THE UNIVERSITY OF QUEENSLAND
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CREATE CHANGE

RCS Characterisation and Controls

Nikky LaBranche

MSHAC RCS Controls Forum

Agenda

Particle size and particle size distributions

- Health Hazard
- Dust controls

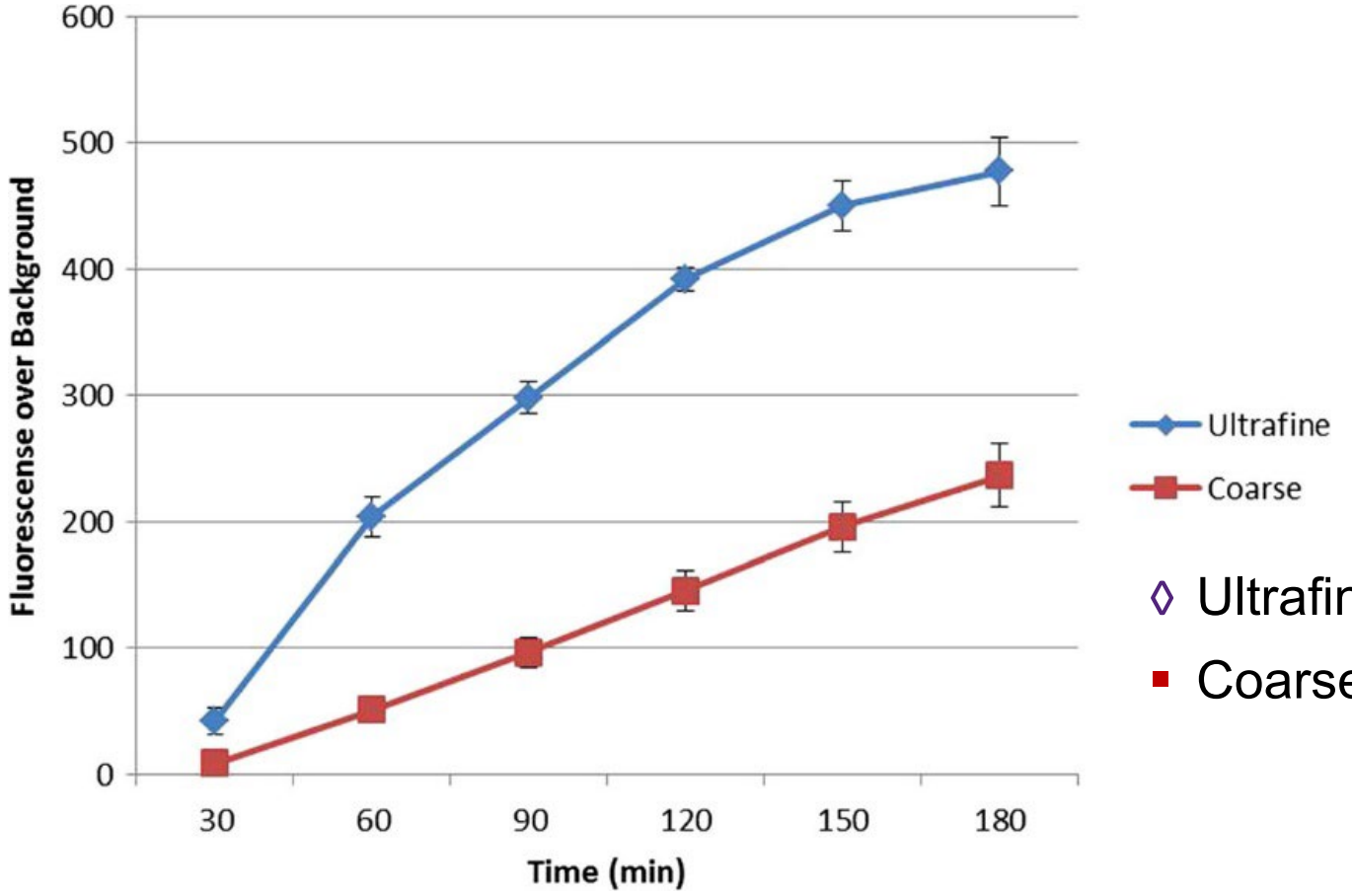
Microagglomerates- complex nature of dust

Controls

- ACARP C26048 Report Volume 4
- Other Resources

RCS size influences health hazard

- Different size RCS dust created a different level of macrophage activation
- Smaller particles causes a greater inflammatory response in the body
- These particles may not have much mass

