

ERCB Draft Tailings Directive—Technical Workshop  
Discovery Centre, Fort McMurray, Alberta  
September 9, 2008

## Summary of Notes by Topic

These notes have been transcribed directly from writing on flipcharts and tablecloths used at the workshops.

### TOPIC 1

**What definitions need clarification? If you could offer a definition for each of these items, what would it be?**

#### Tablecloth and paper notes

- 1) The directive should be higher level
  - a) Too specific on solution
  - b) Needs to look at end goals
- 2) Consume x % fines (to reduce fluid tailings ponding)
- 3) Stable landscape continuously
- 4) In addition to meeting the 45%, sites must apply alternatives as appropriate to meet the end objective
- 5) If you start with 1 billion m<sup>3</sup> [we will need a suite of options]
  - a) Fluid Tailings = 0.1
  - b) Containment = 0.2
  - c) Alternatives = 0.2
  - d) Consolidated Tailings = 0.5

#### Summary of highlight sheets

- 1) Standard definition across the industry for CT
- 2) Deposition criteria part of CT definition
- 3) Align CT and segregated CT definition
- 4) Missing definitions
  - a) NST
  - b) SFR
  - c) Start-up period
  - d) Transitional period

- 5) Trafficable deposit
  - a) Eliminate threshold of 10 -100 kPa; rather, we need to achieve reclamation
  - b) Need appropriate threshold number to achieve reclamation
- 6) Need to consider alternative technologies
- 7) Performance vs. process. Need to focus on performance targets for alternatives and not on defining the types of acceptable alternatives
- 8) Trafficable deposits → need to incorporate 5 principles
  - a) It has to be a sustainable deposit
  - b) Not prone to failure
  - c) Only experiences natural erosion
  - d) Should be tied to SFR composition
  - e) Time
  - f) Disturbance
- 9) The definition should not be tied to CT mixture but rather to the deposit
- 10) On the CT definition
  - a) Change the wording from “CT mixture” to “CT deposit”
  - b) Remove the Clay Mineral Water Ratio threshold of 0.1
- 11) On the fluid fine tails definition
  - a) There should be one definition for FFT and MFT (heard this comment several times)
- 12) On dedicated CT ponds
  - a) Difficult to achieve
- 13) In general there are too many definitions and details are too specific
- 14) The directive should be higher level and not a recipe
- 15) It needs to look at the end goals (heard this comment several times)
- 16) For many sites, meeting the 45% sands requirement may not get you to meet the end goal
  - a) May need a number of alternative technologies to meet end goal
- 17) ERCB needs a tracking/measurement method in order to succeed
- 18) On the definition of trafficability
  - a) Should look at it as reclaimability and not trafficability
  - b) Move away from dedicated CT pond
  - c) But it needs to be measurable

- 19) CT definition does not necessarily mean success
- 20) CT definition should focus on objectives
- 21) On the definition of Operational & Abandonment Plans
  - a) Need to accommodate alternative technologies
  - b) Keep objectives in mind
  - c) Need additional definitions for alternative technologies
  - d) Should be viewed as a management plan
- 22) Industry can meet the objectives of the directive without a dedicated CT pond
- 23) ERCB needs to define what is meant by “proven” technology
- 24) The management of risk is a portfolio of technology
- 25) The end goal will likely include CT plus a number of alternative technologies and needs to incorporate the characteristics of all the different projects
- 26) On the trafficable surface issue
  - a) Definition is appropriate for this directive
  - b) ERCB needs standard operation procedures for measurements to support trafficable surface
- 27) For definition on saline water table
  - a) Remove the reference to the 100 000 g/m<sup>3</sup>
  - b) Should read above 10 000 g/m<sup>3</sup> is considered saline
- 28) Need definition of clay
- 29) Key measurement = MFT inventory vs. time where MFT is defined as tailings with  $S_u < 10 \text{ kPa}$  ( $S_u$  = shear strength)
- 30) The question was raised as to why we need to define CT in the first place
- 31) Some participants expressed the opinion that the ERCB needs more detailed definitions that address all the layers in a pond
  - a) Sand
  - b) Thickened fluids
  - c) Fines
  - d) Liquid
  - e) This would create a “universal language”
  - f) Provide geotechnical charts for industry
- 32) Pond CT deposition is not consistent
- 33) Some segregation will always occur whether in pipes or ponds

