ERCB Backgrounder on Draft Directive: *Tailings Performance Criteria and Requirements for Oil Sands Mining Schemes*

Background

Extraction of bitumen from mined oil sands with water in the presence of additives results in a tailings stream, which is discharged to a pond where solids settle and water is recycled. While coarse solids settle rapidly, fine solids remain in a suspension called fluid fine tailings. The fluid fine tailings concentrate to about 30 per cent mass solids in two to three years but only very slowly thereafter. This material, termed mature fine tailings (MFT), is impounded in the early years of a project in an external pond and in-pit when the mine advance makes space available in-pit. Schemes may have many MFT ponds. MFT is a concern because it may have to be impounded indefinitely and because there is currently no demonstrated means to reclaim it without further processing. MFT reclamation means investigated include treatment to form solid deposits and water capping in end-pit lakes (EPLs).

Many oil sands operators have proposed the consumption of existing inventories of fluid fine tailings, as well as newly produced fluid fine tails, into a trafficable deposit that can be reclaimed to equivalent land use. However, oil sands operators have not met the targets set out in applications to the ERCB for the consumption of fluid fine tailings, and therefore the inventory of fluid fine tailings that requires long-term containment continues to grow rapidly.

The principal means to consolidate fluid fine tailings at existing operations is consolidated tailings (CT) technology. This means will also be used in all other schemes approved to date. CT involves mixing fluid fine tailings, coarse sand, and a chemical agent to form a non-segregating mixture, which may be reclaimed to a solid deposit. Any remaining fluid fine tailings are placed in EPLs and reclaimed by placing a water cap on the EPL. Water capping of fluid fine tailings in EPLs has yet to be proven on a commercial scale. Although CT has been applied commercially in the past 10 years, operators are continually challenged to produce CT on specification and transform CT ponds into solid deposits. Alternative technologies may be required to supplement CT in transforming fluid fine tailings to a solid landscape.

Individual oil sands operators and industry consortia have researched and pilot tested other fine tailings treatment technologies, such as cycloning to separate fine and coarse solids and thickening to dewater the cycloned fines streams. These technologies are used to minimize MFT production and may be used in conjunction with CT technology. CT, cycloning, and thickening technologies are currently applied commercially at oil sands mining schemes. Filtration of whole tailings is proposed in a new project application. Centrifugation of MFT is an alternative to CT for MFT consumption that was recently tested. The objective of these technologies or combinations of them is to consolidate and dewater the fluid tailings and end up with a deposit that may be reclaimed in a solid state.

Board Objectives and Direction

Board and joint Alberta Energy and Utilities Board (EUB, the precursor of the ERCB)/Canadian Environmental Assessment Agency hearing panels (Joint Panels) considered the management of tailings in decisions on each recent mineable oil sands application. These panels expressed concerns about accumulation of fluid fine tailings, the impact of tailings accumulation on resource conservation, and the risk to reclamation. The panels believed that appropriate tailings management objectives for oil sands mines should be to

- maximize intermediate process water recycle to increase energy efficiency and reduce fresh water import,

- reduce stored process-affected waste water volumes on site,
- eliminate or reduce containment of fluid fine tailings in an external tailings disposal area during operations,
- minimize and eventually eliminate long-term storage of fluid tailings in the reclamation landscape, and
- create a trafficable landscape at the earliest opportunity to facilitate progressive reclamation.

Other regulatory objectives considered by the panels in decisions are to

- minimize resource sterilization associated with tailings ponds, and
- ensure that the liability for tailings is managed through reclamation of tailings ponds.

In decisions on the CNRL Horizon[1] and Shell Jackpine[2] projects, Joint Panels considered specific regulation to ensure that tailings are managed satisfactorily. The Joint Panels said that regulation of tailings performance using a uniform set of tailings performance criteria was necessary for the ERCB to regulate effectively. More recent Board and Joint Panel decisions on Suncor North Steepbank Mine Extension,[3] Albian Sands Muskeg River Expansion,[4] and Imperial Oil Kearl[5] projects expressed the same concerns and recommended that the full Board establish a formal mechanism or taskforce to establish tailings performance criteria and specific enforcement actions on an industry-wide basis. The Board endorsed the recommendations of these panels to have recommendations on tailings performance criteria with specific enforcement actions out to industry for review by March 2008.

Proposed Tailings Regulation

The draft directive *Tailings Performance Criteria and Requirements for Oil Sands Mining Schemes* applies to all oil sands operations. All approval holders must assess and compare their tailings management practices with the proposals submitted and approved during application. Any significant changes to tailings management must be reported to the ERCB and may require the operator to apply for an amendment to its approval. If the ERCB approves an application to amend these criteria on a project-specific basis, it may define additional project-specific requirements.

This draft directive sets out new regulatory requirements for the management of oil sands tailings. The new requirements are directly applicable to all approved projects. Ideally, the criteria are performance-based, with the discretion left to operators as to how to meet them. Projects use different technologies to reduce fluid fine tailings accumulation if they achieve the same or better rate of reduction.

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[1] Joint Panel Report and EUB *Decision 2004-005: Canadian Natural Resources Limited, Application for an Oil Sands Mine, Bitumen Extraction Plant, and Bitumen Upgrading Plant, Fort McMurray Area*, January 27, 2004.

