# Surface Mobile Equipment Safety Program

## Best practices for surface mobile equipment

The Surface Mobile Equipment Safety Program Rule requires mine operators to assess mine-specific hazards and risks, identify actions to reduce accidents related to surface mobile equipment, and develop and implement a flexible safety program tailored to local mining conditions and operations. Mine operators should review the lists that follow to help identify best safe practices for mobile equipment and incorporate those that are appropriate in their surface mobile equipment safety program. These lists of best practices are not all-encompassing nor are they all mandatory, but they are widely accepted throughout the industry and strongly recommended.

The lists augment guidance that MSHA and/or its Alliance partners previously developed and published to help miners, mine operators, and contractors prevent accidents caused by working with, on, or near mobile equipment. PROTECTING MINERS - POWERED HAULAGE EQUIPMENT SAFETY GUIDANCE contains more information on hazard recognition, best practices, links to videos and training resources, and other materials.

### Mobile Equipment Best Practices

General

- Establish a strong safety culture marked by management's written statement and actions evident of its commitment to safety as a value. Demonstrate consistent supervisory leadership and role modeling.
- Solicit ideas from miners on ways to improve their work areas and equipment. If feasible, implement these ideas and recognize their efforts towards improving safety and health.
- Design haul roads to minimize curves, turns, intersections, crossing traffic, congested areas, roadway blind spots, and to maximize visibility.
- Establish and maintain effective traffic rules for vehicles and foot traffic. Install traffic control signs or signals in key locations on haulage roads and pit areas. Consider using dispatchers to control roadways with heavy traffic.
- Maintain roadways: clear, smooth, and dust, traction, and visibility hazard-free.
- Train equipment operators. Provide a copy of the operator's manual in the cab.
- Allow only authorized personnel to operate mobile equipment.

- Conduct pre-operational inspections and correct any safety defects before operating mobile equipment.
- Maintain operator stations and windows clean and free of hazards that could impair safe operation or visibility.
- Provide safe access and egress for operators and maintenance personnel.
- Train miners on how to safely mount and dismount equipment, including using three points of contact.
- Wear appropriate clothing and personal protective equipment (PPE).
- Wear and maintain seat belts (see expanded seat belt section below).
- Keep doors and windows closed, and all guards, shields, air filters, and access panels in place during operation. Maintain environmental systems.
- When mobile equipment is unattended, place the controls in the park position and set the parking brake.
- Provide and use wheel chocks of the appropriate size and material to hold the equipment securely, especially when stopped on a grade or in adverse weather conditions.
- Require identification, location, and intended travel route, direction, or destination from operators of other mobile equipment before traveling, and when encountering other equipment on mine site roadways, intersections, and work locations. Confirm understanding.
- Sound a warning horn before starting or moving equipment. Differentiate between moving forward or backing. Communicate any planned movements and location upon entering or exiting a work area.
- Ensure all persons are trained to recognize workplace collision hazards. Specifically, train equipment operators on the limited visibility and blind spot areas that are inherent to the operation of large and small equipment. Do not drive or park smaller vehicles in the potential path of movement of any mobile equipment.
- Implement a mine- or company-wide Fatigue Risk Management System that addresses work schedules and work limitations, breaks and rest periods, sleep, and on-shift supervisory oversight.
- Consider the use of flags or strobe lights on vehicles to make equipment operators aware of other equipment's location. Flags must be high enough to be seen by other equipment operators.
- Install and maintain collision avoidance/warning technologies on mobile equipment.

- Provide adequate lighting for night, pre-dawn, and other limited-lighting operations, including pre-operational examinations.
- Establish a policy for safe radio and cell phone usage while operating mobile equipment.
- Avoid drowsy driving. Never drive under the influence of drugs or alcohol. Consider a testing program to assure miners are not working impaired.
- Ensure fire protection systems are operational and miners are trained on primary and secondary means of egress if there is a fire.

