

# ***Airborne Particulate Exposures: The Environmental & Occupational Perspectives***

*Presentation to*

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*Bryan Wilson, CRSP*

*Natalie Hamilton, P.Eng.*





# Outline

- Background
- *Occupational Perspective*
  - Occupational Exposure Limits
  - Exposures of Concern
  - Mitigation / Controls
- *Environmental Perspective*
  - Environmental Limits
  - BMPPs
  - Conclusions
- Discussion





## Background

- Elevated occupational / environmental dust exposures ongoing concern for sector
- Overexposure to particulates can result in illness or occupational disease
- Chronic exposures of particular concern: May not notice injurious health effects until it is too late
- Permanent or irreversible injury
  - E.g., pneumoconiosis, silicosis, lung fibrosis, COPD (chronic obstructive pulmonary disease), chronic bronchitis, diseases of the small airways, some evidence of cancer link & elevated crystalline silica exposures
- Need to comply with O & E regulatory requirements



## Potential Dust Exposures

- Total dust (particles not otherwise specified—PNOS)
- Respirable dust (PNOS)
- Crystalline Silica (quartz & cristobalite)
  
- Other potential constituents of dust:
  - Mineral fibres
  - Naturally-occurring asbestiform minerals
  
- Constituents of focus in this presentation are total & respirable dust exposure as well as crystalline silica



## Dust Definitions

- PNOS are particles that:
  - Are defined in provincial labour regulation (O.Reg.833/90 as amended)
  - Do not have a specific occupational exposure limit
  - Are poorly soluble or insoluble in water
  - Have low toxicity
- Dust:
  - Matter ranging in diameter up to 100 microns & generated through cutting, crushing, detonation, grinding, drilling, sawing and handling of matter (etc.)
  - Particles <10 microns in size classified as respirable; more hazardous as they can reach deep into lung (cannot see)



## What is silica & how are you exposed?

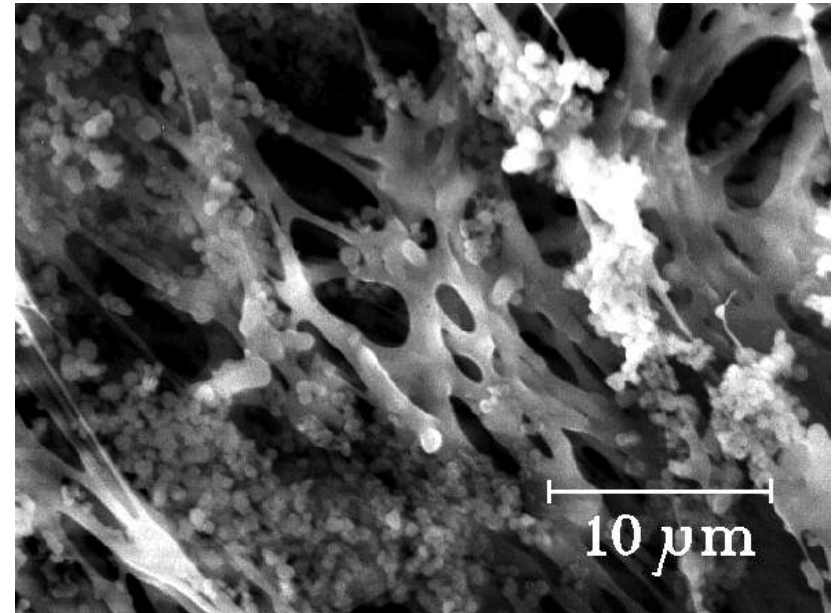
- Most common mineral in earth's crust
- Major component of sand, quartz, rock, & mineral ores
- Sand & granite contain large amounts of *crystalline silica*
- Crystalline silica is also contained in many concrete & masonry products, wallboard, plaster, tile, mortar, grout, gravel & roofing & siding (etc.)
- Exposure to crystalline silica dust occurs when silica-containing materials are ground, crushed, drilled, rubbed or cut (generally disturbed)





