Risk Management at SNOLAB
What is SNOLAB?

SNOLAB is a world-leading deep underground fundamental science research facility, located at 2070m depth in the Vale Creighton mine.

- Operates as a clean-room throughout, and shields sensitive detectors from background radiations by great depth, high purity detectors and shields.

The programme addresses some of the most fundamental questions in contemporary science:

1. Why is the Universe made of matter instead of anti-matter?
2. What is dark matter?
3. Is there physics outside the Standard Model of Particle Physics?
Who do we support?

- >500 faculty researchers from 157 institutions over 24 countries
- > 800 highly qualified personnel and technical support
- ~11,000 underground person-shifts per year (~60/dayshift)
SNOLAB Project Life Cycle

SNOLAB Project Life Cycle

PHASE 0: INITIATION

Start

Expression of Interest

Initiation Evaluation

GW-0 Initiation Approval

PHASE 1: DEFINITION

Conceptual Design

Conceptual Design Package

Conceptual Design Review

MOAs & General Terms

GW-1 Space Approval

G-1/CD-1

TRUMF/DOE

PHASE 1A: PROPOSAL

TDRMf participation if appropriate

G-2/CD-2

Funding Proposal Review Required?

Preliminary Design

Preliminary Design Package & Project Implementation Plan

Preliminary Design Review

GW/1A Proposal Approval

PHASE 2: DEVELOPMENT

Final Design & Planning

Technical Design Package & Project Implementation Plan

TRUMF participation if appropriate

Deliverables & Liability Agreements

GW-2 Deployment Approval

G-3/CD-3

PHASE 3: IMPLEMENTATION

Updated Installation Plan

Installation Review

Installation

Safety Report, Ops, Maint, Emergency P&As

Operational Readiness Review & External Reviews

External Approvals

GW-3 Operations Approval

G-4A/CD-4

PHASE 4: OPERATION

Commissioning & Operations

Updated Decommissioning Plan

Decommissioning Review

GW-4 Decommissioning Approval

PHASE 5: CLOSEOUT

Decommissioning

Project Close Out Reports

End
SNOLAB separates ‘risk’ and ‘hazard’
- SNOLAB Terminology:
  - What is a Hazard? Anything that has the capability to cause harm to people. This is scoped in terms of health and safety, environment, etc.
  - What is a Risk? The likelihood and consequence of a situation arising that can affect a project. This includes internal and external quality factors.
- At the facility level, common approach adopted to monitor risk and hazard through overall facility registers
  - Hazard register takes input from various hazard analyses
  - Risk register takes input from Strategic Risk Group and Managers
  - Registers maintained by SNOLAB Director
  - All documentation available on SNOLAB DocuShare document management system
  - Hazard assessments available to all staff and users
  - Risk assessments available to senior staff team
**Risk Category:** Hazards and risks are broken into general categories in each sheet. Categories of hazards and risks associated with each experiment are detailed within these generic categories, or any additionally required.

**Hazard/Risk description:** For each category and sub-category, specific hazards and risks are described.

**Inherent risk:** The inherent risks associated with a hazard or project risk illustrate those associated risks prior to the adoption of any mitigation strategy. The purpose of identifying inherent risk is to highlight those areas of risk which are deemed of high impact, or high likelihood. The inherent risk assessment is broken into likelihood and impact with the total risk assessment being the product of the two.

**Mitigation strategies:** The strategies adopted to reduce the inherent risk.

**Residual risk:** Following the adoption of the stated mitigation strategies, the likelihood of the hazard/risk occurring is reduced to the residual likelihood. Note that the impact of the hazard or project risk remains the same as the inherent risk. Mitigation does NOT change impact.

**Risk trend:** To provide a mechanism to track hazard and risk assessments through the lifecycle of the project. Risks will eventually be retired when the task or element is completed.

