How to scale loose rock in an underground mine: safety procedure

This procedure explains how to scale loose rock in an underground mine. Scaling removes loose material from the roof, back, face, and ribs of an underground work area. You can use it as a reminder of the essential safety procedures and common-sense practices for working where scaling is routine. Whether scaling is your assigned job or you work in an area that requires it, always scale the right way and the safe way.



A wide view of an underground mine room with a pile of loose material at the far end. An inset shows a miner with a headlamp and glasses watching for hazards during the inspection.

Purpose

This procedure covers scaling and roof control in underground work areas, including the roof, back, face, and ribs. It applies to hand scaling with a pry bar and to mechanical scaling with reach machines such as the Gradall scalers shown in the work area.

The safety objective is to protect you and your coworkers. Strict adherence to roof control procedures is critical, because your life may depend on it. Treat roof hazards with the utmost seriousness and never take shortcuts.

Remember that machines can be repaired if falling rock damages them, but people cannot be replaced. Supervisors and team members must put human safety above all else.



A large yellow Gradall machine extends its arm toward the mine roof underground. Red paint marks on the rock show hazardous areas.

Hazards

Scaling areas contain several hazards. Identify each one before you start work.

Ground control hazards

- Loose material on the roof, back, face, and ribs can fall.
- Small loose stones or unstable material on the roof, ribs (side walls), and face (end wall) can be a hazard.

- Cracks, unusual formations, or discolorations in the roof can indicate instability.
- Falling debris and possible flying chips can injure your head and eyes.
- No perfect method exists for judging the stability of loose rock, so stay cautious and conservative.
- A rock that cannot be pried loose may still fall. Do not assume loose rock will hold for the duration of a short job.



A mine foreman in a striped shirt and hard hat holds a flashlight and inspects the rock face. Red paint markings are visible on the wall behind him.

Mobile equipment hazards

Scaling is typically performed in underground environments with heavy machinery present. Watch for loaders and trucks operating in the area. Stay alert to moving equipment, keep a safe distance from moving machinery, and keep clear communication with operators.



Two workers in hard hats stand in front of a large yellow XL 5100 reach machine in an underground mining area. One worker points while giving instructions.

Other hazards

- Working from a reach machine or lift creates a fall risk. Use a safety line, as described in Pre-task checks.
- Wet conditions require rubber boots.
- You must confirm the atmosphere is safe for workers before you proceed.
- Roof conditions can change, especially after scaling or blasting operations.
- Explosives handling, electrical hazards, and fatigue are not covered in the source material. Add site-specific controls for them here.

Responsibilities

Each role carries specific duties during scaling and roof control.

- **Supervisor or foreman:** Assess the work area before sending personnel inside. Decide whether hand scalers, mechanical scalers, or haulage equipment are needed. Personally investigate reported roof hazards, often by entering a basket to inspect the roof directly. Prioritize human safety above all else.
- **Scaler operator and hand scaler:** Inspect your tools and equipment before use. Wear all required PPE, follow the scaling sequence, and report questionable roof conditions immediately. Confirm you are qualified and trained for the equipment before you perform a pre-operation inspection.
- **Loader operator:** Do not advance beyond the painted line when loading out from the face.
- **Roof technician:** Regularly check roof movement indicators for signs of instability.
- **Spotter:** The source material does not assign a spotter role. Define spotter duties here, such as keeping people and equipment clear during scaling.
- **Maintenance:** The source material does not assign maintenance duties beyond operator walk-around checks. Define repair and defect-reporting responsibilities here.
- **Control room:** The source material does not mention a control room. Define communication and notification responsibilities here.

- **All personnel:** Talk to coworkers and pass critical roof information to the next shift.



A loader dumps material into a large truck inside an underground mining tunnel. Both vehicles are lit, and the tunnel is rocky and enclosed.

Pre-task checks

Complete these checks before you scale loose rock in an underground mine.

Permits and communication

The source material does not mention permits. List any site permits required for scaling here.

Communicate with coworkers before and during the task, and stay alert to moving equipment such as loaders and trucks.

Personal protective equipment

Wear all required PPE before you enter a scaling area:

- Hard hat, which protects your head from falling debris. A hard hat with a headlamp is expected.
- Safety glasses, which protect your eyes from possible flying chips.
- Gloves, which protect your hands and improve grip.
- Steel toe shoes, which protect your feet.
- Rubber boots, which are recommended for wet conditions.

- Hearing protection.



A worker in a hard hat with a headlamp, safety glasses, and gloves adjusts his safety glasses to show proper PPE use.



A gloved hand attaches a safety line to a metal mesh barrier, showing the correct way to secure it.

Safety line

Use a safety line when you operate or work on any type of reach machine. Inspect the line for damage or wear before use. Then attach it properly to a secure anchor point on the equipment or structure.



A worker in gloves holds a safety line and prepares to attach it, inspecting and handling the fall protection equipment.

Hand tool condition

Examine your pry bar for damage, cracks, or excessive wear and tear. Do not use a damaged or worn pry bar for scaling.

Mechanical scaler inspection

Before you operate a mechanical scaler, ask yourself two questions. Are you qualified to perform the inspection? Have you been properly trained for this equipment?

Then complete a thorough walk-around inspection:

- Check for worn hoses or bad couplings.

- Make sure all lights are clean and functional.
- Inspect tires for damage or excessive wear.
- Assess the overall cleanliness and housekeeping of the scaler.

Verify the cab and emergency equipment:

- Make sure the windows are clean for maximum visibility.
- Confirm that emergency equipment, such as fire extinguishers, is present and in operating condition.
- Check that the windshield wipers and lights work properly.



A worker in a yellow hard hat and green plaid shirt inspects a large yellow Gradall XL 5110 scaler before an operation check.

Before you start your shift, turn on the scaler and verify that all lights and windshield wipers operate correctly.



