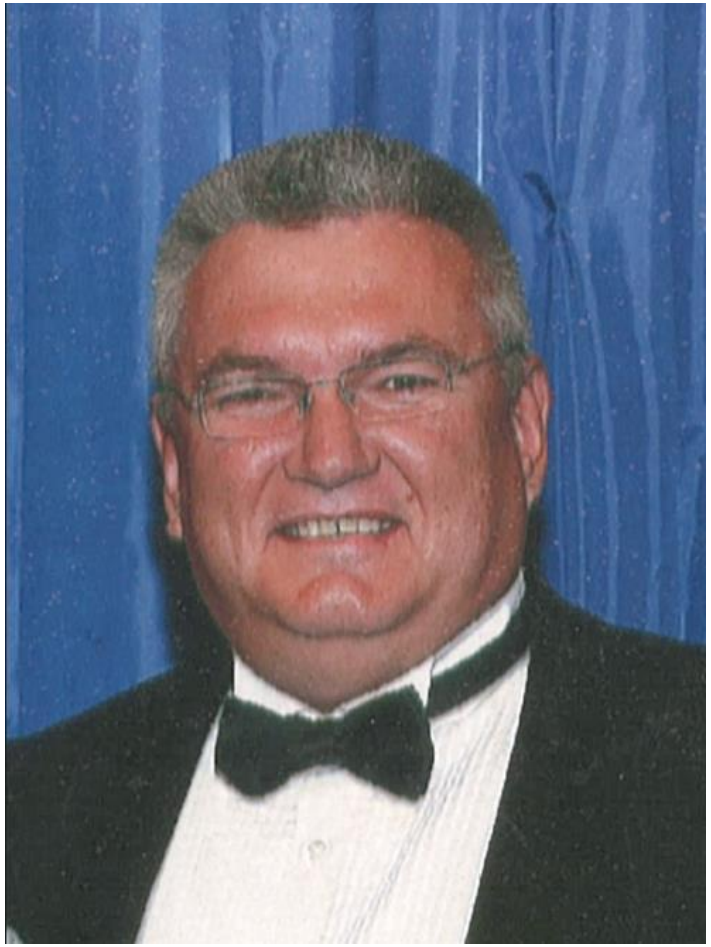
Dust Suppression Spray Technology

Kobus Dekker

MINERALS COUNCIL
SOUTH AFRICA

Biography



Professional

- Master of Public Health: Occupational Hygiene, University of the Witwatersrand, South Africa, 2004
- Radiation Protection Officer Certificate, National Nuclear Regulator, South Africa,1995.
- Certificate in Mine Environmental Control, Chamber of Mines, South Africa, 1992

Memberships

- Mine Ventilation Society of South Africa (Past President)

Work Experience

- **Sept 2007 to date:** Managing Director, Kobus Dekker Occupational Hygiene Consultancy (Pty) Ltd and January 2024 to current, Director Envision Now
- **March 2005 – Aug 2007:** Senior Research Scientist, CSIR – NRE, South Africa
- **Nov 1988 – Apr 2005:** Anglo American including Occupational Environmental Safety and Health Manager, AngloGold Ashanti Mining Company, South Africa

Areas of expertise

- Establishment of qualitative and quantitative occupational hygiene risk assessment
- Development of Occupational Hygiene Management programs and plans for mining houses
- Implementation of appropriate occupational hygiene management systems
- Development and establishment of exposure control strategies, including ventilation control
- Implementation and management of exposure controls
- Project leader and project member on various health and occupational hygiene related research projects for organisations such as the Mine Health and Safety Council, Centre for Scientific and Industrial Research, National Institute for Occupational Health and University of Pretoria.
- Invited lecturer for the Master in Public Health program at Wits and various others.
- Author and presenter of numerous papers and presentation s on the subject of Mine Occupational Hygiene.

Countries of work experience:

South Africa, Lesotho, Mali, Tanzania, Namibia, Mozambique, Zambia, Ghana, Democratic Republic of the Congo, Guinea, Botswana, Mauritania.

