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Continuous Real-time Monitoring of Airborne Pollutant Engineering Controls Leading Practice

Summarised Version

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PUTTING SOUTH AFRICA FIRST

THE MOSH LEADING PRACTICE ADOPTION SYSTEM

Milestones in Health and Safety

In June 2003, at the third Mine Health and Safety Council (MHSC) Summit, the Chamber of Mines of South Africa and its social partners, government and labour, established occupational safety and health milestones to be attained over a 10 year period. This was followed in 2005, and later reinforced in 2008, by the Chief Executive Officers in the mining industry expressing the commitment of industry to achievement of the milestones and continuous improvement towards zero harm. In 2014 a new set of milestones for the next 10 years were established.

The MOSH Leading Practice Adoption System

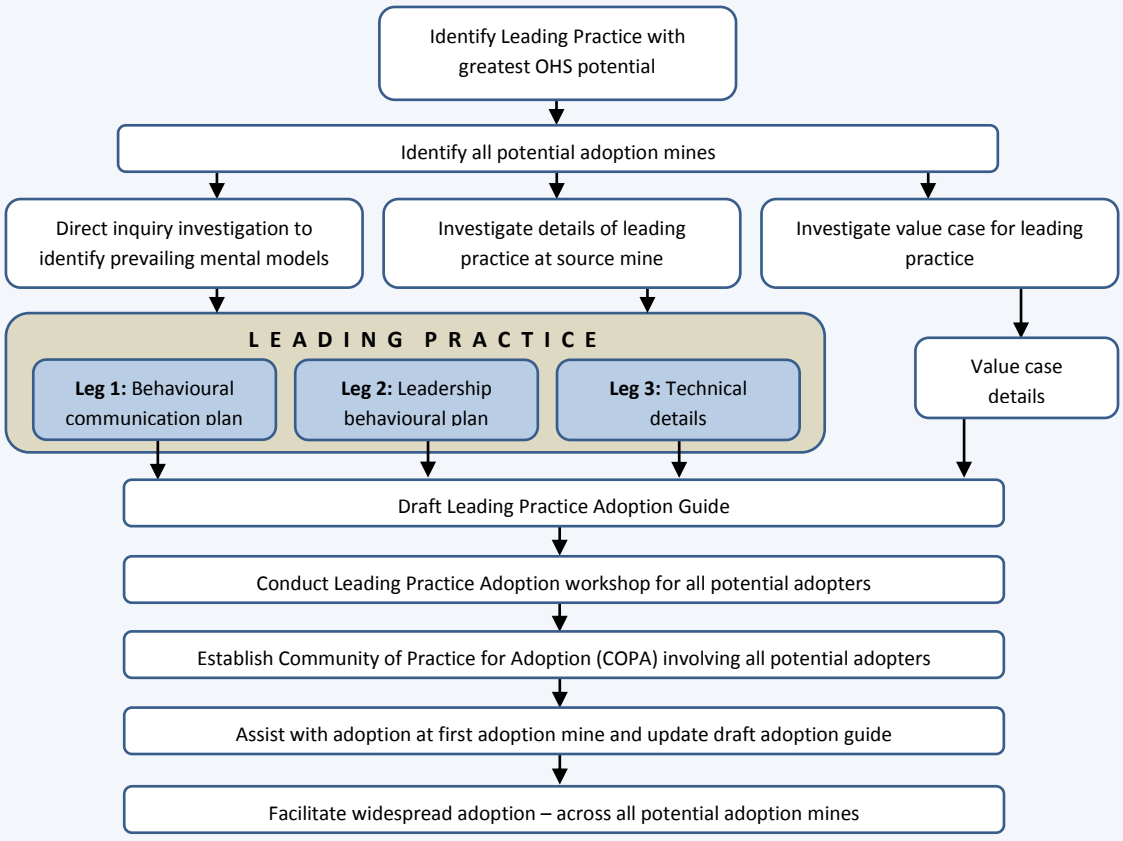
The MOSH Leading Practice Adoption System is a process that finds promising leading practices, selects the best of these, documents it (possibly with refinements) at the operational mine (the source mine) and identifies possible aids and barriers to its adoption at potential adoption mines. Technological details of the leading practice together with detailed leadership behaviour and behavioural communication plans, and procedures for their adoption are then compiled by the relevant MOSH Adoption Team into a Leading Practice Adoption Guide. This guidance is tested at the first adoption mine, or at a special demonstration mine, and then updated by the MOSH Adoption Team to take account of lessons learned. The MOSH Adoption Team facilitates dissemination of this guidance throughout industry by presenting details at a Leading Practice Adoption Workshop and establishing a Community of Practice for Adoption (COPA). The COPA includes key persons from all potential adoption mines and is then used as a forum for providing on going assistance to mines, and for mines to learn from each other in adopting and continuously improving the practice.

