



## Mines Safety Bulletin No. 119

**Subject:** Hazards associated with loading operations at the base of stockpiles

**Date:** 26 May 2015

### Summary of hazard

Stockpiles and other loose materials are generally loaded onto trucks by front-end loaders. Face-shovels are also used to load blasted or loose materials in pits, quarries and larger stockpiles, and work the stockpile similar to front-end loaders.

At a given height and environmental conditions, stockpile materials will vary in strength and overall stability. They usually remain stable if they rest at their natural slope angle. However, if stockpiles are oversteepened or undercut during loading operations, they may slump or collapse, and strike or bury loader operators and other workers and equipment.

There have been several recent incidents on Western Australian mining operations involving the failure of stockpile faces.



*Note: A stockpile face is “undercut” when the toe or base is advanced more than the overall face or slope. A face may also be undercut if loaders push materials at the base of the stockpile along, rather than towards, the face. Early warning signs of failure include visible cracking of the crest or top edge of the pile, and small rocks or particles rolling down the face.*



An undercut face showing overhang (diagram from Mine Safety and Health Administration, 2001)

While the design, construction and operation of stockpiles or other loose materials may differ between mines, the groups of workers that may be affected by unstable stockpiles include:

- loader and dozer operators
- supervisors and safety representatives carrying out inspections
- surveyors carrying out measurements or mapping
- geotechnical engineers carrying out inspections
- geologists and grade controllers
- maintenance crews
- other workers who, by the nature of their job, find themselves at or around stockpiles.

## **Contributory factors**

Factors that contribute to the failure of stockpiles include:

- improper design, construction and operation of stockpiles
- inadequate assessment of material properties and environmental conditions, and their influence on stability
- inadequate and inappropriate equipment working on stockpile faces higher than the equipment's reach
- lack of hazard awareness and insufficient risk assessments that address identified hazards
- inadequate systems of work that expose operators and other employees to hazards
- inadequate supervision and deficient workplace inspections
- inadequate task-specific training.

## **Actions required**

Mine operators are reminded of their duty to provide and maintain workplaces, plant and systems of work that do not expose workers to hazards.

Recommended actions include:

- engaging a competent person to assess material properties and produce design, construction and operation recommendations that clearly convey safe work practices

- designing, constructing and operating stockpiles at the lowest practicable height and natural slope angle
- providing clearly demarcated exclusion zones
- as required, providing a combination of appropriate equipment with sufficient separation distances
- developing safe working procedures for a range of stockpile material conditions
- regularly assessing risks and identifying workers likely to be affected
- providing adequate supervision to focus on safe loading
- providing adequate and relevant training to operators
- developing and implementing simple and effective observational techniques or tools that help identify early warning signs of failure and trigger a response action or plan.

## Further information

- [www.dmp.wa.gov.au/ResourcesSafety](http://www.dmp.wa.gov.au/ResourcesSafety)

Department of Consumer and Employment Protection, 2008, Guide to tipping HIF audit 2008: DOCEP, Western Australia (template and guideline available)

- Terzaghi, K., Peck, R.B., and Mesri, G., 1996, Soil Mechanics in Engineering Practice, 3rd edition: John Wiley and Sons, Inc., New York, 549 pp.
- [www.hse.gov.uk/pubns/books/hsg65](http://www.hse.gov.uk/pubns/books/hsg65)

Health and Safety Executive, 2013, Managing for health and safety (HSG65): UK HSE, 62 pp.

- [www.msha.gov](http://www.msha.gov)

Mine Safety and Health Administration, 2001, Stockpiling safety: Safety Manual Series SM 27: US Department of Labour, 54 pp.

This Mines Safety Bulletin was approved for release by the State Mining Engineer on 26 May 2015