
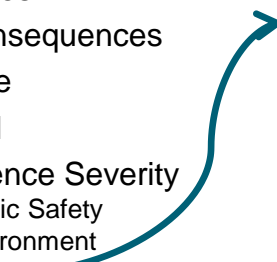


Giant Mine Remediation Project Assessment Worksheet




- Component
- Subcomponent
- Risk Issue / Failure
- Event / Causes
- Potential Consequences
- Risk Estimate
 - Likelihood
 - Consequence Severity
 - Public Safety
 - Environment
 - Cost



- Planned Mitigation / Controls / Management Measures
- Risk Estimate Re-evaluation
 - Likelihood
 - Consequence Severity
 - Public Safety
 - Environment
 - Cost

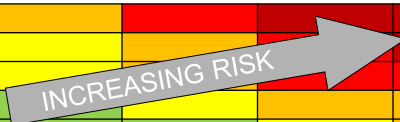
5

Giant Mine Remediation Project Risk Matrix – Human Health & Safety



| CATEGORY | CONSEQUENCE SEVERITY | | | | |
|------------------|---|--|--|--|---|
| | A) Low | B) Minor | C) Moderate | D) Major | E) Critical |
| I) Public Safety | Low-level short-term subjective symptoms/ No measurable physical effect/ No medical treatment | Objective but reversible disability/impairment and/or medical treatment injuries requiring hospitalization | Moderate irreversible disability or impairment to one or more people | Single fatality and /or severe irreversible disability or impairment to one or more people | Multiple fatalities |
| II) Environment | No impact | Minor localized or short-term impacts | Impact on valued ecosystem component | Impact on valued ecosystem component and medium-term impairment of ecosystem function | Serious longterm impairment of ecosystem function |
| III) Cost | < \$100,000 | \$100,000 - \$1 Million | \$ 1.0 - \$ 10 Million | \$ 10 - \$ 50 Million | \$ >50 Million |

| LIKELIHOOD | | | | | | |
|------------|------------------------------|--------|----------|-------------|----------|-------------|
| Index | Event/Years | A) Low | B) Minor | C) Moderate | D) Major | E) Critical |
| 1) | More than once every 5 years | | | | | |
| 2) | Once every 15 years | | | | | |
| 3) | Once every 30 years | | | | | |
| 4) | Once every 100 years | | | | | |
| 5) | Once every 1000 years | | | | | |



Risk Rating
 Low
 Moderate
 Moderately High
 High
 Very High

6



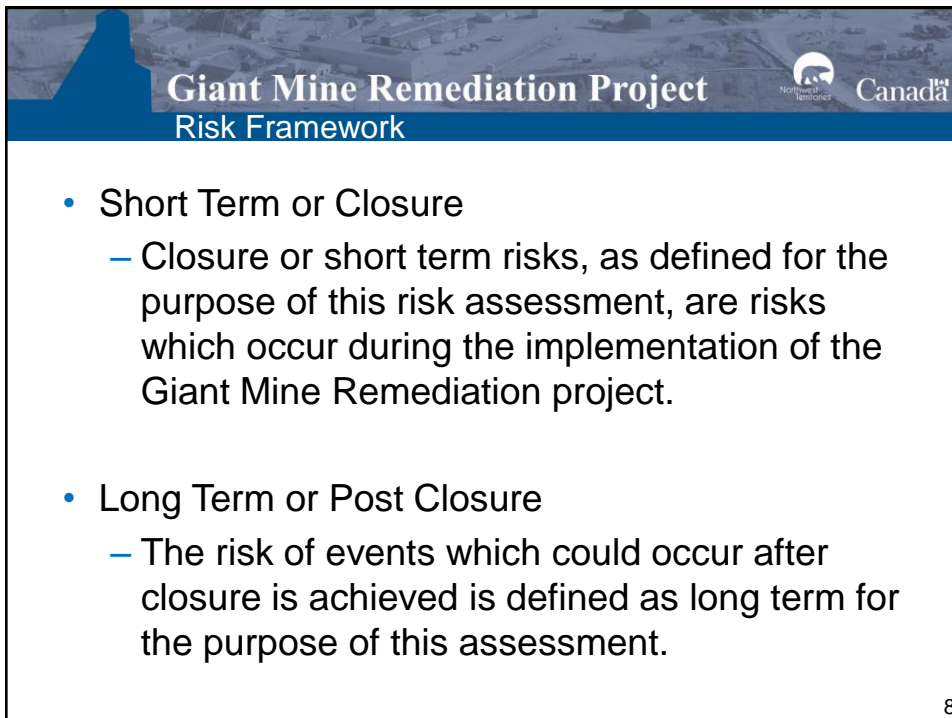
The slide features a header with a blue silhouette of a mountain on the left, the text "Giant Mine Remediation Project" in white, and the "Northwest Territories" and "Canada" logos on the right. Below the header, the text "Risk Workshops" is displayed in white on a dark blue background. The main content area is white and contains a bulleted list of workshop details. A small number "7" is located in the bottom right corner of the slide.

