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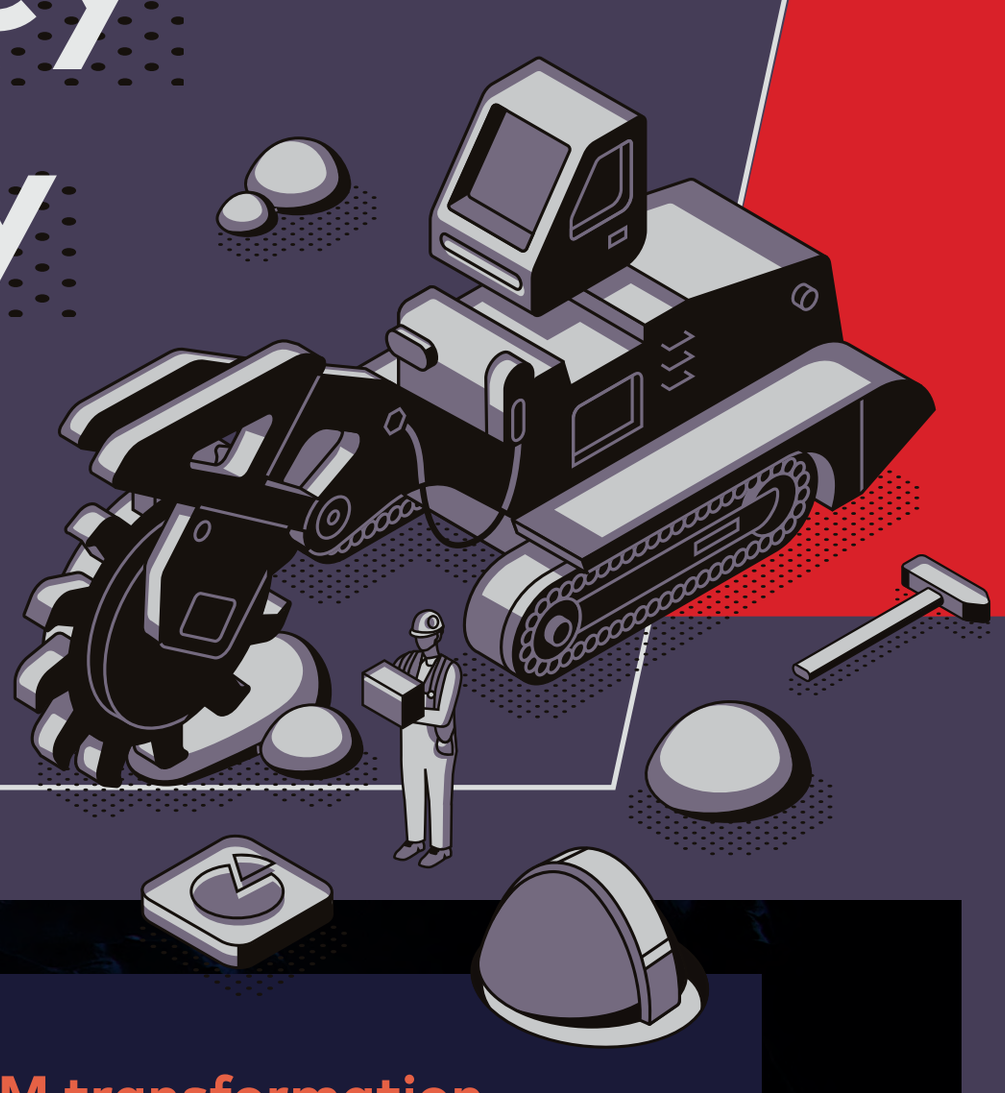
A major platinum producer's journey to process safety excellence



Process Safety Management (PSM) is foundational to managing safety holistically within heavy industry. Despite this, its integration is relatively new in the mining and metals industry.

Below, we demonstrate how a major platinum producer's PSM journey not only reduced the operational risk profile by enhancing the prevention and mitigation of catastrophic events such as fires, explosions and toxic releases, but also generated significant value for the business.

The PSM transformation programme, adopted by a major platinum producer with the help of dss+, demonstrates a more holistic approach to managing operational risk beyond occupational safety, by embedding deeper risk recognition and management practices in day-to-day operational and asset management processes. Adoption of PSM enables safer, more reliable and sustainable operations in high-risk industries such as mining and metals.

2020
- **The PSM programme was initiated** with a PSM diagnostic across processing operations

2021
- The PSM programme identified priority process safety unwanted events and **strengthened associated controls** to prevent and mitigate these events

2022
- **PSM support centered** around rolling out newly adopted PSM standards and building organisational capability

2023
- **Embedded PSM** into operations and the continued capability building effort

IMPROVED ASSESSMENT AND MITIGATION OF KEY PROCESS RISKS

Conducted more than **40** hazard identification (HAZID) and Hazard and Operability (HAZOP) Studies on high risk plants

1500 Analysed process safety risks related to 1,500 scenarios

Conducted Layers of Protection Analysis (LOPA) for more than **450 PRIORITY RISKS**

Streamlined BRAs, removing hundreds of duplicate entries, while adding up to **15** new PS-PUEs (Process Safety Priority Unwanted Events)

Tangible outcomes

PSM performance transformation

The PSM journey has achieved tangible short-term risk reduction improvements, while enhancing core capabilities, practices and systems to sustain and improve the performance.