The MOSH Leading Practice Adoption System fully recognises that, while a technological or procedural solution may have demonstrated effectiveness, success in adoption of the leading practice at another operation will depend on the key people at that operation - at all levels of employment and leadership. It is the behavioural communication (to address knowledge gaps and misperceptions) and leadership behaviour (to facilitate desired behaviour) aspects of the MOSH Leading Practice that address this challenge. Without the buy-in and support of these key people at the mine, enforced “top down” implementation of the practice at the mine is likely to be short-lived.

The two distinguishing features of the Adoption System and why it is so different from past approaches are thus, in addition to the usual necessary technical detail about the practice, the inclusion of:

- a structured communication strategy to achieve appropriate behaviours of key people at the mine, and
- a leadership behaviour strategy to set out and achieve the desired behaviours of key people at all levels.

Fundamental to the development of leadership behaviour and behavioural communication strategies is an understanding of stakeholder and adopter perceptions (mental models) with regard to the risk/hazard being addressed by the recommended leading practice. The behavioural communication and leadership behaviour strategies that form part of the leading practices have been developed to align with and respond to these mental models of potential stakeholders and adopters of the leading practice at each mine that decides to adopt the practice.



Simple schematic of MOSH Leading Practice Adoption System

EXECUTIVE SUMMARY

The objective of this practice is to move away from a reactive management mode into a proactive approach that will enable industry to do predictive and preventative maintenance management on engineering interventions that control airborne pollutants. This practice allows for immediate intervention when the continuous real-time monitoring system detects excessive airborne pollutants levels.

Industry experts (known as the MOSHIAT-D) identified Continuous Real-time Monitoring of Airborne Pollutant Engineering Controls as one of the leading practices for addressing the risk of harmful airborne pollutants at source. This practice offers outstanding management of the effectiveness of engineering controls of airborne pollutants. It has broad applicability, offers easy installation, has low maintenance requirements and has the potential to have a significant impact on a large number of affected employees across a broad range of commodities.

The MOSH Dust Adoption Team commenced with investigations at the source mines, AngloGold Ashanti's Kopanang Mine and Anglo American's New Vaal Colliery to determine verifiable benefit of the systems in ensuring the reduction of airborne pollutants at source. Trends of airborne dust measurements taken at both Kopanang Mine and New Vaal Colliery indicate a significant decrease in respirable dust as a result of the application of real-time dust monitoring to manage the performance of engineering devices used to mitigate the hazard.

Continuous Real-time Monitoring of Airborne Pollutant Engineering Controls and associated behavioural communication and leadership behaviour strategy are included in the guide for industry-wide adoption.

The strategic context of this work is one of continuous improvement towards zero harm from silica dust and other airborne pollutants to which Chief Executive Officers in the mining industry have duly committed. The objective of this document is to serve as a guide to decision makers and adopters to facilitate the adoption of technology whilst addressing the 'people' issues that aid the process. The scope of the identified leading practice is clearly defined.

The guideline is presented in three parts: the first part outlines the practice, the second part outlines the guidance on adoption of the leading practice at adoption mines and the third part provides reference or example material considered vital to successful adoption.

Key elements of the Leading Practice

The leading practice is a means to prevent worker exposure to harmful airborne pollutants. Key features to address unresolved issues are listed. For areas with existing engineering controls relevance starts with element 3.

1. **Identify**: Document areas and activities associated with sources of airborne pollutants.
2. **Evaluate**: Interpret the airborne pollutant data and propose appropriate interventions and controls.
3. **Communicate:** The Management Team must sanction adoption. To facilitate sustainability Behavioural Communication and Leadership Behaviour plans must be in place early in the Adoption Process.
4. **Demonstrate:** Prove the effectiveness of the engineering intervention tailored to control the airborne pollutant. Upgrade the controls until the desired outcome is consistently achieved.
5. **Monitor:** Select a suitable Continuous Real-time Monitoring system and install to monitor the effectiveness of the engineering controls.
6. **Protect:** Create interventions to protect workers from exposure to the hazard and incorporate it into the protection logic.
7. **Review:** Include the procedures and criteria for review and refinement of the practice that are outlined in the Leading Practice Adoption Guide.