Giant Mine Remediation Project

Risk Workshops

- Purpose
 - Develop sequences of events over the long term that may lead to component failures and consequential losses.
- Workshop 1:
 - March 22 to 24, 2011
- Workshop 2:
 - April 4 to 6, 2011
- Workshop 3:
 - May 30 and 31, 2011
- Workshop Participants:
 - GoC, Technical Advisor, and Engineering Team

7



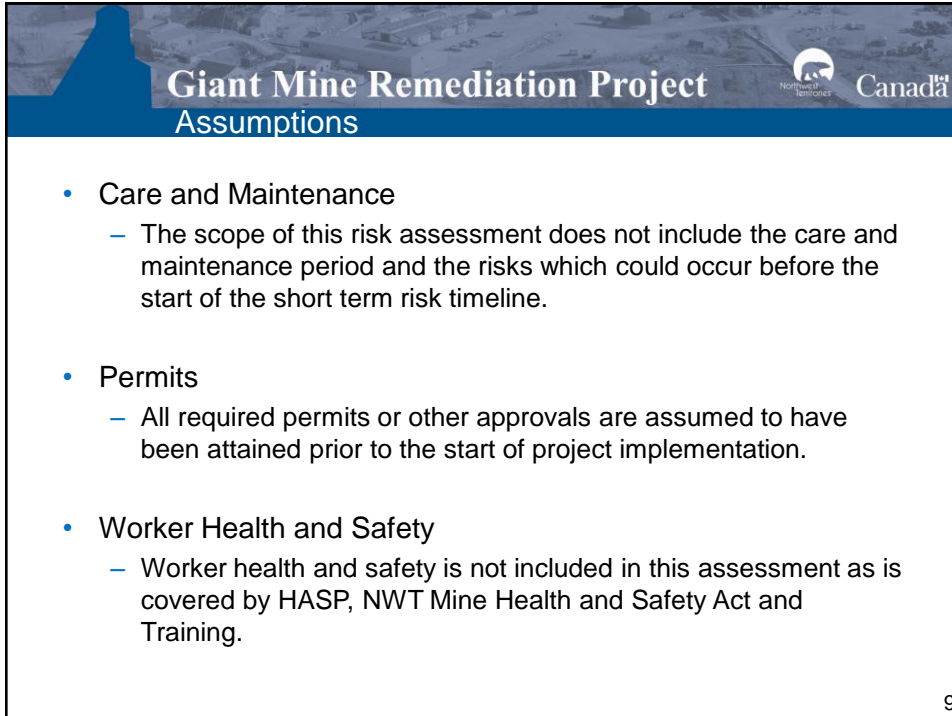
The slide features a header with a blue silhouette of a mountain on the left, the text "Giant Mine Remediation Project" in white, and the "Northwest Territories" and "Canada" logos on the right. Below the header, the text "Risk Framework" is displayed in white on a dark blue background. The main content area is white and contains a bulleted list of risk categories. A small number "8" is located in the bottom right corner of the slide.

Giant Mine Remediation Project

Risk Framework

- Short Term or Closure
 - Closure or short term risks, as defined for the purpose of this risk assessment, are risks which occur during the implementation of the Giant Mine Remediation project.
- Long Term or Post Closure
 - The risk of events which could occur after closure is achieved is defined as long term for the purpose of this assessment.

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Giant Mine Remediation Project
Assumptions

Northwest Territories Canada

- Care and Maintenance
 - The scope of this risk assessment does not include the care and maintenance period and the risks which could occur before the start of the short term risk timeline.
- Permits
 - All required permits or other approvals are assumed to have been attained prior to the start of project implementation.
- Worker Health and Safety
 - Worker health and safety is not included in this assessment as is covered by HASP, NWT Mine Health and Safety Act and Training.

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Giant Mine Remediation Project
Systems and Components

Northwest Territories Canada

- Underground System
 - Bulkheads
 - Plugs
 - Crown Pillar
 - Sill Pillar
- Baker Creek System
 - Baker Creek Channel Integrity
 - Creek Bed
 - Bank
- Freeze System
 - Drill Holes
 - Active Freeze System
 - Frozen Shell
 - Frozen Block
 - Passive Cooling Infrastructure
- Institutional System
 - Governance
 - Regulatory

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Giant Mine Remediation Project