BEFORE			AFTER
The risk recognition process was insufficient to identify, assess & effectively mitigate Process Safety risk across the value chain	Shallow risk recognitions practices Over reliance on inadequate existing controls Gaps in basic Management Of Change (MOC) requirements Outdated and incomplete Process Safety Information that did not support risk identification	1 RISK RECOGNITION	Process safety Priority Unwanted Events (PUE)* identified, controls verified and enhanced, and residual risk reduced * A Priority Unwanted Event could include process fires from loss of containment of flammable material, physical bursting of pressured equipment, chemical explosions, toxic releases, molten metal and water explosion, etc. Improved legal compliance, due to targeted efforts to improve compliance to mandated requirements for prescriptive safety-critical equipment
Inadequate PSM leadership and lack of specific capability building to ensure PSM was being embedded into the organisational culture	No clearly defined PSM roles and responsibilities No systematic PSM capability development	2 ORGANISATIONAL CAPABILITIES	PSM organisation established with priority positions filled More than 1,500 training modules completed, 50% of the target population trained on all priority requirements by end of 2023
The cente was not providing adequate visibility on PSM plans, progress and risk exposure across the value chain	No cascade of PSM vision Lack of governance and leadership oversight on process safety risk exposure and underlying system effectiveness Inadequate integration of risk considerations into Operating Model planning and review routines and meetings Inconsistent Visible Felt Leadership	3 LEADERSHIP OVERSIGHT, GOVERNANCE, AND OPERATING MODEL INTEGRATION	A set of Key Result Areas (KRAs) related to PSM were identified and cascaded A clear PSM governance framework was established Promotion of open environment to enable PSM by managers Approximately 3,500 engagements with communication content on a monthly basis Active Senior Leadership engagement on the PSM journey and more than 79 individuals have been recognised individually within the platinum producer for going above and beyond expectations
The centre was not effectively driving "what good looks like" and setting prioritised standards and minimum requirements for PSM Inadequate asset integrity management practices		4 STANDARDS AND CORE PROCESSES	Development of corporate-level PSM framework, guided by standards and processes already deployed at the platinum producer as a result of the PSM programme. Supporting PSM specification document developed Process Safety Information (PSI) standard developed and programme to update critical PSI and Equipment Master Data launched A new alarm philosophy standard was developed and a 9-step approach was codified and adopted Process Safety Critical Equipment standard developed and piloted to govern identification and management of process safety critical equipment

Linking to the major platinum producer's global goals

A guiding principle underpinning the PSM journey at the major platinum producer was to embed PSM concepts and practices into existing frameworks and programmes, to ensure seamless integration and easier adoption.

The PSM programme enhanced the company's asset strategy and reliability by clearly defining minimum mandatory requirements for safety critical equipment.

The PSM programme enhanced existing operational risk assessment and management processes by highlighting specific Process Safety Unwanted Events and related controls that weren't adequately addressed, such as the potential for coal dust explosion, process fires in specific areas, toxic releases, etc.

Specific project pillars and outcomes

1 RISK RECOGNITION

Outcomes
- Process safety Priority Unwanted Events (PUE) identified, controls enhanced and residual risk reduced

Levers
- Risk-based approach applied to address complex and high hazard processes first
- Incorporation of the newly identified PS PUE's into the Baseline Risk Assessment for all processing sites within the platinum producer
- Baseline Risk Assessments (BRAs) were reviewed and streamlined by removing duplication and using a more consistent taxonomy. More than 800 Process safety-related lines were addded to BRAs
- Completion of more than 40 detailed Process Safety Hazard Identification and Risk Assessment (PSHIRA) studies on all priority operational units, analysing over 1,500 scenarios
- Layer of Protection Analysis and selected Safety Integrity Level (SIL) assessments completed for over 450 high consequene scenarios
- Safe Operating Envelopes (SOEs) identified and subsequent review and updating of critical procedures enabled

On-site success: First-of-its-kind Layer of Protection Analysis

Prompted by the Process Safety Hazard Identification and Risk Assessment studies performed during the project, the completion of Layer of Protection Analysis (LOPA) studies were a natural progression to deepen the understanding of scenarios with the potential to result in a priority unwanted event (PUE), and review and enhance the adequacy of the layers of controls designed to reduce risk at a level deemed acceptable.

The LOPA studies covered 450 high consequence events and enabled a confirmation of the as-operated level of risk, confirming how reliable various layers of protection / controls were to prevent unwanted events from occurring.

