Biography

Prof Cas Badenhorst is a South African-trained Occupational Health and Hygiene Practitioner, holding a Doctorate degree and certification as a Certified Occupational Hygienist. With over 28 years of experience in occupational health and hygiene within the mining industry, he currently serves as the Senior Manager Occupational Health at a leading international mining company.

A dedicated lifelong learner, Cas actively pursues ongoing professional development, particularly in emerging areas such as Sustainability. He is highly interested in leveraging technology to develop innovative strategies that enhance workforce health and wellbeing, ensure business continuity, and boost productivity.

He is appointed as an Associate Professor at North-West University, South Africa, and an Honorary Fellow at the University of Wollongong, Australia—positions that underscore his status as an international authority in occupational health and hygiene.

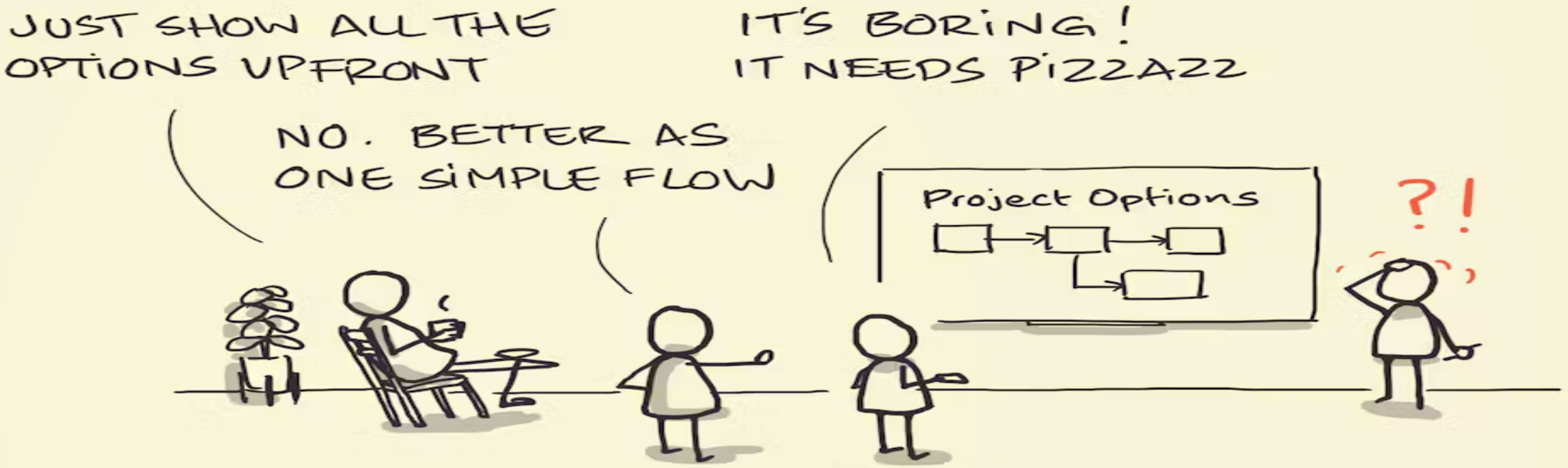
Cas has a proven track record in developing comprehensive Occupational Health and Hygiene Management Strategies, Policies, and Practices. He provides strategic guidance, technical advice, and support in workplace health and wellness initiatives. His experience extends to managing diverse, multi-functional, and multinational teams, with extensive collaboration and networking at both national and international levels.