Systems and Components

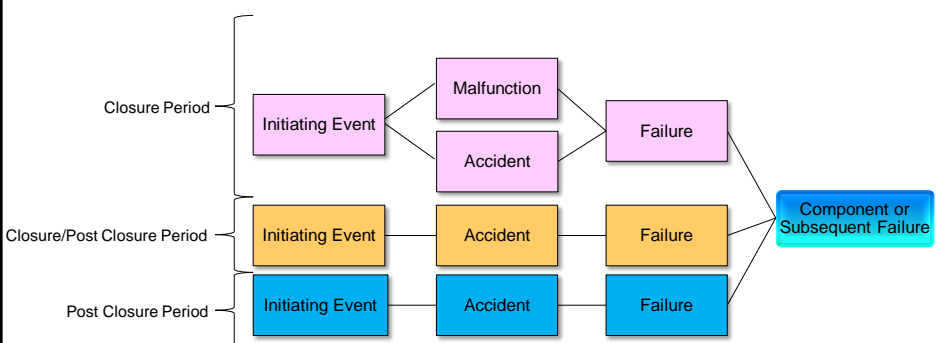
- Surface System
 - Dams
 - Ditches
 - Tailings Covers (including spillway)
 - Public Safety
- Water Management System
 - Existing Plant
 - Settling / Polishing
 - Underground Storage
 - Pumps
 - New WTP
 - Diffuser
 - Receiving Environment
- Infrastructure System
 - Buildings (e.g. Roaster, Mill)
 - Underground Equipment
 - Fuel Storage
 - Mine WTP

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Giant Mine Remediation Project

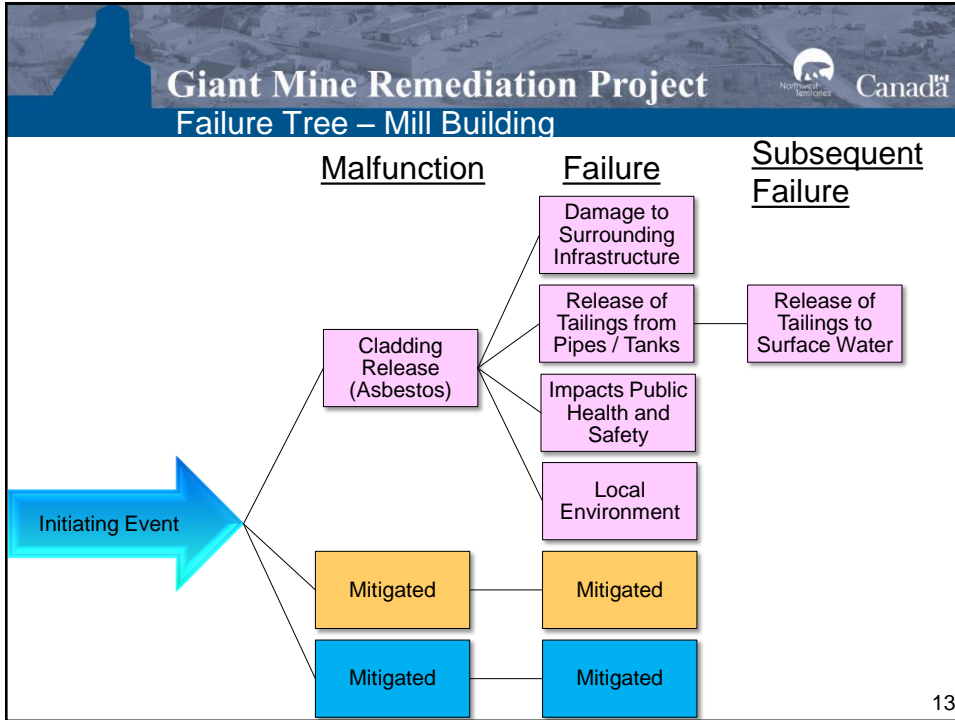
Failure Tree – Risk Identification



```

    graph LR
      subgraph Closure_Period [Closure Period]
        IE1[Initiating Event] --> M[Malfunction]
        IE1 --> A1[Accident]
        M --> F1[Failure]
        A1 --> F1
      end
      subgraph Closure_Post_Closure_Period [Closure/Post Closure Period]
        IE2[Initiating Event] --> A2[Accident]
        A2 --> F2[Failure]
      end
      subgraph Post_Closure_Period [Post Closure Period]
        IE3[Initiating Event] --> A3[Accident]
        A3 --> F3[Failure]
      end
      F1 --> CSF[Component or Subsequent Failure]
      F2 --> CSF
      F3 --> CSF
  
```

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Giant Mine Remediation Project Risk Matrix


| CATEGORY | CONSEQUENCE SEVERITY | | | | |
|------------------|---|--|--|--|---|
| | A) Low | B) Minor | C) Moderate | D) Major | E) Critical |
| I) Public Safety | Low-level short-term subjective symptoms/ No measurable physical effect/ No medical treatment | Objective but reversible disability/impairment and/or medical treatment injuries requiring hospitalization | Moderate irreversible disability or impairment to one or more people | Single fatality and /or severe irreversible disability or impairment to one or more people | Multiple fatalities |
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| III) Cost | < \$100,000 | \$100,000 - \$1 Million | \$ 1.0 - \$ 10 Million | \$ 10 - \$ 50 Million | \$ >50 Million |

| LIKELIHOOD | | | | | | |
|------------|------------------------------|--|--|--|--|--|
| Index | Event/Years | | | | | |
| 1) | More than once every 5 years | | | | | |
| 2) | Once every 15 years | | | | | |
| 3) | Once every 30 years | | | | | |
| 4) | Once every 100 years | | | | | |
| 5) | Once every 1000 years | | | | | |

INCREASING RISK →

Risk Rating: Low Moderate Moderately High High Very High

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Giant Mine Remediation Project FMECA Tables

Component: Baker Creek Flood

Risk Issue / Failure

- Baker Creek loses channel containment during spring freshet resulting in large inflows to the mine underground workings.