**Risk owner:** Specifies responsibility for monitoring and managing the risks and hazards.

**Financial Implications:** Specifies in broad (logarithmic) terms the scale of the financial implications should the risk materialise

**Actions:** Any outstanding actions and additional comments. Completed actions bracketed to maintain visibility of tasks or actions completed.
Likelihood for analyses (hazard assessment may use industry standard frequency analyses, e.g. ODH (Fermilab)):
- 0: retired;
- 1: very unlikely to occur in project lifetime;
- 2: unlikely to occur in project lifetime;
- 3: likely to occur in project lifetime;
- 4: very likely to occur in project lifetime;

Impact for hazard analysis:
- 1: inconvenience;
- 2: minor injury;
- 3: lost time injury;
- 5: serious injuries or death;

Impact for project risk analysis:
- 1: inconvenience to project;
- 2: delay to project, or minor cost overrun;
- 3: serious delay to project, or major cost overrun;
- 5: termination of project;

In SNOLAB Assessments, mitigation strategies affect the likelihood only.
Hazard management processes have been completely rewritten to adopt an integrated process across SNOLAB. Intent is to thread hazard assessment throughout the organisation to capture and mitigate appropriate levels of hazard and threats.

Facility hazard analysis connects top-down and bottom-up hazard analyses:

- **Task Hazards**: completed for specific tasks that are deemed high risk by supervisors, managers or staff
- **Job Hazards**: what hazards are each job holder exposed to?
- **Area Hazards**: what unique hazards are people exposed to within a specific area of the facility
- **Experiment Hazards**: what hazards do the experiments introduce?
- **Facility Hazard Register**: compilation of hazards within the facility across broad categories
Hazard Analyses

103 Hazards actively tracked

Categories of Hazards reviewed during the analysis:
- Asphyxiant/ODA
- Biological
- Chemical / Toxic
- Cryogenic/Gas
- Electrical / HV
- Fire / Explosive
- Flood / Water
- Mechanical / Physical
- Pressure / Vacuum
- Radiation / Laser / Calibration
- Vibration / Noise / Seismicity
- Physical Bodily Harm
Risk Management

SNOLAB has connected Strategic Plan objectives to day-day operations through Facility Business Plan

Risk management supports delivery of Strategic goals
- Defines prioritisation of tasks and time
- Maintains quality of facility and research programme

Facility risk assessment process is currently top-down
- Risks identified and monitored through discussion with Strategic Risk Group and Managers
- Organisational restructuring in progress with additional Associate Director position to provide support

Project risk register maintained by SNOLAB Director
- Monthly(ish) review and re-evaluation, updates to Board meeting quarterly
Risk Analyses

97 Risks actively tracked

Categories of Risks reviewed during the analysis:
- Facility Governance
- Facility Management
- Financial
- Staff
- Environment
- Reputational
- Opportunities
List of all risk areas tracked

- 1.1 SNOLAB Institute governance
- 1.2 SNOLAB Facility governance
- 1.3 Relationship with host
- 1.4 Relationship with funding agencies
- 1.5 Relationship with Canadian physics and science communities

- 2.1 SNOLAB Facility management
- 2.2 SNOLAB Quality management
- 2.3 SNOLAB Experiment interactions
- 2.4 Review of management practices

- 3.1 Federal funding and income
- 3.2 Provincial funding and income
- 3.3 University funding and income
- 3.4 Industrial funding and income
- 3.5 Experimental programme funding and income
- 3.6 Facility insurance
- 3.7 Facility financial management

- 4.1 SNOLAB Directorate, Management and Professional Engineers
- 4.2 SNOLAB Strategic Risk and Core Services
- 4.3 SNOLAB Supervisors
- 4.4 SNOLAB Research Team
- 4.5 SNOLAB Staff
- 4.6 Unionised staff
- 4.7 Contract staff
- 4.8 Visiting scientists and experimental teams

- 5.1 Environment, Health and Safety
- 5.2 Security
- 5.3 Access to Creighton
- 5.4 Act of God

- 6.1 Bad publicity
- 6.2 Scientific Programme

- 7.1 Positive publicity and outreach
- 7.2 Support of underground science community
- 7.3 Support of Major Infrastructures for Science, Technology and Innovation
- 7.4 Additional research programmes
- 7.5 Engagement with Vale
What’s the point?

Thread EH&S and Quality throughout the organisation

- Hazard analyses are used to get staff and users to think before working.
- Review of task, job or experiment
- Identification of potential hazards
- Development of mitigation strategies before a task is undertaken, or before an experiment comes to site

Hazards analyses are essential for dialogue with stakeholders

- In an operational mine potential liability is $3M/day if mine production is halted due to SNOLAB operations
- Development of insurance requires full hazard analyses

Risk analyses are essential for dialogue with stakeholders

- Definition of facility business plan with SNOLAB Board and funding agencies

Risk analyses guide prioritisation of work

- Connect day to day operations with high level objectives and mitigation of associated risks
- Delivery of high quality research requires attention to open risks