- 34) Need to do more work for Topic 1 and 5 after objectives have been firmly established
  - a) Subsequent to setting the objectives, committees should be struck to provide more details around definitions and measurements
- 35) Changing objectives will drive a need for new definitions and measurements
- 36) Simple nontechnical language is needed to communicate the directive and issues to outside groups
- 37) CONRAD has started the process of tailings definitions and standardized testing methods
- 38) Industry could report to ERCB in predefined terms
- 39) ERCB already has CONRAD data and could just pick the terms
- 40) Industry needs to understand the rationale behind SFR of 3.5 and CMWR of 0.1
  - a) This is just one of many ways of being on spec
  - b) Needs technical proof
- 41) The directive is written both at a high level and very prescriptive in places
  - a) The two directions are in opposition to each other
- 42) CT definition – remove last sentence
- 43) CT pond definition – remove entirely
  - a) Or at least change the word “solely” in definition
- 44) Definition of trafficable – change to reclaimable
- 45) Need definition of clays
  - a) Need to be specific to methyl blue test
- 46) Definition of OAP - perhaps look at choosing a different word for “abandonment”
- 47) Remove the definition of segregated CT
- 48) Workshop has not addressed new start-up performance concerns
- 49) Directive needs flexibility
- 50) Directive needs flexible language for start-up

## **TOPIC 2**

**How will CT (NST) meet the directive requirements? How will it not?  
What are the limitations? What are your recommendations on how to deal with the limitations?**

Questions 1 and 2 were closely related, as were Questions 3 and 4.

Question 1: How will CT (NST) meet the directive requirements?

Question 2: How will it not?

Question 1 was clarified as follows: How will CT (NST) meet the intent of the directive requirements?

Question 2 was clarified as follows: How will CT (NST) not meet the intent of the directive requirements?

Summary Answer 1: The two main objectives of the directive are clear, purposeful, and defensible (consumption of fines and creation of a trafficable surface). These two objectives are competing with each other. One requires a lower SFR and the other requires a high SFR. CT technology moves towards accomplishing these objectives but it is not the 100% solution.

Summary Answer 2: The directive is too prescriptive (i.e., too focused on CT) when it should be performance driven (focused on MFT reduction). Thus the directive detracts from the creativity and commitment needed to pursue alternative technologies. CT alone will not flatten the MFT growth curve.

Question 3: What are the limitations?

Question 4: What are your recommendations on how to deal with the limitations (re: fluid fine tailings consumption and trafficable deposits)?

Question 3 was interpreted two ways by participants: What are the limitations of the directive? What are the limitations with CT as a means to consume tailings and to create trafficable deposits?

| Q3. LIMITATIONS  | Q4. RECOMMENDATIONS   |
|--|---|
| <p><b>Sand volumes</b> available for dike construction and capping of CT deposits are <b>limited</b>. Less sand is available at <b>start-up</b> (due to dike construction) and at closure due to the need for <b>suitable capping materials</b> for CT deposits.</p> | <ol style="list-style-type: none"><li>1) Reduce the target SFR (sand-to-fines ratio) from 4:1 to 3:1 or even 2:1. The fines consumption increases dramatically. Deposits will segregate less, but will take longer to dewater and consolidate.</li><li>2) Overstripping sand or stripping sand outside of the lease boundary will lead to a larger footprint.</li><li>3) Reuse and/or rehandling of sand from OPTAs and in-pit dikes to make CT or to cap CT deposits. As these volumes are at a 6:1 or 7:1 SFR, fines consumption (to the directive target of 4:1) will be limited.</li><li>4) Continue to use overburden for dike construction.</li><li>5) Dedicated CT facilities, as proposed by the draft directive, should not be built. Stick with current methods to reduce sand consumption.</li></ol> |

### TOPIC 3

#### How could alternative technologies meet the directive requirements?

(Note that in discussion it was agreed that “directive requirements” refers to “directive objectives.”)

- 1) Alternative technologies were described by all industry participants as a **must**, as experience has proven that CT provides limited success.
- 2) A suite of technologies is required to ensure sustainable landforms and fluid fine tailings reduction.

