

HAZARD ALERT

Muck ejection or rapid run of material from the brow of a partially empty blasthole stope

When can muck ejection or rapid runs of material happen?

An uncontrolled muck ejection – or a rapid slide or run of material at the brow – can be triggered by a fall of ground in a partially mucked out stope. This is a low-frequency, fairly high-consequence potential hazard that can occur in underground mines where long blasthole stoping or similar mining methods are used and remote mucking is implemented. Hazards can exist in accessible mine working areas where remote mucking of long blastholes stopes are conducted.

- High velocity muck ejection occurs from the stope brow into the draw crosscut due to a fall of ground inside a partially mucked out non-entry stope, which could strike the remote stand with the operator on it or workers walking within the access drift, or the “safe zone” in the draw crosscut.
- There is a rapid slide of muck down the slope of the muck pile toward the brow, which has potential to strike the scoop.
- A large boulder from a fall of ground hits the scoop bucket during mucking operations near the brow, resulting in lifting of the rear end of the scoop, which can hit the remote stand with the operator on it when the scoop suddenly drops.

Why do muck ejection or rapid runs of material in stopes happen?

Critical or fatal injury of workers – or damage to scoops in underground mines – can occur when muck is ejected or rolls out unexpectedly from the brow of partially empty stopes as a result of a fall of ground inside a long blasthole stope or similar opening.

When a blasthole stope is partially empty, the angle of repose of the muck pile inside the stope is sloping towards the brow. The main force causing ejection of material out of the brow of a partially empty blasthole stope into the draw crosscut and the unrestricted access drift is the velocity of material from a toppling failure or fall of ground that occurs at the hangingwall of the stope. The higher in elevation of the source and the larger the size of the fall of ground from the hangingwall of the stope, the higher the velocity of the broken material that can be ejected from the stope brow into the draw drift or crosscut when the material hits the slope of the muck pile.

Incidents of this nature can cause injury to the operator at the remote stand or to workers walking down the unrestricted access drift. It can also cause damage to the scoop.

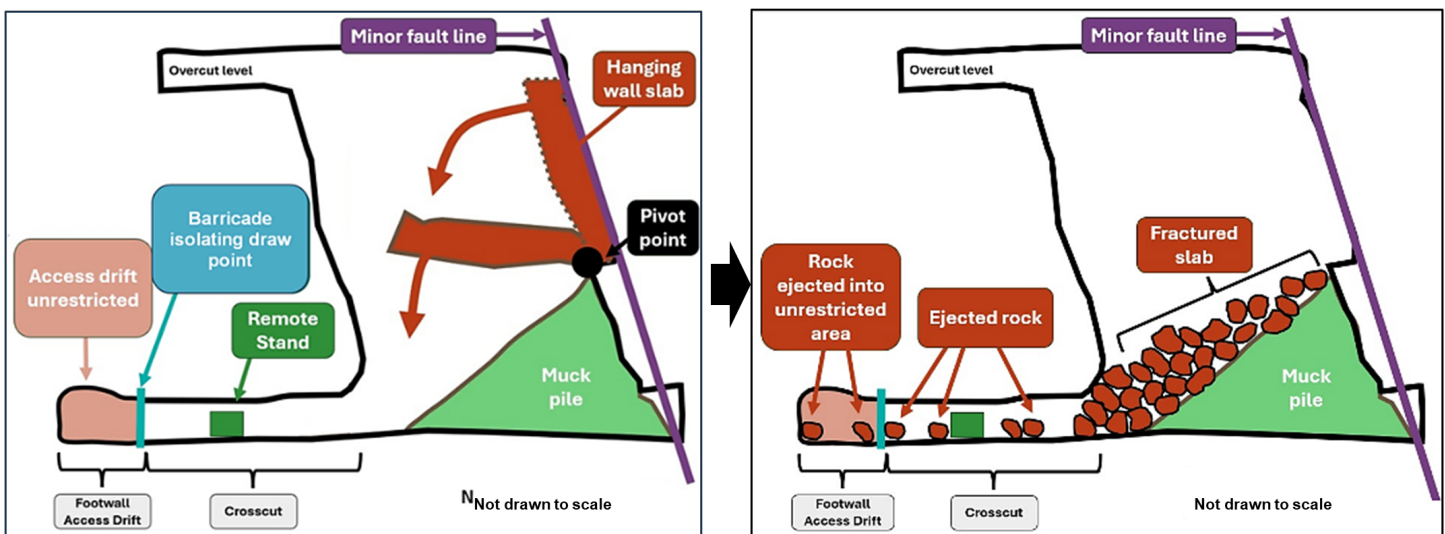
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Large boulders fractured during the fall of ground can slide rapidly on the slope of the muck pile during remote mucking operation, striking the scoop bucket. This can cause the rear portion to lift as the scoop pivots on the front tires and drops suddenly onto the remote stand when a boulder falls on the bucket.