Event Causes

- Accident: Loss of ground support at C-1 Pit and / or B- 1 pit south edge

Risk Before Mitigation

| Likelihood | Consequence Severity | | |
|------------|----------------------|-------------|------|
| | Public Safety | Environment | Cost |
| 3 | B | D | E |

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Giant Mine Remediation Project FMECA Tables



Potential Consequences

- Water would spill into the underground and flood underground workings.



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Giant Mine Remediation Project FMECA Tables

Planned Mitigation / Controls / Management Measures

- Conduct additional investigations to confirm stability assessments (previous and current) and implement monitoring program.

Evaluation



- Based on delayed care and maintenance cost and increased water treatment cost.

Risk After Mitigation

| Likelihood | Consequence After Mitigation | | |
|------------|------------------------------|-------------|------|
| | Public Safety | Environment | Cost |
| 3 | B | C | D |

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Giant Mine Remediation Project Risk Matrix – Baker Creek Flood

| BEFORE | | CATEGORY | CONSEQUENCE SEVERITY | | | | |
|------------|------------------------------|----------|----------------------|----------|-------------|----------|-------------|
| | | | A) Low | B) Minor | C) Moderate | D) Major | E) Critical |
| LIKELIHOOD | | | | | | | |
| Index | Event/Years | | | | | | |
| 1) | More than once every 5 years | | | | | | |
| 2) | Once every 15 years | | | | | | |
| 3) | Once every 30 years | | Public Safety | | Environment | | Cost |
| 4) | Once every 100 years | | | | | | |
| 5) | Once every 1000 years | | | | | | |

| AFTER | | CATEGORY | CONSEQUENCE SEVERITY | | | | |
|------------|------------------------------|----------|----------------------|-------------|-------------|----------|-------------|
| | | | A) Low | B) Minor | C) Moderate | D) Major | E) Critical |
| LIKELIHOOD | | | | | | | |
| Index | Event/Years | | | | | | |
| 1) | More than once every 5 years | | | | | | |
| 2) | Once every 15 years | | | | | | |
| 3) | Once every 30 years | | Public Safety | Environment | | Cost | |
| 4) | Once every 100 years | | | | | | |
| 5) | Once every 1000 years | | | | | | |

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Giant Mine Remediation Project

FMECA Tables

Component: Sill Pillar Failure

Risk Issue / Failure

- Sill pillar failure at arsenic chambers during construction or due to flood flows into mine.

Event Causes

- Accident: Collapse due to rock or ground support degradation.

Risk Before Mitigation

| Likelihood | Consequence Severity | | |
|------------|----------------------|-------------|------|
| | Public Safety | Environment | Cost |
| 3 | B | B | D |

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Giant Mine Remediation Project

FMECA Tables



Potential Consequences

- Loss of arsenic dust to mine pool and to the ventilation system.

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Giant Mine Remediation Project

FMECA Tables

Planned Mitigation / Controls / Management Measures

- Voids under sill pillars will be backfilled.

Risk After Mitigation

| Likelihood | Consequence After Mitigation | | |
|------------|------------------------------|-------------|------|
| | Public Safety | Environment | Cost |
| 5 | A | A | C |

Evaluation

- All sill pillars are currently subject to long-term monitoring.

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Giant Mine Remediation Project

Risk Matrix – Sill Pillar Failure

| BEFORE | | CATEGORY | CONSEQUENCE SEVERITY | | | | |
|------------|------------------------------|----------|-----------------------------|----------|-------------|----------|-------------|
| | | | A) Low | B) Minor | C) Moderate | D) Major | E) Critical |
| LIKELIHOOD | | | | | | | |
| Index | Event/Years | | | | | | |
| 1) | More than once every 5 years | | | | | | |
| 2) | Once every 15 years | | | | | | |
| 3) | Once every 30 years | | Public Safety / Environment | | Cost | | |
| 4) | Once every 100 years | | | | | | |
| 5) | Once every 1000 years | | | | | | |

| AFTER | | CATEGORY | CONSEQUENCE SEVERITY | | | | |
|------------|------------------------------|----------------------------|----------------------|----------|-------------|----------|-------------|
| | | | A) Low | B) Minor | C) Moderate | D) Major | E) Critical |
| LIKELIHOOD | | | | | | | |
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| 3) | Once every 30 years | | | | | | |
| 4) | Once every 100 years | | | | | | |
| 5) | Once every 1000 years | Public Safety/ Environment | | Cost | | | |

22

Giant Mine Remediation Project

FMECA Tables

Component: C-Shaft Headframe

Risk Issue / Failure

- Weather damage.

