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SIGNIFICANT ENGINEERING FAILURE RISK

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PURPOSE

1. Identify issues not captured in standard approach to contaminated sites
 2. Aid in setting priorities for remediation
 3. Identify need for monitoring & interim mitigative strategies
- Focus on critical components of abandoned mines

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RISK = PROBABILITY x CONSEQUENCE

- 4 Steps
 - Identification of potential failures
 - Assessment of probability of failure
 - Estimation of consequences
 - Conversion of probability and consequences into numeric values to obtain risk rating

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- Step 1 – Identification of potential failures
 - Focus on major concerns
 - Avoid developing closure solutions
 - “what could happen without proper closure work”

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- Identification of potential failures
 - Dams
 - Spillways and diversions
 - Bulkheads
 - Crown pillars
 - Waste dump slopes

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- Step 2 - Assessment of probability of failure
 - Semi-quantitative assessment (data is often insufficient)
 - Conservative opinion of qualified professionals who have working knowledge of the site (sites)
 - Common issue is dams and spillways
 - 5 main failure modes
 - Piping, static or seismic slope failure, hydraulic failure, overtop

SEFR – Probability of Failure

SITE	Piping Failure 1 in :	Static Slope Failure 1 in :	Seismic Slope Failure 1 in :	Hydrologic Failure 1 in :	Other Failure 1 in :	FAILURE COMMENTS
GIANT MINE						
NW tailings	833	1000	1000	100		1:20 event (2001 precip) nearly filled pond, no spillway water accum. In North pond could cause dam failure
N-C-S tailings	347	200	475	100		no spillway, dam founded on tailings, failure leads to sludges in mine
Polishing pond	347	200	100	50		short term stability believed to be OK, long term is Table
Crown Pillars				1000		

SEFR – Risk Rating

PROBABILITY	Rank	
very high	> 1:10	10
high	1:100 - 1:10	9
moderate	1:500 - 1:100	5
low	1:1000 - 1:500	2
very low	<1:1000	1

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Step 3 - Estimation of consequences

- 3 areas of impact
 - Fatality
 - Environmental impact
 - Remediation cost
- Other areas – legal, private or First Nations land

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Consequence Rating

	FATALITIES	ENVIRONMENTAL	REMEDICATION	Rank
very high	more than one fatality	irreversible impacts	> \$10 million	10
high	one fatality	reversible impacts	\$2.5 - \$10 million	9
moderate	irreversible injury	Imminent impacts of	\$0.5 - \$2.5 million	5
low	hospital treatment	low site impact	\$100,000 - \$0.5 million	2
very low	no medical treatment	no perceived impact	<\$100,000	1

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SITE	FATALITY	ENVIRONMENT	REMEDICATION
GIANT MINE			
NW tailings	very low	high	high
N-C-S tailings	very low	mod	high
Polishing pond	very low	mod	high
Crown Pillars	very low	high	very high

Step 4 – Numeric Risk Rating

Multiply Probability Rank x Consequence

Rank

Probability	Consequence				
	very low	low	moderate	high	very high
very high	10	20	50	90	100
high	9	18	45	81	90
moderate	5	10	25	45	50
low	2	4	10	18	20
very low	1	2	5	9	10

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SITE	PROBABILITY OF FAILURE			CONSEQUENCE			SCORE	RISK
	Probability	Description	Rating	Consequence	Description	Rank		DESCRIPTIVE RANKING
GIANT MINE								
N-C-S tailings	1:100	high	9	high remediation	high	9	81	high

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- Use the risk ranking to:
 - Capture risks not commonly part of contaminated site assessment
 - Aid in identifying which sites should be remediated first
 - Identify need for monitoring and pre-reclamation mitigation efforts