- 3) Alternative technologies could be developed via a shared, central, third-party development centre and/or tailings management facility.
- 4) Alternative technologies can only satisfy ERCB objectives if success factors are presented. It was recommended that success factors align with fluid fine tails reduction/elimination and sustainable landform development and not sand allocated to CT.
- 5) Alternative technologies could only be developed to meet the directive objectives/requirements if a longer timeframe is allowed. Resource limitations, such as experienced engineers, capital, area, project barriers, and the time required to achieve proof at scale, make developing alternatives lengthy endeavours. Also, to meet the directive as written, insufficient resources are available to fully develop alternatives.

### **What are limitations?**

- 1) It is unclear what the relative importance of success factors of alternatives are:
  - a) Surface disturbance?
  - b) Sterilization of resource?
  - c) Greenhouse gas implications?
  - d) Time to achieve a sustainable landform?
  - e) Trafficable deposit regardless of end use?
  - f) Number of active ponds?
- 2) Fines consumption must not be determined relative to CT at 45% sand, given sand to fines ratios. This neglects technologies that do not incorporate sand (e.g., MFT centrifuge, MFT drying). Ore bodies contain a range of fines concentrations; therefore, a “one size fits all” definition does not work.
- 3) Lengthy regulatory process will limit assessment and implementation of an alternative. Any alternative requires an application, an EIA, and potentially a hearing. Transactional inefficiency (more effort on seeking approval rather than developing and implementing improved technology) will seriously limit the ability to achieve alternative success.
- 4) Given that each tailings deposit has unique characteristics (depending on ore body, timing and sequencing of the mine plan, geography/topography, closure and reclamation plan, processing plant configuration, etc.), each deposit should have its own success criteria. Ensuring compliance across a number of these unique deposits is problematic for the ERCB.

### **What are your recommendations on how to deal with the limitations?**

- 1) Each application must include a detailed path to sustainable landforms.
- 2) The approved path will be stewarded to by the operator and assessed for compliance by the ERCB in terms of
  - a) fluid fine tailings accumulation and fines balance,
  - b) block models on pond/deposit performance, depending on required characteristics (strength, trafficability, chemistry, etc.),
  - c) milestone progress, and
  - d) decision points and contingency strategies as required.

- 3) Further condition approvals.
- 4) Link compliance and enforcement to bitumen production (e.g., limit the amount of fluid fine tails accumulation [and once fluid fine tails volumes are decreasing, tie the reduction of the volume] to the volume of bitumen produced).
- 5) Use the Mine Liability Management Program as the tool to assign appropriate financial liability to accumulated fine tailings volumes.
- 6) Allow operators to manage sand to CT over a multiyear average versus annual obligations.
- 7) The ERCB must use an efficient regulatory process for alternative testing at sufficient scale.
- 8) CT should be presented in the directive as an example, and not the prescriptive solution.

#### **TOPIC 4**

##### **What technical criteria should we use to determine the equivalency of alternative technologies in satisfying the directive (fluid fine tailings consumption and trafficable deposits)?**

- 1) Targets of acceptable project endpoint criteria, such as fluid fine tailings inventory, are required for operators to steward to for all technology.
- 2) A formula is required to incorporate all objectives together, such as footprint disturbance, trafficability, reclamability, and resource sterilization to compare alternative technologies.
- 3) Use Ternary (geotechnical) Diagram as a framework of comparison for end landscape objectives.
- 4) Prior to use of new technologies, the operator must demonstrate that they work, will meet end land-use requirements, and will have no liability for the people of Alberta at the end of the project life.
- 5) Alternative technologies must meet the following requirements:
  - a) Achieve end of project MFT inventory on a dry tonnage basis
  - b) Need a measure to determine that it captures fines
  - c) Meet reclamation requirements, or can be shown that they meet reclamation requirements by producing the required trafficability strength per end landscape objective
- 6) Use MFT inventory and reclamation trajectory versus life of project plan as intermediate checks to determine if the operator is on plan.
- 7) Need to establish relative weighting and importance of directive objectives to be able to compare alternative technologies.
- 8) An alternative technology score card is required to compare key criteria, such as variety of end land uses, time to reclamation, consumption rate of fluid fine tailings and chemical viability to CT, or other proven technologies.
- 9) Trafficability requires more definition—what is trafficable varies by landform (e.g., lakes, marsh lands, flat lands, and hills).