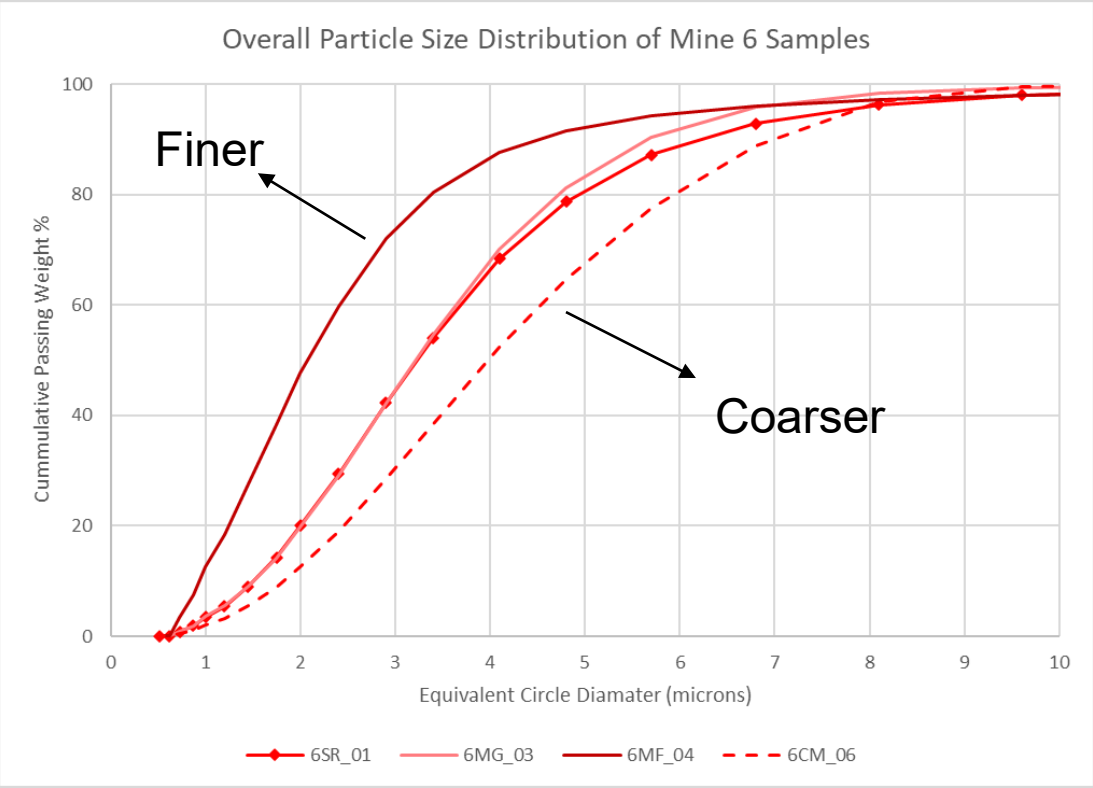


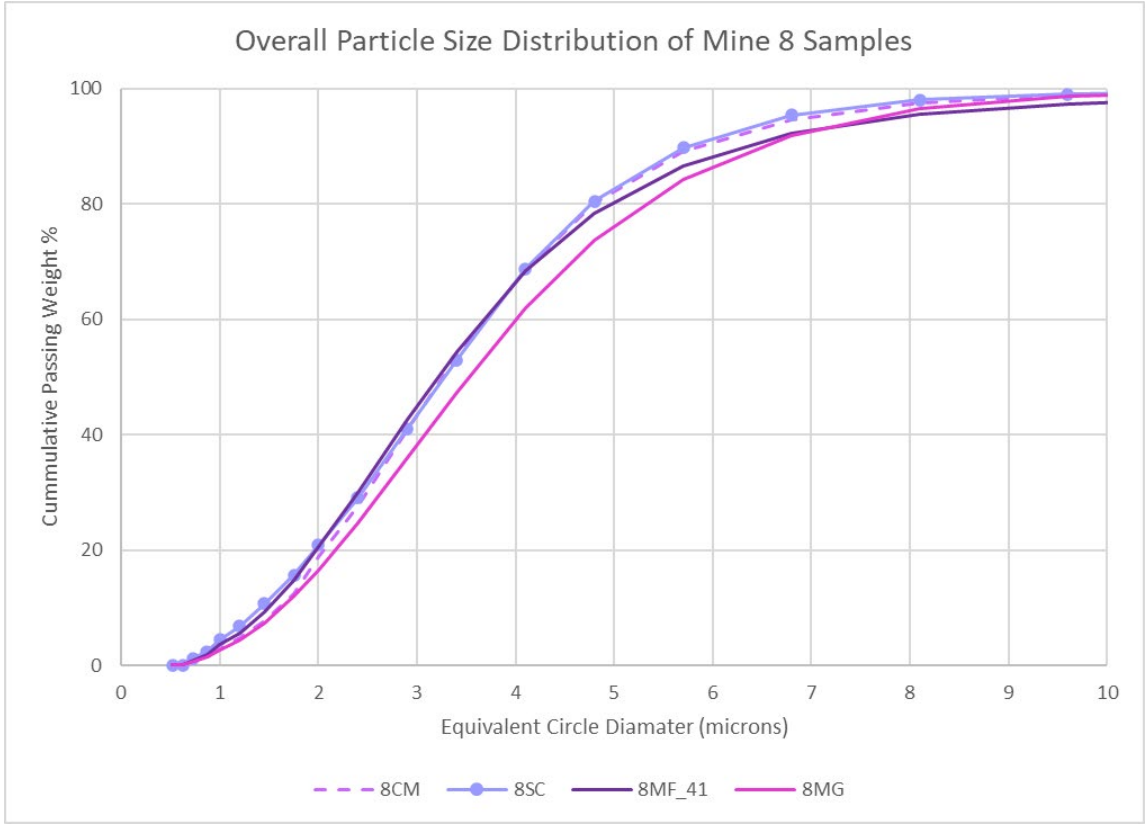
◊ Ultrafine = 0.3 µm

▪ Coarse = 4.1 µm

Mischler et al 2016 Differential activation of RAW 264.7 macrophages by size-segregated crystalline silica