## What is the main concern?

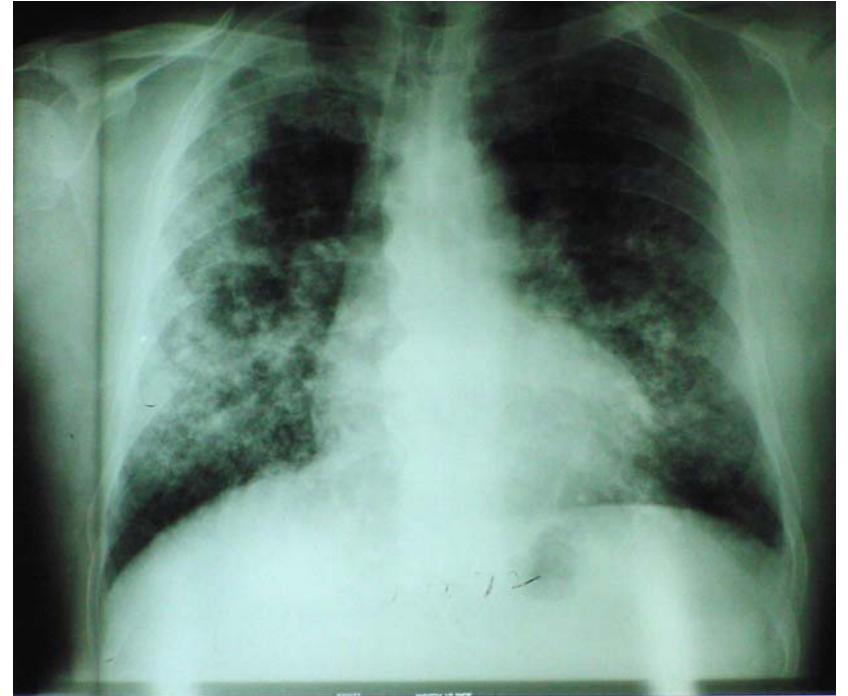
- Crystalline silica in respirable form becomes airborne & uncontrolled exposures occur over a long time
- Small particles travel deep into lung & deposit
- Over time, chronic (longterm) overexposures to respirable crystalline silica can lead to silicosis
- Crystalline silica is non-reactive & insoluble & body cannot break it down over time
- Crystalline structure has sharp edges making tiny cuts causing formation of fibrous scar tissue in lung





# Silicosis

- Over time scar tissue interferes with oxygen & carbon dioxide exchange between lungs & circulatory system, & flexible expansion / contraction of lungs
- This condition known as *silicosis*
- In more severe cases can lead to incapacitation or death
- Severity of the disease is dependent upon dust concentration, amount of (percent) free silica in a given dust exposure, duration of the exposure & possibly the size of the particles







## Chronic or Longterm exposures

- Chronic exposures are experienced by workers who work in dusty conditions & have continual exposure to small amounts of silica on a daily basis
- Symptoms from this type of exposure may develop slowly during one's career, often taking 15 to 20 or more years to manifest



## Occupational Exposure Limits (OELs) (O.Reg.833/90 as amended)

Constituent	Time-Weighted Average (TWA)
Total Dust (PNOS)	10 mg/m <sup>3</sup>
Respirable Dust (PNOS)	3 mg/m <sup>3</sup>
Crystalline Silica (quartz)	0.1 mg/m <sup>3</sup>
Crystalline Silica (cristobalite)	0.05 mg/m <sup>3</sup>

**Note:** Current ACGIH TWA for crystalline silica is 0.025 mg/m<sup>3</sup>  
Classified as suspected human carcinogen



# Potential Dust Sources of Concern

- Drilling
- Blasting
- Crushing
- Screening
- Roadways (vehicle movements)
- Loading / unloading materials
- Material transfer (in process)
- Transport
- Secondary sources (poor housekeeping)
- Other





