaimed wetland area
The Regulatory Process

• **Rigorous Environmental Assessment Process**
  – Stakeholder review and input
  – Regulatory review
  – Public hearings

• **Comprehensive Project Approvals**
  – Significant monitoring and reporting
  – Required involvement in regional multi-stakeholder forums
  – Inspections and compliance reviews
  – Industry is accountable for its commitments and regulatory requirements

• **Approval renewals every 10 years**
The Regulation

• Alberta Environmental Protection and Enhancement Act:
  – “productive capability equivalent to that of the pre-disturbance landscape”
  – “commercial forest on an area equivalent to the pre-disturbance area of commercial forest”
  – “Life of Mine Closure Plan … shall ensure, where practical, that reclaimed upland features have natural appearances characteristic of the region”
  – “integration of landform, topography, and water bodies with adjacent undisturbed areas”

• Regulators able to access corporate assets to pay for reclamation
Efforts are Underway to Improve Industry Governance in terms of Oil Sand Tailings

Tailings Management Framework

Tailings Roadmap

Directive-74

Direction on desired outcomes and balancing of objectives

State of development and promise of methods

Outcome-based Approach

Implemented with recognition as a ‘work in progress’
Tailings Management Framework

• Initiated by Alberta Environment

• Include a full range of outcome objectives for management of tailings through to mine reclamation and closure

• Effective engagement with industry
  – Interfaced through CAPP
  – All OSTC members represented

• Expect the Framework to be put in place some time in 2012
Tailings Roadmap Study

- Initiated by AI-EES and supported by the OSTC, Alberta Environment, Alberta Energy, ERCB and CANMET Energy (NRCan)
- The Study is aimed at identifying current technologies that could be used to help manage oil sand tailings, assessing their current status and determining what work is required for commercial implementation
- Work began in April 2011 with the final report targeted to be complete by Q1 2012
- To date, ~ 450 technologies/ideas have been identified with ~ 135 viewed as worthy of additional study – they range from concept/research to pilot-scale to commercial initiatives
- The Study will help determining the suite of technologies that merit further study/field work, including: research, pilot work and field trials
Tailings Directive 74

• The ERCB issued Oil Sands Tailings Directive 74 on February 3, 2009
• Intended to provide performance criteria for the reduction of fluid tailings and the formation of trafficable deposits
• The Directive requires that 50% of fine tailings be captured in Designated Disposal Areas (DDA`s) by July 2012
• Tailings materials deposited in DDA`s must attain a minimum undrained shear strength of 5kPa within 1 year and must be ready for reclamation within 5 years
• Operators are required to report on compliance on an annual basis
Two basic approaches to managing the “fine tailings issue” are being progressed:

• **Recombined Tailings**
  – Beaching Fines Capture
  – Consolidated Tailings/Composite Tailings/ Non-Segregated Tailings

• **Separate management of coarse and fines**
  – Mature Fines Drying (e.g. AFD/TRO)
  – Tailings Thickening and Drying
  – MFT Centrifugation and Drying
  – Accelerated Dewatering
  – CO2 Coagulation (enhanced settling and fines capture)
  – Froth Tailings Thickening and Drying
  – Water Capped MFT
Suncor TRO-MFT Thin Lift Drying

19 September 2010
Atmospheric Fines Drying (AFD) Phase I, Shell Muskeg River Mine

~65 wt.%

~35 wt.%

~75 wt.%

Tailings and Mine Waste Conference - Vancouver - November 6-9, 2011
Coke Capping (Suncor)

- Installation of wick drains
- Spreading of the coke cap
- Geotextile with drain pipe
Accelerated Dewatering at Syncrude

Construction
(100m x 100m x 10m)

Decant Structure

After Filling
Fall 2009

Fall 2010

Rim Ditching

Filling pit with Flocculated MFT

Objective to determine local (summer / winter) capability / confirm planning parameters carry out environmental assessment.

Construction completed on 80 m by 80 m 10 m deep
Sandhill Fen – Soft Tailings Reclamation – CT Deposit (Syncrude - Mildred Lake Site)

July 2011
Water Capped MFT testing at Syncrude

Syncrude

Base Mine Lake
800 Ha (2012)

Reclaimed Mine Area

4 Ha Test Pond (est. 1994)

Small Test Ponds (est. 1989)
Looking Forward…*What is Important?*

1. Longer term (before or at mine closure)
   - Establishment of a stable closure landscape that directs surface water off the lease into established streams, and supports desired end land use objectives.
   - “Stable” means resistant to natural processes, self-healing after natural erosion, and with a self-sustaining, native vegetation cover.

2. Shorter term (a limited timeframe after completing deposition)
   - “Reclaim” the ground surface – place a cover to support access & plant growth.

3. Pursue solutions that make sense and fit the conditions and operating realities on each lease.

4. Use technically and environmentally effective and low-cost methods for the reclamation of oil sand tailings deposits.

5. Oil sands operators are accountable to regulators for:
   - Meeting the above objectives
   - Submitting plans that contain measurable performance goals,
   - Measuring performance, reporting performance, and
   - Taking action to improve performance when it doesn’t meet plans
OSTC Member Focus

...Continue to Pursue Solutions

• Collaborate on developing new tailings management methods
• Commercialize promising methods
• Develop performance-based framework for adherence to plans and commitments for methods that meet outcome goals:
  – Submitting plans containing measurable performance goals,
  – Measuring performance, reporting performance, and
  – Taking action to improve performance when it doesn’t meet plans
• Enhance corporate governance of tailings operations
• Continue to communicate and engage → transparency for key stakeholders
Disturbed vs. Reclaimed vs. Certified

- ~714 km$^2$ of land disturbed
- ~73 km$^2$ of land reclaimed
- 104 ha certified (Q4-2008)
- All land available for reclamation is reclaimed – progressive reclamation
- Much of the reclaimed land is adjacent to or part of on-going operations
  - Public access to land adjacent to on-going operations represents a safety concern, therefore, operators are unable to relinquish tenure - no ability to certify
- Tailings ponds account for large areas of the disturbance (> 60% of final landscape and are operational for 30+ years
- First waste dump area certified in 2008
- First tailings pond completely reclaimed in 2010
- First In pit lake starting in 2012
- First wetland fen starting in 2012
Gateway Hill – certified in 2008
Suncor Pond 1 Reclamation

Rock Debris & Perching Snags

Rat Root Transplants

Coarse Woody Debris

19 September 2010
From the October Issue (front cover) of the Oilsands Review – Sustainability Issue with the caption: “Why There’s Hope for Oilsands Tailings”