Overall PSD can vary by location in a mine



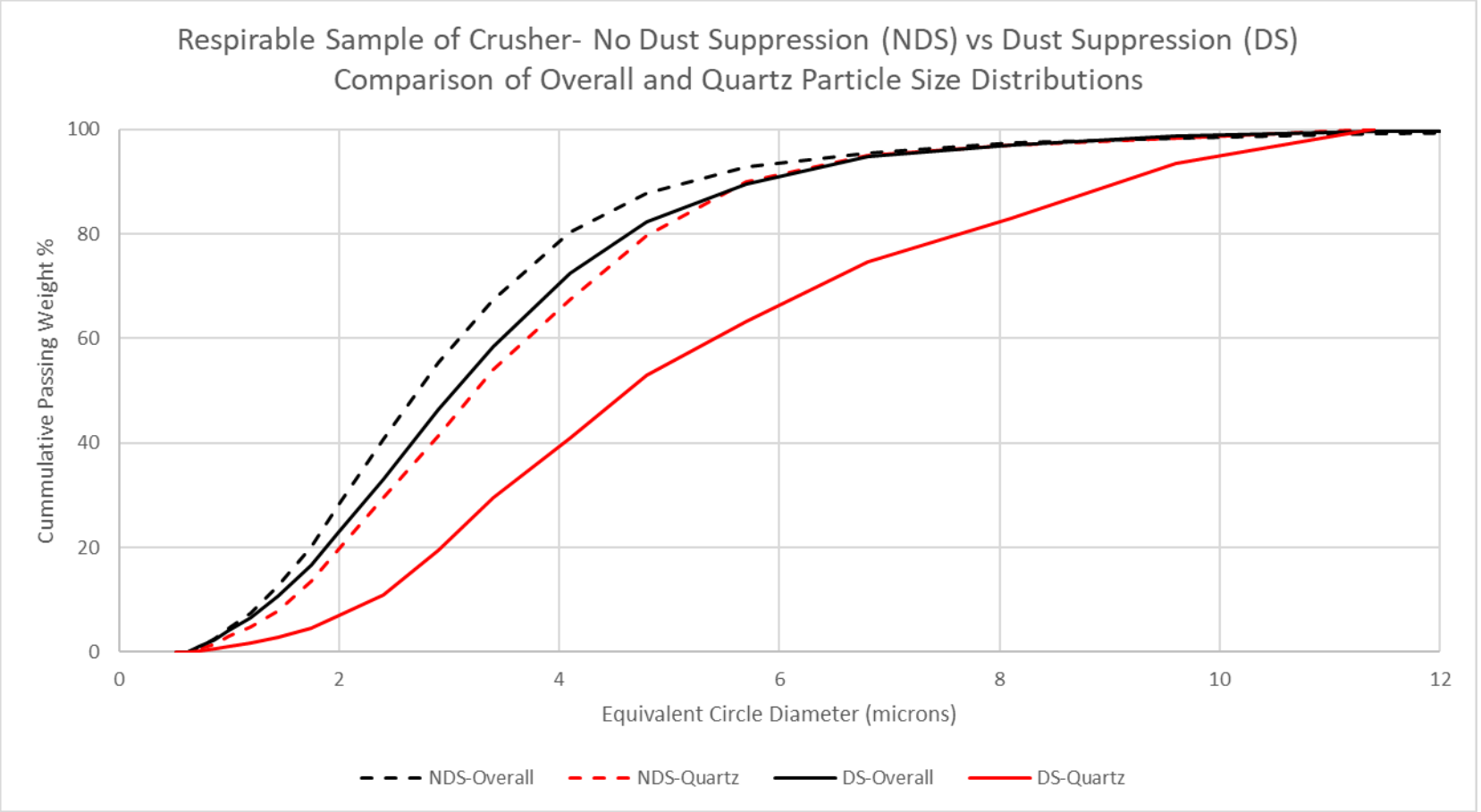


Locations
SR= Secondary Recovery
MG= Longwall Maingate
MF= Longwall Midface
CM= Continuous Miner
SC= Shuttle Car

LaBranche et al 2022. Characterization Analysis of Airborne Particulates from Australian Underground Coal Mines Using the Mineral Liberation Analyser

RD and RCS Particle Size Distributions

- Overall PSD becomes slightly coarser with dust suppression
- Quartz PSD becomes much coarser with dust suppression
- In this case the dust suppression is removing the fine quartz particles