A worker inspects the front lights of a Gradall XL 5110 scaler to make sure they are clean and working.



A worker in a yellow hard hat climbs into the cab of a Gradall scaler. A fire extinguisher and a DANGER sign are visible inside the cab.



Front view of the scaler with protective mesh over the cab and its headlights on, showing the machine is powered up and the lights work.

Work area examination

Begin your pre-shift examination early. For example, arrive before the shift starts, such as at 5:00 AM. Start at the last intersection (outby) and work your way in, examining each room. Look for cracks or hazards from multiple angles, not just from one direction.



Close-up of a worker's black rubber boots with steel toe caps on a rocky underground floor.

Enter the work area and visually inspect the environment before you send personnel inside. Determine whether it is safe and what equipment is required.

Inspect for downed sensors and loose material:

- Look for any sensors that are not functioning or have fallen.
- Examine the roof, ribs, and face for small loose stones or unstable material.

After you check the faces, continue to inspect runways and escape ways for hazards.

Pre-shift examination is a continuous process. Remain vigilant throughout the entire shift. Repeat your checks as people move into new rooms or face areas. Approach each task with safety as your top priority.



A miner with a hard hat, headlamp, and safety glasses looks upward, ready to examine the work area for hazards.

Barricades

The source material describes barriers and berms for unsealed or hazardous areas. See "Block off unsealed or hazardous areas" in Safe work steps.

Safe work steps

Follow these steps in order to scale loose rock in an underground mine.

Examine and mark the roof

1. Inspect the mine roof for hazards. Use a flashlight to closely examine the roof surface for cracks, loose rock, or other signs of instability.

Look for unusual formations or discolorations that may indicate a hazard.

2. Mark hazardous areas on the roof. Use red spray paint or a similar marking tool to clearly indicate areas of concern. Draw lines or symbols directly on the rock to alert others to the hazard.
3. Report questionable roof conditions immediately. If a stone or section of roof looks unstable or questionable, notify your supervisor without delay. This is a stop-work condition. Do not attempt to address the hazard alone, and follow established reporting protocols.

4. Have the supervisor investigate in person. The supervisor enters the work basket and inspects the marked area up close to assess the risk. Use appropriate safety equipment and procedures during the investigation.



A miner's hand holds a flashlight and lights a section of the mine roof marked with a red painted line at a potential hazard.



A miner marks the mine roof with red spray paint, making a visible warning line and symbol on the rock. The miner wears a helmet and uses a flashlight.



Two miners in yellow helmets stand in a raised work basket and inspect and mark a hazardous area on the mine roof with red paint. A large work light is nearby.



A supervisor in a yellow helmet sits in a work basket near the marked hazard on the mine roof. A work light illuminates the area.

Test the roof

5. Understand the limits of hazard detection. No perfect method exists for judging the stability of loose rock. Use all available tools and experience, and remain cautious and conservative.
6. Physically test suspect areas. Use a scaling bar or similar tool to gently probe or tap the roof. Listen for hollow sounds or movement that may indicate loose rock. Watch for dust or debris that falls as a result, because it may signal instability.
7. Assess the roof by sound and by sight. Tap the roof and listen for the difference. A solid, stable roof produces a clear, solid ring. A loose or unstable roof gives a dull, "drummy" thud. Do not rely on sound alone, because visual inspection is also critical.
8. Visually confirm the roof after testing. Examine the probed area for visible changes, such as cracks widening or rock shifting. Make sure all loose material is identified and marked for removal or further action.

9. Document findings and communicate with the team. Record all observations, actions taken, and hazards identified in a logbook or reporting system. Discuss your findings with supervisors and coworkers so everyone knows the current roof conditions.



A miner with a headlamp uses a long tool to tap or probe the mine roof and check for loose rock in a dark, rocky area.



Close-up of a scaling bar probing a suspect area of the mine roof, with visible dust and rock fragments.



Close-up of a tested area on the mine roof showing exposed rock and possible loose material. Part of a miner's helmet is in the foreground.



Two miners stand underground. One writes in a notebook while the other watches. Mining equipment is visible in the background.

Scale the loose rock

10. Follow the correct scaling order. Scale the roof first, then the ribs, and finally the face. This sequence minimizes the risk of dislodging material onto yourself or others.

11. Use proper technique when you hand scale. Hold the blunt end of the pry bar to the side of your body. Position yourself so the bar will not strike you if the rock moves unexpectedly. Push upward rather than downward when you use the bar.