Part 1 – THE PRACTICE

1.1. INTRODUCTION

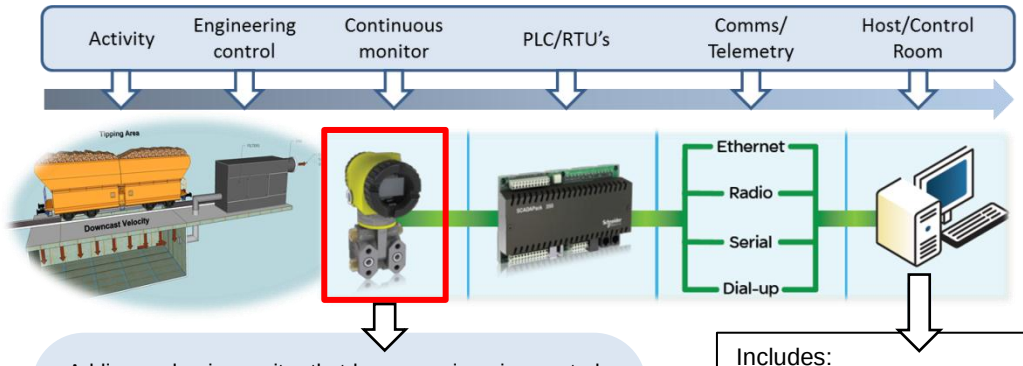
There is a real need for a practice that consistently provides assurance of the sustained integrity of appropriate engineering controls tailored to mitigate airborne pollutants. This practice, which serves that purpose, provides indications to:

- Detect working places or processes with unsatisfactory airborne pollution conditions.
- Determine sources or causes of such conditions.
- Determine the effectiveness of airborne pollutant suppression methods or equipment.
- Upgrade control measures.
- Confirm that satisfactory conditions have been achieved following remedial measures.
- Confirm that satisfactory conditions are being maintained.
- Improve design of ventilation systems.
- Determine trends of ambient conditions.
- Define risk levels through appropriate risk assessments.

The practice incorporates work from the Mine Health and Safety Council (MHSC)' Safety in Mining Research Advisory Committee (SIMRAC) Project '*03 06 03 Track B: Environmental and Engineering Controls'*.

1.2. DESCRIPTION OF PRACTICE

Basic concept of real-time monitoring:



Adding a plug-in monitor that keeps engineering controls "honest" is the essence of the Leading Practice. Instruments are placed strategically at identified sources of an airborne hazard and plugged into an existing telemetry network to monitor the ambient air condition continuously in real-time at an effective engineering control. The data thus generated is utilised to initiate protection logic if a "dust alarm" occurs. All other constituents of the illustration should exist already.

Includes:

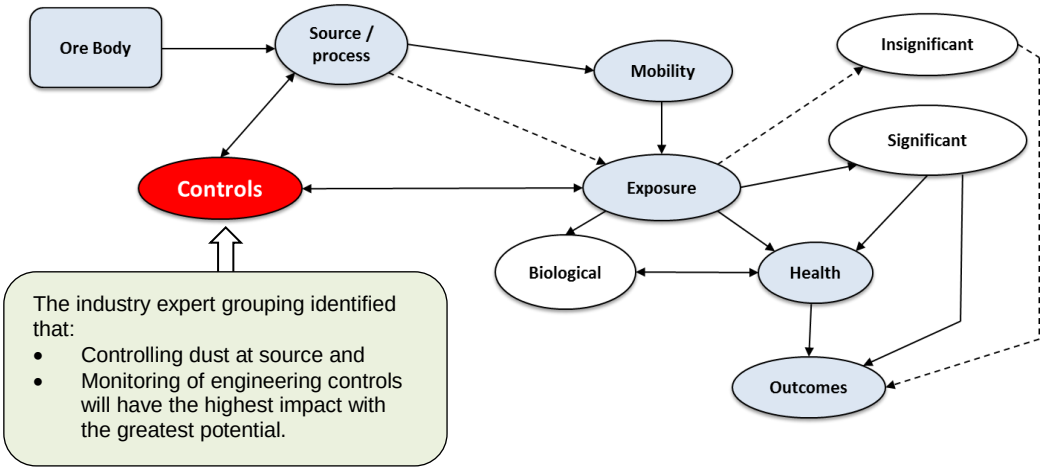
- Communication drivers
- Real-time data monitoring
- Real-time database
- Alarm and event journal
- Historic archive
- Configuration database

