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LBMA Assaying and Refining Conference EHS Highlights and Challenges in PGM Refining

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Behavioural safety and leadership culture in reducing accidents

Leadership:

- Visible behaviours as individuals and in consultation
- EHS into business and investment plan
- EHS Roadmap and programs – manage key risks

Everyone:

- Personal engagement and ownership of safety
- TAKE 5 and other safety mindset programs

Challenge and highlights for metrics and scorecards:

- Actual numbers mean more locally than rates
- Target 'zero' injuries/incidents locally, not dropping rates (lagging indicators)
- Focus on learning and proactive interventions (leading indicators)



Key Risk #1 Occupational Health and Industrial Hygiene

- Chloroplatinates and associated chemicals in refining:
 - Acute toxicity oral and eye damage
 - Skin and respiratory sensitisation
 - Acute and chronic aquatic toxicity
 - Corrosive materials and chlorine

Challenge:

- Managing sensitisation risks; risk and severity of spills

Highlights:

- Industrial Hygiene programs for exposure risk and engineering controls
 - Controls around chlorine (UK HSG40)
 - Automate and enclose tasks where possible



Key Risk #2 Ergonomics for manual lifting and use of glove boxes

- Ergonomic assessment tools for:
 - Heavy lifting
 - Repetitive and awkward tasks
 - Fine dexterity tasks

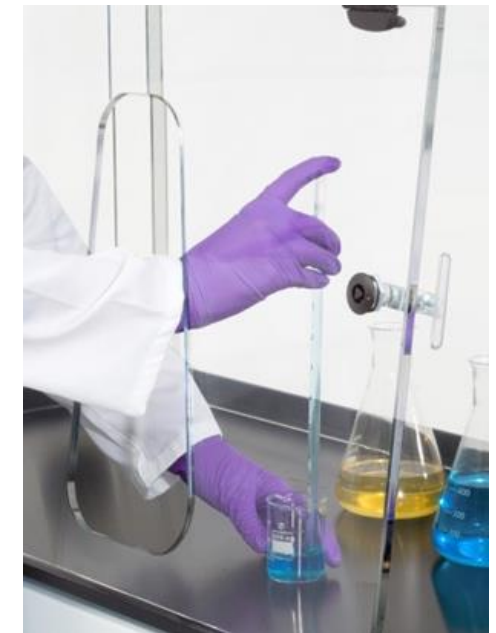


Challenges with Glove boxes:

- Awkward body position with stretched arms
- Glove replacement and hygiene

Opportunities:

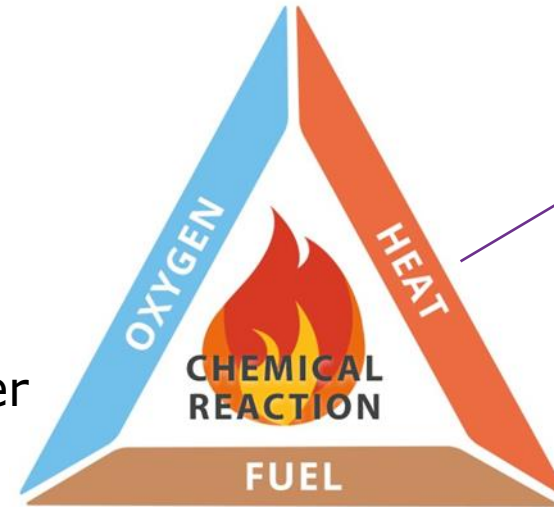
- Automate and enclose tasks where possible e.g. robot arms
- Smart air flow with 'tear drop' openings for flexibility



Key Risk #3 PGM induced fires and dust explosion risk

In PGM refining and catalysts, even in tiny quantities can promote catalysing combustion of any fuel:

- Solvents for refining or catalysts
- Waste materials in bins
- Combustible dusts in extraction systems
- When on carbon/combustible catalyst matrix, either ignition in dust cloud form or self heating
- Pyrophoric products



Ignition sources, catalysts or heat (minimum layer ignition temperature)

Challenges are:

- Generating the right hazard data for design
- Implementing robust procedures to keep labs and plant safe

Highlights are beneficial applications of PGM:

- Vehicle exhaust catalysts
- Chemical and pharmaceutical production catalyst
- Green hydrogen and Hydrogen Fuel Cell catalyst coated membranes

Key Risk #4 Asset integrity management and corrosion

- PGMs are very stable; aggressive conditions needed for refining:
 - Specialised materials needed for vessels and pipework
 - Structural steelwork and other equipment corrosion are likely
- Solutions include:
 - Asset Integrity Management (AIM) system
 - Safety Critical Equipment (SCE) identification
 - Painting programmes and planned maintenance
 - Renewal of aging assets

Key Challenge is escalation of corrosion rates due to atmospheric process or if leaks were to occur

Highlight is Process Safety Performance Indicators (PSPI) for SCE maintenance routines

Personal reflection for PGM refining hazard position vs. wider chemical industry

	Hazard Comparison	Possible reason
#1 Occupational Health and Industrial Hygiene	High hazard and must be well managed	Multiple corrosive and sensitising materials
#2 Ergonomics and manual lifting	Generally high	Not fully automatable
#3 PGM induced fires and dust explosion risk	High and unusual hazards Low flammable inventories	Potent materials but volumes are small
#4 Asset integrity management and corrosion	Generally high	Aggressive conditions needed for the process
Offsite scenarios	Fewer offsite scenarios	Volumes are small
Onsite traffic	Much less	
Waste disposal	Much less	Waste is of such high value

Summary

- Safety culture starts with the top leadership
- Hazards need to be understood and managed
- The societal and sustainability benefits from PGMs are great

JM Value #1: Protecting people and the planet
We practise the highest standards of health and safety, promote wellbeing for people both inside and outside of work, and seek to safeguard our planet.

JM

TAKE 5 for safety

Make time to keep yourself and your colleagues safe from harm



STOP

THINK

ASSESS

CONTROL

COMPLETE