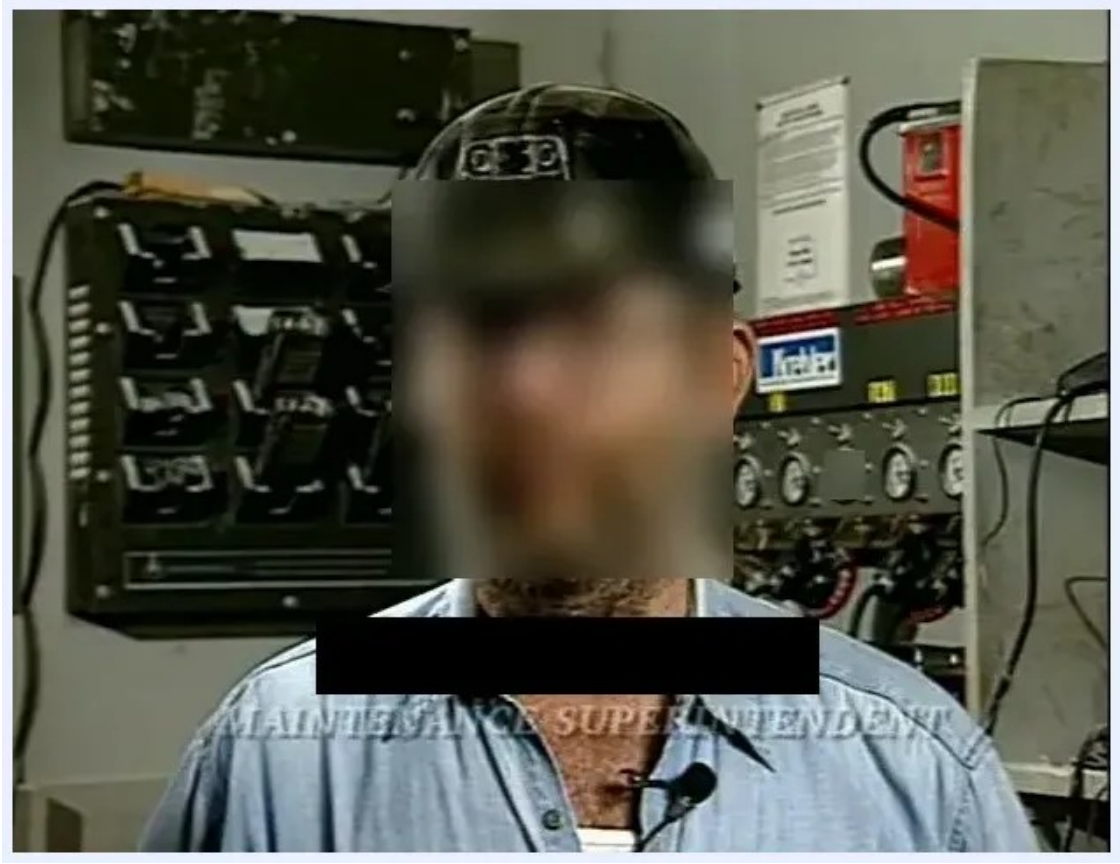
Two workers on a mechanical lift platform in an underground mine. One uses a long pry bar against the rock face to show proper hand scaling technique.

12. Remove loose rock with appropriate equipment. Operate mechanical scaling equipment or other machinery to safely dislodge and remove loose rock from the roof. Keep a safe distance and make sure all personnel are clear of the area during scaling operations.
13. Keep watching as the work proceeds. Close-up work with the scaler arm and head against the roof is an ongoing process of removing loose rock.
14. Mark hazardous areas by hand when necessary. If mechanical scaling is not possible or safe, mark hazardous roof areas manually with paint or chalk. Make sure the markings are clear and visible to all personnel.

15. Mark scaled areas with a dated line. After you scale, draw a visible line on the roof and ribs and date the mark. Instruct loader operators not to advance beyond the painted line when they load out from the face. This ensures that equipment and personnel access only areas confirmed as safely scaled.



Close-up of a mine foreman wearing a hard hat with a headlamp and glasses. The text "MARK McDOWELL MINE FOREMAN" is displayed, reinforcing the importance of continuous vigilance.



Two workers in yellow hard hats stand on a mechanical lift platform and use long scaling bars to scale the roof and ribs of an underground mine.



A large piece of yellow mechanical equipment with an extended arm scales loose rock from the mine roof in a dark, rocky area.



Close-up of the mechanical scaling equipment's arm and head in contact with the mine roof while it removes loose rock.



A close-up of a yellow mining machine (Gradall) with its arm extended to the mine roof. Red paint marks are visible on the rock, indicating hazards. The machine is actively engaged in scaling or roof control work.

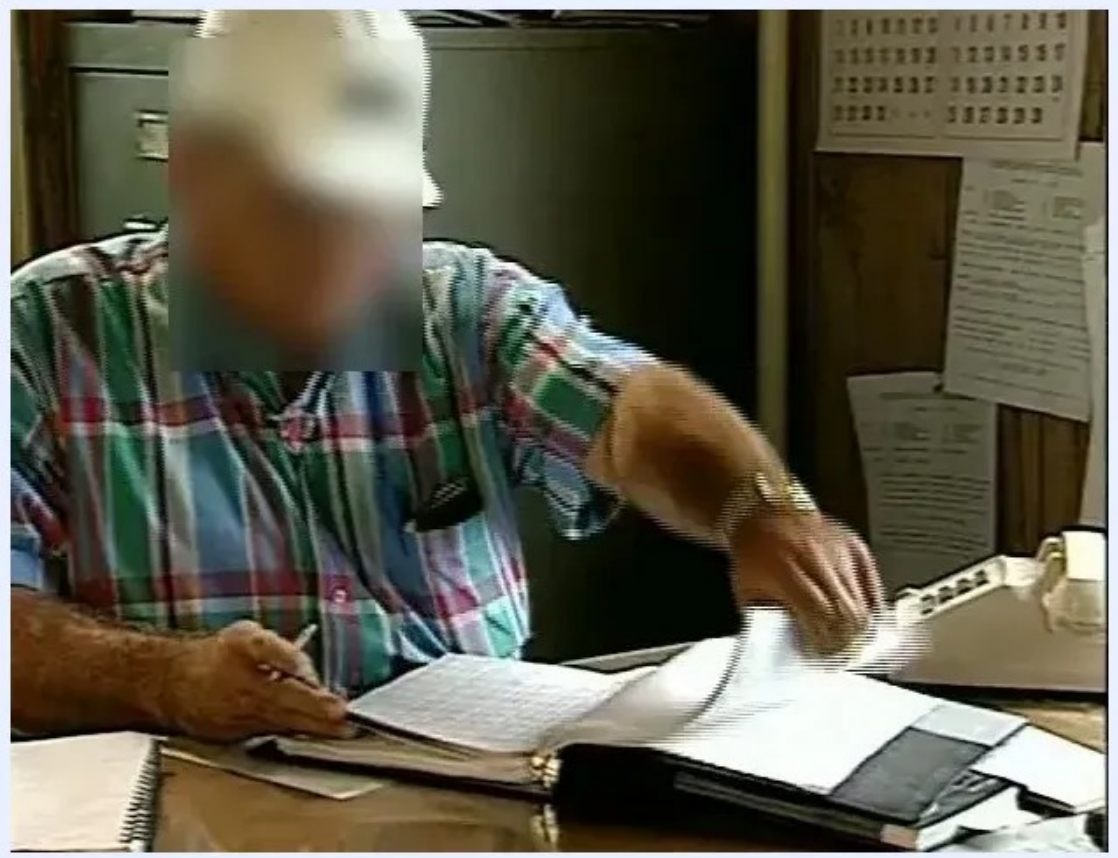


Close-up of the Gradall machine's tool in contact with the mine roof, showing close-up marking and inspection of hazardous areas.