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MOSH
MINE DUST CONFERENCE

WATER SPRAYS EFFECTIVENESS, EFFICIENCY, AND SELECTION FOR DUST SUPPRESSION

JJ Dekker

21 June 2024

CONTENT

- Effective Dust Management System
- General Dust Control Considerations
- Hierarchy Of Control
- Basic Rules For Dust Control
- Common Dust Control Methods
- **Dust Suppression With Water Sprays**
- Information Sources
- Closing Thoughts
- Questions / Comments

EFFECTIVE DUST MANAGEMENT SYSTEM

An effective dust management system consists (at a minimum) of the following main elements:

- Structured commitment from management and employees;
- A defined risk assessment methodology;
- A defined evaluation methodology;
- A defined corrective-action control strategy;
- Health and exposure monitoring systems; and
- Formal education, motivation, awareness and training programmes targeting those exposed to respirable dust.

A thorough understanding of the **interactions** between these elements is also required as none of the abovementioned elements can be viewed or managed in isolation. In addition, these elements must be supported by adequate and appropriate **resources** and **quality control** systems.

GENERAL DUST CONTROL CONSIDERATIONS

To minimise the exposure of employees to dust, consideration needs to be given to the control measures listed below. If applied together, as an integrated set of measures, these will go a long way to ensuring adequate control:

- Assessing the risk to health;
- Implementing and maintaining appropriate controls;
- Improving work practices and maintaining appropriate personal protective equipment;
- Conducting periodic medical surveillance of employees exposed to various types of dust; and
- Providing adequate employee information, instruction and training

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HIERARCHY OF CONTROL

Such controls must be implemented through adhering to the following generic occupational hygiene hierarchy of control:

- Elimination, substitution and isolation of the dust source
- Engineering controls;
- Administrative controls; and
- Personal protective equipment.

The implemented controls must also be **maintained**, **inspected** and **tested** to ensure that they are effectively reducing the risk posed by exposure to respirable silica dust.

BASIC RULES FOR DUST CONTROL

The basic rules to be followed if the control of dust exposure is to be effective include:

- Keeping dust generation to a minimum;
- Preventing contaminating of the atmosphere by controlling dust at source;
- Reducing the amount of dust present in the air;
- Removing workers from the dust-laden air;
- Placing a barrier between workers and the dust-laden air; and
- Ensuring that the installed systems for dust control are working at maximum efficiency for a maximum period of time.

COMMON DUST CONTROL METHODS

The most common dust control methods implemented continue to be:

- the prevention of dust formation at source;
- dust suppression with water;
- dilution by means of ventilation;
- dust extraction and filtration; and
- work procedures and methods to separate workers from dust, such as ventilated control cabins and personal protective equipment.

DUST SUPPRESSION WITH WATER SPRAYS

Electrical Control Input & Panel

Electrical Motor

Water Pump

Water Feed Line

Spray Nozzle

Dust Source

Water Filter

Water Input

Chemical Input

Compressed Air Input

DUST SUPPRESSION WITH WATER SPRAYS

Most important rule to remember
In the design of a dust suppression system:

One Size Does NOT Fit ALL

DUST SUPPRESSION WITH WATER SPRAYS

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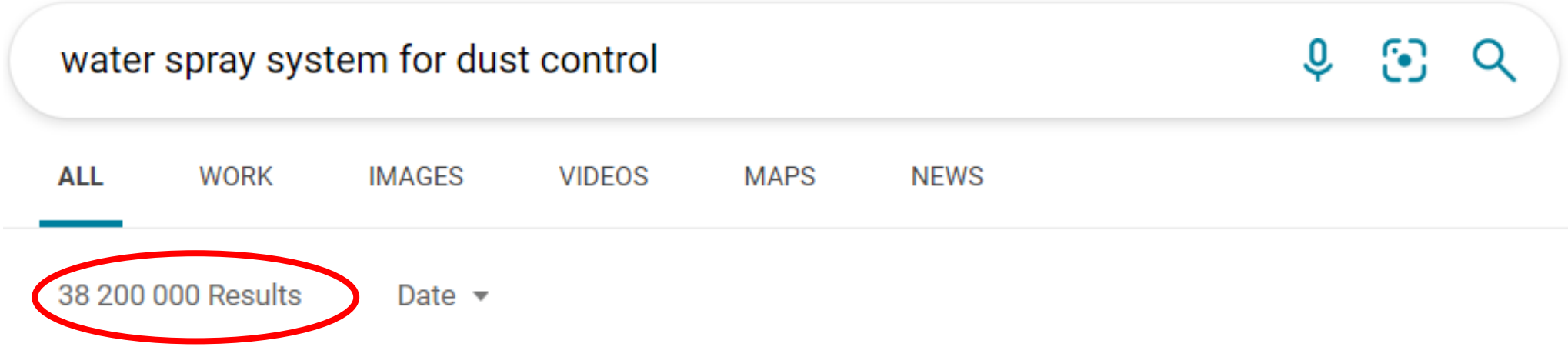
Chemical Input