Risk Before Mitigation

| Likelihood | Consequence Severity | | |
|------------|----------------------|-------------|------|
| | Public Safety | Environment | Cost |
| 4 | C | A | A |

Event Causes

- Accident: Extreme weather / high winds.

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Giant Mine Remediation Project


FMECA Tables



Potential Consequences

- Strong wind results in building debris blown towards highway with the potential to injury.

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Giant Mine Remediation Project

FMECA Tables

Planned Mitigation / Controls / Management Measures

- This structure will be decontaminated prior to demolition.


Evaluation

- Long-term – all buildings will be demolished which will eliminate the risks associated with this structure.

Risk After Mitigation

| Likelihood | Consequence After Mitigation | | |
|------------|------------------------------|-------------|------|
| | Public Safety | Environment | Cost |
| 4 | A | A | A |

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Giant Mine Remediation Project

Risk Matrix – C-Shaft Headframe

| BEFORE | | CONSEQUENCE SEVERITY | | | | |
|------------|------------------------------|----------------------|----------|---------------|----------|-------------|
| CATEGORY | | A) Low | B) Minor | C) Moderate | D) Major | E) Critical |
| LIKELIHOOD | | | | | | |
| Index | Event/Years | | | | | |
| 1) | More than once every 5 years | | | | | |
| 2) | Once every 15 years | | | | | |
| 3) | Once every 30 years | | | | | |
| 4) | Once every 100 years | Environment / Cost | | Public Safety | | |
| 5) | Once every 1000 years | | | | | |

| AFTER | | CONSEQUENCE SEVERITY | | | | |
|------------|------------------------------|------------------------------------|----------|-------------|----------|-------------|
| CATEGORY | | A) Low | B) Minor | C) Moderate | D) Major | E) Critical |
| LIKELIHOOD | | | | | | |
| Index | Event/Years | | | | | |
| 1) | More than once every 5 years | | | | | |
| 2) | Once every 15 years | | | | | |
| 3) | Once every 30 years | | | | | |
| 4) | Once every 100 years | Public Safety / Environment / Cost | | | | |
| 5) | Once every 1000 years | | | | | |

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Giant Mine Remediation Project

Cascading Events Scenario & Multiple Cause Scenario


| Cascading Event Scenario | Multiple Cause Scenario |
|--|--|
| <ul style="list-style-type: none"> • A cascading event scenario starts with one initiating event or cause which causes the failure of multiple systems or components. • Cascading events for both the short and long term time frames were analyzed. | <ul style="list-style-type: none"> • A multiple cause scenario starts with two or more unrelated initiating events or causes which occur simultaneously and cause the failure of systems or components. • Multiple cause scenarios for both the short and long term time frames were analyzed. |

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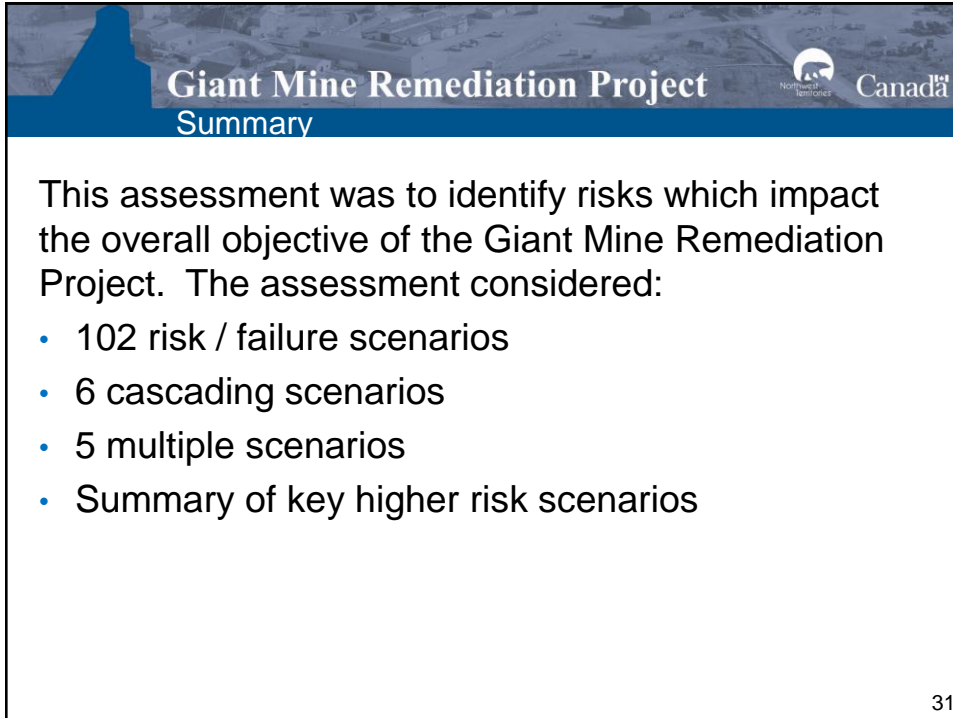


|  | | | | | | | |
|--|--|-----------------|--|---|--------------------------------|--|------------------------|
| Initiating Event | | | | | | | Result |
| Effluent Treatment Plant (ETP) Supply of Chemicals Interrupted (2 months) | Component Failure: Baker Creek Base Collapse | Flood into mine | Flood up to underground pumping system | Component Failure: Underground Pump Failure | Replace pumping system | | Increase in cost |
| Failure of Baker Creek base during freshet | | | Mine floods to surface | New Mine WTP not operational yet | Loss of arsenic into mine pool | Component Failure: ETP Treatment not Effective | Release to environment |