Control access and monitor movement

16. Block off unsealed or hazardous areas. Use barriers, berms, or other clearly marked indicators to warn personnel of unsealed or unsafe zones. Make the warnings visible and robust enough to prevent accidental entry.
17. Install and monitor sensors in hazardous areas. Place sensors at designated points to detect movement or instability in the mine roof or walls. Anchor them securely and position them for maximum effectiveness.
18. Monitor roof movement with visual indicators. Use devices with flags or markers that drop if any movement occurs between the anchor points, typically 4.5 to 5 feet apart from bottom to top. Assign a roof technician to check these indicators regularly for signs of instability.

19. Inspect and handle the indicators carefully. Examine each device closely to make sure it works and is properly installed. Check for any signs of movement or tampering.



A large loader bucket filled with rocks sits in an underground mine, used to build a berm or barrier that blocks off an area.



Three miners in yellow hard hats stand in front of a large pile of rock debris underground. A yellow barrier with reflectors restricts access across the area.



A roof technician stands underground in a hard hat with a headlamp and safety glasses and points upward at a roof movement indicator device.



Close-up of a miner's hand holding a red roof movement indicator device with a white rod during a careful inspection.

Keep working safely

20. Keep monitoring and reassessing the roof. Inspect the roof regularly for new hazards, especially after scaling or blasting operations. Use your knowledge and experience to detect unstable conditions, and act promptly.
21. Never assume a rock is safe. Do not assume a rock will not fall just because you cannot pry it loose. Avoid guesswork, and do not presume loose rock will hold for the duration of a short job.
22. Use a systematic procedure on every job. Apply a consistent and thorough safety protocol. Your ability to detect unstable conditions is vital, because your safety depends on it.
23. Inspect each new work area visually. Before you start work in a new area, check carefully for signs of instability or hazards.
24. Put people ahead of equipment. Wear all required PPE, including a hard hat with a headlamp and hearing protection. Approach every task with safety as your top priority.

25. Communicate changing conditions. Talk to coworkers and pass critical information about roof conditions and hazards to the next shift. Make sure everyone knows of any changes or new risks in the work area.
26. Hold face-to-face discussions at the worksite. Point out hazards and review safety measures with your team.

27. Review safety procedures with coworkers underground. Review notes, share findings, and reinforce safety protocols at the worksite. Make sure all personnel understand current roof conditions and any new hazards.



A miner in a yellow hard hat with a headlamp and ear protection works near a large piece of mining equipment and focuses on the equipment.



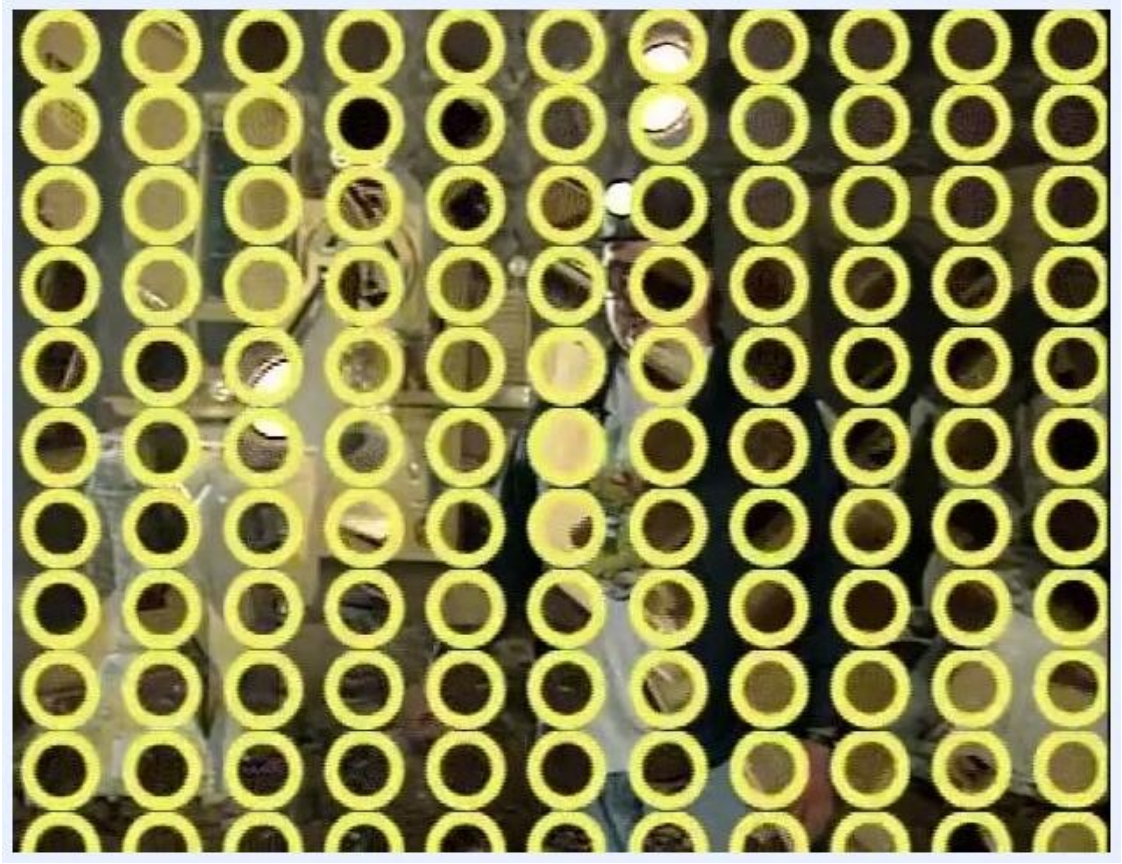
A yellow Gradall machine is positioned against the mine wall in a dusty, rocky area.