MINERALS COUNCIL
SOUTH AFRICA

Unlocking the Value of Dust Critical Control Management

Prof Cas Badenhorst

NWU® | OHHRI



WITHOUT DATA YOU'RE JUST ANOTHER PERSON WITH AN OPINION

— W. EDWARDS DEMING

sketchplanations

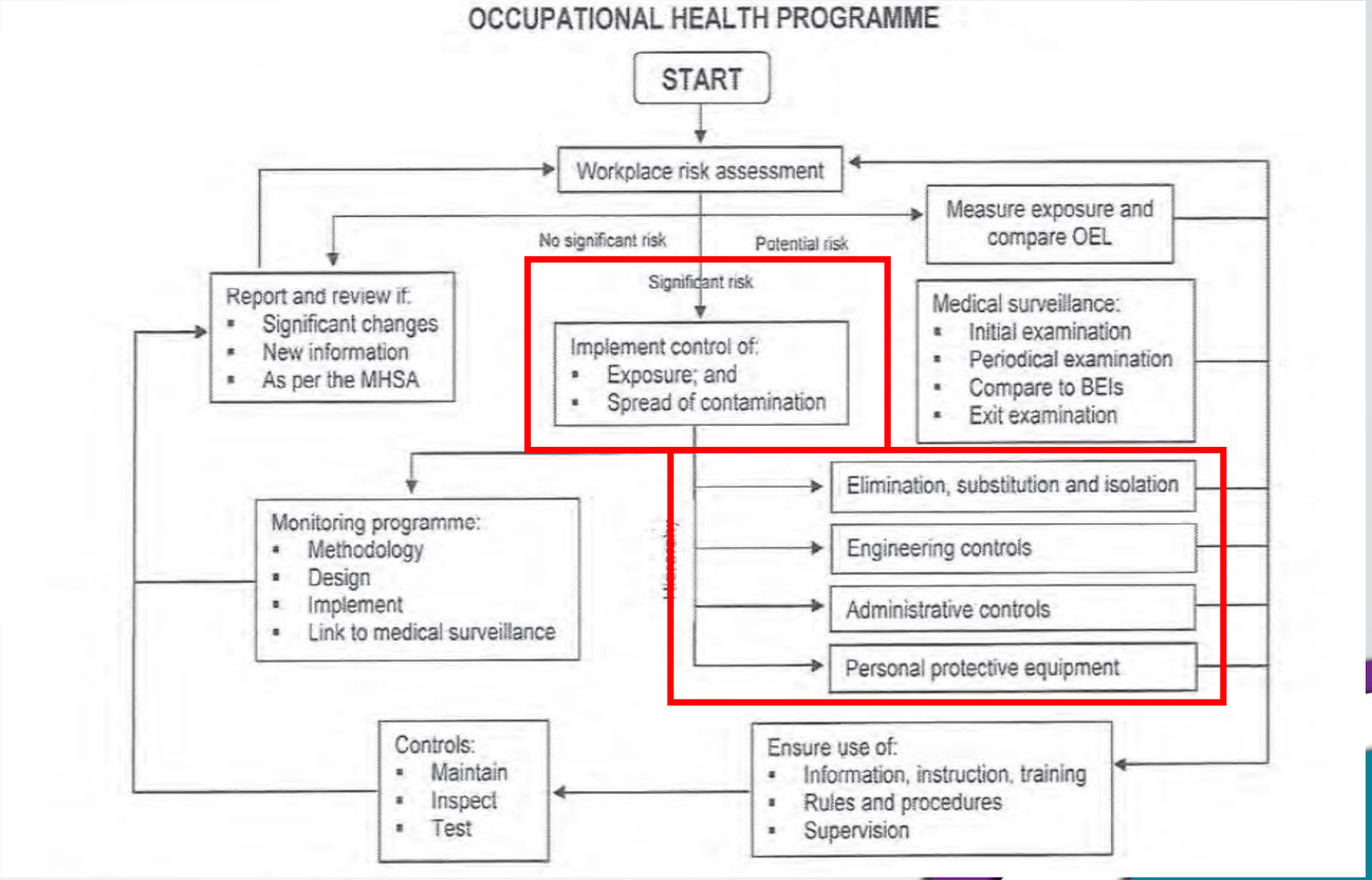
Content

- Exposure control
- Re-cap of key definitions
- Critical Control Management
- Critical Control Management Process
- Realisation of dust CCM value potential
- Call to action

Why is this important?

