Mines Safety Bulletin No. 147

Subject: Minimising exposure to hazardous contaminants in gold rooms

Date: 17 January 2018

Background

A recent review of biological monitoring results has shown that some gold room workers have been repeatedly exposed to elevated levels of heavy metals, such as arsenic, lead and mercury. Subsequent regulatory inspections identified that the control measures (e.g. ventilation) and atmospheric and biological monitoring programs, used to ensure heavy metal contaminants are at levels below exposure standards, are often inadequate and ineffective.

Note: Refer to the Risk-based health surveillance and biological monitoring – guideline for the recommended biological monitoring program for workers exposed to lead, mercury and arsenic.

Summary of hazard

Gold room processes such as acid digestion, calcination, smelting and electrowinning generate fumes, dust and gases that contain hazardous contaminants (e.g. lead, mercury, arsenic).

Chronic exposure to lead may cause neurological and behavioural effects such as anxiety, weakness, headaches, tremors, excessive tiredness, depression and other indicators of nervous system damage. Women of child-bearing age have a much lower limit for blood lead levels (10 µg Pb/dL) to protect the foetuses of any current or future pregnancies.

Chronic exposure to mercury vapour primarily affects the central nervous system and kidneys. Systemic effects have also been reported after acute and chronic exposure to inorganic arsenic compounds. Elevated acute exposures to both inorganic arsenic and arsine has resulted in fatalities. In 2004, arsenic was classified as a known human carcinogen by the International Agency for Research on Cancer.

Contributory factors

- Lack of hazard identification in the early stage of the mineralisation study and analysis of ore body mineralogy.
- Inadequate or ineffective engineering controls [e.g. local extraction ventilation (LEV) systems].
- Inadequate atmospheric and biological monitoring programs.
- Safe work practices (SWPs) do not incorporate specific hygiene programs.
- Inadequate or ineffective selection and use of respiratory protective equipment (RPE).

Actions required

Gold room activities are considered specified occupational exposure work as their processes generate hazardous contaminants. The following actions are recommended to responsible persons to minimise worker's exposure to hazardous contaminants by maintaining atmospheric contaminants at levels below the exposure standard (and as low as practicable).

Mineralisation studies

- Review existing mineralisation data and analyses to determine whether deleterious metals (e.g. lead, mercury, arsenic) are present in the ore.
- Assess the exposure risks associated with handling ore at all stages of mineral processing.

Local extraction and ventilation systems

- Engage competent persons to:
  - assess that the gold room building is fit-for-purpose (e.g. high-security design often overlooks the need for suitable ventilation, such as windows or louvres for adequate fresh air supply)
  - assess that the extraction and ventilation systems have been appropriately designed to minimise the risk of exposure to contaminants.

  Note: Reassess when there have been modifications to the building, process plant and equipment – including equipment upgrades (e.g. changing ovens, furnaces, electrowinning cells).

  - inspect, test and maintain the extraction and ventilation systems according to supplier's or original equipment manufacturer's specifications.
- Rectify any identified defect or deficiency in ventilation systems as soon as is practicable.

Monitoring

- Engage competent persons (e.g. ventilation officer) to regularly inspect and test the efficiency of all extraction and ventilation systems in the gold room.
- Conduct atmospheric and biological monitoring programs, review and analyse the results and implement the action plan according to the risk. For instance, for any results exceeding the exposure standards immediately remove workers out of associated workplace, investigate sources of contaminants and implement actions to reduce further exposure.

  Note: For biological monitoring, results approaching the exposure standards indicate that the control measures are becoming ineffective and should not be ignored. Results above the exposure standards often indicate that the control measures used to prevent or minimise exposure have been inadequate or ineffective and should trigger reviews of the controls.

- Confirm that workers are notified of their biological monitoring results.

Safe systems of work

- Incorporate specific hygiene programs (e.g. appropriate cleaning methods and/or decontamination process) into SWPs.
- Confirm appropriate selection, maintenance and effective use of RPE.

Note: Refer to Australian and New Zealand Standards AS/NZS 1715 Selection, use and maintenance of respiratory protective equipment and AS/NZS 1716 Respiratory protective devices.

- Train workers in the correct use and maintenance of RPE.

Further information

- Standards Australia, www.standards.org.au

AS/NZS 1715 *Selection, use and maintenance of respiratory protective equipment*

AS/NZS 1716 *Respiratory protective devices*

- Department of Mines, Industry Regulation and Safety, Mines safety publication, www.dmp.wa.gov.au/Safety/Mining-Safety-publications-16162.aspx

Risk-based health surveillance and biological monitoring – guideline

Risk-based hygiene management planning and health and hygiene system –procedure

- Health and Safety Executive (HSE), www.hse.gov.uk/pubns/books/hsg258.htm

Controlling airborne contaminants at work: A guide to local exhaust ventilation (LEV)

This Mines Safety Bulletin was approved for release by the State Mining Engineer on 17 January 2018