Reportable fall of ground in stope causing muck ejection or a rapid run of material incident

A long blasthole stope was being mucked out remotely when a fall of ground occurred inside the non-entry stope. The fall of ground in the steeply dipping stope was initiated by the presence of a planar geological structure parallel to the strike length and dip of the inclined and undercut stope hanging wall. As the stope was mucked out and the level of the blasted muck pile in the stope was reduced, the confinement of the hanging wall was diminished, and the resulting angle of repose of the muck pile sloped toward the brow. When the stope was partially empty and the passive support on the hanging wall was reduced sufficiently, the undercut slab formed by the geological structure toppled and fell at high horizontal velocity on the slope of the muck pile. The rotational failure of the slab caused the material to fracture into various sizes as it hit the slope of the muck pile at the bottom of the stope. Some smaller material was ejected from the brow into the crosscut, ultimately coming to rest in the access drift, in excess of 30 meters from the brow of the stope. The release continued until the brow choked with large blocks.

Historically, incidents related to the ejection of material have caused reportable worker injury to the lower extremities. These can occur if prevention strategies are not in place. The lifting and sudden drop of the rear portion of the scoop when a large boulder rolls on the bucket during mucking operations can also cause serious injuries if controls are not implemented.



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Legislation

- **Sections 5.1, 5.2, and 5.3 of Regulation 854** (risk assessment and management) require employers to conduct risk assessments to identify and manage hazards, and to develop procedures to eliminate or control risks associated with material movement.
- **Section 6. (2.1) of Regulation 854** stipulates that mine design is to be based upon sound geotechnical engineering practices.
- **Section 84. of Regulation 854** requires the following when workers are in areas affected by this hazard:
 - **Subsections (1) and (2):** Ensure that written procedures are prepared;
 - **Subsection (3):** Workers are prohibited from being positioned where access to an exit from the area may be blocked by an uncontrolled run of material, water or slime;
 - **Subsection (4):** Mechanical locking devices must installed to operate chute gates;
 - **Subsection (5):** Design and installation of power-operated safety guard or gates is required to minimize hazards in the event of power failure.

Resources for dealing with runs of material

Best Practices for Assessing Ground Control Hazards in the Workplace: This guideline is designed to assist employers, workers, and other workplace parties with understanding the requirements in Regulation 854 (Mines and Mining Plants) regarding ground control.

Reference Document for Developing a Trigger Response Action Plan (TARP): This document contains information to assist mining operations with developing a plan for high-stress and seismically active conditions in accordance with Section 71.1 of Regulation 854 (Mines and Mining Plants).

How Workplace Safety North can help

As the health and safety association for Ontario's mining sector, Workplace Safety North offers confidential support to Ontario mines, including:

- Health and safety training
- Downloadable, fillable resources
- Risk assessment assistance
- Safety audits
- Consultations

For more information, **contact your local health and safety specialist.**