Significant opportunities exist for South African mines to enhance dust control through CCM

Exposure control

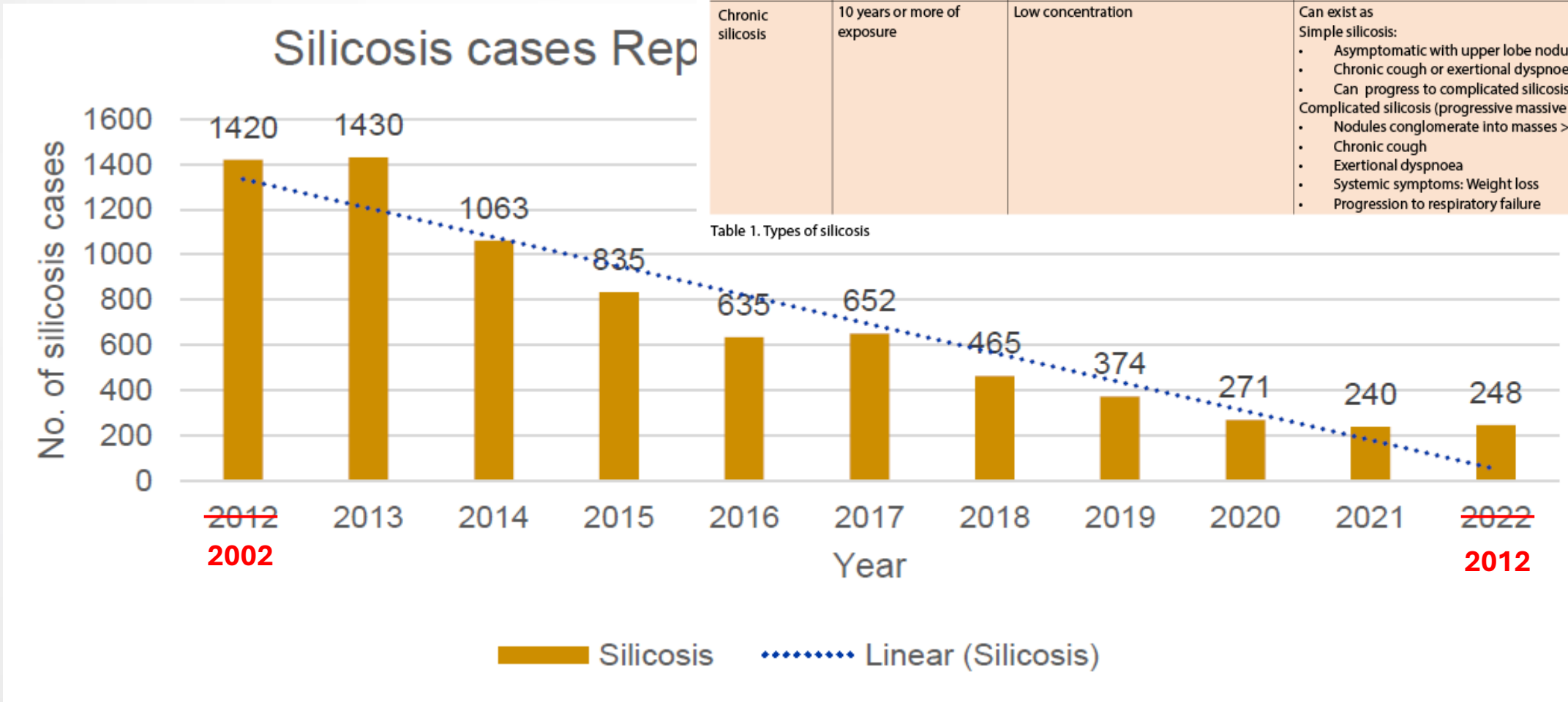


Exposure control

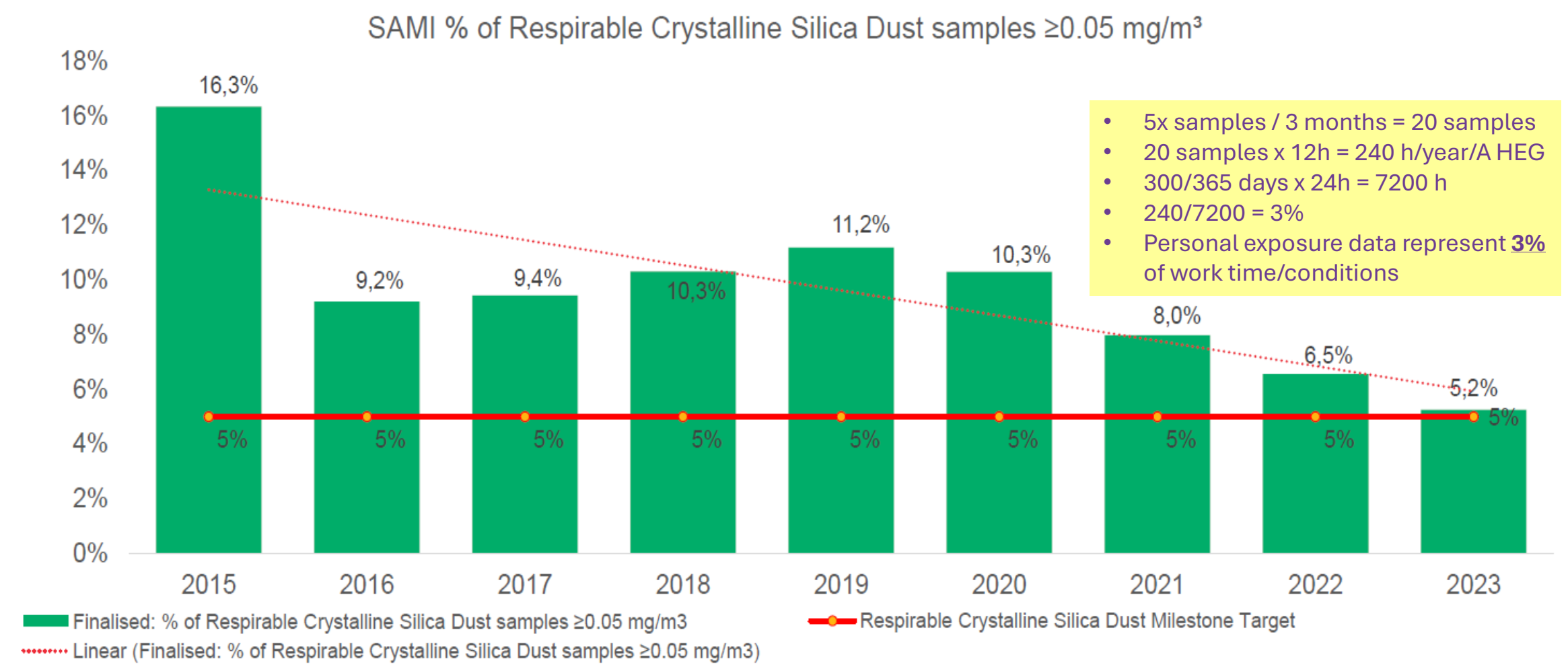
Performance

FORM	DURATION OF EXPOSURE	RESPIRABLE DUST CONCENTRATION EXPOSURE	CLINICAL FINDINGS
Acute silicosis	< 5 years	High concentration	• Rapidly progressive dyspnoea • Cough • Systemic symptoms: Weight loss • Progression to respiratory failure
Accelerated silicosis	5-10 years after initial exposure	High concentration	• Rapidly progressive dyspnoea • Cough • Systemic symptoms: Weight loss • Progression to respiratory failure
Chronic silicosis	10 years or more of exposure	Low concentration	Can exist as Simple silicosis: • Asymptomatic with upper lobe nodules <1cm in size. • Chronic cough or exertional dyspnoea • Can progress to complicated silicosis Complicated silicosis (progressive massive fibrosis) • Nodules conglomerate into masses > 1cm in size • Chronic cough • Exertional dyspnoea • Systemic symptoms: Weight loss • Progression to respiratory failure

