AS/NZ ISO 23875: Standard for Air Quality Control Systems for Operator Enclosures (Mining)

Masters in Occupational Hygiene Program – 2024 Semester 1

On Campus Teaching Session

Guest Presenter: Liam Wilson

Committee Member AS ME-018 Mining, ISO TC-82 Mining

UNIVERSITY OF WOLLONGONG AUSTRALIA

Disclaimer

I have no affiliation with, am not employed by or receive payment from any Original Equipment Manufacturer (OEM) or Supplier of control equipment. I do not represent any OEM or Supplier.

Any technologies, products that are shown or discussed throughout the presentation are to provide case studies/examples and each individual/company should conduct their own due diligence to confirm the product performance and company capabilities.

I present today as a representative of AS/ISO Standard Committees.

Agenda

- Background/History
- Objective of the Standard
- Development
- Requirements
  - Maintenance
- Relevance
  - Standards/Guidelines etc.
- Challenges/Implementation for an IH
- Legal requirements
- Other Applications?
- Who?
- Real World
- What else?

Background/History

- ISO 10263 – Earth Moving Machinery, Operator Enclosure Environments published 2009;
- Latest Revision 2020;
- Six (6) parts;
- Part 4: Heating, ventilating and air conditioning (HVAC) test method and performance;
- Standard is silent for section – Hazardous Environments

AS ISO 10263.4:2022
ISO 10263-4:2009

Australian STANDARD®

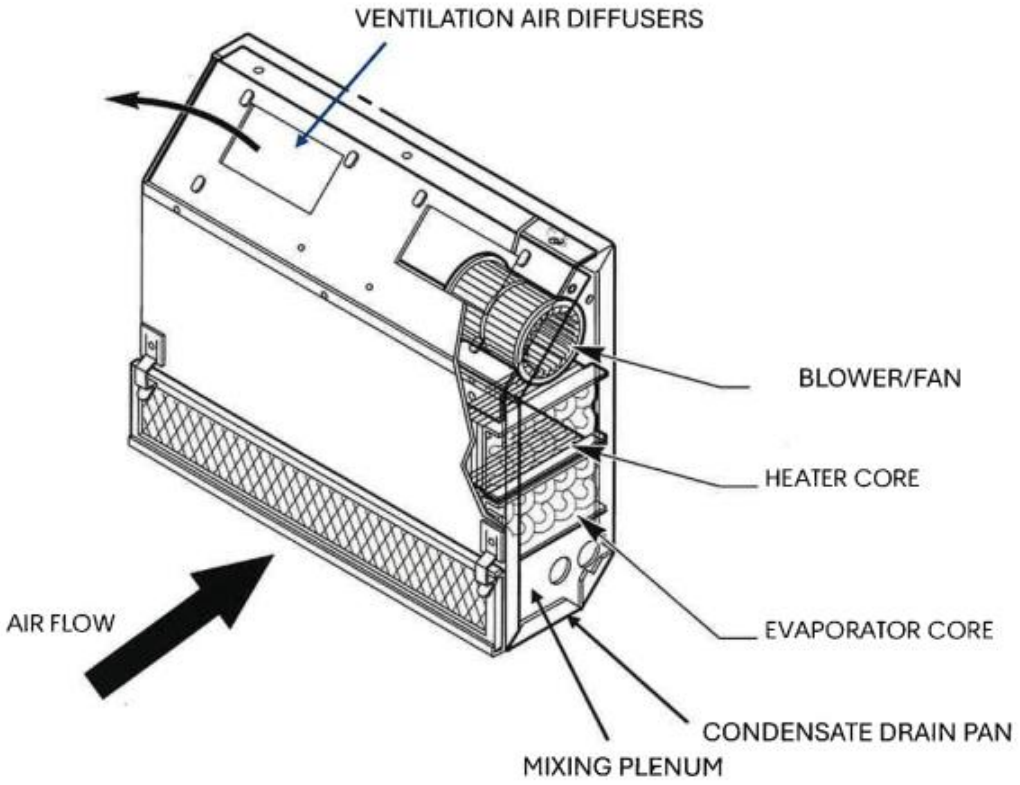
STANDARDS Australia

Earth-moving machinery — Operator enclosure environment

Part 4: Heating, ventilating and air conditioning (HVAC) test method and performance

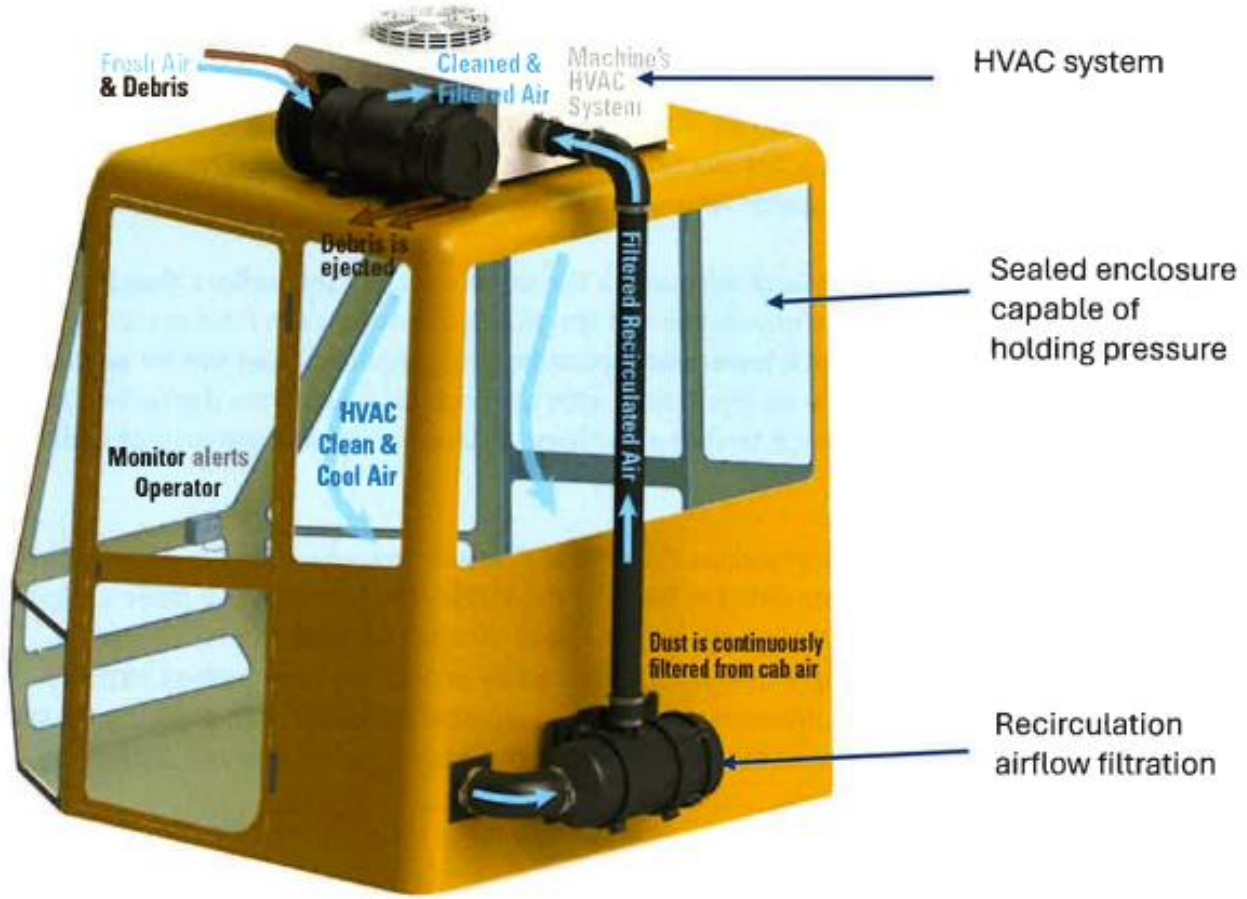
Background (HVAC)

- Filters in HVAC System are designed to protect the HVAC System;
- HVAC is not designed (fans/blowers) to remove hazardous substances (e.g. respirable dust, silica, asbestos etc, gases)



With Permission ISEEE. Source: ISEEE ACTW

Background (Operator Exposure)



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Background/History

2009: ISO 10263 – Earth Moving Machinery, Operator Enclosure Environments published;

2009 RESPA Trial in a Qld Quarry to manage respirable crystalline silica in a sandstone mine (Fritz Djurkic – Senior Inspector (Occupational Hygiene) RSHQ;

2012 ISEEE formed - to protect the lung health of equipment operators by developing best practices and educational materials in the field of environmental enclosure air quality engineering;

No universal standard for the design, testing, operation and maintenance of operator enclosures for airborne particulate (or gas) control;

