



The Safety Association for Canada's  
Upstream Oil and Gas Industry

# Silica Dust:

It will take your breath away



Enform's Exposure Control Plan (ECP)  
October 8, 2015



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# Outline

- What is silica?
- Why should I care?
- Exposure risk
- Exposure control
- Enform's approach
- Questions?



# What is silica

- Silica is naturally occurring and can be found everywhere ( $\text{SiO}_2$ )
- Silica can be crystalline (quartz) or non-crystalline (amorphous)
- Crystalline silica can be found in:
  - Rock
  - Sand
  - Products like cement, etc.



Photo: Wikipedia, [http://upload.wikimedia.org/wikipedia/commons/1/14/Quartz%2C\\_Tibet.jpg](http://upload.wikimedia.org/wikipedia/commons/1/14/Quartz%2C_Tibet.jpg)

# Why should I care?

- Silica is a hazard (primarily chronic) when it is breathed deep into the lungs (respirable)
- Silica causes the following illnesses:
  - Silicosis - lung scar tissue
  - Lung cancer
  - Bronchitis
  - Kidney disease
- Irreversible and progressive



# Exposure risk

- Silica's OEL
  - 8-hour TWA
  - What does that mean?
  - 2X lower than lead (0.05 mg/m<sup>3</sup>)
  - 400X lower than nuisance dust (10 mg/m<sup>3</sup>)
  - **If it's silica and it's visible, overexposure is just a matter of time!**



# Exposure risk

- How do we re-think our perceptions of risk?



Photo Courtesy of NIOSH

# Exposure risk

- You may be thinking that I am exposed for only a few days, weeks or months, I will be ok, right?
- A worker at 100X the Silica OEL
  - With no respirator they get a working lifetime in 90 days
    - Even at 100X, acute health effects may not provide adequate warning
    - After 100X, risks are likely not linear,
      - i.e. high exposures for even short periods have more risk



# Where could I be exposed?



## Frack

Proppant  
Handling and  
Storage



## Seismic

Air-hammer  
Drilling



## Drilling

Drilling Mud  
Additives



# Fracking - Exposure Sources

- Proppant (sand: 30-99% quartz)
  - The high percentage of quartz and amount of energy imparted into the sand makes this hazard unique
  - Any transfer points
    - Rail to truck
    - Truck to sand tent or site sand storage (vertical or horizontal)
    - Site sand storage to hopper
    - Pneumatic in-loading on site
  - Working in visible frack dust?



# Drilling - Exposure Sources

- Handling and adding drilling mud dry-product additives
  - Barites, Graphite, etc...
  - If it's naturally sourced, be suspicious
- Cement In-loading
  - Portland cement verses additives
- Cuttings Dryers
  - Most of cuttings are rock = silica
- Shaker Mist
  - Rock dust and fluid additives