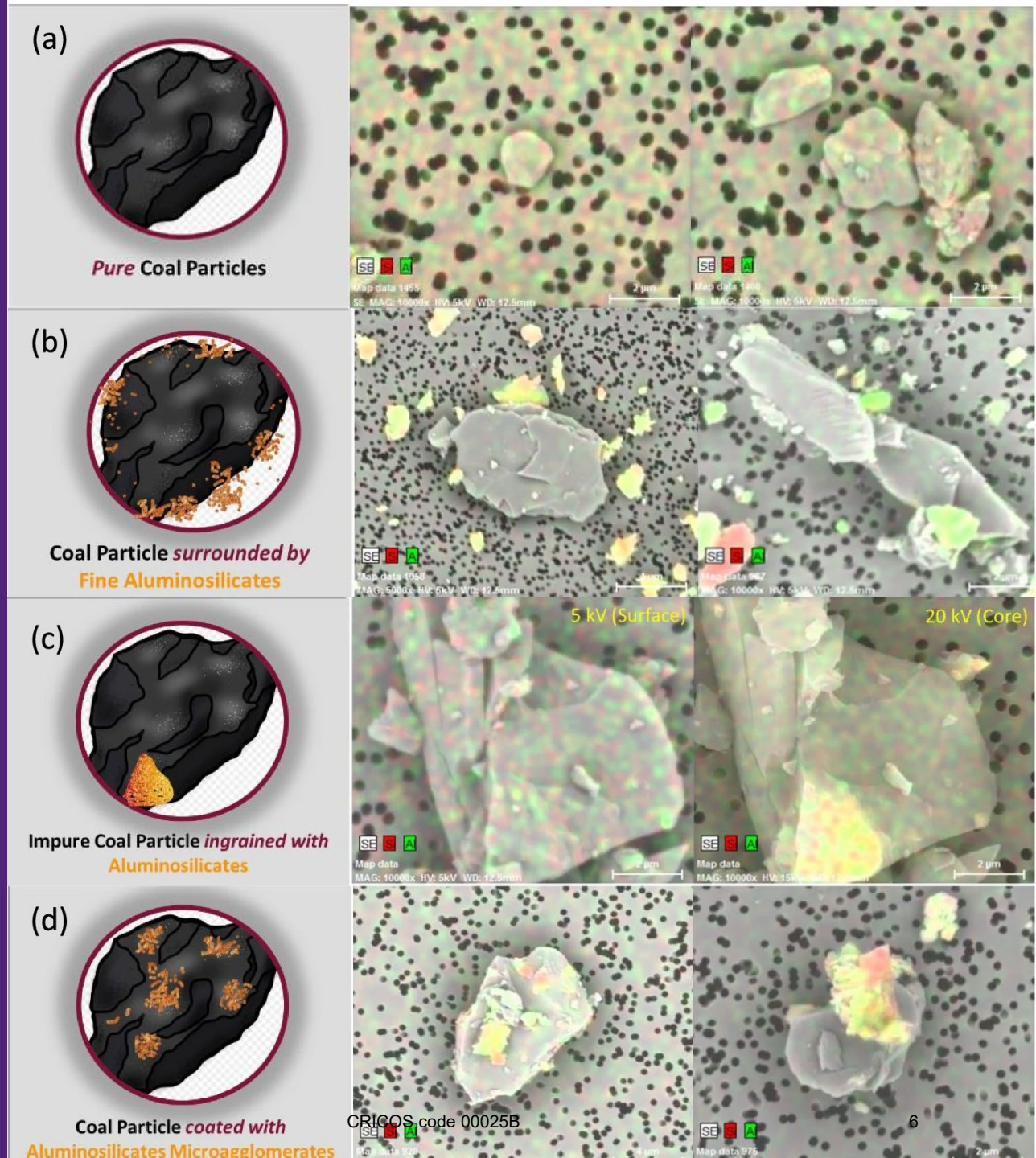


Microagglomerates (MAGs)

