# Loose Scaling in Underground Mines

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## Introduction

Loose scaling is a critical ground control practice in underground mining, aimed at ensuring the safety of workers and the stability of excavations. It involves the identification and removal of loose, fractured, or unstable rock from the backs (roof), ribs (walls), and faces of underground openings. Failure to perform effective scaling is a leading contributor to rockfall incidents, which remain one of the most serious hazards in underground mines.

## What Is Loose Scaling?

Loose scaling is the deliberate removal of rock that is no longer securely attached to the surrounding rock mass. Such rock may appear intact but can detach unexpectedly due to gravity, blasting vibrations, stress redistribution, or weathering. Scaling is typically performed using hand-held scaling bars, mechanized scaling equipment, or a combination of both, depending on ground conditions and mines design.

## Causes of Loose Rock in Underground Mines

Loose rock can develop for several reasons, including:

1. **Blasting Effects**: Poor blast design or excessive explosive energy can fracture the surrounding rock, creating unstable slabs and wedges.
2. **Geological Discontinuities**: Faults, joints, bedding planes, and foliation can weaken rock mass cohesion, increasing the likelihood of detachment.
3. **Stress Redistribution**: Mining activities alter in-situ stresses, potentially causing rock deformation, spalling, or slabbing.
4. **Weathering and Water Ingress**: Moisture can weaken rock strength over time, especially in clay-rich or highly fractured formations.
5. **Vibration and Equipment Movement**: Repeated vibration from machinery or nearby blasts may dislodge previously stable rock.

## Importance of Loose Scaling

Loose scaling plays a vital role in underground mine safety and productivity:

- **Prevention of Rockfall Accidents**: Removing loose rock significantly reduces the risk of injury or fatality from falling material.
- **Protection of Equipment and Infrastructure**: Rockfalls can damage machinery, ground support systems, and ventilation controls.
- **Improved Working Conditions**: Clean, stable excavations enhance visibility, access, and overall operational efficiency.

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- **Regulatory Compliance**: Most mining regulations require regular inspection and scaling of underground openings.

**Methods of Loose Scaling**

1. **Manual Scaling:** Manual scaling is commonly performed using steel scaling bars of varying lengths.

**Advantages:**

- High level of control
- Effective in tight or irregular spaces
- Low equipment cost

**Limitations:**

- Exposes workers to close-proximity hazards
- Physically demanding
- Less effective for large or high backs

2. **Mechanized Scaling:** Mechanized scalers use hydraulic booms fitted with scaling tools to remove loose rock from a safe distance.

**Advantages:**

- Improved worker safety
- Greater reach and productivity
- Suitable for large openings

**Limitations:**

- Higher capital and maintenance costs
- Requires trained operators
- Limited access in narrow headings

**Safe Loose Scaling Practices**

To ensure effective and safe scaling, the following best practices should be followed:

- **Conduct Thorough Inspections**: Inspect the ground conditions before, during, and after scaling. Look for cracks, drummy sounds, or visible separations.
- **Scale from a Safe Position**: Always stand under supported ground and scale from the perimeter toward the centre.
- **Use Appropriate Tools and PPE**: Proper scaling bars, hard hats, eye protection, gloves, and steel-toe boots are essential.
- **Maintain Clear Communication**: Ensure nearby workers are aware of scaling activities and keep the area barricaded if necessary.
- **Never Scale Unsupported Ground Alone**: Scaling should be done with supervision and in accordance with mines procedures.

**Integration with Ground Support**

Loose scaling does not replace ground support but complements it. Scaling should always be performed before installing rock bolts, mesh, or shotcrete. Even after support installation, ongoing scaling may be required as ground conditions change. Regular re-scaling is especially important in high-stress or weak rock environments.

**Training and Competency**

Loose scaling is a fundamental component of underground mine safety and ground control. Effective loose scaling depends mainly on proper worker training and experience. Workers must know how to identify loose or unstable rock and understand the safest way to remove it. With good training, they can use scaling tools correctly, follow safe work procedures, and recognize dangerous ground conditions early. Experienced and well-trained workers help reduce rockfall risks and make underground workplaces safer for everyone.