Assessing Water Management Risks through Integrating Tailings Deposition and Water Balance Modeling
Presentation Outline

1. Introduction
2. Assessment Approach
3. Project Examples
Introduction

- Risk-based tailings management

Identify

Understand and assess

Mitigation, implementation or monitoring

Risks and critical controls
Introduction

Potentially Acid Generating (PAG) Tailings
Introduction

A “reactive” approach can increase the likelihood and/or potential consequences of unwanted events.
On a site-wide level, a “reactive” approach can lead to water supply or operational issues.
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Assessment Approach
Assessment Approach

Operating Pond Volume **
- Flood storage volume requirements**
- Delineation of contributing catchments (if changed by water balance)**

Tailings Deposition
- Amount and location of deposited tailings

Operating Pond Volume **
- Operating pond Area, depth and water cover (for PAG tailings)
- Delineation of contributing catchments**
- (IDF or EDF) Flooded pond volume, area and extents**
- Pond and TSF stage-storage relationships

Water Balance

** denotes interdependencies
Assessment Approach

Workflow 1 – pond water volume is determined by project objectives/ design criteria

Workflow 2 – pond water volume is determined by WB inflows and outflows
Workflow #1

Pond water volume based on design criteria

**Step 1**

Tailings Deposition

- e.g. water cover
- PAG TAILINGS

**Step 2**

Water Balance

- Operating pond volume**
- Operating pond Area, depth and water cover (for PAG tailings)
- Delineation of contributing catchments**
- (IDF or EDF) Flooded pond volume, area and extents**
- Pond and TSF stage-storage relationships

**Step 3**

- repeat for all timesteps

- Pond water volume based on design criteria

- Amount and location of deposited tailings
Workflow #2

Tailings Deposition

Water Balance

Pond water volume based on WB inflows and outflows

Approximate initial operating pond volume

Updated Operating Pond Volume

e.g. water cover

ARE THESE VERY DIFFERENT?

Output

- Amount and location of deposited tailings
- Operating pond volume**
- Operating pond Area, depth and water cover (for PAG tailings)
- Delineation of contributing catchments**
- (IDF or EDF) Flooded pond volume, area and extents**
- Pond and TSF stage-storage relationships

Input

Step 2

Water Balance

Approximate initial operating pond volume

Updated Operating Pond Volume

ARE THESE VERY DIFFERENT?
Workflow #2

Pond size based on WB inflows and outflows

Step 1: Initial pond volume

Step 2: Tailings Deposition

Step 3: Water Balance

Step 4: Repeat for subsequent timesteps

Step 5: Updated Operating Pond Volume

IF SO...

- Amount and location of deposited tailings
- Operating pond volume (for PAG tailings)
- Delineation of contributing catchments
- (IDF or EDF) Flooded pond volume, area and extents
- Pond and TSF stage-storage relationships

input

output
Assessment Uncertainties

- Manage uncertainties using sensitivity analysis or using stochastic/probabilistic approach

Credit: GoldSim
Presentation Outline

1. Introduction
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Example 1

Objectives
- Maintain PAG tailings saturation
- Estimate water losses for alternatives assessment

Methodology
- Workflow 1

Results
- Used in a multi-criteria analysis for alternatives assessment
Example 2

Objectives
- PAG tailings saturation
- Size water treatment plant to adequately deal with wet periods

Methodology
- Workflow 1
- Site-wide water balance

Results used to
- Design water treatment plant
- Size the water storage dam and TSF
Example 3

Objectives
- PAG tailings and waste rock saturation
- Provide adequate water and flood storage during dry and wet seasons.

Methodology
- Workflow 2
- Site-wide water balance with synthetic climate

Results used
- To size WSD and TSF
- To identify critical dry climate scenarios
- For dry season planning to maintain river baseflow for downstream users
Example 4

**Objective**
- Develop tailings deposition plan for future facility expansion and closure within existing footprint

**Methodology**
- Model calibration and Workflow 2
Example 4

Results

- Used to determine the pond levels for ongoing dam raise and construction planning;
- Deposition plan and pond levels are incorporated into the facility’s OMS manual and tailings management program.
- May reveal potential problems in the tailings management plan, such as depositing too much tailings underwater, or not producing enough cyclone sand for dam raise.
Conclusion

Risk-based Tailings Management

Tailings Deposition

Water Balance

PAG TAILINGS
Questions?