Two miners in hard hats stand in front of a Gradall machine underground. One gestures toward the roof while discussing hazards or procedures.



Two miners, one in a yellow hard hat and one in a white hard hat, stand together underground. One holds a notepad.



A miner underground, partly covered by a grid of yellow safety circles that stress safety barriers and inspection. The miner wears a hard hat with a headlamp.

Emergency response

The source material does not cover evacuation routes, muster points, first aid, rescue contacts, or incident notification. Document those site-specific arrangements here.

The source material does give these instructions for roof concerns:

- Report any question or concern about roof control or scaling to your supervisor immediately.
- Supervisors are experienced and will personally investigate questionable areas, often using a basket to inspect the roof directly.
- Check that fire extinguishers and other emergency equipment on the scaler are present and in operating condition before you start your shift.

Records

Keep a mine log book of roof control activities. Record these items:

- Areas that have been scaled.
- The personnel involved.
- The date and time of scaling.
- The equipment used and its location.
- Who performed the roof control work, what actions were taken, where and when the work occurred, and why specific actions were necessary.

Use these records to track safety actions and inform future shifts. Refer back to them to answer questions about past activities.

Record the specific machines used for scaling and their current locations in the mine. Make sure all team members are accounted for and aware of equipment positions.

You can access the log books without going underground. The mine office is typically near the main site entrance and is marked by utility vehicles and signage.

In the office, sit at the desk and use the log book to record or review roof control details.

Keep records organized and up to date. Flip through the log book to find previous entries or to add new information. Make sure every record is clear, complete, and accessible for future reference.

Record new roof control activities as they occur. Write detailed notes that include all relevant information about the work performed, and double-check entries for accuracy and completeness.

Record safety observations underground as well. Use a notepad to document roof conditions, hazards, and any actions taken. Wear all required PPE, including a yellow hard hat with a headlamp, while you make these observations.

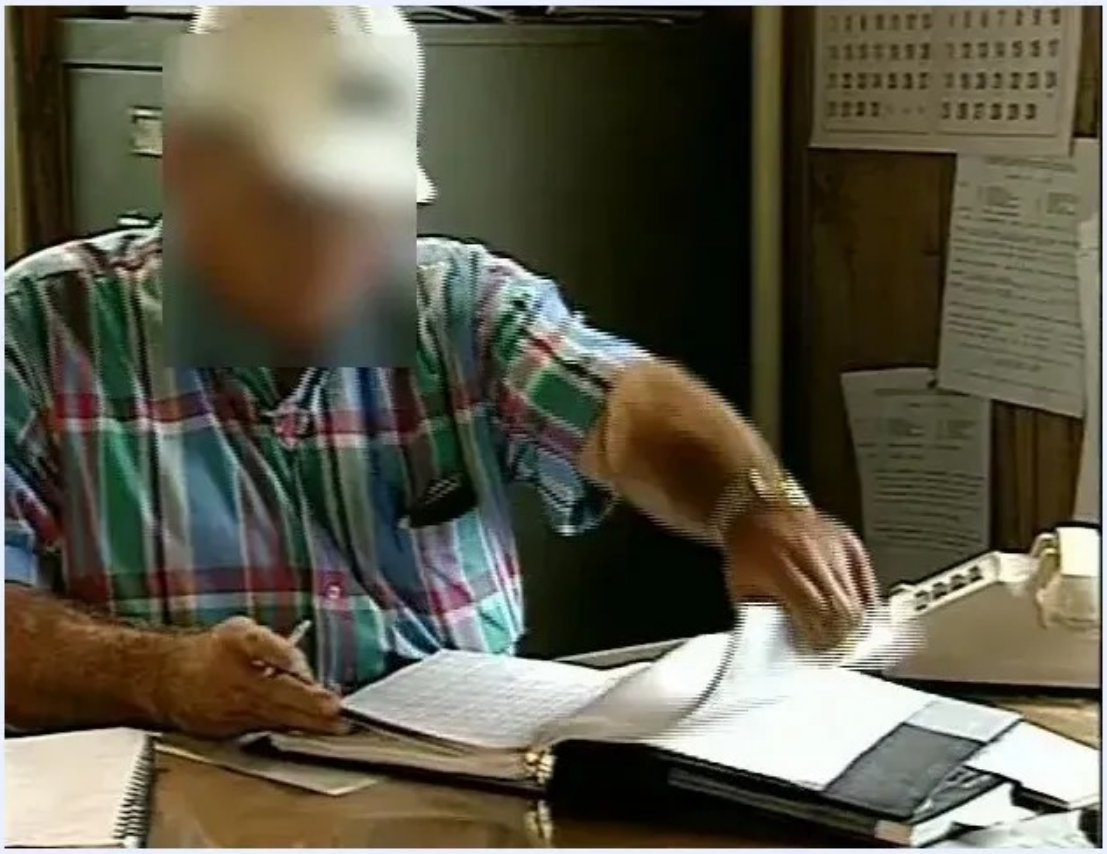
The source material does not specify form numbers or a retention period. State the required forms and retention period for your site here.