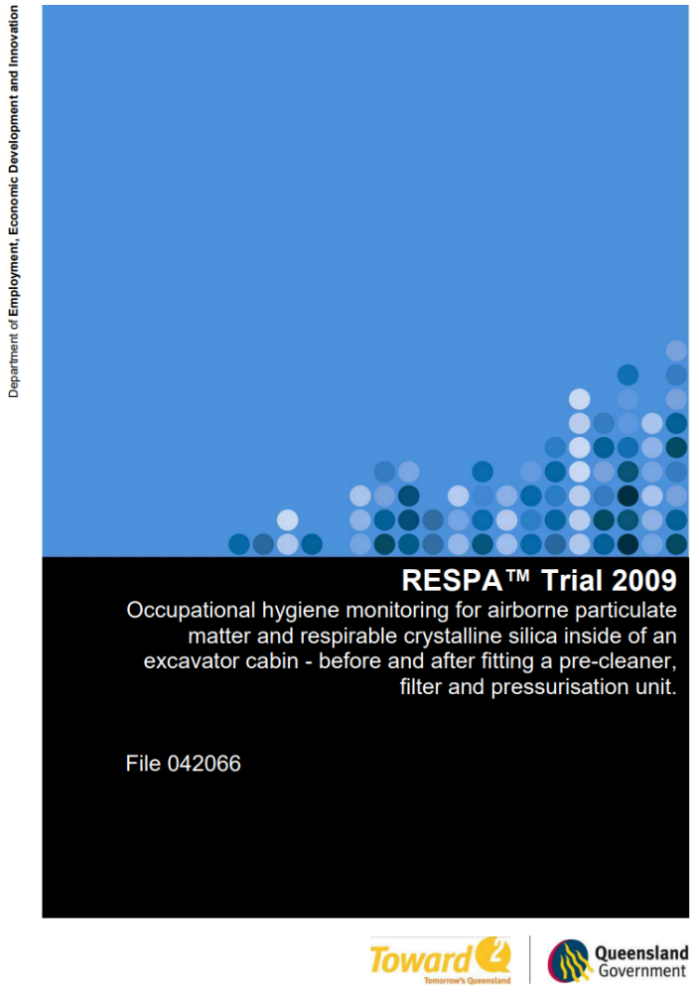
2018 Development of ISO Standard commenced;

2021 February, ISO23875 Published: Mining – Air quality control enclosures - Performance requirements and test methods;

2022 June, Amendment 1 Published: ISO 23875:2021/Amd 1:2022 Mining — Air quality control systems for operator enclosures — Performance requirements and test methods — Amendment 1;

Only covers dusts, Gas Standard development progressing;

Legislated: Columbia, Denmark, Sweden



2009 Trial

Why?

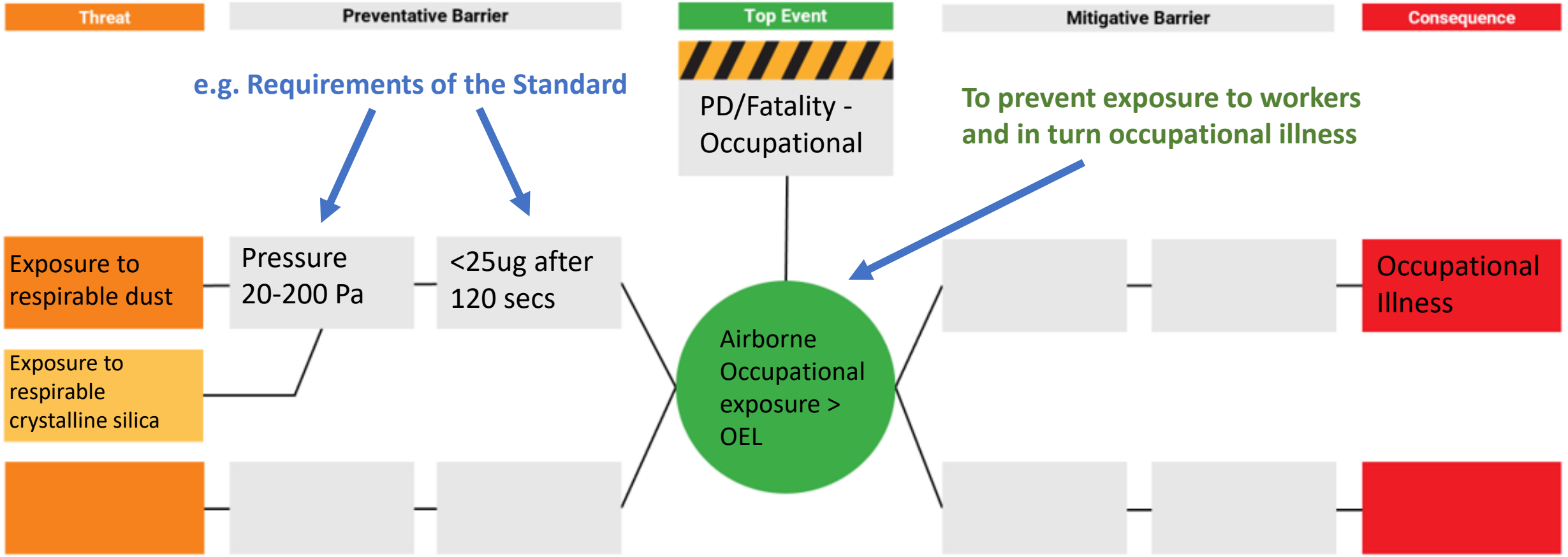
Technical perspective:

- Fills the void of other ISO Standard gaps e.g. ISO 10263;
- Standardised approach for Original Equipment Manufacturers (OEMs) and Users

Practical perspective:

- Practical approach (How) to protect workers (preventative) and equipment for organisations

Why?


Threat
Preventative Barrier
Top Event
Mitigative Barrier
Consequence
e.g. Requirements of the Standard
PD/Fatality - Occupational
To prevent exposure to workers and in turn occupational illness
Exposure to respirable dust
Pressure 20-200 Pa
<25ug after 120 secs
Exposure to respirable crystalline silica
Airborne Occupational exposure > OEL
Occupational Illness

https://breathefreely.ca/

Objective of the Standard

50%
HIGHER LUNG CANCER MORTALITIES AMONG CONSTRUCTION WORKERS THAN AMONG THE GENERAL POPULATION

Barriers to Participation in the NIOSH Coal Workers Health Surveillance Program

IOC responds to silica dust study findings in Labrador City

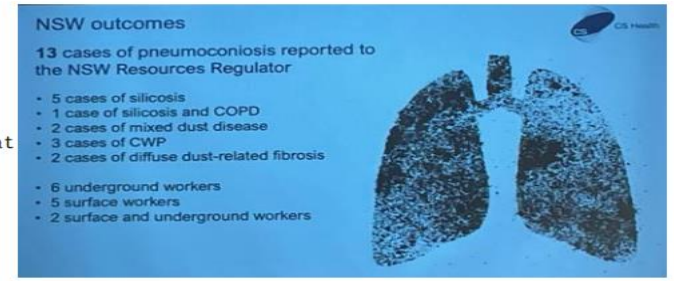
Company encourages employees with health concerns to contact a doctor

Jacob Barker · CBC News · Posted: Feb 08, 2017 9:48 AM EST | Last Updated: February 9, 2017

Cases of mine-dust lung disease and silicosis increasingly found in Queensland coal mine workers

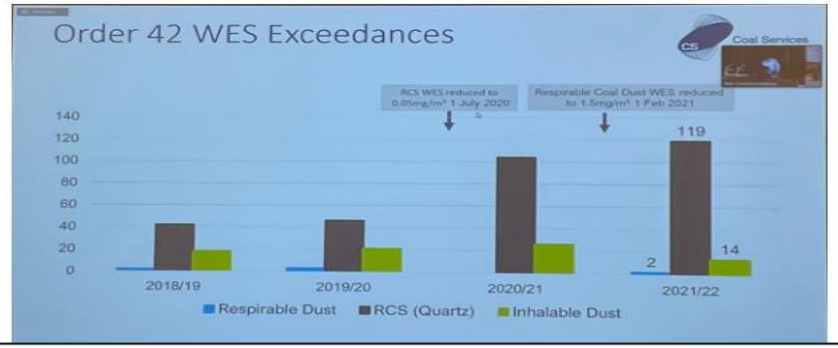
ABC Capricornia / By Jemima Burt and Rachel McGhee

Posted Tue 25 Feb 2020 at 5:55pm, updated Thu 27 Feb 2020 at



COMMODITIES MAY 3, 2018 / 9:39 PM / UPDATED 5 YEARS AGO

South Africa miners reach $400 million silicosis settlement with mining companies



> Am J Public Health. 2018 Sep;108(9):1220-1222. doi: 10.2105/AJPH.2018.304517. Epub 2018 Jul 19.