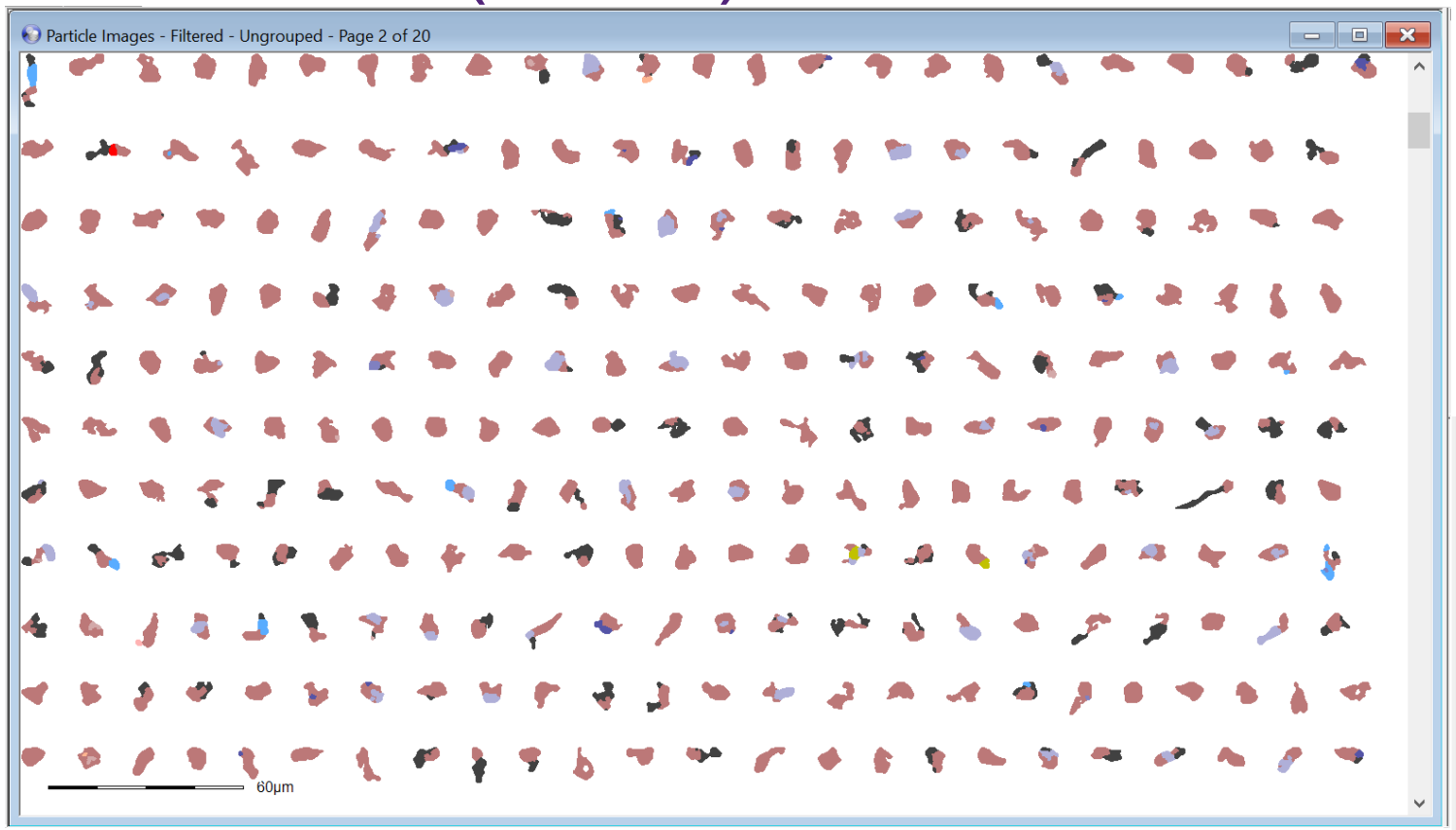
MAGs form in the mine environment

May Have Implications for the Health Hazard

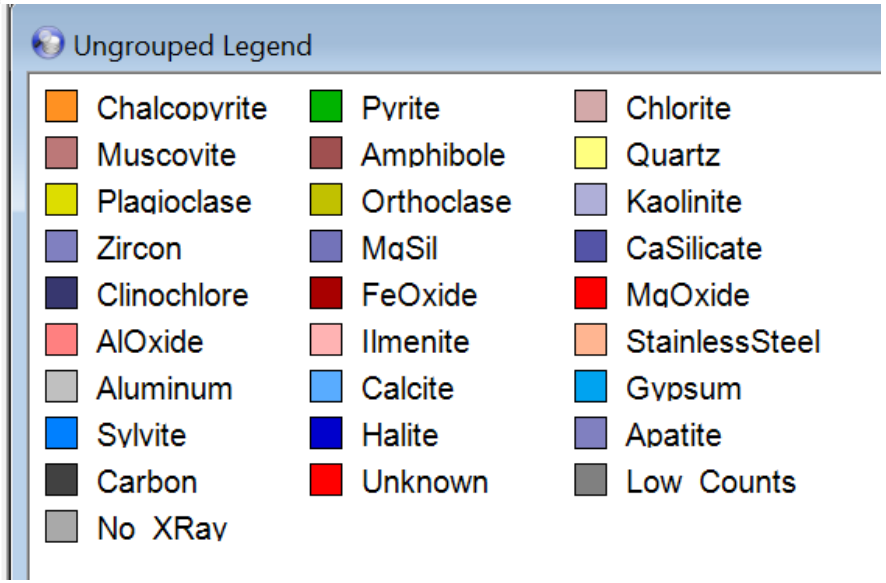
Gonzalez et al 2022. On the Occurrence and Persistence of Coal-Mineral Microagglomerates in Respirable Coal Mine Dust



Muscovite (>25%)



Muscovite agglomerated with carbon, kaolinite, calcite

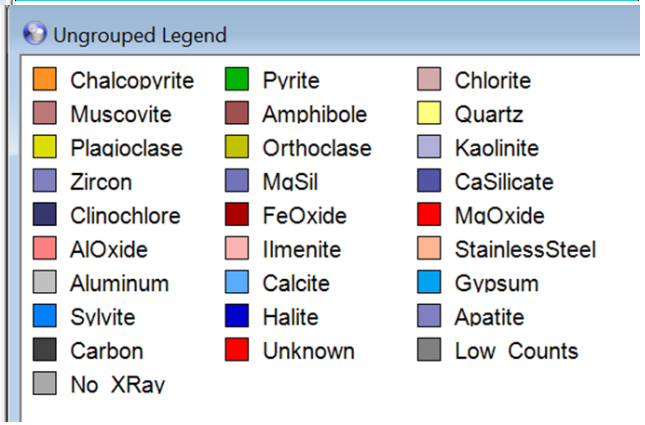


Silica Particles

>25% silica by Weight %

Modal Mineralogy: Filtered - Silica 25+ - Passed ...

Mineral	Wt%	Area%	Area (micron)	Particle Count	Grain Count
Chalcopyrite	0.04	0.02	29.26	2	2
Pyrite	0.00	0.00	0.00	0	0
Chlorite	0.11	0.09	115.33	21	21
Muscovite	0.49	0.45	552.49	106	109
Amphibole	0.62	0.47	573.83	110	113
Quartz	69.95	69.00	84191.14	12591	13004
Plagioclase	0.96	0.95	1161.38	206	213
Orthoclase	1.87	1.90	2316.49	325	370
Kaolinite	2.48	2.47	3018.59	329	364
Zircon	0.00	0.00	0.00	0	0
MgSil	0.00	0.00	0.00	0	0
CaSilicate	4.11	2.73	3333.52	384	438
Clinochlore	0.01	0.01	12.40	2	2
FeOxide	0.00	0.00	0.00	0	0
MgOxide	0.00	0.00	0.00	0	0
AlOxide	0.00	0.00	0.00	0	0
Ilmenite	0.02	0.01	12.00	3	3
StainlessSteel	0.06	0.02	23.46	5	5
Aluminum	0.00	0.00	0.00	0	0
Calcite	1.20	1.15	1398.79	152	163
Gypsum	0.00	0.00	0.00	0	0
Sylvite	0.00	0.00	0.00	0	0
Halite	0.00	0.00	0.00	0	0
Apatite	0.10	0.08	100.66	17	17
Carbon	17.96	20.61	25150.80	2099	2531
Unknown	0.03	0.02	29.11	2	2
Low_Counts	0.00	0.00	0.00	0	0
No_XRay	0.00	0.00	0.00	0	0
Total	100.00	100.00	122019.26	12591	17357