Continuous monitors are placed strategically and plugged into an existing telemetry network to monitor the ambient air condition continuously in real-time at an engineering control. The data they generate is utilised to initiate protection logic if a “dust alarm” occurs.

1.3. PROBLEM ADDRESSED (exposure to airborne pollutants)

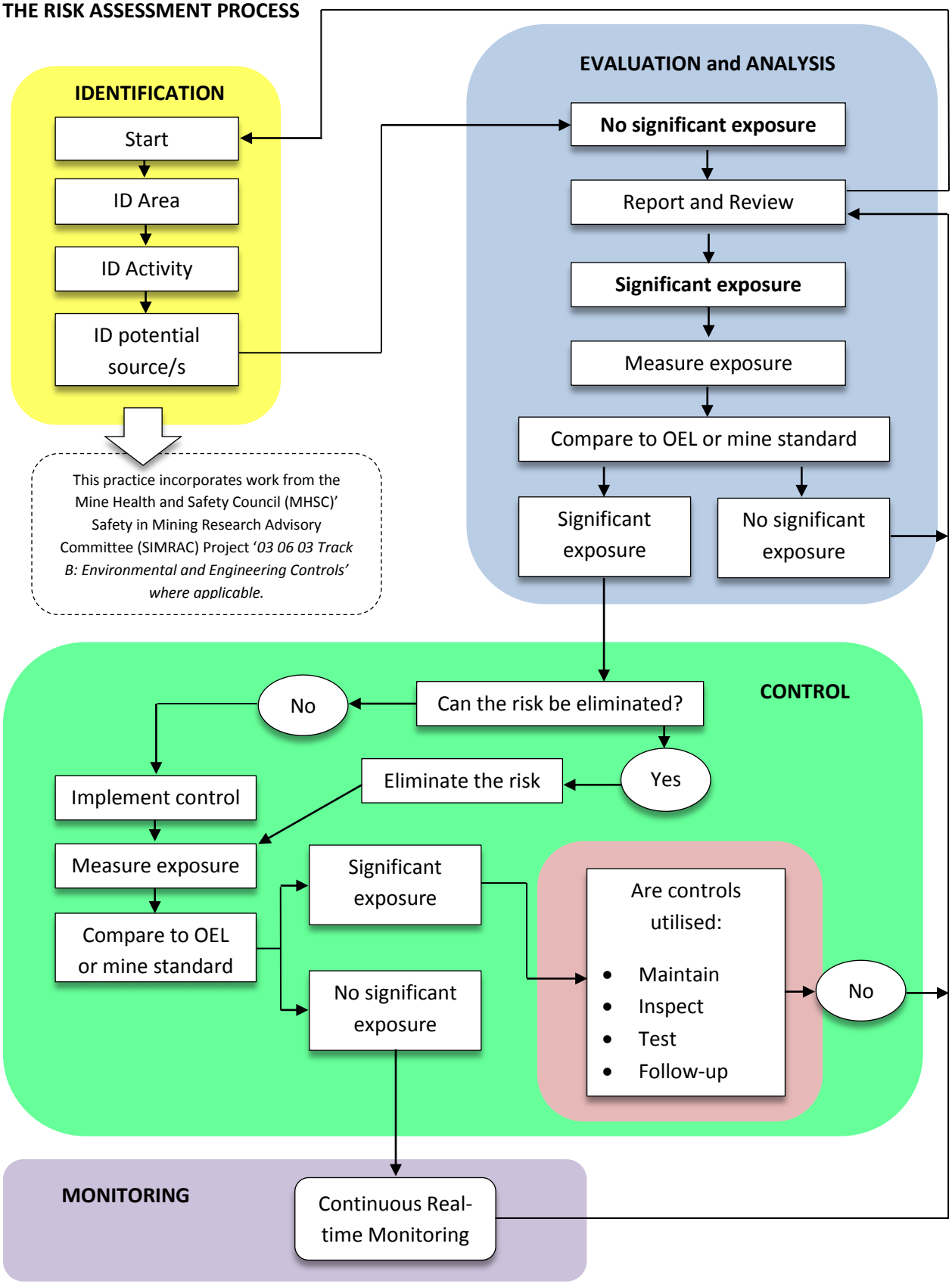
In addressing the problem of exposure to airborne pollutants a risk based approach must be used as shown below taking cognisance of the dust “expert model”:

BASIC DUST EXPERT MODEL: (detailed version attached and explained later in *Part 3* in this document)

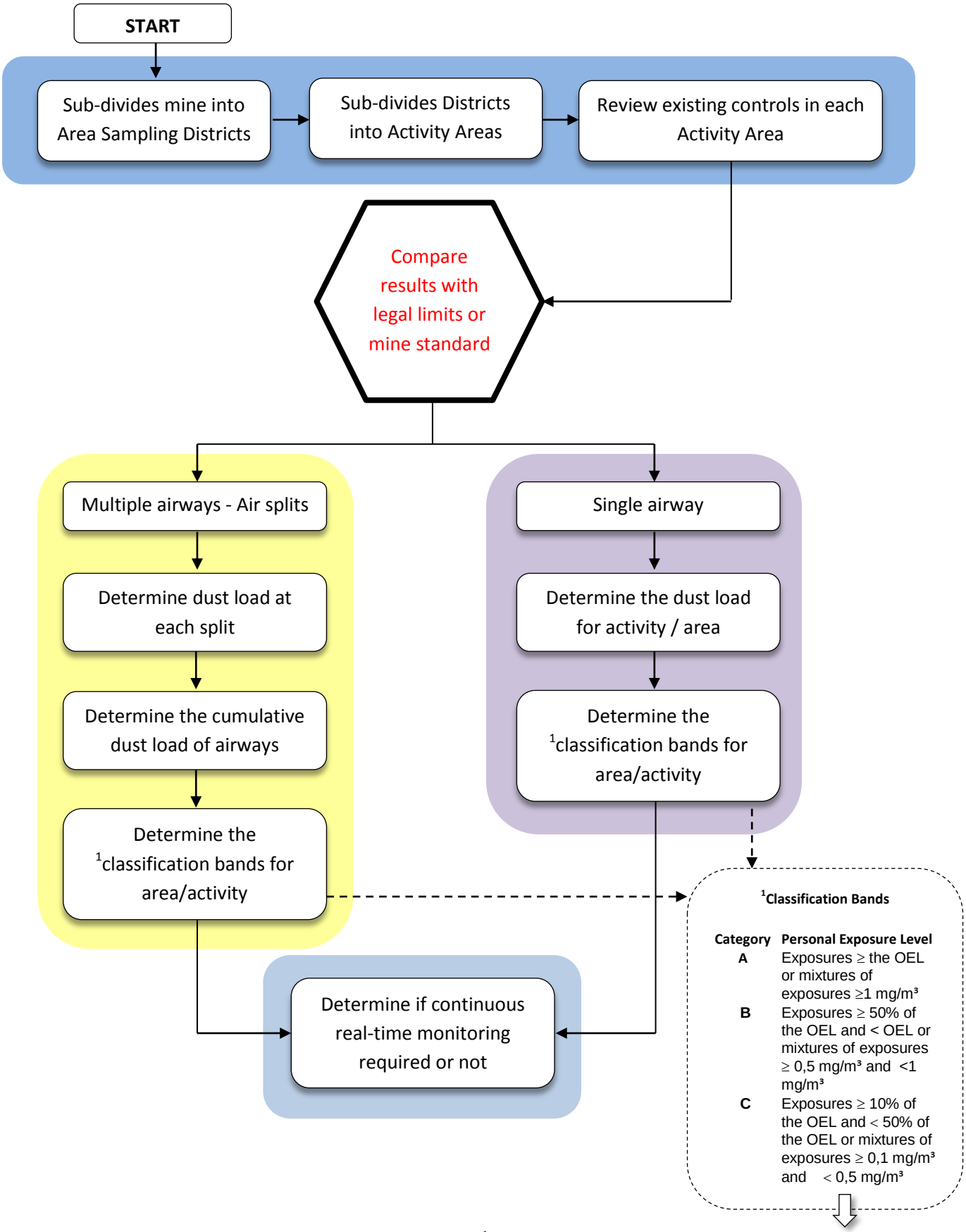


The importance of an “expert model” is to develop an expert understanding of the risk situation. Without such an understanding the risk of addressing symptoms and not causes is real. In the adoption system there is another equally important reason. Unless one has such an understanding, it is not possible to identify the knowledge gaps, misperceptions and mistaken beliefs of adopters and key stakeholders. It is these mental models that can act as barriers to adoption of a selected leading practice.

