A common process to evaluate a tailings management technology is to gradually increase test scales, from the laboratory-scale test, to the pilot scale / prototype scale, and to the commercial scale. With test scales increasing, test time and cost can increase substantially. Furthermore, monitoring becomes more challenging when the test is at the pilot scale and commercial scale, because of temporal and spatial variations of tailings properties and natural variables. One critical question may raise in scale-up from pilot testing to commercial pouring: is there an approach available to predict tailings behaviour at the commercial scale from monitoring data at the pilot scale?

**METHODOLOGY**

**Understand the Effect of Scale**
- Testing at the laboratory-scale usually focuses on understanding and assessing technologies.
- Testing at the pilot-scale focuses on scale-up and performance under continuous operation. The pilot test is usually closely controlled and instrumented, and often conducted under favourable conditions.
- Testing at the prototype scale is a full scale test, focusing on development of parameters, design optimization for commercial operation, and achievement of commercial scale experience for operators.
- Tailings operations at the commercial scale focus on safety, reliability, cost effectiveness and continuous improvement.

**Understand Natural Variables**
- Natural variables change with test size scale and spatial scale.
- Identifying how natural variables are affected by test scales is important to scale up.

**Understand Dewatering Mechanisms**
- Dewatering mechanisms are associated with natural variables. For example, under-drainage may not occur when the foundation is impermeable.
- Contribution of each dewatering mechanism to tailings performance varies with test scale.
- In a specific test, dewatering mechanisms are also related to spatial and temporal scales.

**Define Time Frames**
- Limitations of small time scales: limited number of boundary variables or limited evolution of variables; limited tailings deposition plan and evolution of tailings properties.
- Monitoring should include key performance indicators (such as pore-water pressure, solids content, strength, etc.) and natural variables.

**Develop Conceptual Model**
- Initial dewatering is associated with deposition scale and deposit properties (on-spec vs. off-spec).
- Evaporation and under-drainage change with natural variables and time-scale.
- A conceptual model may only correspond to a certain test scale, but components of the conceptual model may be scaled up when natural variables are understood and defined.

**Comparison of tailings performance in the pilot test and commercial operation**

** ABSTRACT**

A common process to evaluate a tailings management technology is to gradually increase test scales, from the laboratory-scale test, to the pilot scale / prototype scale, and to the commercial scale. With test scales increasing, test time and cost can increase substantially. Furthermore, monitoring becomes more challenging when the test is at the pilot scale and commercial scale, because of temporal and spatial variations of tailings properties and natural variables. One critical question may raise in scale-up from pilot testing to commercial pouring: is there an approach available to predict tailings behaviour at the commercial scale from monitoring data at the pilot scale?

**GENERIC EXAMPLE**

**Performance Indicators**

**SUMMARY**

There are a number of complexities associated with tailings dewatering performance because of temporal and spatial variations; however, the conceptual model approach can enhance and simplify understanding of tailings dewatering processes, hence assisting with tailings management. The conceptual model approach can:
- help design monitoring at the pilot scale and other test scales;
- help interpretation of monitoring data;
- help understanding of tailings dewatering behavior even before monitoring; and
- be used as a universal approach for data exchange among various tailings management technologies.

**IMPLICATIONS**

1) Detailed monitoring at various scales is necessary.
2) Developing a conceptual model incorporating dewatering mechanisms and natural variables at each test scale is critical to monitoring implementation and scale-up of test scales.
3) The conceptual model approach can build relationships among various scales of tailings deposits and hence can be used to guide commercial production based on monitoring at the pilot scale.
4) Dewatering mechanisms are key issues in tailings tests. However, not every dewatering mechanism contributes equally to tailings dewatering efficiency.
5) Natural variables such as climatic conditions and hydrogeological settings can affect contributions of dewatering mechanisms.