Reviews of Exposure Data

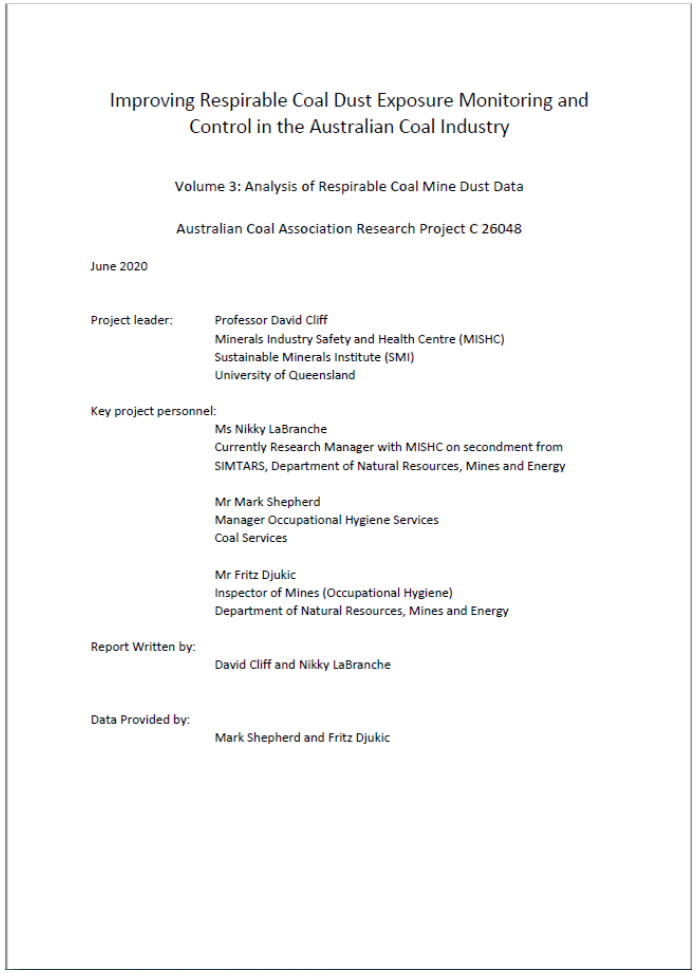
Two recent reviews of exposure data

Baseline Review of Occupational Health Risks Report 2021

MMQ data for RD, RCS

ACARP C26048, 2020

QLD coal mines compared to NSW and USA



Improving Respirable Coal Dust Exposure Monitoring and Control in the Australian Coal Industry

Volume 3: Analysis of Respirable Coal Mine Dust Data

Australian Coal Association Research Project C 26048

June 2020

Project leader: Professor David Cliff
Minerals Industry Safety and Health Centre (MISHC)
Sustainable Minerals Institute (SMI)
University of Queensland

Key project personnel:
Ms Nikky LaBranche
Currently Research Manager with MISHC on secondment from SIMTARS, Department of Natural Resources, Mines and Energy

Mr Mark Shepherd
Manager Occupational Hygiene Services
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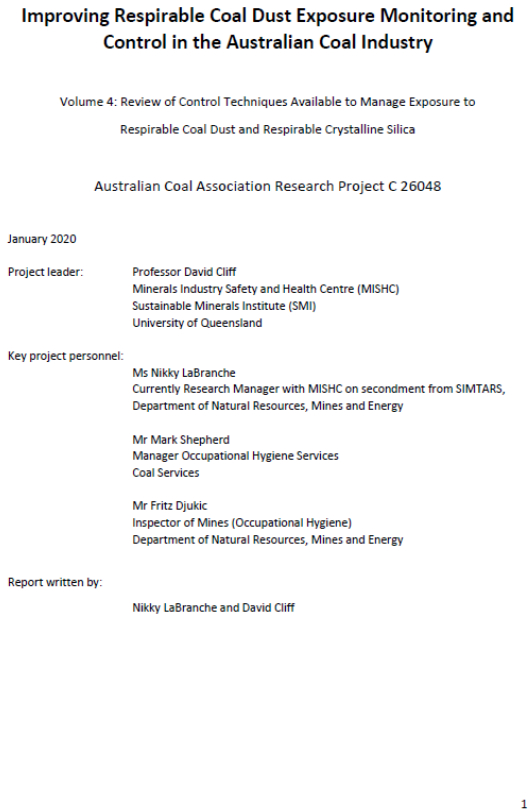
Mr Fritz Djukic
Inspector of Mines (Occupational Hygiene)
Department of Natural Resources, Mines and Energy

Report Written by:
David Cliff and Nikky LaBranche

Data Provided by:
Mark Shepherd and Fritz Djukic

ACARP C26048- Volume 4



Improving Respirable Coal Dust Exposure Monitoring and Control in the Australian Coal Industry

Volume 4: Review of Control Techniques Available to Manage Exposure to Respirable Coal Dust and Respirable Crystalline Silica

Australian Coal Association Research Project C 26048

January 2020

Project leader: Professor David Cliff
Minerals Industry Safety and Health Centre (MISHC)
Sustainable Minerals Institute (SMI)
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Key project personnel:
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Currently Research Manager with MISHC on secondment from SIMTARS, Department of Natural Resources, Mines and Energy

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Report written by:
Nikky LaBranche and David Cliff

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Workshops held to showcase controls.

These controls could be grouped into the following categories:

1. Preventing a hazardous atmosphere from being created
2. Reducing the concentration of dust to non-hazardous levels
3. Isolating the worker from the hazardous environment.