Compressed Air Input

DUST SUPPRESSION WITH WATER SPRAYS

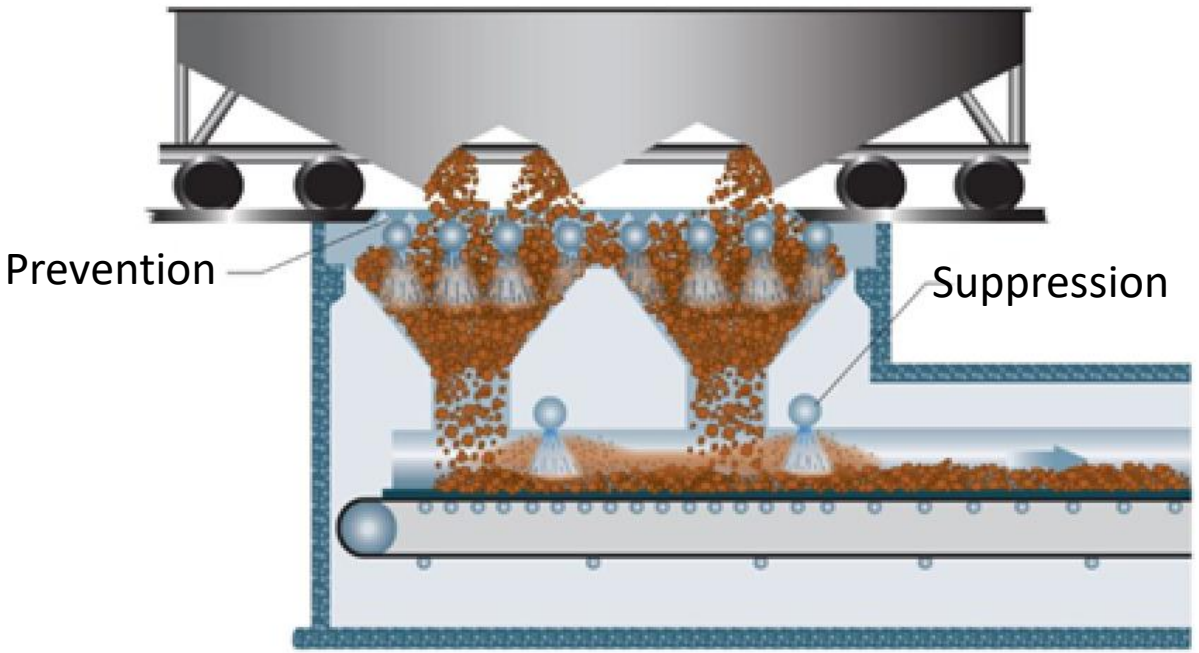


Some thoughts to follow

DUST SUPPRESSION WITH WATER SPRAYS

Dust Source

Energy Release Points ??



DUST SUPPRESSION WITH WATER SPRAYS

- **Dust Source:**
  - At source?
  - Airborne?

- **Properties of Dust:**
  - Elemental Composition?
  - Size of Dust?
  - Quantity of Dust?
  - Dust Production Rate?

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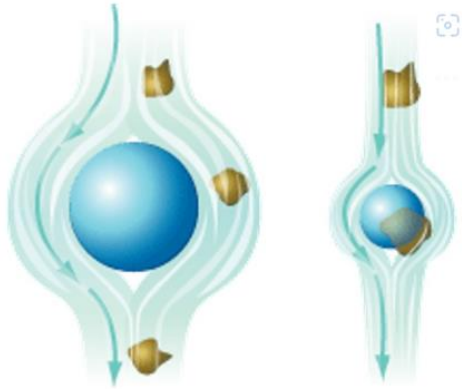