As a result, more than **900 recommendations** were made to reduce residual risk exposure of which more than **90%** have been closed already - reducing residual risk exposure **significantly.**

2 ORGANISATIONAL CAPABILITIES

Outcomes
- PSM capability building programme established

→ More than **50%** of the target population trained on all priority 1 requirements by end of 2023

Levers
- Significant capability building efforts launched, including tailored e-learning courses, instructor-led training sessions and on-the-job coaching
- All site induction-related material updated to include PSM awareness to ensure coverage of the entire organisation and contractors

On-site success: Increase Chlorine leak reporting at the Precious Metal Refinery

Historically Chlorine leaks were underreported, resulting in residual risk exposure. As part of the programme the site leadership created an environment where these leaks could be reported and subsequently addressed.

The team employed effective problem-solving techniques to pinpoint underlying issues, develop and execute targeted solutions. The impact has been significant, with the current status indicating that one of the key failure mechanisms (fan draft related failures) was completely eliminated, and bolted flange connection-related failures have also improved markedly.

3 LEADERSHIP OVERSIGHT, GOVERNANCE AND OPERATING MODEL INTEGRATION

Outcomes
- A set of Key Result Areas (KRAs) related to PSM were identified and cascaded
- A clear PSM governance framework was established
- Promotion of open environment to enable PSM by managers

Approximately **3,500** employees actively engaged with content on a monthly basis

- More than 79 individuals have been recognised individually within the platinum producer for going above and beyond expectations

Levers
- PSM Element-specific "Technical Authorities for critical PSM elements" were identified and appointed to provide technical guidance and support to the organisation
- Significant engagement across the entire organization with over 3,500 interactions via newsletters and digital communication channels to catalyse the effort
- Successful employee recognition programme developed and carried out
- Integration of PSM expectations into existing processes

On-site success: Applying a risk-based approach develop priority Process Safety Information documents and procedures

Priority PSI documents were identified for development on selected pilot sites, with alignment to the Process Safety Hazard Identification and Risk Assessment study results.

For example, this approach resulted in the creation of critical documents at a key operation, including 35 Process Flow Diagram drawings to illustrate the as-built conditions at the plant, updating of 123 Piping and Instrumentation Diagrams to reflect the current state, 41 functional specifications for the highest risk processes, the sourcing of Material Safety Datasheets for toxic and hazardous materials, and a cause-and-effect matrix for high and medium risk areas.

4 STANDARDS AND CORE PROCESSES

Outcomes
- Development of corporate-level PSM standard and supporting PSM specification document
- Process Safety Information (PSI) management standard developed and rolled out
- New alarm philosophy standard with a codified 9-step approach to drive alarms rationalisation
- Improved legal compliance, due to targeted efforts to improve compliance to mandated requirements for prescriptive safety-critical equipment
- Formal review of the platinum producers group level standard on Management of Change (MOC) and subsequent supporting procedure developed and tested
- New Pre-Start Up Safety Review checklist developed and tested during shutdown and new project environment

Levers
- Review and commencement of priority technical standards by Technical standards committee
- Priority PSI documents identified for development on selected pilot sites
- Establishment of PSI management systems and digital platforms. Novel technologies trialled and applied to enable the process of updating of PSI
- On-the-job coaching to support and enhance the review of Process Change Notifications
- Process Safety Critical Equipment standard developed and piloted to govern identification and management of process safety critical equipment
- Functional safety management standard developed to enhance management of Safety Instrument Function and Systems
- Safety Integrity Level-rated Safety Instrumented System designed and implemented to strengthen protection layers
- Process safety critical equipment lists were created for pilot areas, and maintenance practices for this equipment was assessed, considering quality assurance and control, asset tactics, training, defect management and elimination, reliability engineering and verification
- Enhancement of designs and QA/QC processes associated with the supply of Safety Critical Equipment (SCE), including identification of priority scenarios, failure mechanisms and corrective or preventative actions
- Identification and rectification of non-conformances associated with the supply of safety or process critical equipment
- Enhancement of the incident investigation to include PSM-related aspects

On-site success: Technical Standards Committee to drive review and enhancement of priority standards

A new alarm philosophy standard, with 9-step codified approach, was launched at Precious Metals Refinery, alongside dedicated capability building of key personnel. The results of the pilot demonstrated a significant reduction in monthly alarm rates, from 33M to 1.25M, 31.75M nuisance alarms being completely eliminated, the elimination of process forces in area 706/806 and IM, and a demonstrated significant improvement by staff in understanding process control limits and control narratives. The result was a significant risk exposure reduction at the plant and a remarkable improvement in understanding and monitoring process limits at the control room operator level.

In conclusion: The dss+ approach to PSM

An outcome driven and integrated approach was developed, with clear objectives to support the journey and steer the effort of the teams. It was applied in a staged manner, with 3 distinct phases:

Phase 1 was focused on mitigating key process safety risks, establishing PSM governance requirements and driving quick wins to catalyse momentum

Phase 2 aimed at enhancing PSM capabilities & deploying priority PSM systems into the organisation at a site level

Phase 3 aimed at embedding PSM into execution-level activities and driving continuous improvement effort

The PSM programme implemented with a risk-based approach with the support of dss+ team, is a critical milestone toward safer, stable, reliable and more sustainable operations. It provided leadership and shareholders with higher confidence on the achievements of short and longer term business goals.

dss+
Protect. Transform. Sustain.