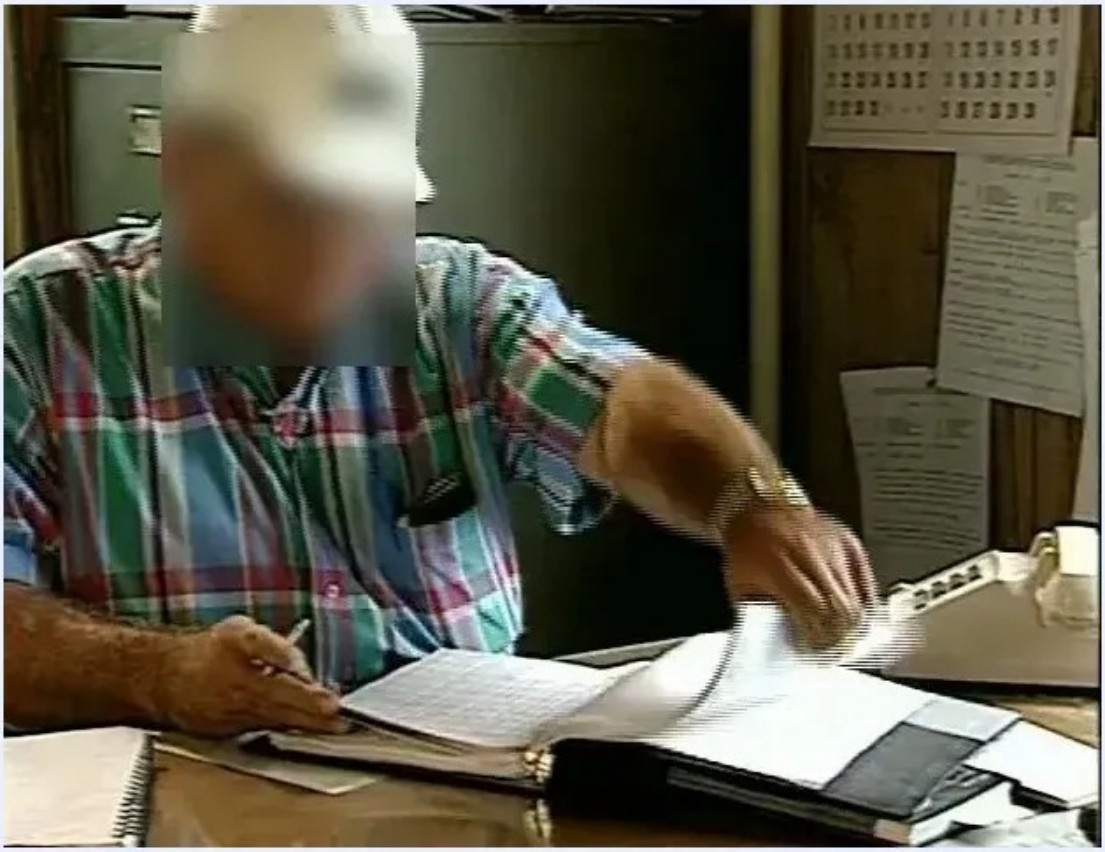
A supervisor sits at a desk in an office with paperwork, a calendar, and a telephone. His white hard hat and glasses stress documentation and record-keeping.



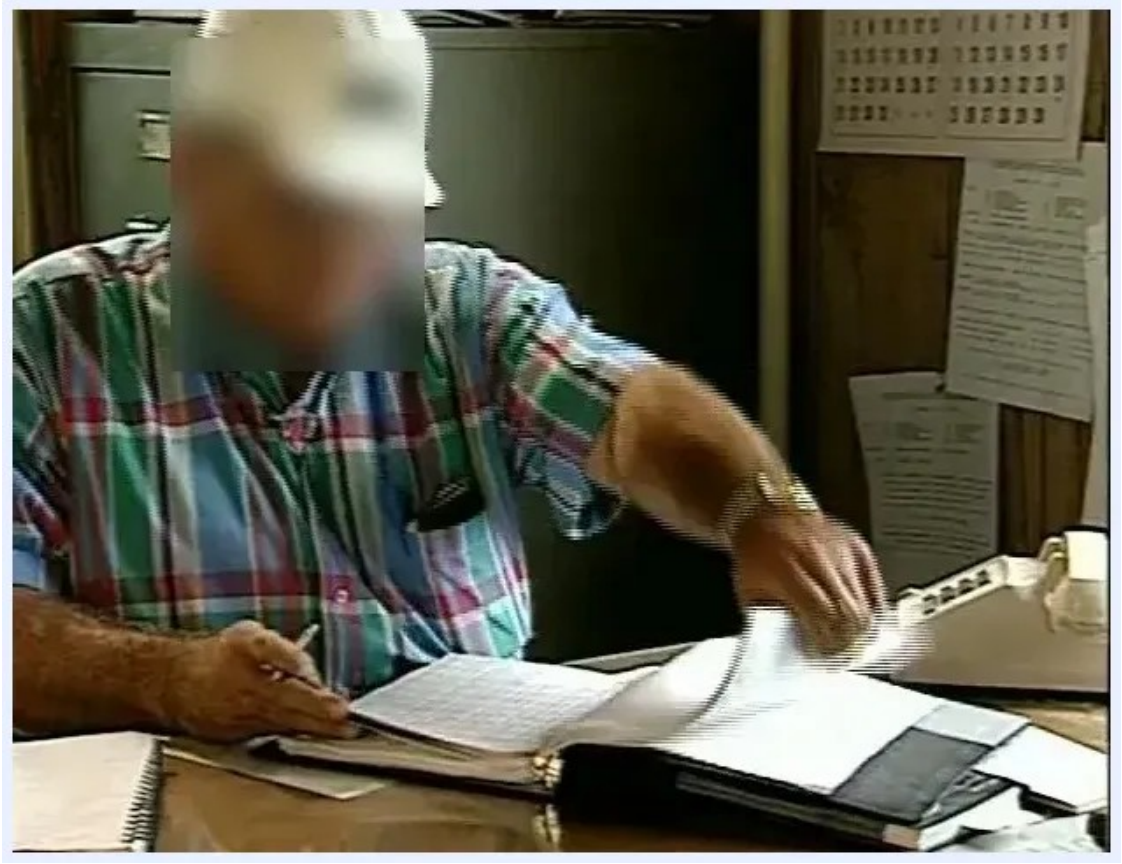
Two miners in yellow hard hats stand next to a large piece of mining equipment with heavy-duty tires, labeled 988B, underground. One looks up, possibly inspecting the roof.