[2] Joint Panel Report and EUB *Decision 2004-009: Shell Canada Limited, Application for an Oil Sands Mine, Bitumen Extraction Plant, Cogeneration Plant, Water Pipeline, Fort McMurray Area*, February 5, 2004.

[3] EUB *Decision 2006-112: Suncor Energy Inc., Application for Expansion of an Oil Sands Mine (North Steepbank Mine Extension) and a Bitumen Upgrading Facility (Voyager Upgrader), Fort McMurray Area*, November 14, 2006.

[4] Joint Panel Report and EUB *Decision 2006-128: Albian Sands Energy Inc., Application to Expand the Oil Sands Mining and Processing Facilities at the Muskeg River Mine*, December 17, 2006.

[5] Joint Panel Report and EUB *Decision 2007-013: Imperial Oil Resources Ventures Limited, Application for an Oil Sands Mine and Bitumen Processing Facility (Kearl Oil Sands Project), Fort McMurray Area*, February 27, 2007.

This directive forms one component of a larger initiative to deliver tailings performance criteria for conservation and reclamation in the mineable oil sands to assist the ERCB in regulating mining and tailings operations and Alberta Environment (AENV) in achieving its environmental responsibilities.

Operators will be required to satisfy three categories of compliance so as to achieve the purposes of this directive:

- management of fluid fine tailings (reduction of fluid fine tailings by production of consolidated tailings [CT] or equivalent means)
- management of CT ponds (or equivalent deposits) over their full life cycle, and
- satisfactory measurement methods, record keeping, and reporting.

The performance criteria for CT production are detailed in Section 4.1 of the draft directive. The remainder of Section 4 addresses CT ponds management and CT reporting requirements.

Consideration of Tailings Performance Criteria

Four categories of performance criteria were considered to achieve this directive's goal and objectives:

- fine tailings consolidation,
- reduction of fine tailings accumulation,
- water management, and
- preparation for reclamation.

Within these categories, several criteria were contemplated to manage tailings. Comments on their use follow:

Fine Tailings Consolidation: Fine tailings consolidation is effected by making CT. CT may also be referred to as non-segregating tailings, engineered tailings, and composite tailings. CT technology is applied at Suncor and Syncrude operations and is planned for all other approved projects. The Suncor North Steepbank Mine approval established a condition of approval with respect to CT performance. Measurement and reporting of the production and formation of consolidated tailings is required for Suncor's operations. Syncrude also monitors CT production. A similar regulatory approach could be applied at all approved schemes, with project-specific modifications if necessary, e.g., due to production technology and reclamation plan differences.

Reduction of Fine Tailings Accumulation: All applications present a profile of expected rates of tailings production, management methods, and accumulations over the life of a mine. Applicants expect the accumulation of fluid fine tailings to be near zero or negative after CT production starts. (Recent applications suggest that the maximum accumulation of fluid fine tailings occurs when the first pit is ready for filling.) All approved operations also monitor tailings production and tailings accumulation. However, there are complications to this. First, the actual tailings accumulations have greatly exceeded the projected volumes. Second, tailings ponds are very large and complex; their fluid contents are changing, due to ongoing settling and consolidation, tailings input, and water withdrawal. Measurement of ponds requires extensive sampling and a model to estimate the contents (solids, semi-solids, fluid tailings, and water).

A potential criterion for fine tailings accumulation would be expressed on the basis of oil sands processed (i.e., cubic metres of fluid fine tailings per tonne of oil sands). Another potential criterion is

that fine tailings accumulation never exceeds the volume of fine tailings measured at the time the first pond is available for CT production.

Water Management: Water management at oil sands projects is interdependent with tailings management. Ponds hold, clarify, and recycle tailings water. A tailings plan that leads to faster recovery, recycling, and eventual release of water would reduce fluid tailings accumulation. The faster recovery of water would reduce fresh water demand and require treatment to ensure that water quality is acceptable for reuse or release. Tailings performance could be managed indirectly by limiting the water withdrawal rates and water accumulation from the river and by increasing the required recycle rates from tailings ponds.

Water-based tailings performance criteria could be applicable to all mining projects. However, due to differences between projects (e.g., in bitumen or synthetic crude oil production, ore grade and fines content, amount and duration of water recycling), the values may vary from project to project. Ongoing monitoring and reporting will provide additional information necessary for the consideration of performance criteria associated with water management. Further work with operators and AENV is required to investigate water-based criteria as a means to regulate tailings performance.

Preparation for Reclamation: The ERCB assists in the reclamation process by regulating tailings ponds during the operational phase of a mine. The ERCB regulates tailings deposits up to and including their abandonment, thus preparing for the land reclamation stage.

Some potential policies were considered to link tailings management to reclamation, including

1) limiting land disturbance to a maximum footprint relative to land reclaimed,
2) tracking and managing liability on a feature-specific basis,
3) managing specific landforms and eventual state of the entire project area,
4) adding project-specific conditions of approval (e.g., tailings performance requirements prior to production rate increases and/or new mine development), and
5) applying project-specific and/or sector-wide checklists requiring structure-specific abandonment plans, consistent with closure and reclamation plans.

Fine tailings consolidation was selected as the most appropriate initial tailings performance criterion for the reasons given above.