Table 1. Types of silicosis



Performance



- 5x samples / 3 months = 20 samples
- 20 samples x 12h = 240 h/year/A HEG
- 300/365 days x 24h = 7200 h
- 240/7200 = 3%
- Personal exposure data represent **3%** of work time/conditions

Saliant points

- **Lack of data drives imprecise & expensive dust control**
  - Shift-average sampling masks root causes:
    - Process-driven spikes?
    - Employee behaviour?
    - Control system failures?

- **Engineering controls implemented based solely on shift-average samples carry significant risks**

  - Over-engineered and costly solutions: Controls may reduce exposure, but are likely more extensive than necessary, resulting in avoidable expenses.
  - Ineffective solutions and wasted resources: Controls may fail to address the core issue, leaving the mine out of pocket and potentially non-compliant.

Re-cap of key definitions

Material Unwanted Event - A description of a situation where the *hazard has or could possibly be released* in an unplanned way, including a description of the consequences.

Cause

Control - An act, object (engineered) or system (combination of act and object) intended to prevent or mitigate an unwanted event.

Cause

Critical control - A control that is crucial to preventing the event or mitigating the consequences of the event. The *absence or failure of a critical control would significantly increase the risk* despite the existence of the other controls.

Critical Control Management

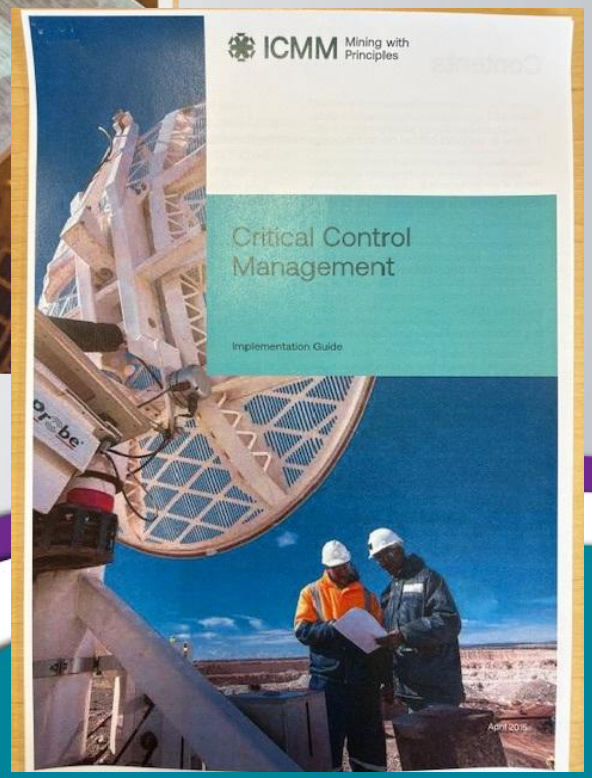
A process of managing the risk of MUEs that involves a systematic approach to ensure critical controls are in place and effective.