THE RISK ASSESSMENT PROCESS



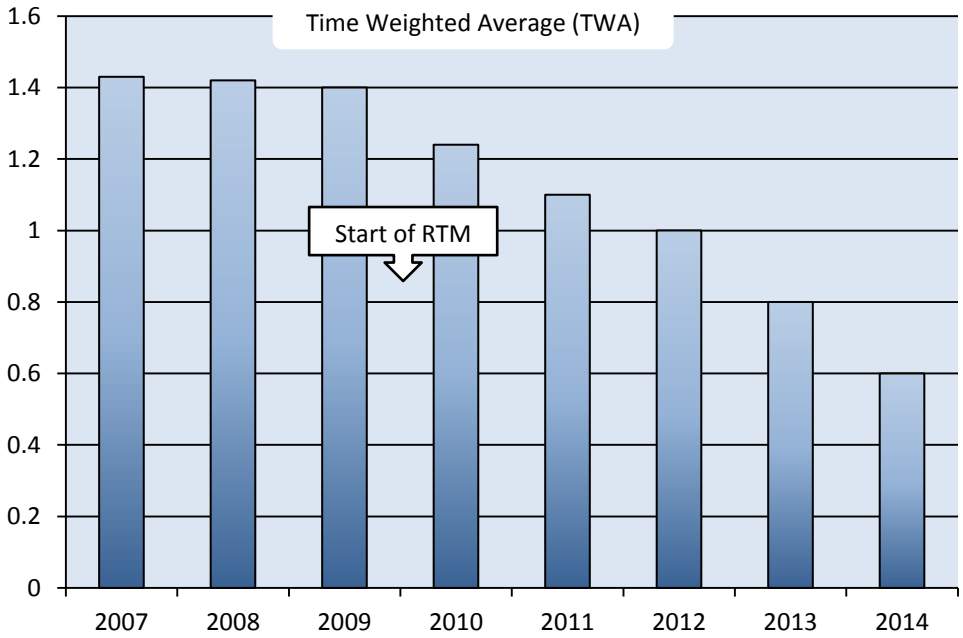
The following process can be used to determine areas for continuous real-time monitoring:



[1]Ref: Mandatory Code of Practice for the Assessment of Personal Exposure to Airborne Pollutants (current)