Preventing a hazardous atmosphere from being created

- Using additives including salt when building/maintaining roadways as well as misting sprays
- Improved maintenance of roadways
- Improved housekeeping to prevent build-up of dust
- Enclosure of conveyor discharge points, with additional sprays
- Brattice covering of transfer points
- Use of water cannon at portal to prevent surface dust from entering mine

Mobile Misting Kit for Temporary Use in Case Other Controls Fail

NSW TAP Report: Dust and Other Airborne Contaminants in Open Cut Coal Mines

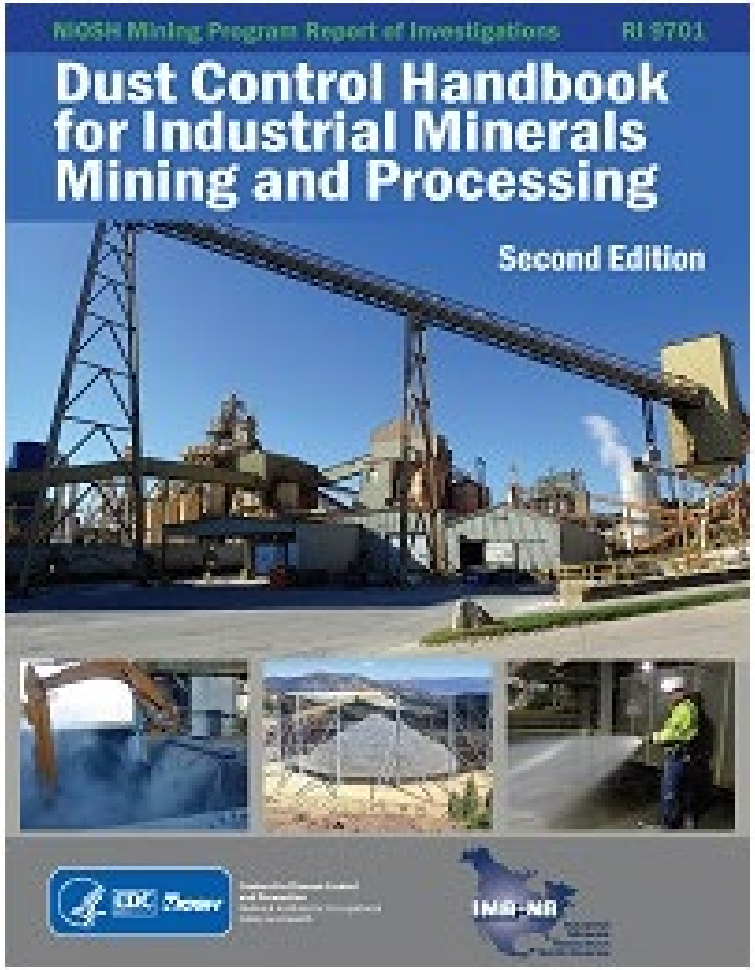
The 2019 report on the open cut mines found that:

- Risk assessments did not always include a cross section of the workforce or workers per SEG at increased risk due to the nature of their work
- No documented evidence that the risk assessment considered the hierarchy of controls
- The induction process lacked sufficient information, training and instruction for workers on the risks to their health from dust and other airborne contaminants
- Additional training was not always conducted on a regular basis or provide and maintain workers' specific knowledge on the hazards
- Some mines assessed were implementing a critical control identification and management process. Documentation did not always exist for the implementation and integration into the existing safety management systems and the criteria for the critical controls were not always well defined.
- The PHMP did not include all control measures identified in the risk assessment and did not set out reasons for adopting or rejecting each control measure considered.
- In many case mine standards for PPE and task specific procedures did not nominate mandatory respiratory protection equipment (RPE) where workers are at increased risk of exposure

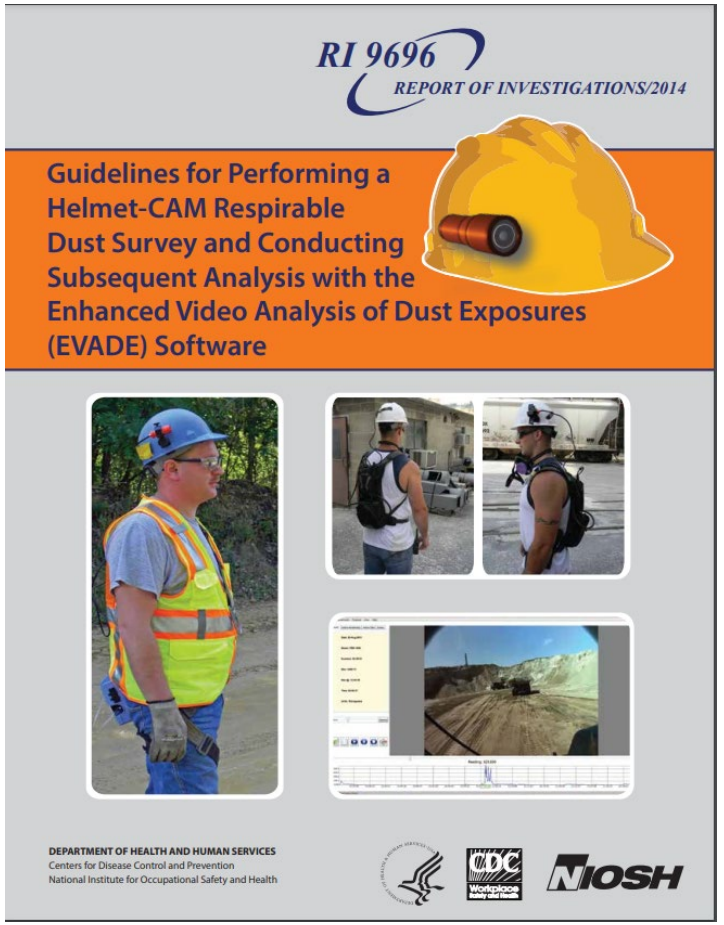
NSW TAP Report: Dust and Other Airborne Contaminants in Open Cut Coal Mines (Cont'd)