- 10) More definition required for acceptability of various technologies that recognize objectives of the directive.
- 11) More equivalency criteria are required for new technologies in the directive.
- 12) Rephrase the directive “objectives” to
  - a) reduce/avoid FFT (on dry tonnage basis), and
  - b) produce/demonstrate reclaimable landform. Dam Safety Branch will sign off on the dam/impoundment and time scales are acknowledged.
- 13) The objectives below apply to any technology:
  - a) The objective of the new technologies is the same—consumption of fines. Therefore, the measurement will be the same. Based on the fines that would be consumed using CT as prescribed in the directive, the expectation would be that the new technology would consume the same amount of fines as the CT case.
  - b) A sliding scale is required for new technology if new technology does not achieve design performance. This would allow operators to adjust and tweak new technology or implement a contingency plan to make up for the shortfall of the new technology.
  - c) Incorporate a measure of cumulative benefit for new technologies if the minimum tailings criteria are not achieved (e.g., less footprint disturbance, less air emissions, less water use, and less energy use).
  - d) Instead of monitoring CT performance or other technology performance, link operator’s security deposit in the Mine Liability Management Program (MLMP) to MFT inventory versus approved life of project plan. If MFT inventory exceeds what was approved during the operation of the project, the operator would have to increase its security deposit in the MLMP.
- 14) Stewarding to the requirements of the directive may not produce the best outcome for the specific project. Therefore, the requirements of the directive should be compared to the operator’s tailings management plan to ensure that stewarding to the directive is in alignment, and not detrimental to the objectives of the operator’s tailings management plan.

## TOPIC 5

**What measurements and methods would be required to check compliance with the directive (determination of fluid tailings volumes, trafficability, fines distribution site-wide)? How will the fines consumption be determined? How will the fines in the resultant deposit be determined? (In the directive, see Appendix B for compliance and Appendices E and F for checking.)**

- 1) For soft tailings deposits, cone penetration testing (CPT) can be used to check for strength. One operator indicated that CPT will not provide fines content in soft tailings.
- 2) The concern with CPT is accessibility to non-water-capped soft deposits in CT-only ponds and safety concerns with access for boats to the soft deposits.
- 3) Sampling of the product produced and drillhole density would be decided based on consistency of product produced. The requirement would need to be manageable and practical. If the deposit is homogenous, the sample frequency may not need to be as rigorous. Drilling to evaluate composition for CT is not effective, as most of the present deposits are heterogeneous.

## **Measurement**

- 1) One operator uses a nuclear source meter to measure the fines in slurry.
- 2) Sand can be measured in extraction by laser technology.
- 3) Deposits are not homogenous. Therefore they are difficult to measure and predict.
- 4) Fines management needs to be considered on a site-wide basis. A predictive tool or model needs to include future ore deposit data, as well as data for existing ore deposits. A concern is extrapolation of data to predict future fines.
- 5) A method to validate the actual performance vs. expected tailings/CT performance is required. Timeframe suggested was no shorter than annual.
- 6) Measurements suggestions:
  - a) Complete an annual mass balancing on fines with the performance measurement being the difference between the fines in oil sands and the fines in MFT. Inputs include density, composition, flow. Outputs include fluid inventory.
  - b) Track performance by measuring MFT volumes vs. time or tonnes of ore to measure the success of fines reduction/capture.
- 7) A correlation between fines types and destination (beach, CT, etc.) is needed.
- 8) Measurement focus should be on MFT inventory/mass. Measurement inputs include annual pond surveys, cross-sectional sampling of pond for density. Fines to be reconciled on a dry tonnage basis.
- 9) One operator has in place the ability to measure, mass balance, and report fines consumption on a quarterly basis. Lab analysis of sample streams is performed. A comparison between the material balance model and the annual pond survey is typically within ~5%. This is based on two independent methods.
- 10) There is limited expertise with respect to persons to complete pond surveys.
- 11) Concern was raised that even with an SFR of 4 and 45% sand consumption, there may be segregation.

## **Trafficability**

- 1) Trafficability should be redefined to be consistent with the end land use.
- 2) Measurement should match the final objective for end land use. One concern raised with this approach is that the measurement is too far in the future to be a reference point.

## **Reporting**

- 1) Some operators are unsure of the purpose of the quarterly report.
- 2) The quarterly report may be achievable using data including tonnes of oil sand delivered and fines in the ore. If the MFT approach is used on an annual basis, there may be a large variance.