# Dust Controls

- Engineering controls:
    - Enclose at source
    - Enclose at worker such as booth or cab use
    - Use of machinery for material handling
    - Dust suppression & / or dust capture, etc.
    - Control along the path (re barriers)
    - Progressive rehabilitation
  - Administrative controls
    - Limit time workers spend in dusty conditions
    - Change way work is performed
    - Training in controls & work measures / procedures
    - Roadway & stockpile maintenance
- 
- Stand upwind to dust sources



## Prevention of Dust Generation & Controls

- Reduce drop height of material
- Control vehicle speed
- Control blasting
- Careful location of process equipment & stockpiles
- Enclosure & barrier use
  - Construction of windbreaks, buffer zones, plantings
  - Use of telescopic chutes, dust skirts, covers
- Suppression
  - Treat roadways & piles
- Capture
  - Dust collection on drill rigs & stationary process equipment



## Further Controls

- Personal Protective Equipment
- Last resort or interim measure if other controls are not feasible (or to complement controls)
- Must be trained in respiratory protection & fit tested
- NIOSH-approved respiratory protection for the hazard (e.g., respirable crystalline silica requires high efficiency air particle filtration)





# Workplace Exposure Monitoring

- Risk assessment, qualitative
- Personal air sampling to quantify dust & silica in air
- Longterm, full shift exposure
- Use NIOSH Methods & AIHA-approved laboratories for analysis
- Report back to workers
- Evaluate controls for effectiveness
- Recommend changes based on results of monitoring
- Monitor under different conditions, want to capture worst case



# Industrial Hygiene Program

- Program with stated purpose, scope, responsibilities, measures & procedures, resources
- Training (hazard information, control comprehension / application)
- Engineering & Administrative Controls
- Personal Protective Equipment
- Worker Exposure Assessment
  - Qualitative & Quantitative
  - Control Evaluation
- Medical Monitoring (required for silica control programs)
- Record keeping



## Industrial Hygiene Program (*cont'd*)

- Identify a person responsible to oversee program
- Preliminary dust exposure assessment to identify potentially problematic dust exposures
- Identify suitable dust control measures
- Select, provide & maintain respiratory protection for interim / short term use, if necessary
- Identify dust control areas
- Provide orientation & ongoing training to workers
- Maintain records in an easily understood format & available for inspection (including work site conditions & jobs performed)



## Resources

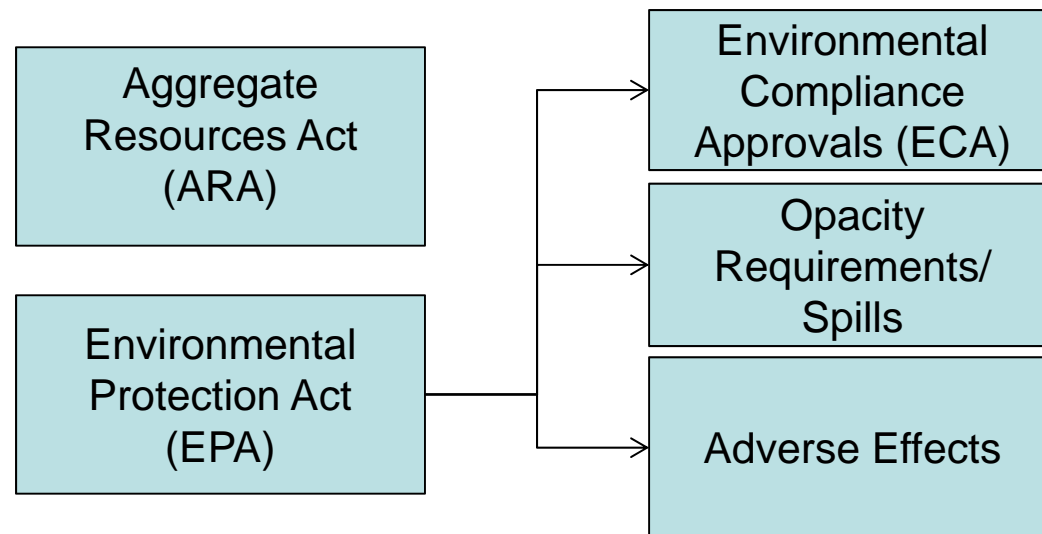
- WSIB
  - *Silica documents*
- CCOHS
- Ontario Ministry of Labour
  - *Silica Guideline*
- ACGIH
  - *TLV / BEI Booklet & Documentation*