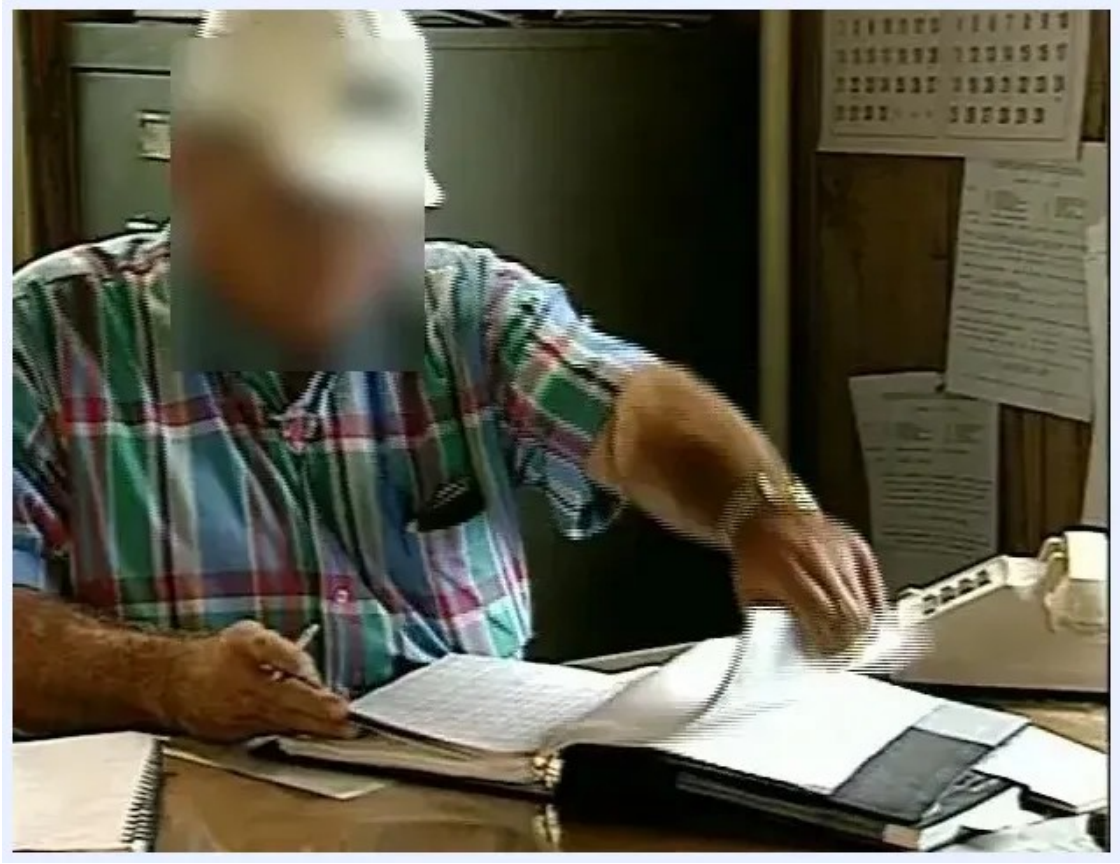
A person in a plaid shirt and white hard hat approaches a small office building at a mining site. Two trucks are parked nearby, and a sign is visible near the entrance.



A supervisor in a plaid shirt and white hard hat sits at a desk in a wood-paneled office and writes in a large log book. A telephone, calculator, binder, and paperwork are on the desk.



A supervisor in a white hard hat flips through pages of a large log book at a desk surrounded by paperwork and office equipment.



A supervisor in a white hard hat writes in a large log book at a desk. Office supplies and paperwork are visible.