## **Other**

- 1) The objective of the tailings directive may impact the objective of bitumen recovery, as there may be competing objectives that will impact the operational parameters (e.g., underflow). In some operations, equipment modifications may be required to meet both objectives.

## **TOPIC 6**

**How do we collaborate in the future to ensure appropriate and effective management of tailings? What can industry do to collaborate on technical and regional issues? What can we all collaborate on?**

**How do we collaborate in the future to ensure appropriate and effective management of tailings?**

- 1) Clarification on the question (tailings ponds or tailings)—tailings.
- 2) Are we sharing info or working together on projects?
- 3) CONRAD—perhaps it should have a broader scale and a more collaborative role
- 4) Differentiate between sharing information on tailings and information about extraction

**What can industry do to collaborate on technical and regional issues?**

- 1) Physical collaborations include thickeners, centrifuges, high-density slurry pumps, dikes, testing (some of these collaborations already exist, some could in the future).
- 2) Waste dump? Tailings pond? End pit? What are the legal issues surrounding these? Is it logistically and legally feasible? A communal pipeline that goes to a regional water treatment facility (same idea could be considered for tailings)? Contracting out waste so another operator can treat it?
- 3) New players would like to get involved with seasoned players for research and development.
- 4) There is an interest in third-party processing of fines.
- 5) Share fundamental science (majority of this work is done); however, companies that divulge information should be compensated.
- 6) Raiding of research and development staff has created hard feelings between companies.
- 7) Business agreements depending on party.
- 8) Put intellectual property as a lower priority.
- 9) Integrating individual plans with a neighbour or another lease owner.
- 10) Development of a regional facility that treats fluid fine tailings. It should work on a user pays principle.
- 11) Companies that have fluid fine tailings should give them to another company that does not (for free) for research purposes, and the findings from the research would then be shared between both groups.

- 12) Perhaps an information sharing model used in the past (such as dragline user group) could work for tailings management.
- 13) Develop a framework to share cost/benefits.
- 14) Introduce step-out technology.
- 15) Develop a buy-in research program for new players.
- 16) Industry already participates in a tailings consortium, although attendance is not mandatory.
- 17) Companies already have one-on-one collaborations.

**What can we all collaborate on?**

- 1) Regular communication between ERCB and industry in the form of conferences, face-to-face meetings, phone calls, peer-reviewed publications where deficiencies with plans can be noted.
- 2) Solving the problem needs to be at the forefront instead of applied science (IP); it's a shared problem.
- 3) A venue to talk about technical issues and concerns in the public eye needs to be established.
- 4) ERCB should speak with CEOs about working on the tailings problem in a group effort. In addition, they would have to agree not to pursue a competitive edge on tailings or end pits.
- 5) A tailings course to ensure everyone has the same understanding of tests. Can current training be built upon or used more effectively?
- 6) Steps need to be taken to protect the rights of those who are doing the research.
- 7) Government should accept one group's tailings going into another group's pond (third party). This could reduce footprint, but how feasible is it? They should also make tailings available for research if one group needs tailings for research.
- 8) Tailings ponds could have third-party ownership. Everyone would pay the third party (user pays).
- 9) There should be regulatory incentives to encourage the sharing of resources. Also legal issues need to be dealt with to encourage resource sharing.
- 10) Government should have a more active role in tailings management.
- 11) Government should give a financial commitment to tailings research and development.
- 12) Develop an understanding of who would hold liability if resources were to be shared.
- 13) ERCB should introduce fines; companies need to be held accountable for not addressing tailings ponds in a timely fashion.
- 14) Directive should ask industry what work they have done on the research front and hold them accountable for reporting it to other operators.
- 15) More regulatory framework (more regular feedback between operators and ERCB).

16) Collaborate with CAPP to keep public more informed.

17) Industry and ERCB should have working groups to keep the ERCB more technically informed when writing directive.

### **Background Information and Parking Lot Issues**

#### ***Roadblocks to Collaboration***

- 1) Corporate liability
- 2) Legalities
- 3) Intellectual property and patenting
- 4) Potential appearance of collusion

#### ***Parking Lot Issues***

- 1) Budgets for cross-boundary leases
- 2) Develop a standard for measuring MFT
- 3) CONRAD dictionary of definitions
- 4) Technical tailings items that need to be done better at CONRAD are discussed at CONRAD