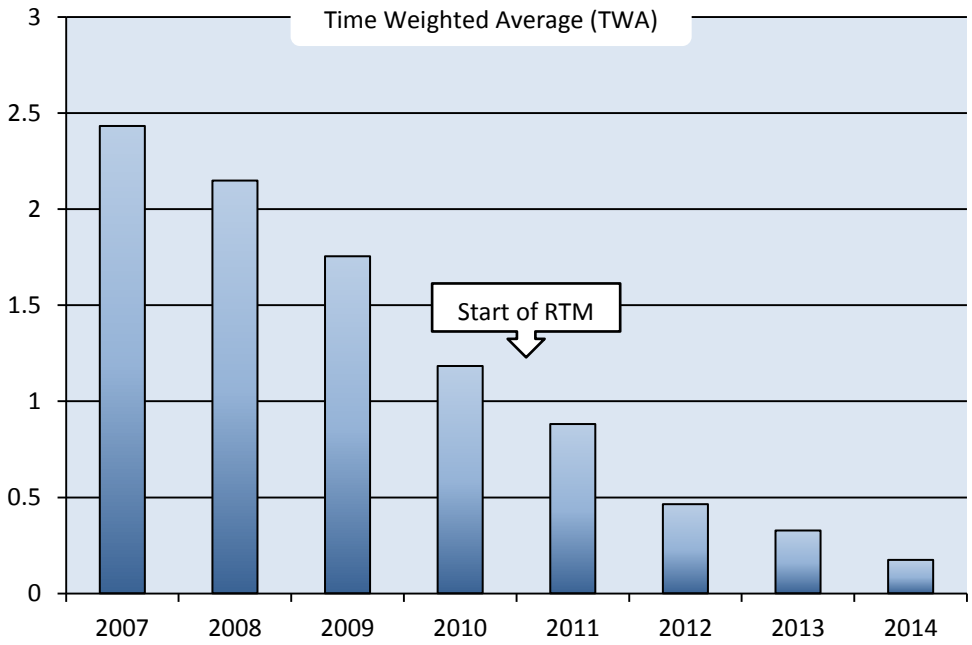
1.4. SUMMARY OF PERFORMANCE AND IMPACTS

Kopanang - Source Mine



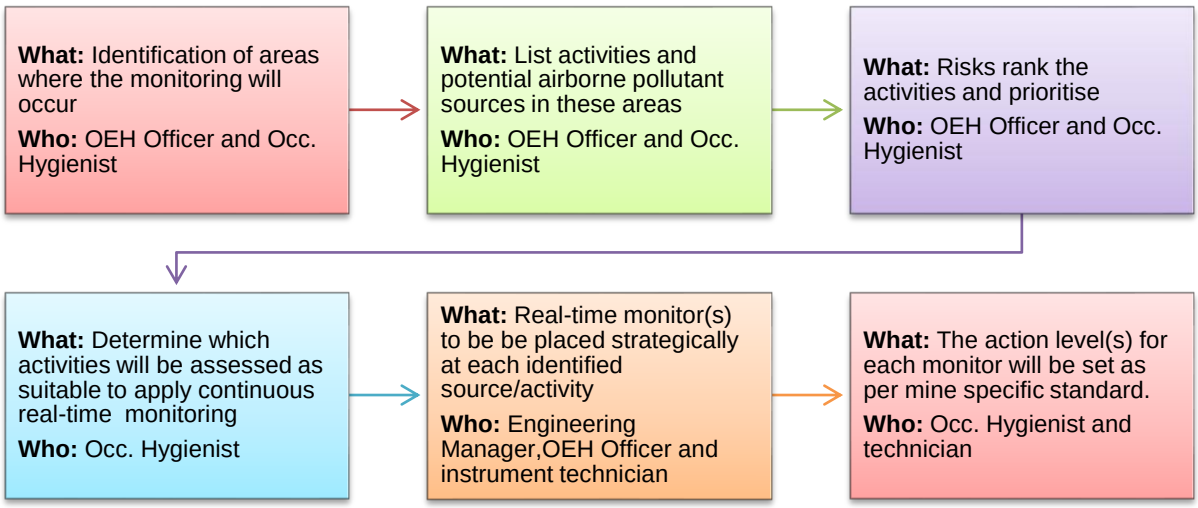
New Vaal Colliery – Source Mine

The average annual workers' exposure to respirable coal dust is shown below. The improvement from 2010 on is attributed to the introduction of Real-time Monitoring of the effectiveness of the dust controls at the Primary Tip. This is an 85% improvement between sampling results (annual averages) for 2010 and 2014.



METHODOLOGY

PROCESS FLOW OF THE PRACTICE



1.5. CRITICAL SUCCESS FACTORS

Identification of critical issues and potential unintended consequences at industry level				
No	**Critical issues / Unintended consequences**	**Assessment of urgency for action (high – moderate – low)**	**Possible mitigating action**	**Possible pre-emptive communication**
Affecting workers				
1	Early engagement	High	Ensure that workers are briefed through the Health and Safety Structures	We as a mine are serious about taking care of the health of our workers in terms of reducing the effect of airborne pollutants
Risk specific group (airborne pollutant team)				
2	Lack of awareness and understanding of the problem	High	Establish sub teams within the mine Health and Safety Structure to assist with awareness and adoption plan Give continuous feedback to workforce on progress and impact achieved (closing the loop)	Appoint people to form part of the sub-committee
Senior Management				
3	Lack of commitment and support towards health related issues	High	Senior management should “walk the talk” and ensure a multi-disciplinary sustainable approach is embedded. LIVE your company’s and personal values of caring	It is a requirement in terms of the MHSA and the CTF and the tri-partite milestones.