## Environmental Perspective

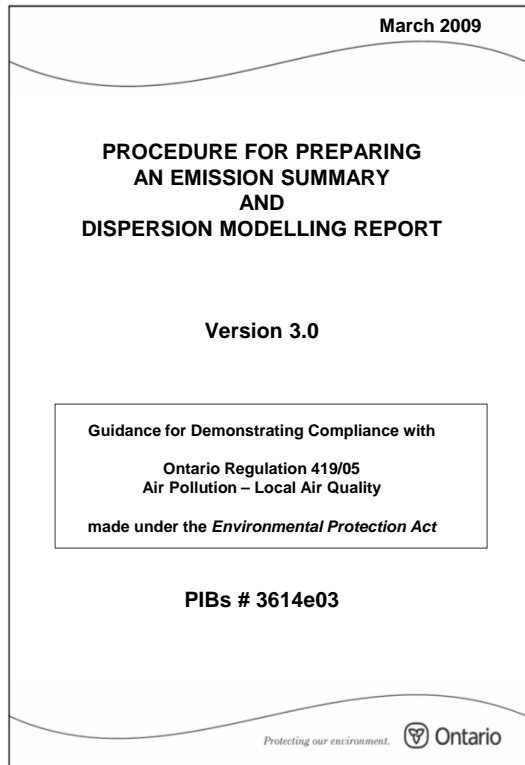
- In Ontario, fugitive dust emissions are regulated through various Acts and Regulations
- Federally, reporting requirements under National Pollutant Release Inventory (NPRI) – *data publically available*

### Ontario Regulatory Requirements (Fugitive Dust)





# Environmental Compliance Approvals



- Dust emissions regulated under O.Reg.419/05 (point and fugitive sources)
- All facilities must obtain an Environmental Compliance Approval (ECA) for operations at the site
- Compliance determined through dispersion modelling assessment of significant sources, documented in Emission Summary and Dispersion Modelling Report (ESDM)
- Guidance allows OSSGA members to exclude fugitive dust sources (roads and storage piles) if a BMPP is in place





## Current Environmental Limits (O.Reg.419/05 as amended, AAQCs)

Constituent	½ Hour POI Standard/ Guideline	24-Hour Standard/AAQC
Suspended Particulate Matter (SPM)	100 µg/m <sup>3</sup> (S)	120 µg/m <sup>3</sup> (S)
PM <sub>10</sub>	—	50 µg/m <sup>3</sup> (G)
PM <sub>2.5</sub>	—	25 µg/m <sup>3</sup> *(G)
Silica – respirable (< 10 µm diameter), quartz	15 µg/m <sup>3</sup> (G)	5 µg/m <sup>3</sup> (G)
Silica – respirable (< 10 µm diameter), cristobalite	15 µg/m <sup>3</sup> (G)	5 µg/m <sup>3</sup> (G)
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*\*Single facility emission level*

*(G) = guideline*

*(S) = Standard*



# The Limits

- For ECAs:
  - OSSGA Facilities must comply with Schedule 3 standards using advanced dispersion models by February 1, 2020
  - Can submit “speed-up request”
  - *Site specific requests for speciated SPM (e.g. silica) are on the rise*
    - ***The higher the PM<sub>10</sub> impact, the lower % silica can be present in the stone to comply with the silica standard***

Modelled PM <sub>10</sub> Concentration (µg/m <sup>3</sup> )	Allowable Silica Levels (24-Hour Basis)	Allowable Silica Levels (1/2-Hour Basis)
75	7%	20%
50	10%	30%
25	20%	60%
10	50%	100%