Continued Increase in Prevalence of Coal Workers' Pneumoconiosis in the United States, 1970–2017

David J Blackley [1], Cara N Halldin [1], A Scott Laney [1]

Affiliations + expand

PMID: 30024799 PMCID: PMC6085042 DOI: 10.2105/AJPH.2018.304517

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Objective of the Standard

- We can't change the past, we can mitigate it now and into future

South African human rights lawyer Richard Spoor announced yesterday that he had filed a class action against global mining companies South32, BHP Billiton and Seriti Power, seeking legal remedies for sick miners and the families of workers who died due to coal mine dust lung disease (CMDLD) in the form of pneumoconiosis and chronic obstructive pulmonary disease (COPD).

Spoor filed the class action in the High Court of South Africa, Gauteng Local Division, and he said this application for certification of a class action seeks recourse for current and former coal miners, as well as dependants of deceased workers who contracted the illness.

Spoor files class action lawsuit on behalf of coal miners against South32, BHP Billiton, Seriti Power (iol.co.za). 16 Aug 2023

Spoor files class action lawsuit on behalf of coal miners against South32, BHP Billiton, Seriti Power

Nine Anglo American companies named in class action suit over harm to coal miners

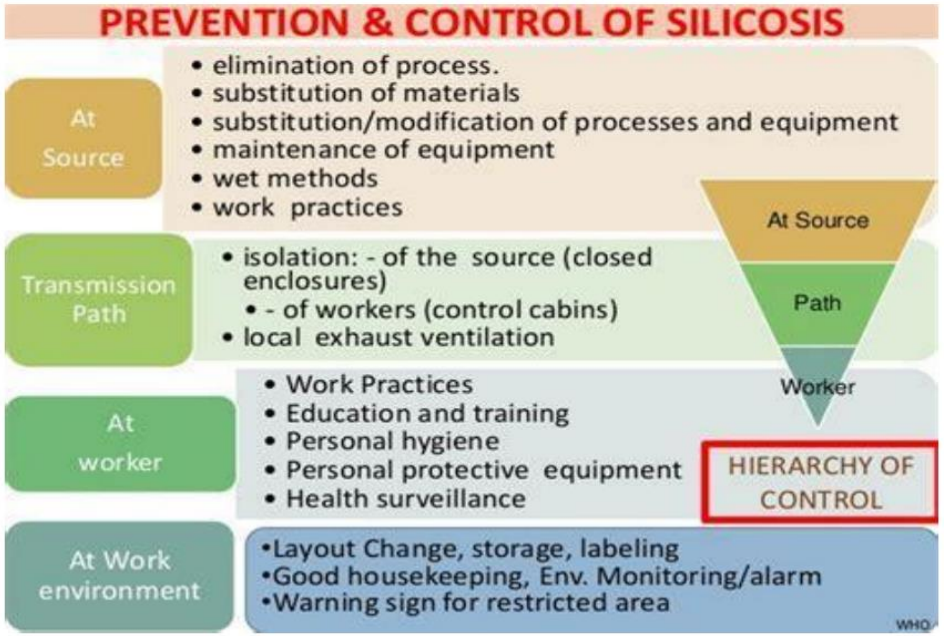
Class action specialist Richard Spoor filed the action in the Gauteng High Court last week.

By **Ciaran Ryan** 25 Oct 2023 04:00

Objective of the Standard

- Standardised approach: Protect workers in operator enclosures (mining equipment/other industries) from harmful levels of respirable particulate matter and CO_2 (and impact fatigue);
- One component of a holistic airborne particulate control management system to prevent occupational illness;

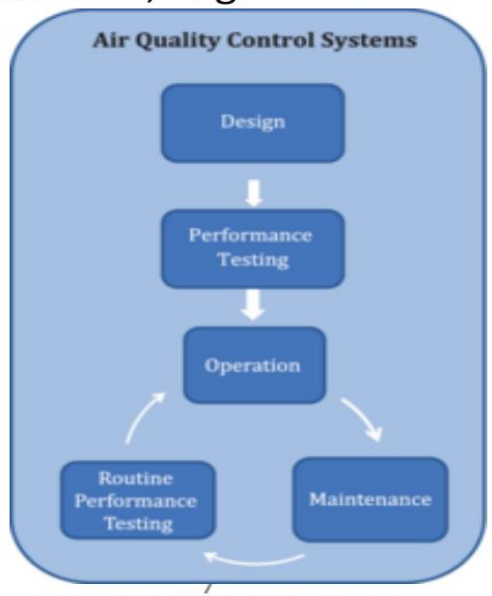
Source: OSHA



Source: WHO

Development

- Different approach taken in development;
- Lifecycle approach – end to end;
- Different people involved:- broad cross section, Safety professionals/Industrial Hygienists;
- Reviewed/commented on by OEMs, Operators, Consultants, Regulators Internationally;
- Goal: Usable by Industry



Source: ISO 23875, Figure 1, pg. v

Cross-Industry Team of Experts

Committee that wrote standard composed of cross-functional members, including:

- 22 Subject matter experts
- 10 Countries
- 6 Industrial hygienists
- 6 Mining machine manufacturers
- 3 International mining companies
- 3 Consultants to the mining industry
- 2 Suppliers to the mining industry
- 1 Field engineering company

Additional comments on draft from:

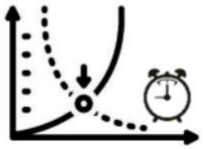
- TC-42 WG4 – ISO 29463
- Rio Tinto
- Volvo
- EPIROC
- EMERST – Australia
- NIOSH – USA
- MSHA – USA
- OSHA – USA

Requirements of the Standard

ISO 23875 Standardizes Machine Requirements

Maintain Defined CO_2 Levels

First alarm for CO2 = Ambient CO2+400ppm
Second alarm is the Action Level of 2500 ppm



Recirculation Efficiency

Maximum respirable particulate matter concentration ≤25 µg/m3 at start/end of decay test, maximum of 120 seconds decay time

Increased Filter Efficiency

A filter that meets more stringent test criteria, > 94% efficiency at 0.3µ, that meets the labelling requirements, and passes the system leakage and decay tests

System Maintains Cab Pressurization

Minimum sustained pressurization, when the machine starting device moves to the "on" position shall be ≥20 Pa, maximum sustained pressure shall not exceed 200 Pa

Real-time Operator Cab Monitoring

Cab pressurization and CO2 levels monitored by permanently installed monitoring system

All engineer controls must be applied to provide supplier's declaration of conformity – No short cuts

* Includes paperwork/certificate. (Compliance ≠ Certification)

Filters – Information required (for external/recirculation)

Matrix barcode to retrieve Filter information

- Name/trademark/manufacturer;
- Model/Part #, Lot #;
- Ref to Standard;
- Filter efficiency e.g. 99.98% @ 0.3-0.4um;
- air flow rate filter has been tested at m3/min;
- differential pressure filter has been tested at

Leaking seal

Standard Tools

Practicalities

- Tools, checklists, training materials etc;
- OEM's, Operators integrating Standard into Specs, equipment

Appendix 1: Performance Test Results Report Template

Machine Asset # Make/Model Serial number		**External Air Filter Classification**	❑ ISO 15 E ❑ ISO 35 H ❑ _____
Date of Performance Test:		**Recirculation Air Filter Classification**	❑ ISO 15 E ❑ ISO 35 H ❑ _____

Equipment Type	**Make**	**Model**	**Serial #**	**Calibration Date**
Aerosol Generator (fog machine)			N/A	N/A
Dust Monitor				

1) Pressure Test

Pressure ❑ Pa ❑ In-H_2O	**Fan Speed**			
	No fan Key "On."	**Low**	**Med**	**High**

2) External Air System Leakage Test

External air System Leakage	Pressure ❑ Pa ❑ In-H_2O	Max Concentration (required <100 µg/m³) (µg/m³)

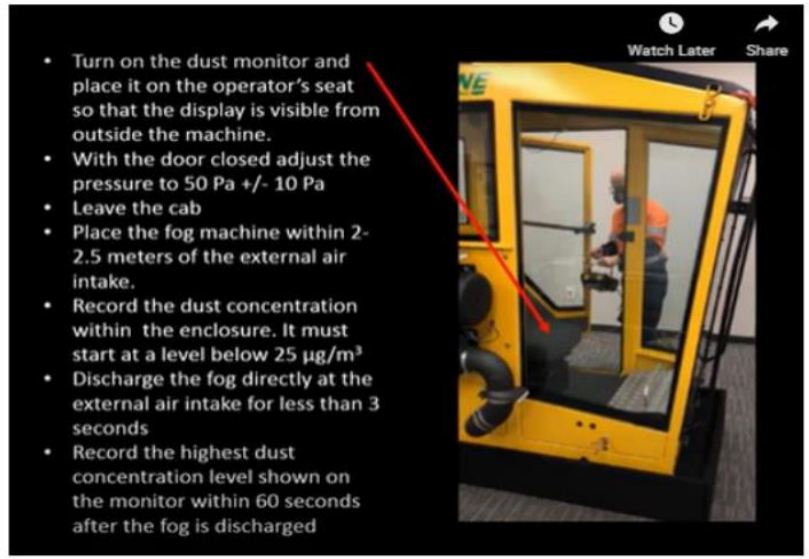
3) Decay Time Test

Decay Time (performed on low fan speed)	Initial Concentration (µg/m³)	Max Concentration >2000 µg/m³ but less than <5000 µg/m³	Decay time from Max Concentration to ≤25 µg/m³ (in seconds)	Pressure (requirement 50 Pa ± 10 Pa) ❑ Pa ❑ In-H_2O