Seat belts

- Implement a policy on seat belt usage and enforce as a "condition of employment." Maintain zero tolerance for nonuse or misuse. Install high visibility seat belts to assist in identifying proper seat belt usage.
- Incorporate equipment manufacturers' interlock technology that restricts equipment movement until the seat belt is properly worn and latched.
- Reinforce the importance of seat belt use through training and orientation programs, and supervisory oversight.
- Inspect seat belt and mounting hardware before operating the equipment to be sure the restraint devices are in good condition and function properly. Promptly replace any damaged or worn parts.
- Never jump from a moving vehicle. Remain in the seat with your seat belt secured except when making a planned exit when the equipment is stopped and the parking brake has been set.
- See Seat Belt Safety Best Practices - by IMA-NA/MSHA Alliance.
- See Seat Belt Use on Mobile Equipment, a white paper by the Association of Equipment Manufacturers, an MSHA Alliance partner.
- See Mine Safety Minute – Seat Belt Safety, video by VA Dept. of Mines, Minerals and Energy, 2019.
- See Seat Belt Safety – The Mine Safety Institute – Part 46 New Miner training, video by Mine Safety Institute, 2018.

Collision avoidance (with mobile equipment, pedestrians, or roadway features such as berms or structures)

- Maintain mobile equipment safety systems in good operating condition.
- Maintain cab interior clean and windows clear and unobstructed.
- Broadcast radio message when a small vehicle enters an area where large equipment is operating.

- Install "safety flags" or beacons on all small vehicles operating in the same area as large equipment.
- Install cameras, collision avoidance, and proximity detection systems on mobile equipment and establish an "exclusion zone" with an in-cab alarm system (for example: a system that monitors a 150-ft. diameter zone.) Cease equipment operation if a vehicle or person enters the exclusion zone.
- Maintain roadways: clear, smooth, and dust free; minimize curves, turns, and intersections. Eliminate roadway blind spots.
- Establish safe traffic patterns, speeds, and rights of way. Provide signage in appropriate languages or use recognized traffic signals as indicators to miners and others, such as over-the-road truck operators.
- Operate mobile equipment at speeds consistent with the conditions of roadways, tracks, grades, clearance, visibility, curves, and other traffic. Lower speed of the mobile equipment for weather and other conditions affecting visibility, traction, or control.
- Ignore distractions (such as using cell phones, and playing broadcast radio stations, podcasts, or music). Remain alert and in full control of the mobile equipment.
- See Powered Haulage Collision Prevention flyer – by IMA-NA/MSHA Alliance.

Stockpiles

- Adequately illuminate the area and conduct workplace and ground condition examinations before beginning work. Train equipment operators to identify dangerous conditions.
- Dump material from a safe location and push the material over the edge with bulldozers. Bulldozers must keep the blade or other equipment between them and the edges of stockpiles.
- Construct substantial berms or similar impeding devices at dumping locations as a visual indicator to prevent overtravel or overturning. Use backup cameras, locating devices, or spotters to aid equipment operators.
- Clearly mark dump locations with reflectors and/or markers.
- Ensure dump locations are properly designed, constructed, and maintained. Raise the bed only when the truck is on firm ground, level, and properly positioned and aligned for dumping.
- Never work on top of a stockpile where the sides are over-steepened and unstable (*i.e.*, sloped at greater than the angle of repose) or where cracks, excessive settling, or other uncertainty about stability exists.

- Never load material from the toe of a stockpile when it would create instability at the dumping location. Do not remove material from a stockpile that is directly below an active dump point. This may lead to an over-steepened and unstable slope (*i.e.,* greater than the angle of repose), and stockpile collapse.
- For the safety of the operators of bulldozers or other equipment, or if persons go onto a stockpile, clearly identify the location of subsurface withdrawal feeders, known or suspected subsurface cavities, or other potential subsurface hazardous conditions.