Process

System

CC in place

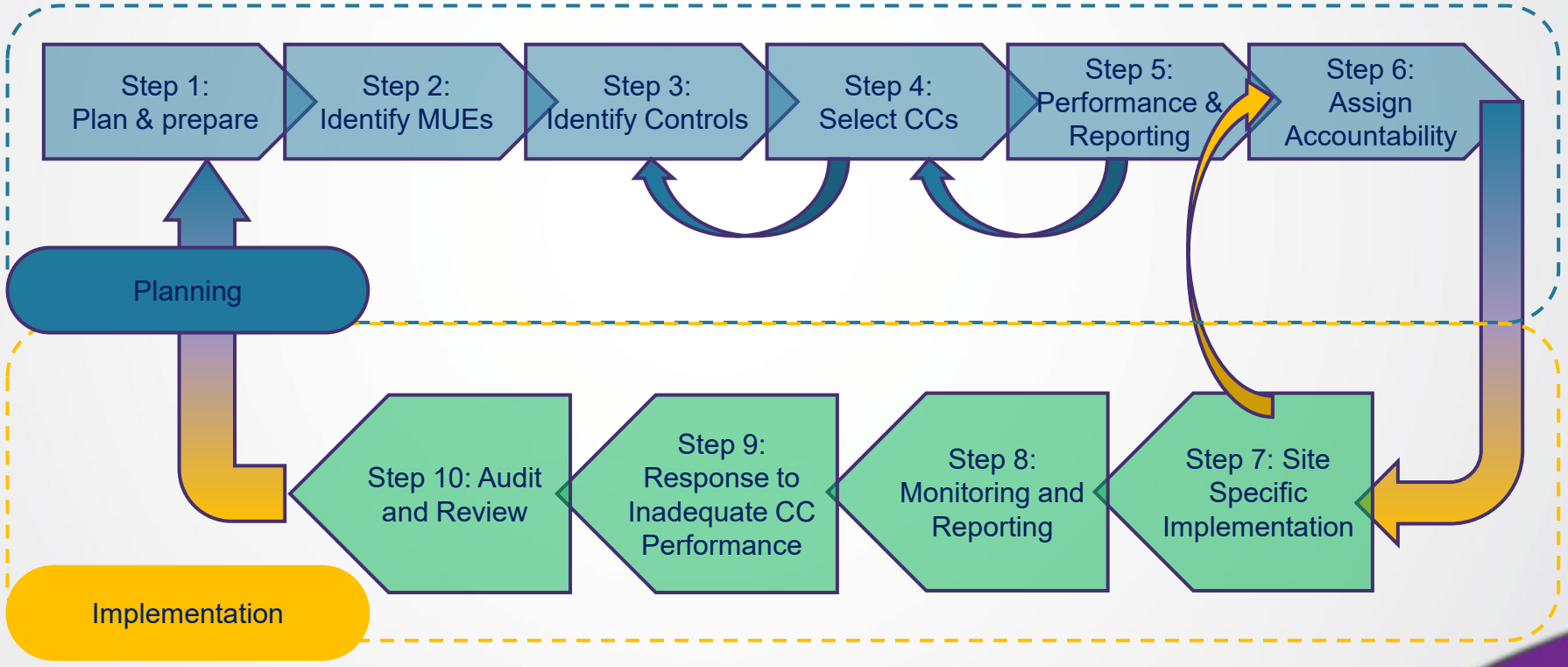
CC effective

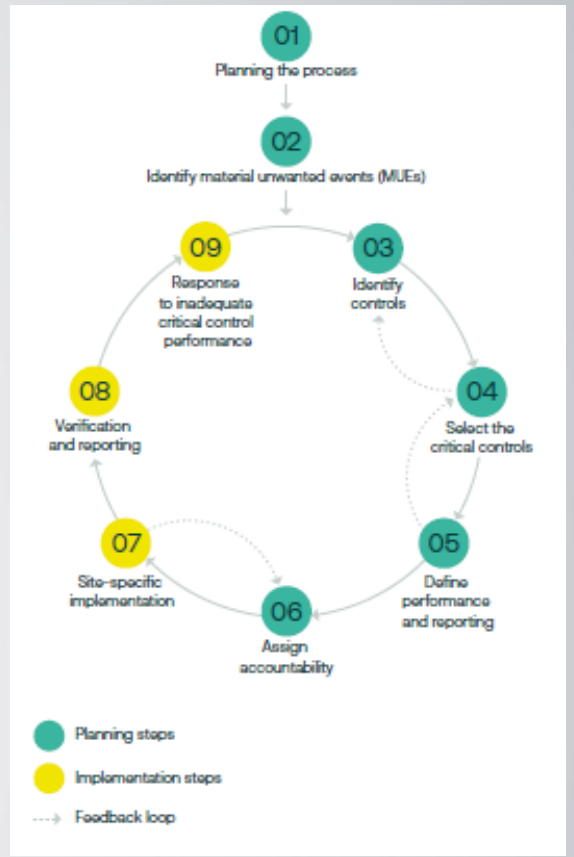


Intended deliverables of the CCM process

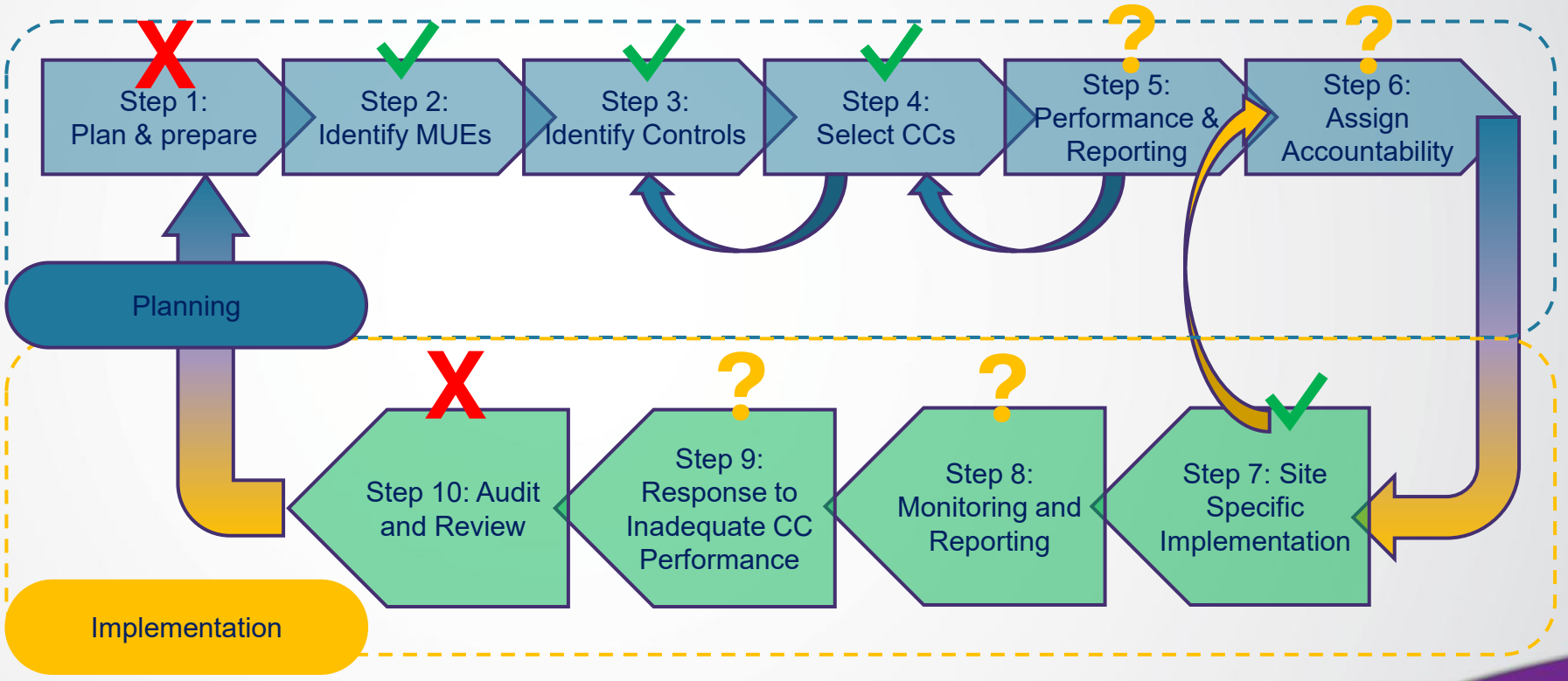
1. **Transparency:** Openly share risk information throughout the organization.
2. **Fewer MUEs:** Reduce the number of Major Undesirable Events.
3. **Stop Drift:** Counteract organizational drift and deviance normalization.
4. **Proactive Learning:** Learn before dust release incidents.
5. **Sustained Learning:** Learn from incidents; prevent repeat occurrences.
6. **Control MUEs:** Maintain residual risk levels for MUEs within threshold limits.
7. **Risk Intelligence:** Strengthen risk intelligence integrity & knowledge management.
8. **Stable Controls:** Minimize variability in control performance.
9. **Manage Dynamic Risk:** Proactively manage risk from workplace variability.
10. **Cost-Effective:** Optimize the cost of risk management; prioritize.
11. **Mitigate Failures:** Identify and mitigate critical control failures.