4) CO_2 Levels Test

Carbon Dioxide Check one: ❑ One operator ❑ Two operators ❑ Three operators	Pressure ❑ Pa ❑ In-H_2O	Ambient concentration (ppm)	Concentration after 15 minutes of CO_2 (ppm) Requirement: (≤ ambient + 400 PPM)

Additional Comments:



With permission: https://www.ise3.com/

Appendix 6: Operator Enclosure Planned Maintenance Inspection Form Template

Machine Asset #									
Total hours in the planned maintenance cycle									
	PM Inspection # 1 (within 24 hours)			PM Inspection #2 (~50%)			PM Inspection #3 (~80%)		
Date of inspection									
Machine hours at planned maintenance									
Pressure	Fan Speed			Fan Speed			Fan Speed		
	Low	Med	High	Low	Med	High	Low	Med	High
___(Pa) ___(In-H_2O)									
Is HVAC airflow at vents unrestricted through all fan speeds?	**Yes / No**			**Yes / No**			**Yes / No**		
Visual inspection of external/recirculation filters?	**Good / Fair / Poor**			**Good / Fair / Poor**			**Good / Fair / Poor**		
Visual evidence of particulate accumulation on surfaces in operator enclosure?	**Low / Med / High**			**Low / Med / High**			**Low / Med / High**		
Visual inspection of operator enclosure integrity – door/window seals, presence of cracks, ability to close all windows and doors tightly	**Good / Fair / Poor**			**Good / Fair / Poor**			**Good / Fair / Poor**		
Operator enclosure housekeeping	**Good / Fair / Poor**			**Good / Fair / Poor**			**Good / Fair / Poor**		
Is HVAC cooling/heating efficiently?	**Good / Fair / Poor**			**Good / Fair / Poor**			**Good / Fair / Poor**		
Notes:									

Why is it Relevant?

Figure 9: Grader Intake air filter – Engine grade. Not HEPA.

Figure 10: Cat 992K Loader Intake air filter – Engine grade. Not HEPA

Resources Safety & Health
Queensland

Recognised Standard 20

Summary of audits & inspections

Coal Inspectorate

September 2022 | Version 1

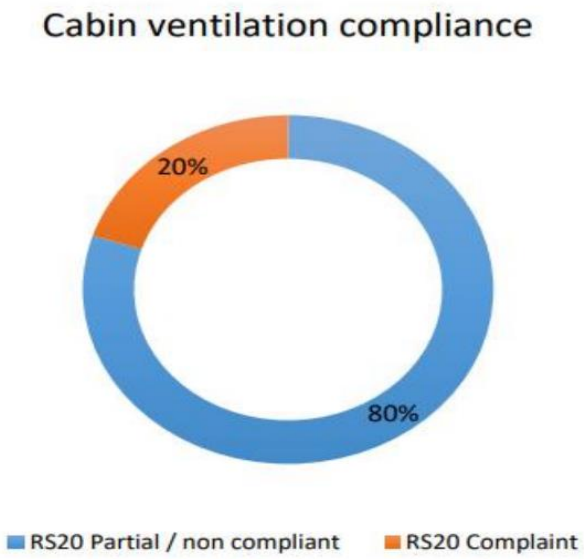


Figure 2: Cabin ventilation systems compliance to RS20

Note: Qld Quarrying lagging mining

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Why is it being implemented?

Note: MSHA announced New Final Silica Rule: 50ug/m3, action level 25ug/m3 (16/4/24)

- Values/Duty of Care: Worker protection against exposure risk;
- Regulatory Compliance (OEL's) – SWA Proposed reduction in Respirable Crystalline Silica (RCS) to 0.025 mg/m3 (half), 3yr transition period;
- Holistic and due to other benefits e.g. monitors pressure and CO_2 real time (A number of operations also putting in real-time particulate monitors);
- Due to CO_2 and fatigue risk;
- Other benefits e.g. reduced maintenance SEG exposure, integrated into maintenance schedules, reduced maintenance and parts costs (e.g. filters, electrical components).

A number of Studies planned to investigate cab CO_2 and fatigue risk and reduction based on Standard:

- Dr Robin Burgess-Limerick (UQ SMI) – Proposed ACARP Study – CO_2 against recorded fatigue events;
- Rio Tinto Kennecott Operation Study 2023/24;
- Anglo South Africa;
- Glencore South Africa

Real Time Particulate sensors:

- NIOSH low cost real time particulate sensor/cab research: CDC - Mining Project - Emerging Respirable Dust Sensing and Control - NIOSH Justin Patts;
- ECU | Overview : Real time monitoring research : School research areas : Our research : Medical and Health Sciences : Schools – Ben Walsh

Mining Project: Emerging Respirable Dust Sensing and Control for M/NM Mining

Print

Keywords: Dust control | Respirable dust | Silica dust | Welding fumes

Principal Investigator	Justin Patts - Request information
Start Date	10/1/2019
Objective	To demonstrate the suitability and efficiency of monitoring and control solutions which will help to lower the respirable dust exposure of metal/nonmetal miners.
Topic Areas	Respirable Dust Respiratory Diseases

Will it be Mandatory? Jurisdictions?

- Very doubtful will be mandatory in Australia, referenced and promoted by through Regulations etc;
- Adoption of the Standard into legislation in Columbia, Sweden, Denmark. All EU countries will require it to be put into legislation in coming years;
- Potential to be mandated in the USA through the Silica Rule;

Australia:

- **Queensland**: RS20 Dust Control in Surface Mines in review, included as reference to meet RS20 requirements:
- Priority P1-P3 equipment (Management Plan in place/complied with)

Priority	P1 - High	P2 - Medium	P3 - Low
Equip Type	Drills, Ex/Shovels >100T, Tracked dozers	Ex/Shovels <100T, scrapers, loaders, wheel dozers	Graders, IT carriers, Haul Trucks, Water Tankers, Services Trucks, EME floats
Mandatory from:	30/09/22	30/06/23	Procured after 01/01/20

- **NSW**: Standing Dust Committee
- Tier 4 engines to reduce DPM mandate (2024 purchases)
- Awaiting recommendations from the Independent assurance review of coal industry health surveillance scheme
- Follow Qld with audit to understand current state?

- Other states currently silent: risk based approach

What does it mean for IH's?

- Provides another tool/engineering solution to reduce worker exposure (one control as a part of system);
- Use of real time monitoring/data;
- Move to control effectiveness (is it working as should, is t effective at managing risk?);
- Can provide a sound business case based on cost/benefit