Spray Nozzle

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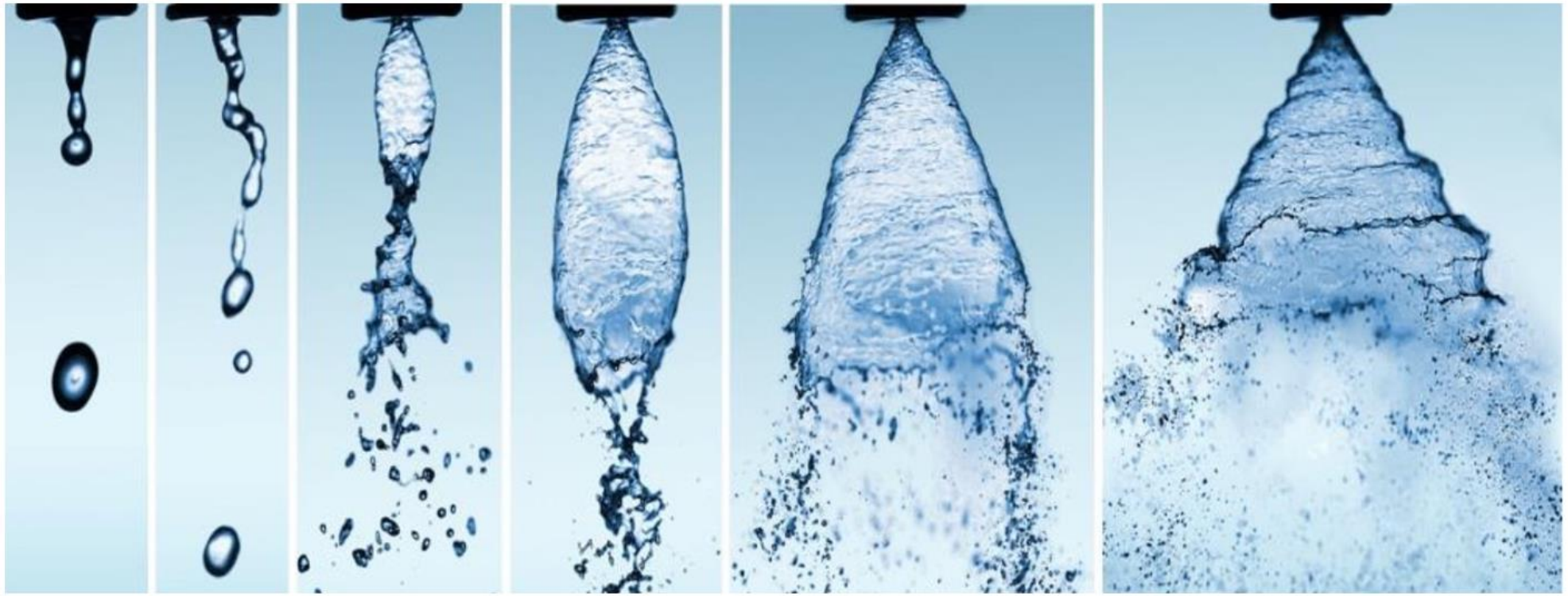
DUST SUPPRESSION WITH WATER SPRAYS

Stages of spray pattern formation



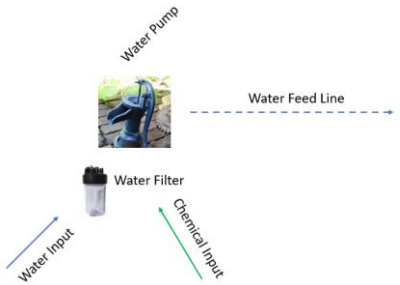
DUST SUPPRESSION WITH WATER SPRAYS

- **Flow Rate**
- **Spray Pattern**
- **Spray Angle**
- **Spray distance**
- **Spray configuration**
- **Droplet size**
- **Orifice size (water quality)**

- Creating Cold Environment
- Creating Humid Environment
- Visibility issues

- Water Pressure
- Nozzle Type
- Environmental Factors
  - Temperature
  - Humidity
  - Air Ventilation Speed
  - Other Energy Sources, e.g., vehicles, conveyor belt direction and speed
- **NB - Maintenance Capability**
- Etc.

