Government of Western Australia
Department of Mines, Industry Regulation and Safety

Mines Safety Bulletin No. 179

Subject: Adequacy of windrows (bunds) for vehicle impact

Date: 20 August 2020

Background

Since January 2018, more than 180 interactions with windrows (or bunds) have been reported on Western Australian mine sites. These involved vehicles breaching windrows, with incidents resulting in injuries to workers and one fatality.

Windrows are a safety device to prevent workers in vehicles, and those working in the areas below, from being exposed to more severe hazards when a vehicle has a loss of control. Regulation 13.7(5) of the Mines Safety and Inspection Regulations states that *the manager of a mine must ensure that an adequate windrow or bund of material is provided on the outer edge of roadways in the open pit and on the outer edge of any roadway on the surface adjacent to a bank or steep slope*.

Mines inspectors have identified more than 150 defects and issued notices related to the inadequacy of bunds or windrows. An analysis of serious injuries and fatalities in the last two years shows that:

- in 80% of cases, the windrow was not adequate for the vehicle impact
- in 60% of cases, the vehicle was not travelling parallel to the windrow, impacting the windrow perpendicular to, or up to an angle of 45 degrees.

Haul truck breaches windrow.

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Near perpendicular vehicle impact with windrows

Design of critical windrows for T-intersections and sharp corners, particularly on downhill sections and with steep drop-offs, is a specialist area. Traditional 'rule-of-thumb' designs are generally indequate by a sizeable factor for these situations. They should be designed by a competent person (i.e. specialist designer), taking the speed, size and mass of the range of vehicles into consideration, as well as the geotechnical parameters of the fill material and other windrow design features.

The competent person should also assess other practicable measures such as 'forms' or 'proprietary items' creating near vertical faces, reinforced windrows and speed control measures. In recent times, these practicable solutions have become an efficient and effective measure to manage the hazards involved during the life of the operation.

Haul truck breaching inadequate windrow.

Summary of hazard

Inadequate windrows expose workers to additional and greater hazards on a mine site than the original vehicle loss of control. These include:

- falls from height as a vehicle breaches the windrow and descends the adjacent steep slope
- impact with obstacles protected by inadequate windrows
- vehicles entering water filled pits or tailings dams
- vehicles cartwheeling or unintended rollovers
- workers beyond or below the windrow/incident being exposed to falling objects and/or the vehicle.

Emergency workers involved in the retrieval of injured workers and damaged equipment are exposed to increased risks as they work on unstable vehicles and slopes.

Contributory factors

- Not engaging competent person(s) to design the windrow and roads.

- Inadequate design of critical windrows for T intersections, downhill ramps and sharp corners.
- Failure to assess alternatives to windrows such as vertical face forms and other barriers.
- Inadequate analysis of the geotechnical parameters for material used in building windrows.
- Road layouts that allow excessive speed impacts with the windrow and near perpendicular impacts.
- Inadequate specification and supervision of windrow construction.
- Narrowing by undercutting or pushing up the windrow during road maintenance or bench preparation activities.
- Maintenance activities or erosion resulting in loss of effective windrow profile, shape and height.

Support vehicle rolls over windrow.

Actions required

Mining operations should take the following steps to ensure that windrows provide adequate protection.

- Risk assess haul roads and potential for loss of control events when designing roads and windrows, considering:
  - road and intersection design, including traffic management, speed and speed control
  - windrow design
  - direction of travel
  - night time visibility and fatigue problems
  - road and windrow construction material
  - all vehicle types using the road and accounting for all situations.
- All windrows required for the protection of the occupants of a vehicle must be:
  - designed by a competent person, using engineering principles and appropriate geotechnical parameters for construction material
  - constructed and tested according to site specific engineering specifications
  - constructed of competent "blocky" material. Where competent blocky material is not available, the windrow dimensions must be adjusted to adequately protect occupants of a vehicle in the case of uncontrolled movement

- maintained to the appropriate height and dimension.

- Where the range of impact angles is greater than 45 degrees (and the range of impact speeds exceeds 10 km/hr):
  - engage a competent person with experience in the area of windrow design under these conditions
  - investigate practicable alternatives to standard windrows, including the use of forms, walls or proprietary items to create a vertical face, and reinforcing or stabilising of the windrow material.

Further information

- Department of Mines, Industry Regulation and Safety

  SIR No. 277 Haul truck over open pit wall edge - fatal accident

  www.dmp.wa.gov.au/Documents/Safety/MSH_SIR_277.pdf

- Queensland Department of Natural Resources, Mines and Energy

  Restricting access to hazardous areas: How important are safety rills/berms

  www.dnrme.qld.gov.au/business/mining/safety-and-health/alerts-and-bulletins/mines-safety/restricting-access-to-hazardous-areasbrhow-important-are-safety-rillsberms

  Recognised standard 19 mine roads

  www.dnrme.qld.gov.au/__data/assets/pdf_file/0008/1453175/recognised-standard-19-mine-roads.pdf

- Resources and Geoscience in NSW

  SA06-10 Lucky Escape from Underwater Truck

  resourcesandgeoscience.nsw.gov.au/__data/assets/pdf_file/0003/67350/Safety-Alert-06-10-Lucky-Escape-from-Underwater-Truck.pdf

  SB18-11 Windrow management and demarcation

  resourcesandgeoscience.nsw.gov.au/__data/assets/pdf_file/0020/822530/SB18-11-Windrow-management-and-demarcation.pdf

This Mines Safety Bulletin was approved for release by the State Mining Engineer on 20 August 2020