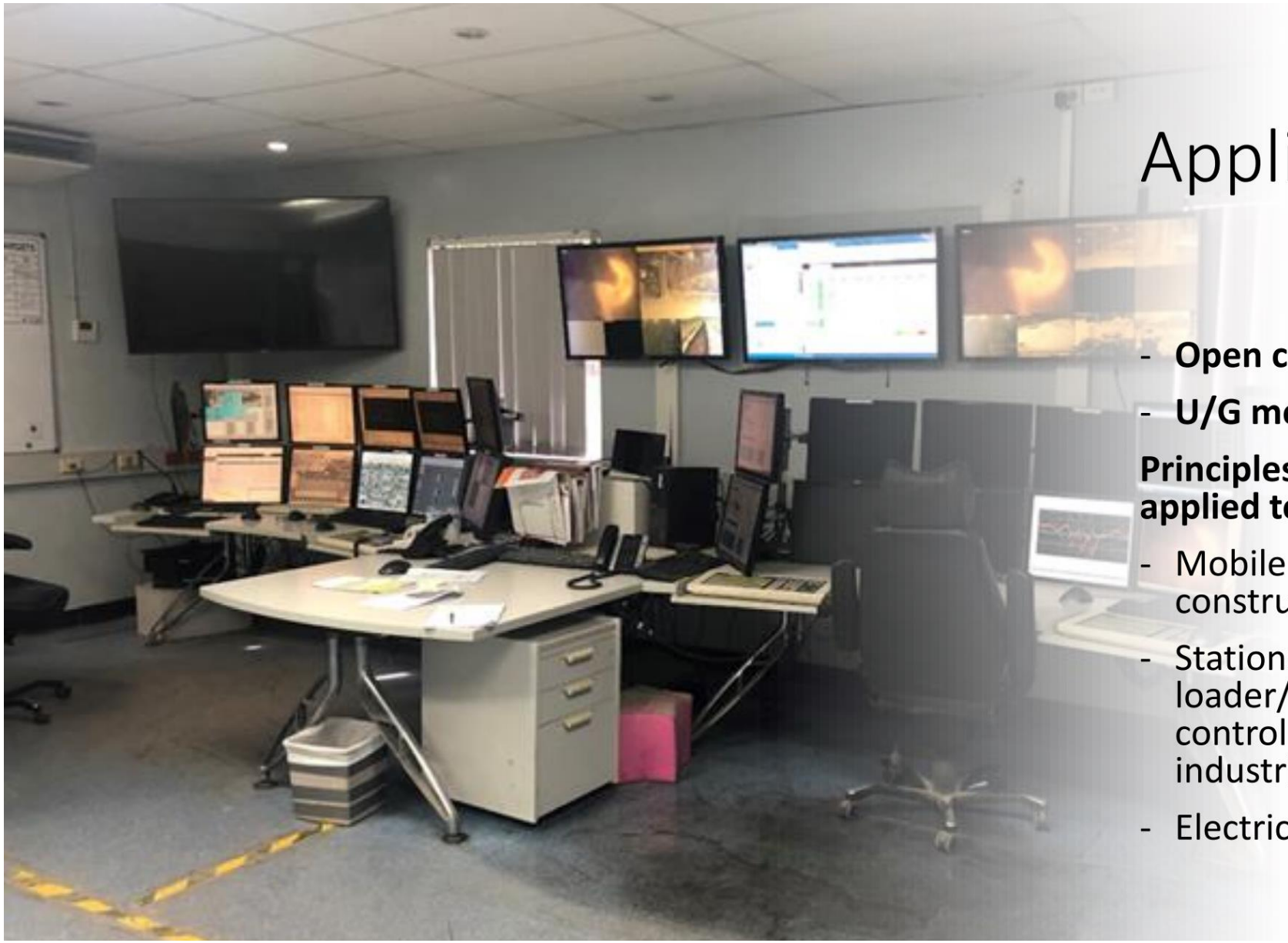
ROI - KOMATSU HAUL TRUCK ELECTRICAL HV CABINET BREATHESAFE HEPA PRESSURISED SYSTEM VERSUS MANUAL CLEANOUTS AT 4000-HOURS INTERVAL			
NOT COMPLIANT WITH OHS DIRECTIVES FOR RESPIRABLE DUST		SUPPLY BREATHESAFE HEPA KIT	**$ 9,772.36**
		COST OF INSTALL	**$ 2,650.00**
		COST OF KIT AND INSTALLATION	**$ 12,422.36**
		REPLACE FHESH AIR FILTER	
PPE PER WORKER - PPE FILTERS FOR FACEMASK	**$ 50.00**	TLF700EN HEPA H14 (BREATHE SAFE FILTER COST @409.71 X3)	**$ 1,229.13**
COST PER WORKER EVERY 500-HOURS	**$ 80.00**		
2 WORKERS	**$ 260.00**		
LABOUR 1.5	**$ 145.00**		
3 HOURS AT SERVICE INTERVAL	**$ 435.00**		
COST PER SERVICE	**$ 695.00**		
COST OF SERVICE 4000/500 = 8	**$ 5,560.00**	COST OF FILTERS PER 4000 HOURS	**$ 1,229.13**
COST OF PPE FACEMASKS PER WORKER	**$ 800.00**	COST OF SERVICE PER MACHINE PER YEAR	**$ 1,229.13**
COST PER 365 DAYS	**$ 7,160.00**	**COST PER 365 DAYS 1ST YEAR**	

Is it only applicable to mining?

No, and it's not just applicable to human enclosures

What other industries could it be applicable to?

What other applications could it be used for?



Applicability?

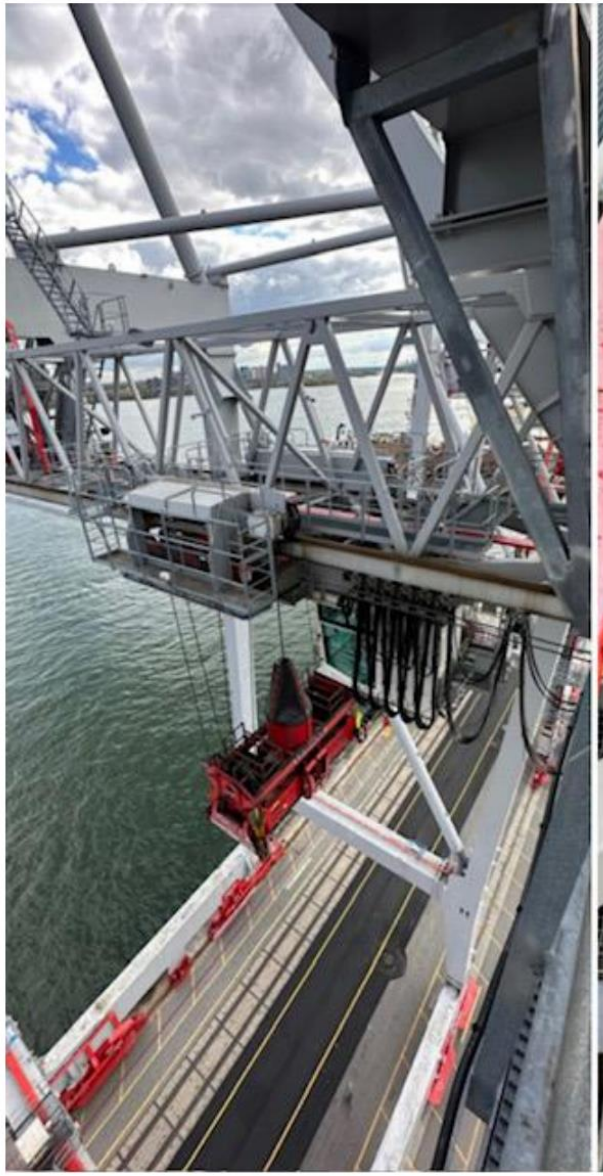
- **Open cut mining,**
- **U/G metals mining;**

Principles/technologies can be applied to:

- Mobile equipment e.g. construction/demolition
- Stationary/fixed cabs e.g. ship loader/unloader, train loadout, control rooms (various industries), draglines;
- Electrical Cabinets;

Broader Application of Principles

- Recent installation on Port Gantry Crane cabin



Challenges/How can IH's get it implemented? It's not easy

Business Priorities

- Financial: Conflict with other challenges/priorities; Capex/OpEx budgets – annual/MTP e.g. 3 years;
- Acute e.g. Fatality risk vs Chronic exposures:
  - Collision detection/avoidance;
  - Auto Haul Solutions – eliminates exposure;
  - Carbon reduction/neutral equipment.

Knowledge/ education

- Standard new, not known, not understood by operations, maintenance, functions;

Technology

- Additional equipment
- Interface/notifications – data overload, need to get notification processes right – visual vs. sound, who, when (acute vs notification)? Integrate into existing systems, records etc

- Business enablers: external – regulations, internal – commitments/targets?
- Prioritisation of exposure risks
- Socialise, educate, Develop the business case (Cost/benefit – prevention, associated benefits)

Who is implementing it?

Seeing a few different strategies:

- Most effective, Tier 1 miners specifying ISO 23875 in HV Equip Purchasing Specifications;

- Others, two step:
  - Implement on future/new HM equipment;
  - Retrofit technology existing based on risk, then look to ISO certification

- Regulation vs. Risk
- Qld coal mines: e.g. Glencore, BMA, Anglo American etc
- Qld metals , quarries following

- Some companies doing organisationally wide, others regionally/commodity based on exposure risk (e.g. Teck, BHP)

What maintenance is required?