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|  | | | | | | | |
|--|--|--|--|---|--|--|--|
| Initiating Event | | | | | | | Result |
| Fill Plan for Freeze System Not Effective. Saturated Unfrozen in Chambers | Component Failure: Underground Stability Failure | Major loss of arsenic slurry into mine | Component Failure: ETP would require upgrades or additional temporary treatment would be required to treat the elevated arsenic in minewater | Component Failure: Re-design of Underground Stability Program | | | Increase in cost |
| Sill Pillar Failure | | | | | | | Component Failure: Loss of arsenic into other portions of the mine (previously non-arsenic containing) would require a re-design of a portion of the freeze system |

30

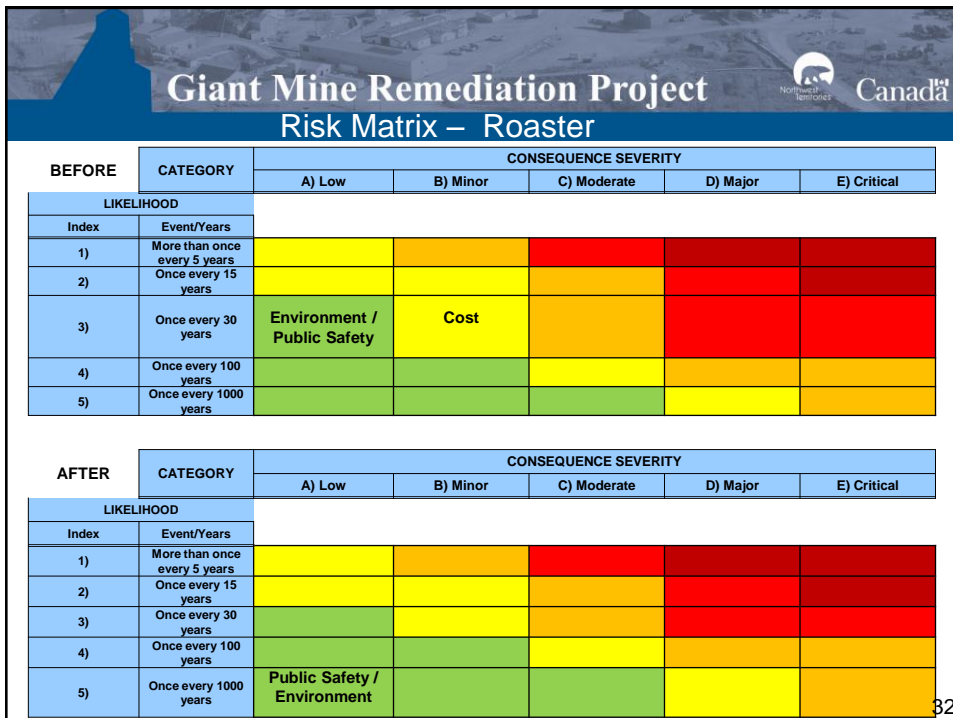


Giant Mine Remediation Project
Summary

This assessment was to identify risks which impact the overall objective of the Giant Mine Remediation Project. The assessment considered:

- 102 risk / failure scenarios
- 6 cascading scenarios
- 5 multiple scenarios
- Summary of key higher risk scenarios