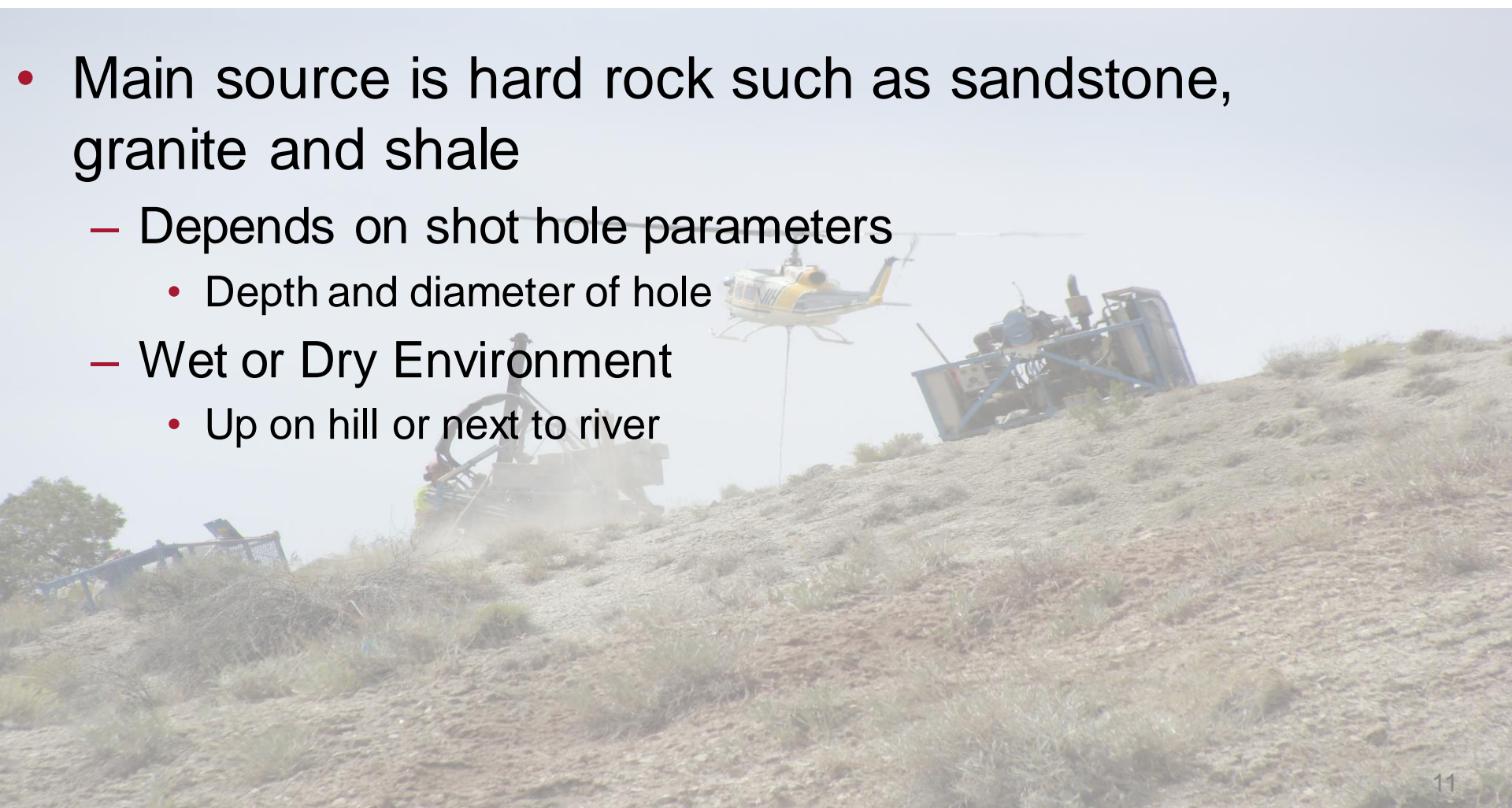


Photo: Eelgin Industries



# Seismic - Exposure Sources

- Main source is hard rock such as sandstone, granite and shale
  - Depends on shot hole parameters
    - Depth and diameter of hole
  - Wet or Dry Environment
    - Up on hill or next to river



# Other Sources

- Refractory brick removal - furnaces\*
- Construction - road and lease
- Abrasive blasting - sand substitutes\*
- Cement handling
- Cutting, grinding, and drilling concrete



# Controls - Engineering

- The answer to many silica exposures is engineering and administrative controls
  - This does not have to be expensive/difficult
    - Wet materials
    - Distance/time etc.
- Look for opportunities to make a difference!
  - Take some action (action = caring)



# Controls - PPE

- Different dust levels = different protection levels
  - Respirator protection factors
    - Half-face - 10
    - Full-face - 50 and 100
    - PAPR or Supply Air - 1,000
  - Why? Leakage, where the respirator meets the face
  - Coveralls



# So what do I need to do?

- Fracking
  - Depends on the presence of engineering controls and where you are working
  - What is needed?
    - Consistently applied engineering controls



Photo: Industrial Vacuum Equipment Corp.

# So what do I need to do?

- Fracking

- Some workers need a ½ mask
  - Not in dust on an on-going basis
  - At least 3 meters from source
- Some workers need full-face or better
  - On-going and close to source
  - Handling frack dust (powders)
- Adjacent workers may be at risk
  - If you are breathing visible frack dust you need a respirator (micro-seismic, flow back, medics etc.)