Manufacturer warranty conditions

Maintenance carried out in conjunction with existing schedules e.g. 250, 500, 1000Hr services

Check, replacement, re certification intervals

Maintenance frequency adjustable (i.e. filter replacement) based on environment and performance

Standard provides a number of tools and inspection frequencies. Recertification annually

Main cost is filter replacement, calibration of monitors (can do at scheduled maintenance)

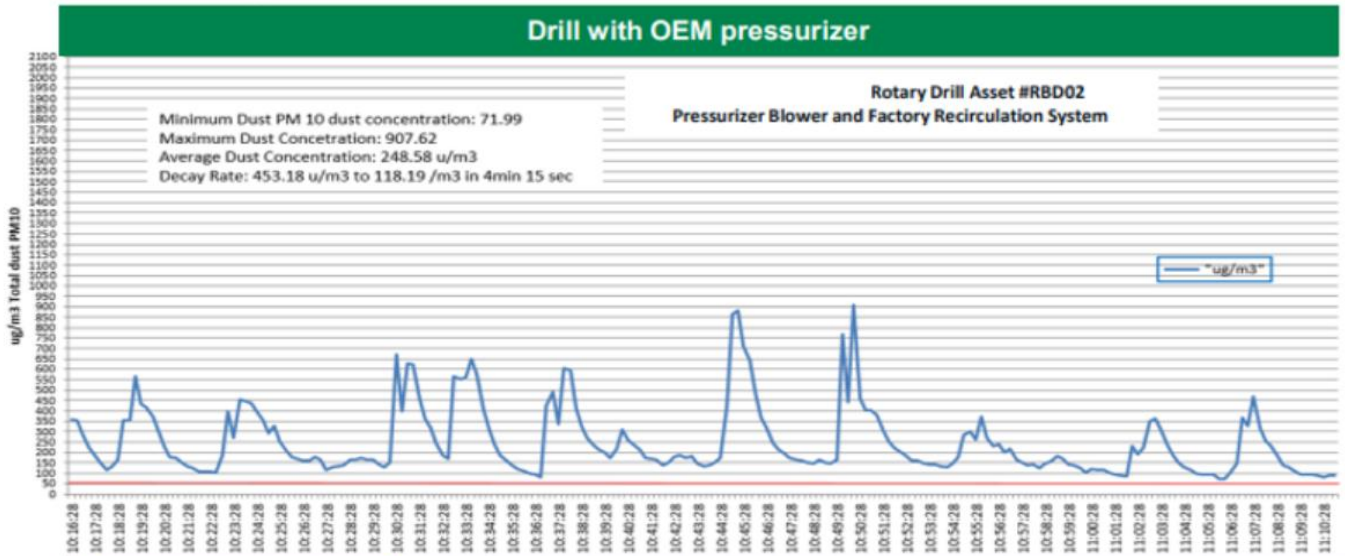
Case Studies

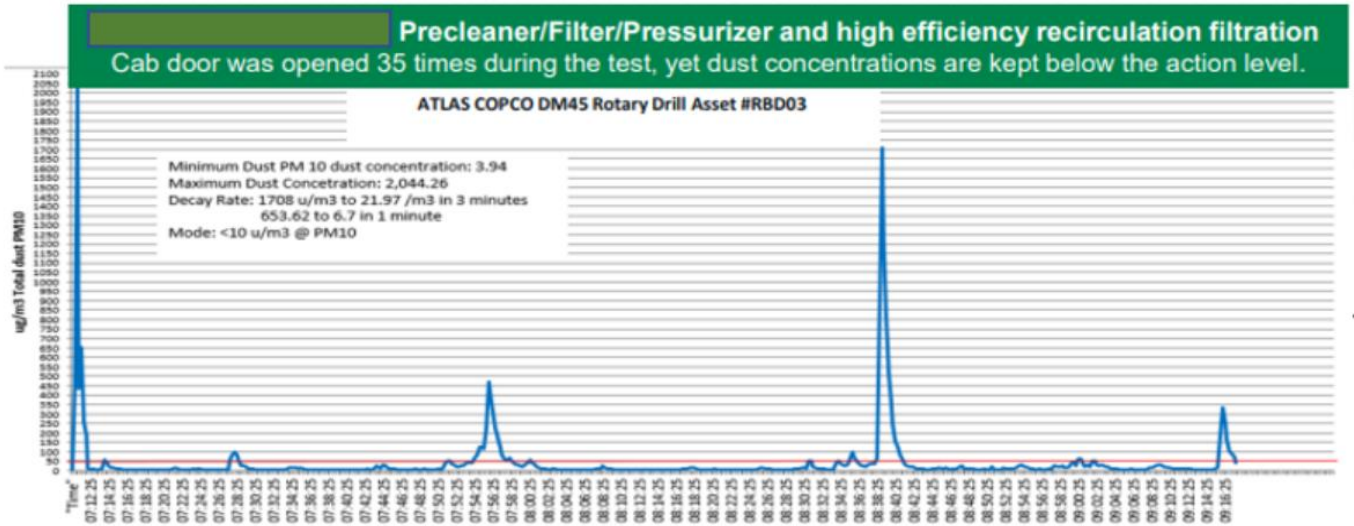
Case Studies – Haul Trucks

Winner of the 2021 NIOSH Mine Safety and Health Technology Innovations Award- Hanson

- Total dust concentrations in the cab averaging 6 µg/m^3, 94% below the MSHA requirement for silica of 100 µg/m3
- CO_2 concentrations within the cab are consistently within a range of 750 PPM to 800 PPM, 50% lower than the maximum allowed under ISO 23875:2021.
- Dust contamination of the HVAC duct work and internal components i.e. the evaporator core have been almost entirely eliminated
- Dust brought into the cab is removed from the air, restoring dust concentrations to levels well below 25 µg/m^3 within two minutes of the door being closed.

Case Studies – Drills





NIOSH 7500 test results for Silica and NIOSH 7400 test results for Asbestos
RESPA-CF and FFX2 equipped Drill (Drill 03) vs. similar drill with Traditional pressurizer system

Subject: Drill 03 testing IH results

Hi to All,

We did two days of air quality sampling (Silica and Asbestos) in the Drill 03 versus another similar drill on the same pattern the same day in order to have a good comparison. The variables, environmental conditions and the composition of ore, were pretty much the same except the only possible difference can be the working methods adopted by each driller; such as one driller leaving the door open while getting the sample and the other closing their door. Other differences might be the housekeeping habits of each individuals during or after the shift.

Here are the Regulatory Limits and Action Levels for the contaminants of concern:

Contaminant	ACGIH 1994-95 Adjusted TWA 12h **Regulatory Limit**	ACGIH 2014 Adjusted TWA 12h **Action Level**
Silica (quartz)	0.05 mg/m³	0.024 mg/m³
Asbestos	0.1 f/cc	0.095 f/cc

Here are the results of the comparison sampling of Drill 03, equipped with a pressurization and recirculation system, versus a drill without such system. The results in the table below are ambient in the cabin.

Silica:

	Silica Quartz (mg/m3)	
Date	Drill 08	Similar Drill
10-Mar-15	<0.0050	0.019
13-Mar-15	<0.0047	0.021

The silica result in light green are close to the Action Level (0.024).

Asbestos:

	Calculated TWA for Asbestos (f/cc)	
Date	Drill 08	Similar Drill
10-Mar-15	0.020	0.080
13-Mar-15	0.011	0.251

Therefore as you can see, there is a significant difference between both results.

That is a good news! ☺

Regards,

KM
Industrial Hygeniest

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Case Study – Komatsu 930E-4 Haul Truck

Komatsu 930E-4 ISO 23875 retrofit installation with HEPA Filter at 480 hours run time in Coal mine

Sample type	Pre ISO 23875 compliance		Post ISO 23875 compliance	
	Number of Samples Taken	Non- Compliant	Number of Samples Taken	Non- Compliant
Personal - Operator	20	60%	18	11%
Area - Cab	16	44%	5	0%