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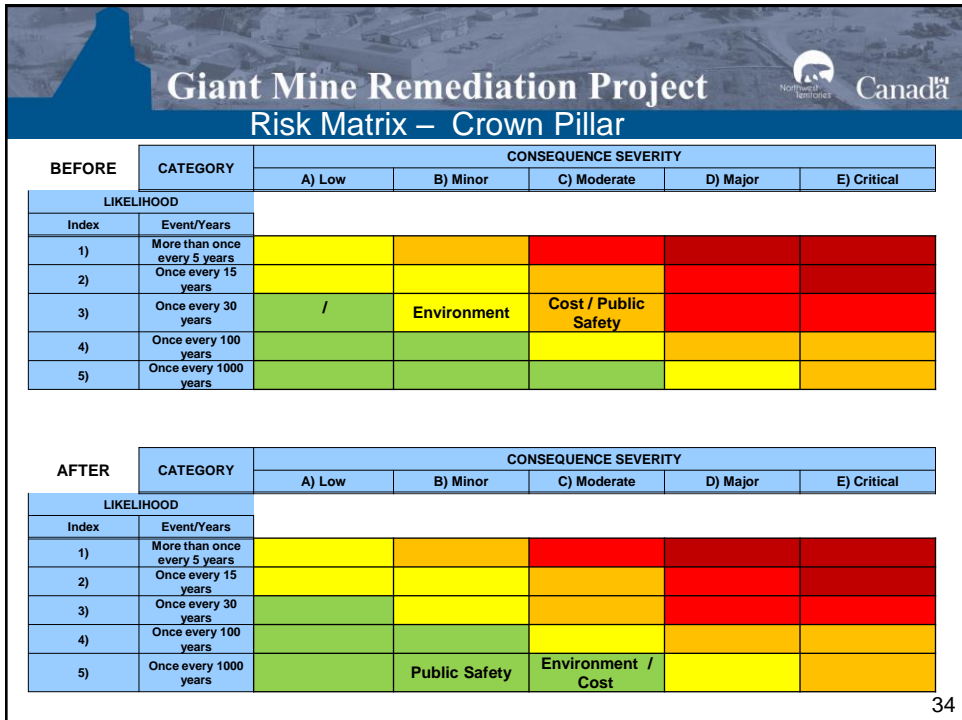
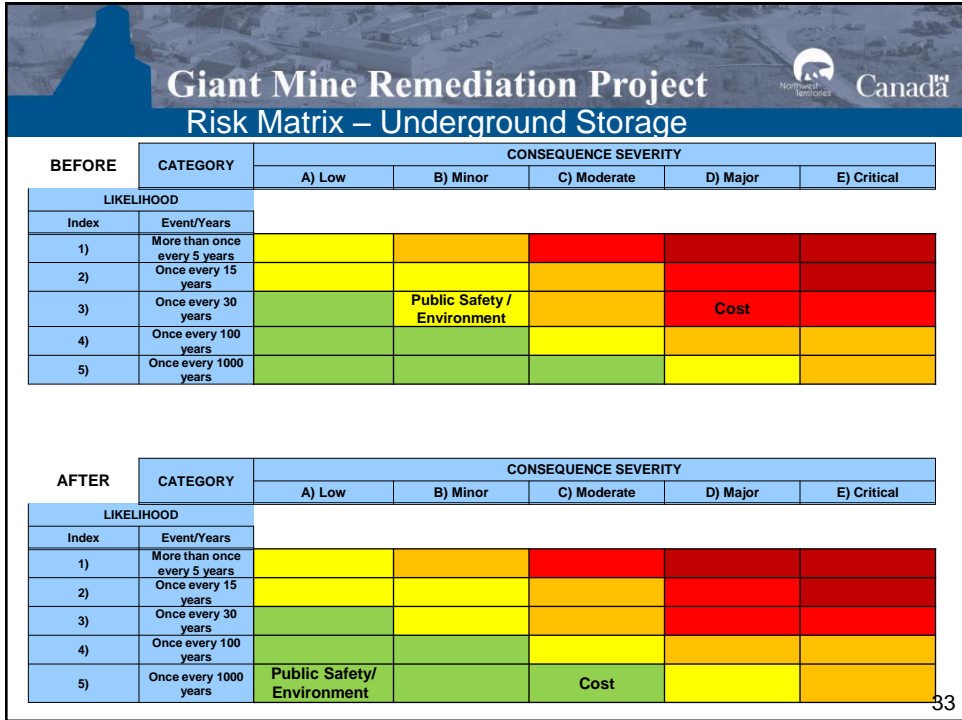