DUST SUPPRESSION WITH WATER SPRAYS



Water Pump

Water Feed Line

Water Filter

Water Input

Chemical Input

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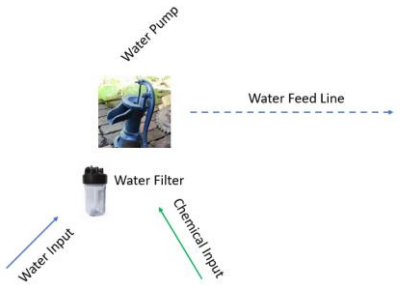
DUST SUPPRESSION WITH WATER SPRAYS



- **Water availability / reliability of availability**
  - Water Quality
  - Water Quantity
  - Water Pressure
- **Filtration Type & Maintenance**
- **Chemical Required**
  - Surfactant (water tension)
  - Foam (adhesive)
  - Polymer (improved airborne efficiency)
  - Hybrid (e.g. Polymer with surfactant)
  - MSDS Requirements
  - Purpose
    - Pump performance
    - Nozzle performance
    - Dust Capture
    - Dust Containment

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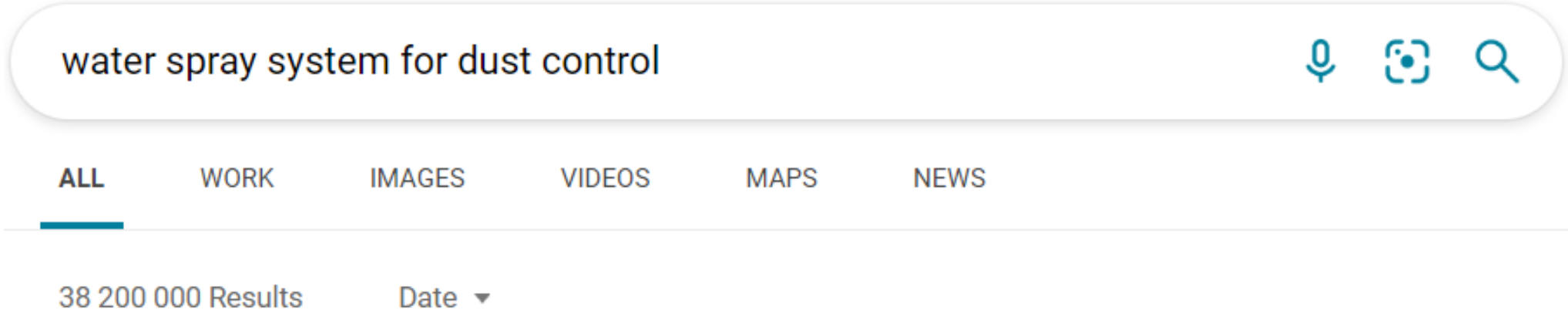
DUST SUPPRESSION WITH WATER SPRAYS

Activation

- Timer
- Real-time monitoring
- Task / Activity (Lazer)
- Etc.

INFORMATION SOURCES



How do we evaluate efficiency and efficacy?

INFORMATION SOURCES

Mine Health and Safety Council

Project Number: SIM 03 06 03 (B)

Engineering and Environmental Controls

Date: 3 May 2011

Venue: CSIR Convention Centre, Pretoria

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INFORMATION SOURCES

Mine Health and Safety Council

Project Number: SIM 03 06 03 (B)
Engineering and Environmental Controls
Date: 3 May 2011
Venue: CSIR Convention Centre, Pretoria

LIST OF PRESENTATIONS MADE DURING THE DAY

- DATA VISUALISATION SOFTWARE (DATAVIZ) AND ACTIVITY RECOGNITION SOFTWARE (SCOREKEEPER)
- MANUAL OF GOOD PRACTICE FOR DUST SAMPLING FOR COAL MINES
- MANUAL OF GOOD PRACTICE FOR DUST SAMPLING FOR GOLD MINES
- LABORATORY DUST FILTRATION EFFICIENCY TESTING
- OPERATIONAL DUST FILTRATION EFFICIENCY TESTING
- DEVELOP A DRAFT GOOD PRACTICE MANUAL FOR QUARRIES BASED ON LITERATURE FINDINGS
- PILOT AND EVAULATE POTENTIALLY COST-EFFECTIVE NEW AND EXISTING DUST CONTROL METHODS FOR UNDERGROUND GOLD MINING
- PILOT AND EVAULATE POTENTIALLY COST-EFFECTIVE NEW AND EXISTING DUST CONTROL METHODS FOR UNDERGROUND COAL MINING

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CLOSING THOUGHTS

- ? Need Best Practice Manual (Explain basics – no final answer – literature review)
- ? Need Testing Methodology
- ? Need Testing Facility

Note to Experienced Practitioner

DO NOT IGNORE
COMMON SENSE / GUT FEELING

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Thank you for your time

Questions / Comments ?