Uncontrolled movement on mine roads, including skidding, sliding, and light or heavy vehicle roll-over

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Recent trends in uncontrolled movements by various vehicle types on Queensland open cut coal mine roads have raised serious concerns. While some increase in the number of such incidents may be due to improved reporting, high potential incidents of this type have averaged 7-10 per month for some time now. Several have resulted in serious consequences, while a significant number of narrow misses had potentially severe outcomes.

Given the large number of both light and heavy vehicle movements on mine roads, around the clock, and the significant probability of uncontrolled movement, then the risk to coal mine workers from such a hazard is high.

Refer to Safety Alert 232 (25 August 2009) 'Vehicle collisions - how long before it's really bad?' and Safety Bulletin 94 (22 Jan 2010) 'Excessive watering of haul-roads.'

Past incidents

Analysis of reported incidents and observations by inspectors during follow-up inspections has shown:

- Most of the incidents (59%) took place on ramps.
- Watering or excessive watering was identified as the primary cause of such incidents (46%).
- Wet road conditions due to rain has been a causal factor in (8%) of incidents.
- Fatigue or micro-sleeps caused (9%) of incidents.
- Other causes, including animals on the haul road, distraction, and loss of propulsion or traction, collectively contributed a (37%).

Causal factors

Analysis of the incidents revealed:

- **Surface material** of the road is critical in providing adequate frictional resistance/grip. This prevents vehicles losing control, which may result in skidding, sliding or roll-over. Ramps are often constructed of tertiary or clay materials, which are mostly available in pre-strip operation. The frictional coefficient of such material is poor. Further, watering such roads reduces the frictional coefficient by 30%. The combined effect of poor surface material and excessively wet conditions results in a very low overall frictional resistance at the road surface, providing insufficient grip for vehicle tyres to prevent skidding, sliding or rolling.
- Relatively **steep grades** of ramps to in-pit dumps, particularly in switchback mining methods, increases potential uncontrolled movement of vehicles down the ramp. The situation is exacerbated when wet. Further, a wet surface may not be identified in dark conditions.
- **Speed** of vehicle is one of the major causes for uncontrolled movement for light vehicles, mainly at haul road intersections. There have been a number of very serious uncontrolled movements through intersections, when a light vehicle has been unable to stop at a stop sign, due to higher speed coupled with wet road conditions.
- **Sharp corners, bends at intersections, angled intersections and wrong location of intersection** etc. cause poor visibility. This exacerbates the situation creating additional causal factors in uncontrolled movements.
- Analysis of the Inspectorate's data base has identified **excessive watering** as the primary cause in most such incidents. The prevailing practice in most mines calls for two way communications between water truck operators and other road users before water trucks enter and water the circuit. However, the hazard of excessive watering is not well recognised by either water truck operators or other road users. In most cases excessive watering is identified only after a skidding or sliding incident. Watering at night increases the hazard, as engineering controls to prevent excessive watering are largely absent, and it is often left to the judgement of the water truck operator.

Regulatory requirement

The **Coal Mining Safety and Health Regulation 2001, Section 128 'Specification for design and construction of mine roads'**, includes the following requirements:

1. A surface mine's safety and health management system must provide a specification for the design and construction of mine roads to enable the safe movement of vehicles about the mine.
2. The specification must have regard to the particular conditions at the mine, including the following—
    a. the characteristics of the mine vehicles;
    b. the types of materials used for road construction;
    c. the methods of working the mine.
3. The specification must be developed through a formal risk assessment process and must provide for the following for the roads—
    a. barriers;
    b. curvature;
    c. grade;
    d. guideposts;
    e. pavement shape;
    f. safety berms;
    g. signs;
    h. surface material;
    i. width.

and **Section 129 Standard operating procedure**, states:

> A surface mine must have a standard operating procedure for maintaining and watering mine roads, including dealing with hazards caused by excessive watering of roads.

Recommendations from previous Safety bulletin 94 'Excessive watering of haul-roads'

- Mines' Standard operating procedures (SOPs) for dealing with excessive watering of haul-roads require urgent review (Section 129, the Coal Mining Safety and Health Regulation 2001(CMSHR)).
- Mines' risk assessments and SOPs for haul-road design, including safety berms, require urgent review (S 128 (3), CMSHR).
- The material types used by mines for road construction, including on the road surface to provide for frictional value, require urgent review (S 128 (2), CMSHR).
- Water trucks should be fitted with pulsed infusion systems that can be effectively controlled by the operator to manage the water output.
- Experienced operators should be utilised to water roads.
- Mine officials and vehicle drivers must ensure that the risk is as low as reasonably achievable.

Follow-up inspections

Follow-up inspections in some mines have revealed the following issues regarding regulatory compliance or implementation of the previous Safety bulletin 94 recommendations:

- Most mines have some standards or procedures in place for construction of mine roads. However, many such documents are generic, and some are corporate guidelines that were not developed on site as required by the statute.
- In some cases, risk assessments had not been conducted onsite to develop the specifications for construction of roads.
- Often, references to surface materials for different mine road construction are generic, with terms such as 'suitable materials', 'best material locally available' being used without any engineering assessment of its suitability.
- For construction of ramps or other semi-permanent roads, design specifications with regard to the width, thickness or material for sub-base, base course or surface course etc. are not defined.
- The standards or procedures for construction of roads lack any specific provision for verification of design and actual specification during or after construction.
- SOPs for maintaining and watering mine roads either don't exist, or if they do, are not based on risk assessment. Though the regulation specifically requires the SOP to deal with hazards due to excessive watering, this aspect is not well addressed in most cases.
- In many cases the most critical item of watering, the method of spraying or watering different sections of mine roads, is not well defined or specified.
- There is also a gap between the contents of the SOP and the water truck operators' understanding of hazards due to excessive watering.
- Training and assessment of water truck operators does not ensure they are well informed about the hazards and how to deal with situations in case of excessive watering.
- It is also imperative that more engineering controls replace administrative controls, to reduce or eliminate the probability of judgemental errors by water truck operators.

Comments and recommendations

- Site senior executives at all surface coal mines should conduct an audit to satisfy themselves that the likelihood of uncontrolled movement of vehicles on mine roads is minimized or eliminated.
- Ensure the SOPs required under legislation are in place, are effective and have been developed in accordance with the requirements of Section 10 of the Coal Mining Safety and Health Regulation 2001. In particular:
    - Mine road design should be properly carried out and its implementation verified during and after construction.
    - Introduce engineering controls in place of administrative controls to reduce or eliminate the probability of judgemental error by the water truck operator.
    - Roles and responsibilities of all supervisors and operators should be clear and understood.
    - Training and assessing of operators should be effective to ensure competence in the tasks assigned.

Authorised by Gavin Taylor - Chief Inspector of Coal Mines
Contact: minesafetyandhealth@dnrm.qld.gov.au
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