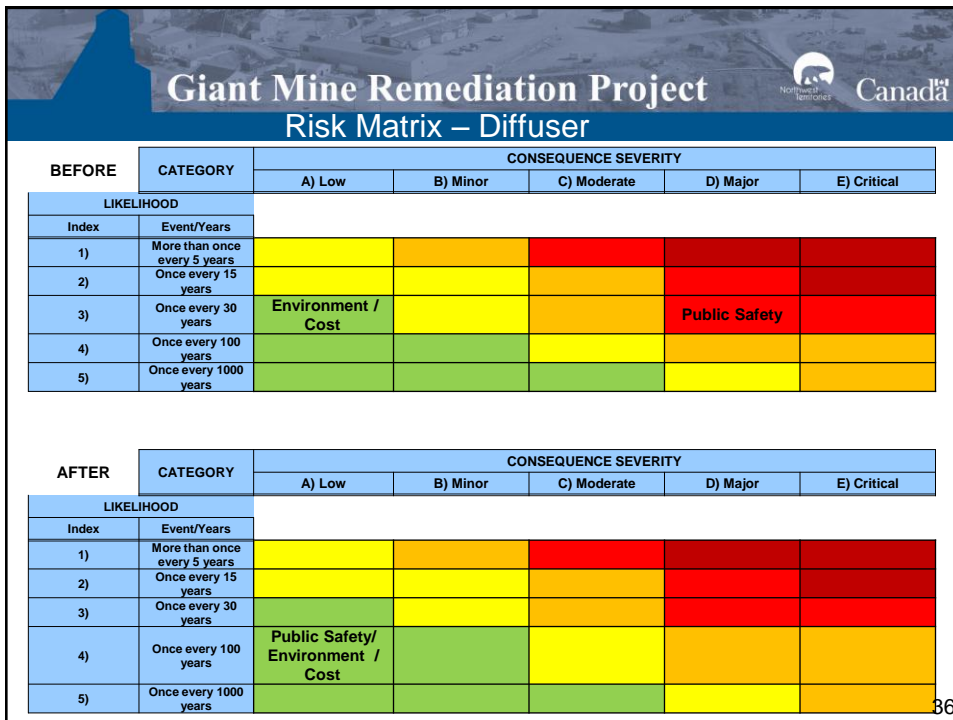
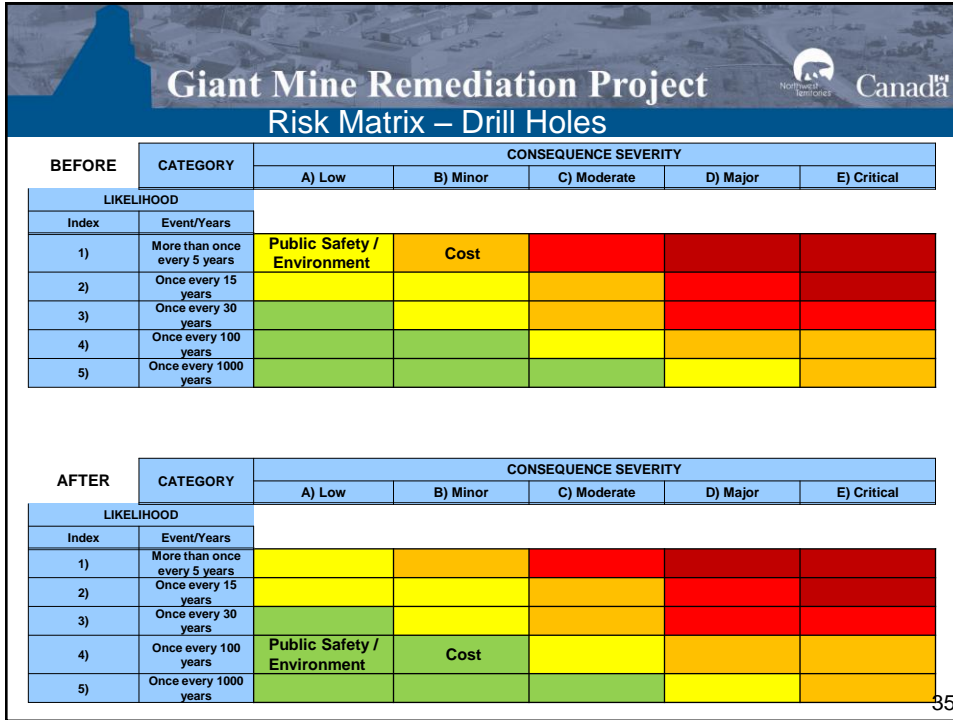
Giant Mine Remediation Project
Risk Matrix – Roaster


| BEFORE | | CATEGORY | CONSEQUENCE SEVERITY | | | | |
|------------|------------------------------|-----------------------------|----------------------|----------|-------------|----------|-------------|
| | | | A) Low | B) Minor | C) Moderate | D) Major | E) Critical |
| LIKELIHOOD | | | | | | | |
| Index | Event/Years | | | | | | |
| 1) | More than once every 5 years | | | | | | |
| 2) | Once every 15 years | | | | | | |
| 3) | Once every 30 years | Environment / Public Safety | Cost | | | | |
| 4) | Once every 100 years | | | | | | |
| 5) | Once every 1000 years | | | | | | |

| AFTER | | CATEGORY | CONSEQUENCE SEVERITY | | | | |
|------------|------------------------------|-----------------------------|----------------------|----------|-------------|----------|-------------|
| | | | A) Low | B) Minor | C) Moderate | D) Major | E) Critical |
| LIKELIHOOD | | | | | | | |
| Index | Event/Years | | | | | | |
| 1) | More than once every 5 years | | | | | | |
| 2) | Once every 15 years | | | | | | |
| 3) | Once every 30 years | | | | | | |
| 4) | Once every 100 years | | | | | | |
| 5) | Once every 1000 years | Public Safety / Environment | | | | | |

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Giant Mine Remediation Project
Summary

Northwest Territories Canada

This assessment was to identify risks which may impact the overall success of the Giant Mine Remediation Project,. These include:

- Assess project components / elements and identify the impacts to project success that could represent a risk to public safety and the environment
- Allows the operator and the owner to note high risk events to set priorities for mitigation and current maintenance
- Assist with planning and sequencing of the closure in efficient manner
- Assist in minimizing risk to public health and safety associated with buildings, opening pits, and other physical hazards at the site

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