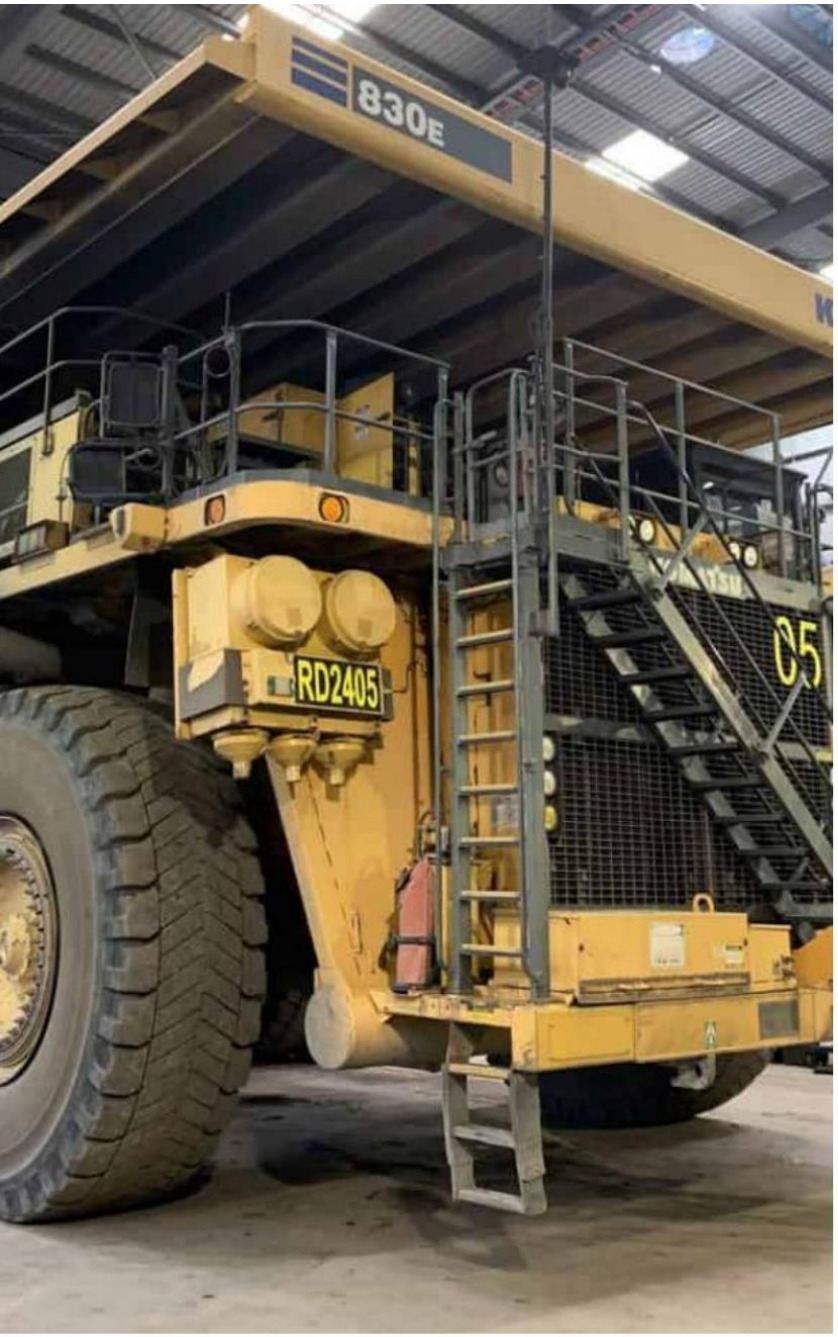
With Permission ISEEE. Source ISEEE ACTW

Case Study – P&H Shovel

Sample type	Pre ISO 23875 compliance	Post ISO 23875 compliance
	Silica Concentration as a percent of the Occupational Exposure Limit (OEL)	
Personal	479%	Below the limit of detection
Area - Cab	521%	18%
Personal	124%	Below the limit of detection
Area- Cab	141%	18%
Personal	82%	Below the limit of detection
Area- Cab	190%	50%

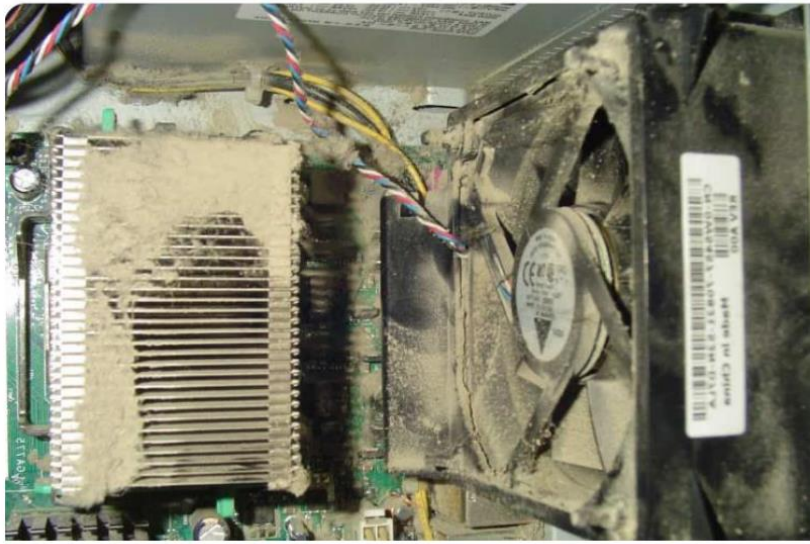
Samples taken over several weeks on mining shovel operating in extreme ultrafine dust environment with high silica content.

With Permission ISEEE. Source ISEEE ACTW



Case Studies – 830E Electric Cabinets

- Dust build up in cabinets, electrical failures, worker cleaning exposure
- Over 12 months and still going with original parts and filters following PM inspections



Installations

Dozers

Education/awareness

- www.iseee.net

About ISEEE | Education

Home / Course catalog / **Development of ISO 23875:2021 with Amendme...** (101)

Get this course ($199.00)

Standards Education

Development of ISO 23875:2021 with Amendment 1 Declaration of Conformity (101)

Who should take this course? Anyone that is using ISO 23875 to design, retrofit, performance test, certify, or maintain an operator enclosure. The course is focused on the implementation of the testing, reporting, and maintenance manual requirements. It provides a template for each of these administrative areas which are designed to save time and speed up the process of operator enclosure compliance certification as required under ISO 23875.

To maximize the benefit of this course, you will need to have access to ISO 23875. We strongly encourage you to read the standard thoroughly before starting this course. Many of the concepts presented presuppose a working understanding of the standard and its contents. ISO 23875 can be purchased from your national standards organization or from www.iso.org/standards. This course is designed to give assistance in understanding and completing the administrative requirements of the standard.

CONTENT

- For fill in the blank pdf version, download the Operator's Maintenance Manual
- For non english speakers: Operators Maintenance Manual Part 1 Sections 1-10
- For non english speakers: Operator's Maintenance Manual Part 2 Appendices 2-9
- For non english speakers: Operator's Maintenance Manual Appendices 7-9
- Part 1
- Part 1 Quiz
- Please submit your questions on Part 1
- Part 2
- Part 2 Quiz
- Please submit your questions on Part 2
- Part 3
- Part 3 Quiz
- Please submit your questions on Part 3
- Part 4
- Quiz Part 4
- Please submit your questions on Part 4
- Please complete end of course survey

Enter code AIOH1 to get course for free

UNIVERSITY OF WOLLONGONG AUSTRALIA

What Next?

- Adopted identically as an AS/NZ Standard 4th August 2023;

Please note that the ballot for following draft has been finalised

Designation: AS/NZS ISO 23875

Title: Mining - Air quality control systems for operator enclosures — Performance requirements and test methods

Committee: ME-018 - MINING EQUIPMENT

Ballot Closed Date: 23/03/2023 11:59 AEST

To view ballot results please select here.

Kind Regards

Standards Australia

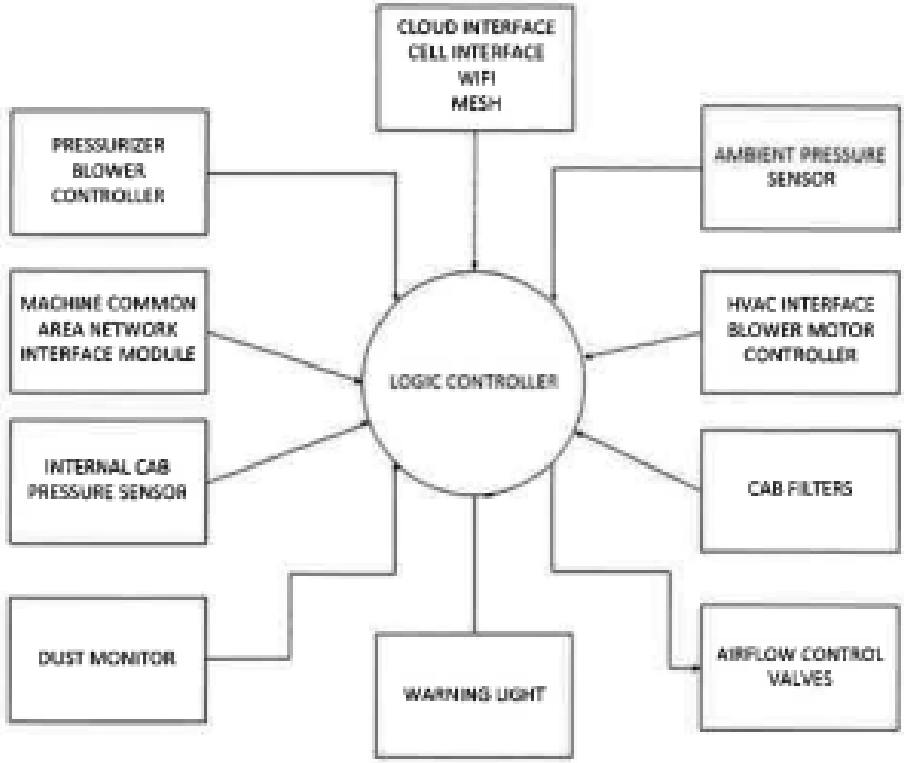
- Further develop/implement education for different roles on the Standard;

- The development of an ISO Standard has commenced;
  - Operator enclosures – Gas filtration;
- Covers gas filtration performance and operational integration of gas filtration;
- Expands to include additional industries e.g. waste management;
- Can be applied for gaseous environments e.g. operating cranes in smelting operations;
- Current draft field testing @ Teck Coal, RTA;
- WG meeting held 28th Sept to continue development

What Next?