Highwalls

- Develop and follow a plan for the safe control of highwalls where mobile equipment travels in proximity to the highwall. Include procedures for safe operations when weather conditions (dark, fog, heavy rain, ice, or snow) are present that could reduce miners' control of equipment or visibility. Establish exclusion zones that limit how closely equipment can approach or work at the top, toe or on a bench. Barricade where necessary.
- Train miners to identify highwall hazards.
- Before beginning work, adequately illuminate the area and conduct highwall, bench, and ground condition examinations. Examine more frequently after rain, or during periods of freezing and thawing.
- Inspect the highwall for hazards (*e.g.,* loose rocks, overhangs, trees, etc.) Note face height and condition, bench width, obstructions on the bench or in the travelway, and the locations of other equipment operating in the area. Ensure hazards are corrected prior to work or travel near a highwall.
- Ensure that mobile equipment is operated on benches of sufficient width or at a safe distance from the crest of or the base of a highwall. Provide berms where they are needed.
- When scaling highwalls to eliminate hazards, place warning signs or barricades to prevent entry.
- Never operate or park equipment, perform maintenance, or store materials beneath highwalls.

Rail-mounted equipment

- Clearly define and post the work zone, including rail crossings and roadway intersections. Maintain all rails, ties, switches, and rail stops in good condition. Remove all hazards, including water accumulated over the rails or debris on the rails.

- Conduct a thorough pre-operational check, make a written record of checks, and correct noted deficiencies before any equipment is put into operation.
- Sound horn or whistle before moving equipment, at crossings, when emerging from tunnels or structures, and when the locomotive operator's vision is obscured. Horn sounds should differentiate between forward and backward (or up- and down-track) direction.
- Ensure spare railcars are parked in the clear and there is sufficient clearance to allow passage on an active track.
- Do not move cars unless the locomotive operator and brakeman are sure the way is clear and can plainly communicate by hand signals or radio.
- Brakeman should ride on the sides of cars, not between cars.
- Set handbrakes and chock wheels when railcars are parked. Utilize derailers when appropriate.
- Uncouple cars only when the train is stopped.
- Inspect rolling stock for safety before loading or unloading. Examine brakes, ladders, platforms, doors, and pockets. If a railcar is damaged, do not load the car; remove the equipment from service and repair it.
- Account for braking/stopping on up- or down-grades and in inclement weather (wet/icy tracks). When locomotives are equipped with sanders, assure they are properly serviced and functioning.
- Install and maintain elevated platforms to safely access the tops of rail cars. Use fall protection equipment attached to a secure anchorage when working atop rail cars. Lanyards must be short enough to keep persons from falling below or under the wheels.
- Before entering a rail car obtain a confined space entry permit. Employ gas monitoring devices, utilize predetermined safe entry, egress, and ventilation procedures.

Cranes, general:

- Use the proper crane: size, configuration, and capacity.
- Permit only trained persons, preferably qualified or certified, to operate a crane.
- Set up on firm ground, fully extend the outriggers if provided, and level the crane.
- Perform recommended preventative maintenance.
- Use properly rated and well-maintained rigging equipment.
- Inspect all equipment, including rigging, daily and/or before use.
- Thoroughly plan every lift, including load pick and placement locations.

- Determine the load's weight and center of gravity. Assess the crane's lift capacity and stability through the entire path of movement. Never exceed the crane's lifting and reach capacity or override any safety systems.
- During the lift, refer to the load management chart and utilize load monitoring tools.
- Remain aware of the load in relation to the surroundings and personnel. Keep loads under control and move slowly enough to prevent load swing.
- Maintain safe clearances with boom and jib.
- Position the crane away from overhead power lines. Maintain a sufficient separation to prevent energized power lines to prevent contact or an electrical energy jump (at least 10 feet, more if line voltage dictates), or deenergize power lines.
- Do not swing loads over the sides of cranes, over persons, or occupied mobile equipment.
- Establish personnel "no-go" zones.
- Do not travel, work, or allow work under suspended loads.
- Use tag lines to control the load. Never try to stop a moving load with your hands or body.
- Do not allow anyone to ride on a load carried by the crane, or on the crane hook or bucket.
- Do not attempt to lengthen or repair damaged wire rope. Periodically remove the ends of wire ropes damaged or worn by flexing or stress at bucket or load block connections.
- Do not use the wire rope, any part of the crane, hoist, or the load block and hook as a ground for welding. Do not allow a welding electrode to touch the wire rope.
- When working at height, such as when performing maintenance, wear a fall protection harness with the lanyard attached to a secure anchorage.