# So what do I need to do?

- Drilling - Dry-Product Additive Handling
  - Use engineering ventilation controls
    - Direct exhaust ventilation into mud tanks
  - Add product slowly - one bag per minute
    - Reduces dust generation (energy)
    - Ensures complete incorporation into drilling fluid
  - Wear a respirator (minimum half mask)
  - Keep your distance from cement in-loading and use a dust capture bag on exhaust
  - Follow Invert exposure control plan



# So what do I need to do?

- Air-hammer Drilling
  - Engineering controls
    - Venturi
    - Vacuum
    - Water injection
    - Blower fan
  - Stay upwind of dust when ever possible
  - Use respirator
    - No engineering controls? You may need a full-face respirator



# Enform's Approach

- Silica ECP template
  - Modular approach
- Guidance Sheets
  - Sources
  - Controls
  - Hazard Assessment



## EXPOSURE HAZARD ASSESSMENT – HYDRAULIC FRACTURING

The list of work site situations is not exhaustive; some tasks, such as equipment maintenance, are likely needed. Review the tables and look for the work site situations that are applicable to your work site. Implement the associated controls. For Tier 1 or higher work situations, evaluate how often the work situation occurs and conduct regular exposure measurements to ensure controls are working. If the work situation occurs 30 or more days in a calendar year, implement periodic health surveillance.

**Tier 0 – No respiratory protection required**  
(Includes standard controls such as signs and training on the hazards of silica)

Applies on work site (check all that apply)	Tier 0 (<0.0125 mg/m <sup>3</sup> )	Other control considerations	Monitoring data collected?
<input type="checkbox"/>	At least 10 meters from any emission sources, not present in visible frack dust at any time and if pneumatic in-loading is being conducted engineering controls are in use such as dust suppressants, ventilation, etc.		<input type="checkbox"/>
<input type="checkbox"/>	Personnel inside cab of blender that is positively pressurized with HEPA-filtered heated/cooled air and with air-tight doors and windows that remain closed	Half-face respirator required to exit cab provided you remain 3 meters from sources	<input type="checkbox"/>

**Tier 1 – Half-face respirator with P100 filters**  
(Includes standard controls such as signs, training on respirators and silica. Medically cleared to wear a respirator and fit tested)

Applies on work site (check all that apply)	Tier 1 (0.0125 – <0.125 mg/m <sup>3</sup> )	Other control considerations	Monitoring data collected?
<input type="checkbox"/>	Hopper attendant on frack site or sand tent where proppant is dumped from an end dump truck directly into hopper.		<input type="checkbox"/>
<input type="checkbox"/>	At least 3 meters from any emission sources and present in visible frack dust occasionally	Use engineering controls, as adjacent personnel on site may be at risk of overexposure	<input type="checkbox"/>
<input type="checkbox"/>	Personnel inside cab of blender that is <b>NOT</b> positively pressurized with HEPA-filtered heated/cooled air and with air-tight doors or when dust suppressant not in use	Half-face respirator required to exit cab	<input type="checkbox"/>
<input type="checkbox"/>	Trucking personnel conducting loading or unloading	Consider keeping truckers restricted to cab of truck for conveyor or auger loading/unloading	<input type="checkbox"/>
<input type="checkbox"/>	Personnel within 1-3 meters of hopper or conveyor junctions with dust suppressant or ceramic proppant in use	Keep personnel at least 1 meter away from edge of source equipment to manage excursion limits	<input type="checkbox"/>
<input type="checkbox"/>	Personnel within 3 meters of Vertical Sand Storage discharged directly into Hopper with dust suppressant or ceramic proppant in use		<input type="checkbox"/>
<input type="checkbox"/>	Personnel handling used silica-contaminated coveralls or HEPA vacuuming contaminated buildings etc.	Vacuum must be HEPA-filtered, consider wetting coveralls prior to handling	<input type="checkbox"/>

Further Reading and References  
 1. Enform's Silica Exposure Control Plan  
 2. Enform's Silica Information website: <http://www.enform.ca/silica>

