Tailings and Mine Waste 2017
Coarse and fine tailings slurry separation in iron ore mines
Philippe Rio Roberge, P. Eng.
Frédéric Choquet, P. Eng., M.A.Sc.
1. Introduction and Context

— Iron ore mines output
— Regulation and best practices
— Cost reductions / budgetary rigor
Presentation plan

1. Introduction and Context
2. What is tailings slurry separation
   1. The separation process
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2. What is tailings slurry separation
The separation process

— The action of creating two tailings streams (coarser and finer) to be pumped independently to the TSF.
2. What is tailings slurry separation

The cut-off point

— The cut-off points in the gravity separation can require multiple separation steps to obtain the required PSD.
2. What is tailings slurry separation
The pumping

— Separated slurry pumping is less efficient than a mixed slurry.
— The coarse PSD stream requires higher velocities to prevent settling in the pipeline.
— Increased monitoring, maintenance, inspection and training.
— Cost reductions in the TSF must therefore justify the increased investment and ”risk”. 
3. Why separate tailings slurry

— Draw benefits from the specific properties of each tailings

— Therefore:
  — *Reduce environmental impact*
  — *Reduce environmental risk*
  — *Reduce the construction costs*
3. Why separate tailings slurry
Reducing the environmental impact

— Coarse tailings have a steep deposition slope => potentially smaller footprint

— How to optimize?

**Two different TSF**

Select adequate locations with regard to the expected properties of tailings to be impounded

**One TSF for both fine and coarse tailings**

Coarse tailings can be used as confinement material:

- Confine fine tailings along the topography
- Use coarse tailings to confine fines in the middle of the impoundment
3. Why separate tailings slurry
Reducing the environmental risk

— Draining properties and settlement of coarse tailings
  — Smaller sedimentation pond required
    — Possible relocation of the process water pond outside of the TSF
  — Partial desaturation of the tailings inside the TSF
  — Reduce liquefaction risks
    — Coarse tailings beaches can act as drains for the fine tailings they confine
    — Reduction of the amount of tailings prone to liquefaction
  — Monitoring can be performed according to each tailings characteristics and behavior
3. Why separate tailings slurry
Reducing the construction costs

— Coarse tailings can be a reliable source of construction material
  — Borrow areas: temporarily stockpiled, then trucked and placed
  — Spigotted: deposited along the dyke sections to be raised then leveled and compacted
4. Management strategies

— The key to reducing sustaining capital and operating cost in the TSF is to integrate the management strategy with the design of containment and conveyance structures.

— Tool to develop the management strategy: the deposition plan
  — Present the preferred approach to tailings management
  — Provide the containment elevations required to be designed for safe operation
  — Define the future pumping requirements
  — Identify gaps and risks between present and future operation
4. Management strategies
Fine tailings

— Fine tailings can be impounded in the same TSF or in a different one.
4. Management strategies
Coarse tailings

— Use of coarse tailings:
  — Hydraulically placed borrow zone
  — Spigotted to create beaches
  — Spigotted and raised

— Requires efforts from the mill operator
— Requires efforts in the field

Operational flexibility
4. Management strategies
Seasonal management

— Cold climate
  — Approximately 5 month of winter (mid-nov to mid-april)
— Mix the tailings for easier operation
— Increase effort
  — Pay particular attention to the deposition lines and deposition points
  — Can’t work the material like in the summer (freezing)
  — Need available storage area

Average temperature curve over the year in Fermont, Qc
Source: fr.climate-data.org
4. Management strategies
OMS manual

— The benefits of tailings slurry separation come with increased responsibilities

— The OMS manual is a tool to ensure that the management, the design, the operationnal and emergency procedures, the surveillance and the monitoring as well as the training are updated and followed.
4. Management strategies
Reference project: Quebec Iron Ore Inc., Bloom Lake Mine

— Coarse and fine tailings hydraulic deposition in separate management facilities.
— Reduction of footprint by increasing the deposition angle.
5. Conclusion

— Tailings slurry separation is relatively easy to achieve
— New mines and existing operations can develop this technique to increase the overall performance of their TSF
— This solution has environmental and economic advantages
— Helps to reduce the overall risk associated with tailing containment
— Most mines could benefit from having a coarse and fine tailings stream. The capital and operational costs must be compared to the environmental and safety benefits.
Questions?