## The Limits

- For non-ECA assessments (e.g. health impact assessments, EAs)
  - All sources must be included regardless of BMPP
  - Advance models are typically used

Best Management Practices Plan (BMPP) for dust reduces potential for non-compliance situations



## Required BMPP Elements

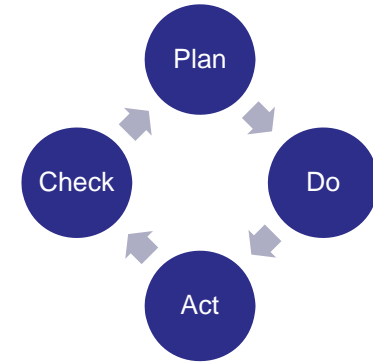
- Guidance on BMPPs is provided in ESDM Procedure Document
- Requirements:
  1. *Identify sources of dust*
  2. *Review composition and size range of dust (health risk)*
  3. *Describe how each dust emissions will be controlled from each source*
  4. *Implementation schedule for BMPP, including employee training*
  5. *Describe inspection and maintenance procedures*
  6. *Describe methods of monitoring and record keeping to verify compliance with the plan*

**MOE is currently updating BMP Guidance**



# Successful BMPPs

- A successful BMPP goes beyond MOE required elements
- Must integrate principles of continuous improvement



## Why do you need a BMPP?

- Stringent POI/AAQC limits require management of fugitive dust
- To maintain positive community relations through demonstrating proactive management of dust
- Documentation of actions
- Tool to provide better allocation of capital resources

## How to Make it work

- Use principles of continuous improvement
- Integrate dust control as part of company culture through education/training at all levels
- Make it a living document



## Additional Elements for Success

### ■ Source Ranking

- Rank based on emission rate and off-property impacts

### ■ Use a Fugitive Dust Risk Management Tool

- Provides risk ranking to sources
- Allows analysis of various control options
- Aids in decision making regarding resource allocation to control fugitive dust
- Sample tool can be found at:

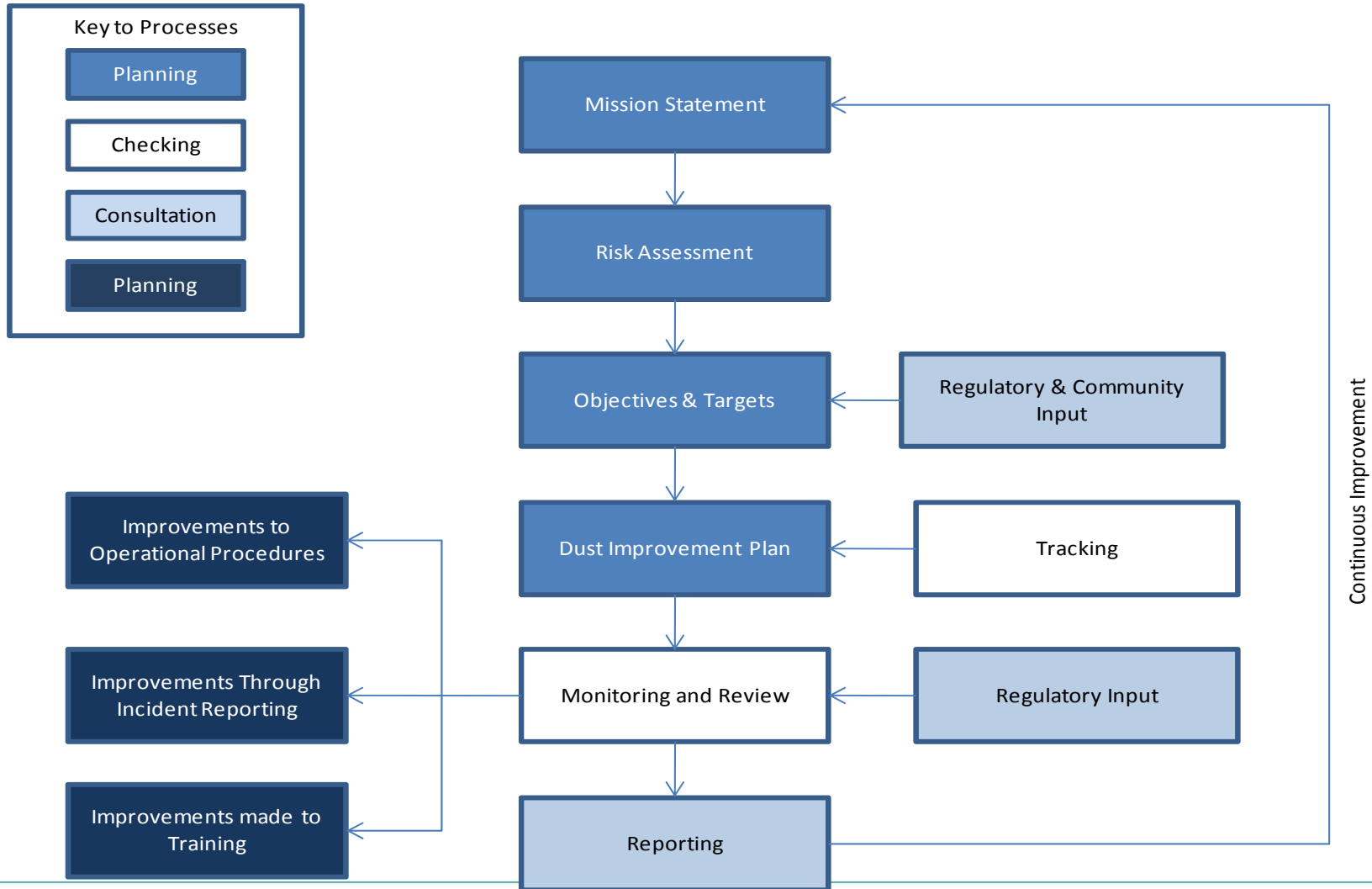
[http://www.miningexcellence.ca/knowledge/reports/Fugitive\\_Dust/](http://www.miningexcellence.ca/knowledge/reports/Fugitive_Dust/)







# Typical BMPP Framework





# Dust Control Measures

- Three phased approach:
  - Select appropriate Preventative Measures - what can you do to prevent the dust?
  - Reactive Measures - what do you require in order to accommodate immediate circumstances, unanticipated or expected?
  - Monitoring and reporting - what do you have to document and monitor to determine if the BMPP is working?





## Opacity/Spills

- Opacity is Regulated under Section 46 of O.Reg 419/05
  - *No person shall cause or permit an emission into the air that, during a period of six consecutive minutes, obstructs the passage of light at any point by an average of more than 20 percent*
- For fugitive sources this is measured through visible observation:
  - Method 9: Point Sources
  - Method 22: Fugitive Sources
- If an exceedence occurs, notification to MOE required within 24-hours
- If a spill occurs (to air or water) MOE must also be notified



## Adverse Effects

- Regulated under Section 45 of O.Reg 419/05
  - *No person shall cause or permit to be caused the emission of any air contaminant to such extent or degree as may,*
    - (a) cause discomfort to persons;*
    - (b) cause loss of enjoyment of normal use of property;*
    - (c) interfere with normal conduct of business; or*
    - (d) cause damage to property.*
- Often referred to as the “nuisance clause”
- A comprehensive BMPP is the best defence to demonstrate due diligence in controlling fugitive dust



# Benefits of Dust Control

- Reduced occupational and community exposures to dust & crystalline silica
- Healthy workforce
- Reduced WSIB costs
- Good Neighbour

Continuous Improvement in controlling Fugitive Dust

Compliance with Occupational Exposure Limits

Compliance with POI/AAQC Limits, Opacity Levels

Positive Community Perception

**LICENCE  
TO  
OPERATE**

**BMPP**



# Questions & Answers