Rail-mounted, overhead cranes

- Establish a safe location and procedure for operator shift change, or for onboarding or offboarding other personnel. Provide safe access and egress.
- If moving a load using other than the standard material bucket, determine the load's weight, center of gravity, and rig the load accordingly.
- Equip the crane with safe work platforms for maintenance inspections and repairs.

- Equip the craneway at rail and other working levels with secure anchorages to attach fall protection lanyards, such as anchors, a cable, or a bar running the full length of the craneway.
- When working at height, either on the crane or along the craneway, work from a safety platform or wear a fall protection harness with the lanyard attached to a secure anchorage. Practice 100% tie-off.
- When operating more than one crane in the same craneway, establish safe operating and communication procedures to avoid collisions or injuring persons performing maintenance on the crane or along the rails.

Self-propelled aerial lifts (boom and scissor)

- Note: scissor lifts are technically not aerial lifts; they are elevating scaffolds, or mobile elevating work platforms, some of which are equipped with motorized wheels for limited movement. Their weight-lifting capacities are generally limited because they are designed to carry only workers, tools, and light materials. Refer to the operator's manual or information located on the lifts for specific capacity ratings.
- Ensure workers who operate lifts are trained in the safe use of the equipment, including operational procedures, safety, and emergency response.
- Follow the guidance, instructions and recommendations provided in the equipment manufacturer's user operating and maintenance manuals.
- Conduct a pre-operational inspection for signs of damage or component malfunction.
- Test the controls to ensure they are clearly marked and function properly.
- Inspect the surrounding work area for hazards and remain attentive to your surroundings. When tramming, face in the direction of travel. Separate the lift from other traffic.
- Operate the lift on firm, level ground. If outriggers are provided, fully deploy them on firm or reinforced ground.
- Operate under favorable weather conditions. Do not operate in high winds or when electrical storm activity threatens.
- Position the lift away from overhead power lines. Maintain a sufficient separation to prevent energized power lines to prevent contact or an electrical energy jump (at least 10 feet, more if line voltage dictates), or deenergize power lines.
- Ensure that the lift's occupancy and weight of tools do not exceed the manufacturer's load rating. Boom lifts are intended to position personnel and

carry a limited amount of tools, not materials. Do not exceed weight or reach limits on any lift, whether it be boom or scissor type.

- Ensure that all occupants are wearing properly fitted fall protection (PPE) in good condition and their lanyards are attached to the manufacturer-provided anchorages. Only tie off on anchor points specifically designed, rated and marked by the manufacturer.
- Do not lean against or stand on the lift's handrails.
- To prevent falling object injuries, do not work above other workers, or work or travel below elevated lifts.
- If aerial lifts are used beneath elevated belt conveyors, maintain a safe distance from rotating parts such as head, tail, and bend pulleys, and return idlers. If lifts are used to clean, maintain, or repair conveyor components, first deenergize and lock out power sources.
- Lower scissor lift platforms before moving horizontally.
- Monitor miners routinely to determine that safe work procedures are followed while operating lifts.

**Disclaimers**

MSHA is providing best practices, methods, lists of equipment, templates and example programs as guidance to assist operators in developing and updating a surface mobile equipment safety program. This guidance is not all inclusive and is for informational purposes. Because each mine has unique conditions and features, each operator is responsible for tailoring its surface mobile equipment safety program to meet its individual mine's needs. (30 U.S.C. § 952(b))

As part of the agency's cooperative programs with its Alliance partners, State grantees, and others, MSHA is providing mining industry-developed templates as guidance in developing and updating your mine-specific surface mobile equipment safety program. (30 U.S.C. §§ 952(b), 962)

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