- Workers did not always wear or carry appropriate RPE when working in areas where respiratory dust was likely to be present.
- Prestart mobile equipment checklists did not always include specific inspections of the cabin cleanliness, sealing arrangements and the operation of the filtered pressurised system. Some checklists were in conflict with standard mine practice.
- At some sites workers were only notified of their personal monitoring results when there was an exceedance.
- TARPs for dust did not include actions required for workers on the ground. Shotfirers and maintenance workers were often overlooked when weather conditions required operations to be modified or cease.
- Real time dust monitoring on shot bench
- Monitoring pressurised operator cabins in real time to alert operators of possible dust ingress
- Relocating haul trucks in response to dust generation from wind direction and speed
- Progressive rehabilitation of mined-out areas of the pit, to reduce the dust potentially liberated into the atmosphere.
- Using powered air purifying respirators to clean high voltage cabinets
- Enclosing conveyors on fixed and mobile plant (NSW Resource Regulator, 2019).

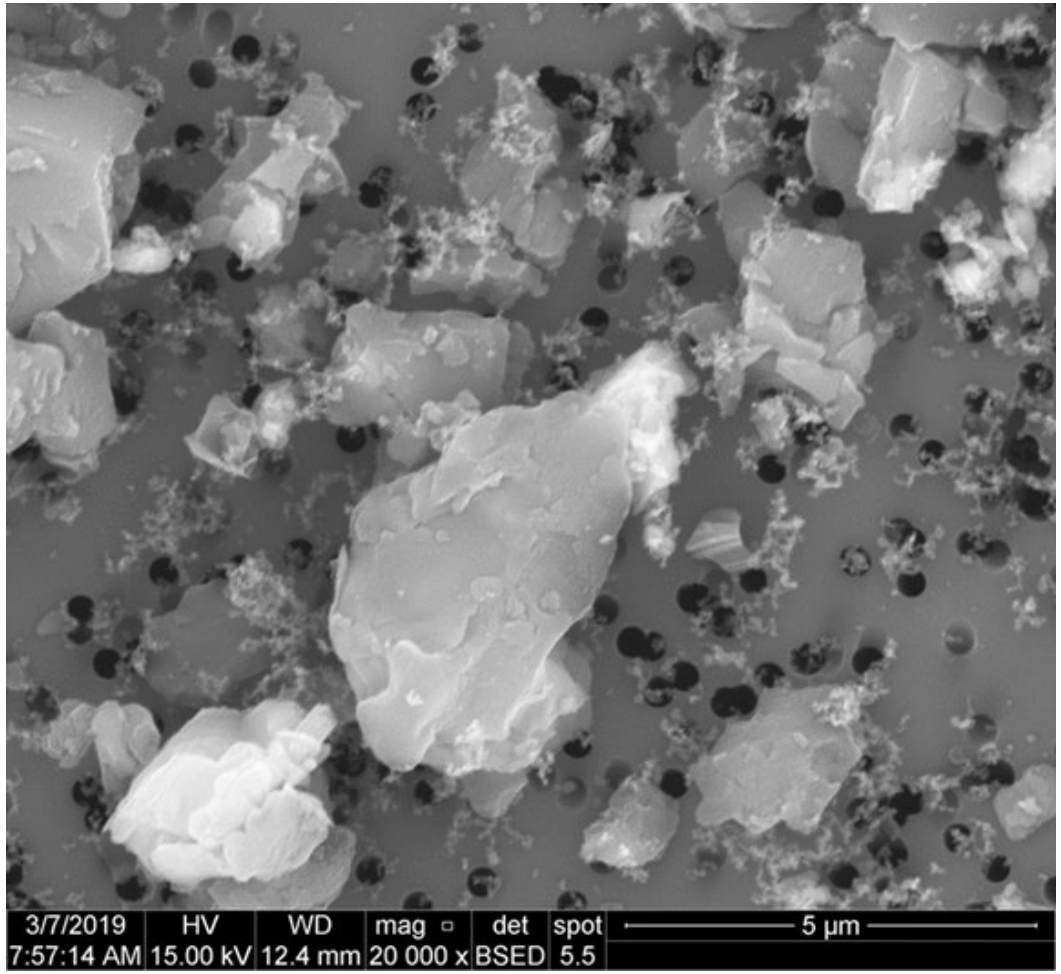
Other resources



Riskgate.org



Diesel Particulate Matter



- Not monitored and reported to RSHQ in MMQ
- Potential for high levels in UG mines and high traffic surface areas
- In cab measurements of DPM levels

5th Annual Dust & Respiratory Health Forum

The Forum brings together experts from around the world and features the advancements and latest trends in the management of dust and mine dust lung diseases in the mining industry.

Hybrid delivery- In person registrations are now open

3 November at University of Queensland St Lucia

Conclusions

- RCS Size affects the health hazard
- PSD of dust can change with geology and mining process
- Dust is a complex mixture including microagglomerates- this may affect the health hazard
- We need a better understanding of the dust PSD and components to understand if controls are working properly