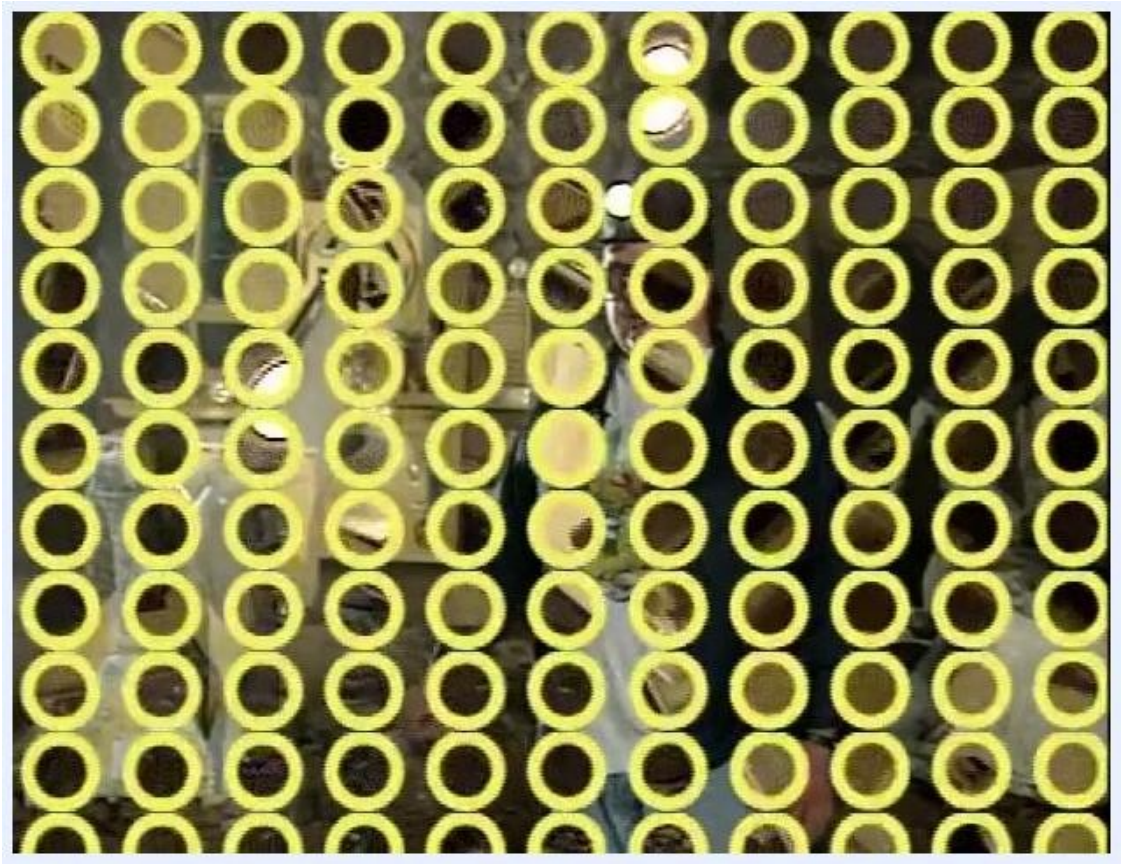


A miner in a yellow hard hat and green uniform writes in a notepad underground. A green circle highlights the notepad to show the importance of documentation.

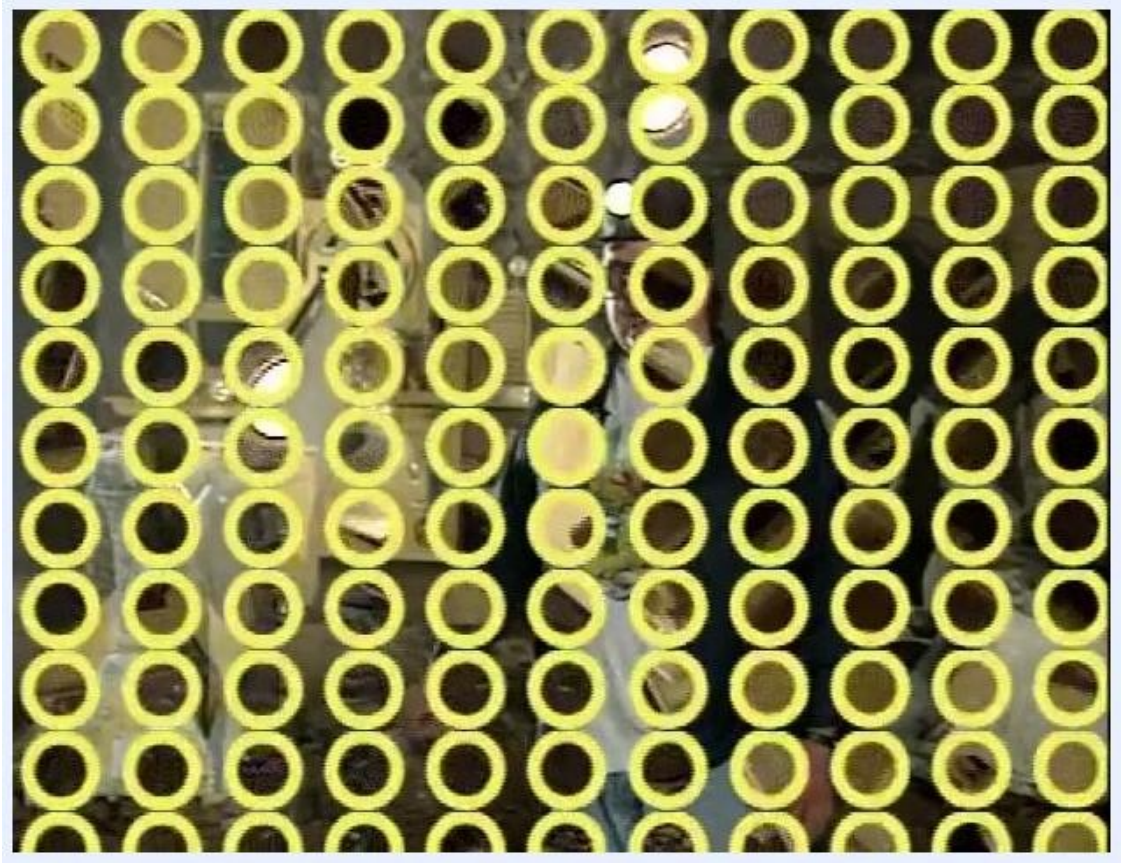
What's next

- Follow your mine's specific roof control plan and reporting procedures. Never rely on guesswork. If in doubt, report and investigate all questionable roof conditions.
- Align all procedures and training with the guidelines of the Mine Safety and Health Administration (MSHA), which oversees and enforces mine safety standards.

- Add site-specific permits, emergency arrangements, and record retention requirements to the sections marked above.



A blue screen with white and green text reading "SPECIAL THANKS TO: -THOMASVILLE STONE AND LIME -DAVISON SAND AND GRAVEL -LATROBE CONSTRUCTION -PENNSYLVANIA DEPARTMENT OF DEEP MINE SAFETY".



A blue screen with bold text reading "MINE SAFETY AND MSHA HEALTH ADMINISTRATION" in white, black, and red.