CCM Process


Step 1: Plan & prepare
Step 2: Identify MUEs
Step 3: Identify Controls
Step 4: Select CCs
Step 5: Performance & Reporting
Step 6: Assign Accountability
Planning
Step 10: Audit and Review
Step 9: Response to Inadequate CC Performance
Step 8: Monitoring and Reporting
Step 7: Site Specific Implementation
Implementation


01
Planning the process
02
Identify material unwanted events (MUEs)
03
Identify controls
04
Select the critical controls
05
Define performance and reporting
06
Assign accountability
07
Site-specific implementation
08
Verification and reporting
09
Response to inadequate critical control performance
Planning steps
Implementation steps
Feedback loop

CCM Scorecard



Realisation of dust CCM value potential

- **Plan and prepare**
  - "Lack of mine management support" & "Lack of resources"… "because of inadequate planning & situational analysis"….*MOSH DUST @ Mine Dust Conference 2024*
  - Overall Mine Philosophy & Objectives, LoM plans, ERM framework, etc.
  - Senior Leadership support
  - Management of change programmes
  - Risk language (ICMM, ISO 31 000, etc.)
  - Risk strategy alternatives & business case
  - Project plan (objectives, responsibilities, time lines, finance, etc.)

- **MUEs – sources**
  - "After extensive engagements deliberations, it was agreed that the industry needs to address the dust risk at source" "….*MOSH DUST @ Mine Dust Conference 2024*. So what?
  - MUE identified, described (incl. relevant hazard, mechanism of release & consequences)
  - Quantify sources…

Realisation of dust CCM value potential

- **Define performance & reporting**
  - Define control objective (specific description)
  - Define CC performance requirements (specific, measurable, appropriate & realistic)
  - Identify activities that impact CC performance
    - CC performance dependencies & vulnerabilities identified – FMECA methodology
  - Define verification or "checking" activities

- **Assign accountability**
  - Assign ownership and reporting accountabilities
  - MUE owner, CC owner, Verification activity owner
  - Maintenance Department?
    - Artisans – maintenance & skills
  - Owners access to appropriate/accurate/real time data & information

Realisation of dust CCM value potential

- **Monitoring (Verification) & Reporting**
  - Undertake verification activities for CCs with verification activity reports
  - CC owner to review verification activity reports
  - Conduct verification by active monitoring (e.g. checking maintenance logs, routine inspections, etc.)
  - Occupational hygiene / ventilation measurements?

- **Response to inadequate CC performance**
  - Digitalisation and automation
  - Investigate causes of CC underperformance
  - Leading indicators
  - Proactive learning from performance investigations

- **Assurance (Audit) & Review**
  - Process compliance audits
  - Process effectiveness and efficiency reviews
  - Dust CCM audit protocol to:
    i) Provide reliable rating of current dust CCM implementation
    ii) Credible opinion on the reasons behind the current performance

Call to Action

- Risk and Critical Control Management training for VOHE practitioners
- MUE descriptions
- CCs verification activities (beyond occupational hygiene measurements)
- Accountability & ownership
- Data strengthening
- Simplification of processes, incl. BTAs, verification activities, etc.
- Collaboration between Mines and between Companies
- Develop and implement a process to identify and incrementally improve the maturity of performance drivers
    - ICMM CCM Journey Model & Mapping Tool

Thank you

dr.cas.badenhorst@gmail.com