### ARE YOU AT RISK?

Conduct a hazard assessment in the design of work, in the implementation of the work and in the execution of the work

### PLANNER?

- Design the site and equipment so that exposures are minimized
- Communicate your control strategies to site supervisor
- Organize exposure monitoring to verify

### SUPERVISOR?

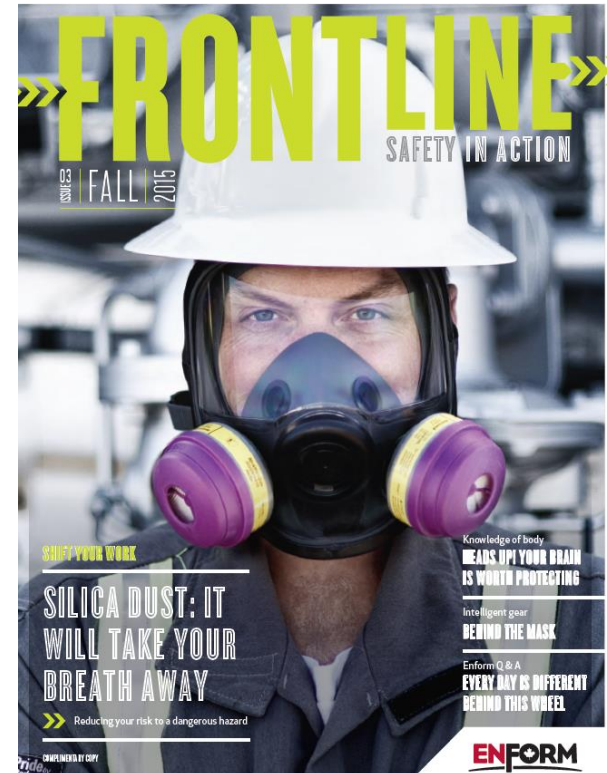
- Conduct a hazard assessment of site and implement controls
- Check that controls are being used and effective and make changes if required
- Communicate learnings back to the planners

### WORKER?

- Properly use controls provided
- Stay as far away from silica sources as practical
- Communicate concerns to supervisor

# What Now?

- Silica ECP and Guidance sheets (frack) available at [enform.ca](http://enform.ca)
- Worker tools and resources are being completed
- The [CCH Guideline](#) update for release later this year
- Pick up the Fall issue of *Frontline*



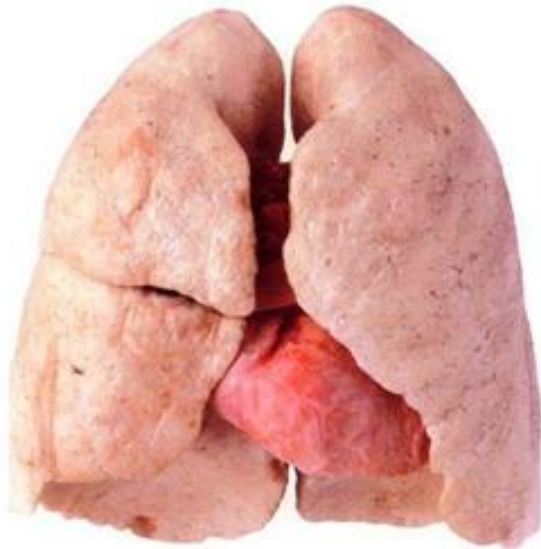
# Summary

- Silica is not nuisance dust!
- Silica is everywhere
- What you don't know will still hurt you
- Enform's Controlling Chemical Hazards Guideline has the answers you need
- Solutions by industry - for industry



# Is your worker's future clear?

Healthy Lung



Silicosis Lung



Photo: <https://www.pinterest.com/pin/262968065712044291/> and Wikipedia, [http://commons.wikimedia.org/wiki/File:8.-\\_Miner%27s\\_lung\\_with\\_silicosis\\_and\\_tuberculosis.jpg](http://commons.wikimedia.org/wiki/File:8.-_Miner%27s_lung_with_silicosis_and_tuberculosis.jpg)

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# Questions

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