Department of **Local Government, Industry Regulation and Safety**

GOVERNMENT OF WESTERN AUSTRALIA

WorkSafe Western Australia Mines Safety

INFORMATION SHEET

Prohibition of polyurethane products in underground mines

This information sheet provides general guidance for mine operators on prohibiting the use of polyurethane products due to their potential flammability and toxicity during the polymeric process for strata injection, void filling and ventilation sealants underground in mines in Western Australia.

Polyurethane chemical properties and applications

Polyurethane refers to a class of polymers composed of organic units joined by carbamate (urethane) links. In contrast to other common polymers such as polyethylene and polystyrene, the term polyurethane does not refer to a single type of polymer but a group of polymers. Polyurethanes can be produced from a wide range and number of preparatory materials and additives. There are many different applications for polyurethanes. These include ground support resins and foams, rigid and flexible foams, coatings, adhesives, electrical potting compounds, and fibres such as spandex and polyurethane laminate.

Polyurethane flammability and toxicity

Polyurethane is flammable but will not ignite spontaneously at room temperature. It does have capacity to heat (exothermic reaction) when undergoing the polymeric process (mixing before application) or through exposure to various environmental conditions, such as pressure, friction, and exposure to fire. The byproduct of its heating and combustion is the production of a significant number of toxic gases, such as carbon monoxide and hydrogen cyanide, nitrogen oxides, isocyanates, and other toxic products.

In an underground mine where personnel are confined within the tunnels and roadways, the hazards arising from the combustion of a polyurethane product poses a catastrophic risk to life through generating a toxic atmosphere and potential for fires underground.

The dangers associated with polyurethane combustion can occur in several ways underground, including:

- exothermic reaction and ignition of organic materials
- combustion triggered by a mobile equipment fire
- combustion triggered by a fixed plant fire.

Legislative requirements

Under the WHS (Mines) Regulations 2022 (WHS Mines Regulations), mine operators must take all reasonable steps to ensure substances specified in the following regulation and associated schedule are not used in a place, or for a purpose, that is prohibited or restricted:

- Regulation 632 – Prohibited uses
- Schedule 20 – Prohibited uses in mines.

Schedule 20 of the WHS Mines Regulations outlines that polyurethane products which undergo a polymeric process are banned and prohibited from all uses underground.

The prohibition of the use of polyurethane products underground is in line with control measure requirements under regulation 35 of the WHS Mines Regulations which places management responsibility on all duty holders to eliminate risks to health and safety, so far as is practicable.

Past incidents

- On 12 January 2025, workers used chemical and mechanical ground support to remediate an area in the haulage shaft at a mine in NSW. The remediation was due to a wedge failure of rock at the area intersecting the haulage shaft and the level 23 platform. The chemical ground stabiliser was a two-part chemical classified as a polymeric or polyurethane chemical, which caused an exothermic reaction when mixed. Heating is usually managed through careful application in correct mixing ratios of the chemicals or by using chemicals that do not significantly self-heat. During the stabilisation process, workers reported fumes and vapour. All workers who were underground at the time retreated from work areas to fresh air bases and awaited rescue or clearance until the fumes subsided. But the fumes and vapour did not subside, and the area ignited. Most workers were able to safely exit the mine unassisted, however, five workers stayed in a fresh air base for several hours until it was deemed safe by the mine's emergency team to rescue them and safely retreat. There were no reported injuries because of the incident.
- In August 2023, a polyurethane resin was used to fill a void in the backs of a decline portal during ground support rehabilitation at a Western Australian mine. The polyurethane resin had an exothermic reaction after being injected though the shotcrete into the void. The heat generated caused the surrounding area and existing timber beams and boards to reach sufficient temperature to emit smoke. This was followed by the timbers reaching the auto ignition temperature and catching fire. This resulted in toxic gas and smoke being emitted in the decline portal, causing the evacuation of all underground personnel and closure of all surface mining operations, including the aerodrome, process plant and paste plant. The emergency response team mobilised to use a water cart to cool the area down and deal with the emergency. The chemical reaction took three days to stabilise.
- On 16 September 1986, one of the most significant disasters involving polyurethane occurred at the Kinross mine in South Africa where an acetylene tank sparked flames that swept through the underground tunnels igniting plastic covering on the wiring. The flames also set fire to the polyurethane foam tunnel lining that was used to keep walls in the mine dry. The burning plastic and polyurethane foam lining released toxic fumes that filled the shafts and underground mine tunnels resulting in the deaths of 177 miners and injury of 235 others. This makes the use of polyurethane a significantly well-known hazard that needs to be eliminated in underground mines.

Further information

For more information about the hazards of polyurethane products underground and the safety hazards of extreme heat in your workplace, visit:

Mines Safety and Health Administration (MSHA - USA)

- *Heat ignition hazard - Safety Alert*

NSW Resources

- *Causal investigation – polyurethane ground stabiliser fire exposes workers to health, safety risk: Investigation information release*
- Minerals industry safety handbook (Section 3.6.1.4)

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