- Continued retrofitting of equipment;
- OEM's competing to have first new certified machine – most likely 2025;

- NIOSH SMART cab to be unveiled at MineExpo 2025:
  - Variety of sensors which control all aspects of the air quality;
  - Report air quality and performance real-time to the cloud;
  - Timely air quality monitoring and machine maintenance prediction;
  - Remote performance viewing/analysis/inspection etc



Standards/Guidelines etc (not exhaustive)

Federal/International:

- SafeWork Australia Workplace exposure standards for airborne contaminants;
- Overview - National Silicosis Prevention Strategy (lungfoundation.com.au)
- Standards Australia ME-018 Mining, ME-063 Earth Moving Equipment;
- NIOSH Dust Control Handbook for Industrial Minerals Mining and Processing
- NIOSH Handbook for Dust Control in Mining;
- NIOSH Best Practices for Dust Control in Coal Mining

State:

Recognised standards, guidelines and guidance notes | Business Queensland

- Qld Recognised Standard 20: Dust Control in Surface Mines;
- Qld Guidance Note 04 (QGN04): Guideline for management of respirable dust in Queensland mineral mines and quarries;
- Qld Guidance Note (QGN21): Management of diesel engine exhaust in metalliferous mines;
- Qld Managing respirable crystalline silica dust exposure in construction and manufacturing of construction elements Code of Practice 2022;

Technical reference guidelines | NSW Resources Regulator;

- NSW Airborne Dust: Airborne contaminants and dust | NSW Resources Regulator;
- NSW Mining Design Guideline (MDG29): Management of diesel engine pollutants;
- Victoria OHS Amendment (Crystalline Silica) Regulations 2021;
- SA Work Health and Safety Act/Regs 2012, Mining Act 1971
- WA Dust: Dust and fibres | Department of Mines, Industry Regulation and Safety (commerce.wa.gov.au);
- WA Underground air quality: Guidance about underground air quality and ventilation (dmp.wa.gov.au)

Industry Bodies:

- AIOH POSITION PAPER RESPIRABLE CRYSTALLINE SILICA (RCS) - PUBLISHED DECEMBER 2018;
- ICMM – Cleaner Safer Vehicles;
- CCAA - Workplace Health and Safety Guideline - Management of Respirable Crystalline Silica in Quarries

Manufacturers/Suppliers of equipment (not confirmed ISO Certified)

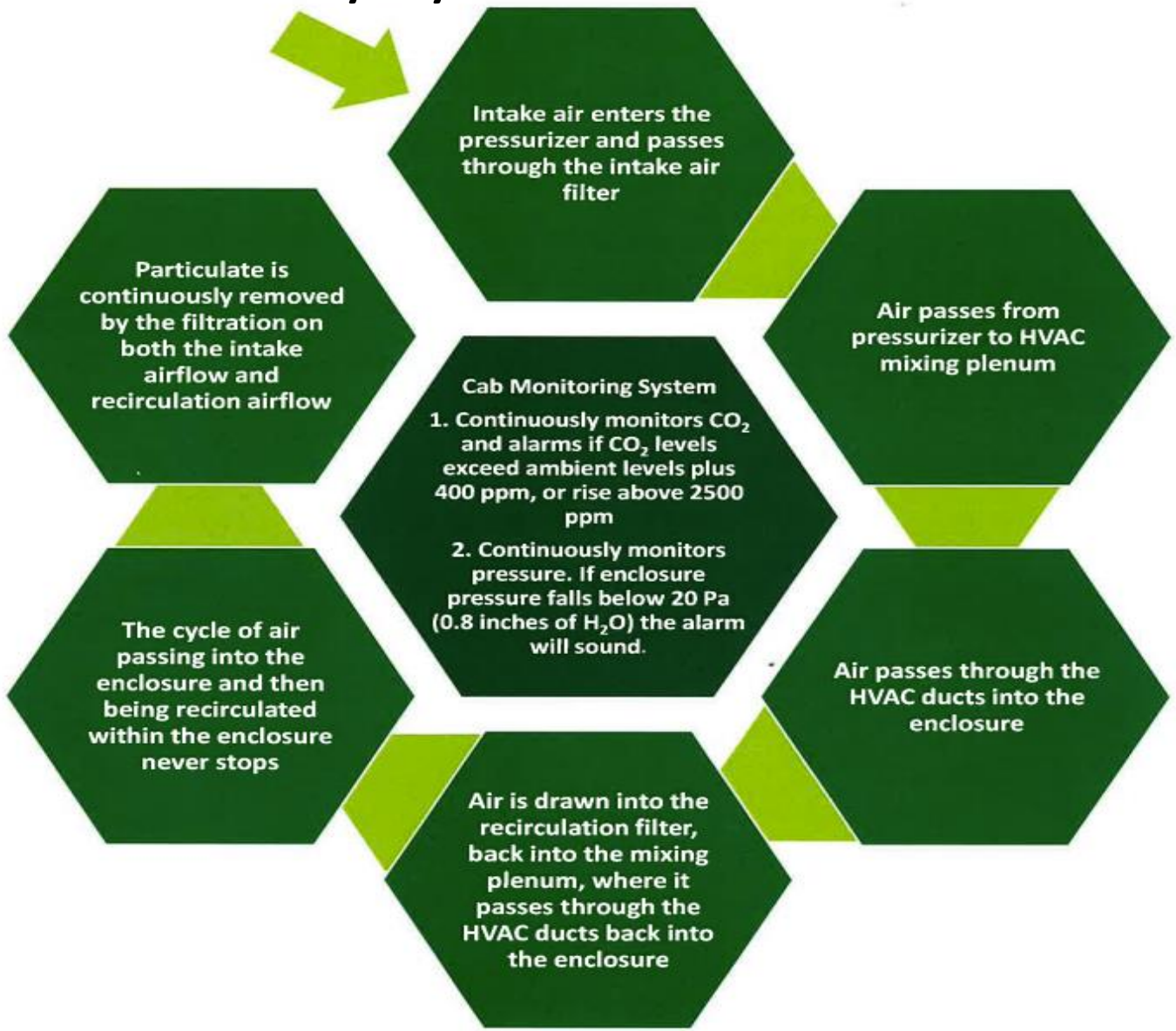
In Australia there are a number of manufacturers/suppliers/installers that can assist in selecting, installing and maintaining the right air quality system for your working environment including;

- Knorr Bremse Australia Pty (Sigma) - mid.aus@sigma-hvac.com;
- Freudenberg - Freudenberg Filtration Technologies - Technology Leader in Air, Gas Phase, Water, Liquids Filtration - www.freudenberg-filter.com (microfreshfilters.com.au);
- NB Industries (East Coast). Sy-Klone - NB Industries – Optimising Your Equipment's Performance;
- BreatheSafe - BreatheSafe - Intelligent HEPA H14 Cabin Air Filtration (breathe-safe.com.au);
- LSM Q-CabAir - LSM Technologies- Our Company - Lubrication Safety and Maintenance;
- SmartTech, Freshfilter - smarttechaustralia.com.au;
- Lyons (West Coast). Sy-Klone. lyonsaircon.com.au;
- United Safety &Survivability Solutions. Sy-Klone - https://unitedsafetycorporation.com.au

Filter Manufacture: AES Environmental AES Environmental: Clyde-APAC, Email Airhandling & Vokes Filtration Technology

Source: Sy-Klone ISO 23875 Operator and Maintenance Manual

Summary – Cab Air Quality System



Discussion

Questions?

Bio

Liam Wilson is a Senior HSE Professional. Liam is a Certified Occupational Hygienist (COH) with over 25 years of industry experience. Liam has Post Graduate qualifications in Industrial Hygiene Science, a B.Sc. (Env), and an Ad. Dip. in Process Plant Technology.

Liam is a Board Member of the International Society of Environmental Enclosure Engineers (ISEEE – USA non-profit). Liam is a representative on a number of Industry Health & Safety Committee's and Working Groups including the Minerals Council of Australia, Queensland Resources Council and NSW Minerals Council. Liam continues to be involved in Working Groups of the Australian Institute of Occupational Hygienists (AIOH – COH Certification Committee, Awards Committee). Liam is an Industry member on Standards Australia and ISO Committee's.

Liam has worked in the Private and Public sectors, in mining, construction, manufacturing, refining and smelting. Liam has worked globally in Australia, North America, UK, Iceland and Africa covering commodities including coal, aluminium, diamonds, copper and uranium. Liam has worked for a number of Tier 1 Companies.

Liam has presented a number of papers over the years at the AIOH Annual Scientific Conferences covering a range of Occupational hygiene topics.