Hydraulic Fracturing - OSHA's Silica Exposure Guidelines & Proposed Regulation

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Use of Silica in Hydraulic Fracturing

- **Processing of fracturing fluid**
  - Mixed with water and other chemicals
  - Sand constitutes ≈9.5% of fracturing fluid

- **Injection into drilling hole**
  - Creates fissures in shale
  - Keeps fissures open, allowing oil or natural gas from shale to flow up and out of well

Primary Sources of Silica Dust Exposure During Hydraulic Fracturing

Silica dust cloud created when moving sand from sand mover to transfer belt.
***Photo Credit*: NIOSH**

Silica dust generated during sand transfer operations.
***Photo Credit*: NIOSH**

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Primary Sources of Silica Dust Exposure During Hydraulic Fracturing

- **National Institute for Occupational Safety and Health (NIOSH) found that silica dust is:**
  - Emitted from sand movers
  - Generated by on-site vehicle traffic
  - Released from transfer belts under sand movers
  - Created as sand drops into blender hopper and on sand movers
  - Released from end of sand transfer belt on sand movers
  - Released from operations of transfer belts

NIOSH Field Studies

- **Samples Collected**
  - 116 full shift air samples at 11 hydraulic fracturing sites in five states:
    - Arkansas
    - Colorado
    - North Dakota
    - Pennsylvania
    - Texas

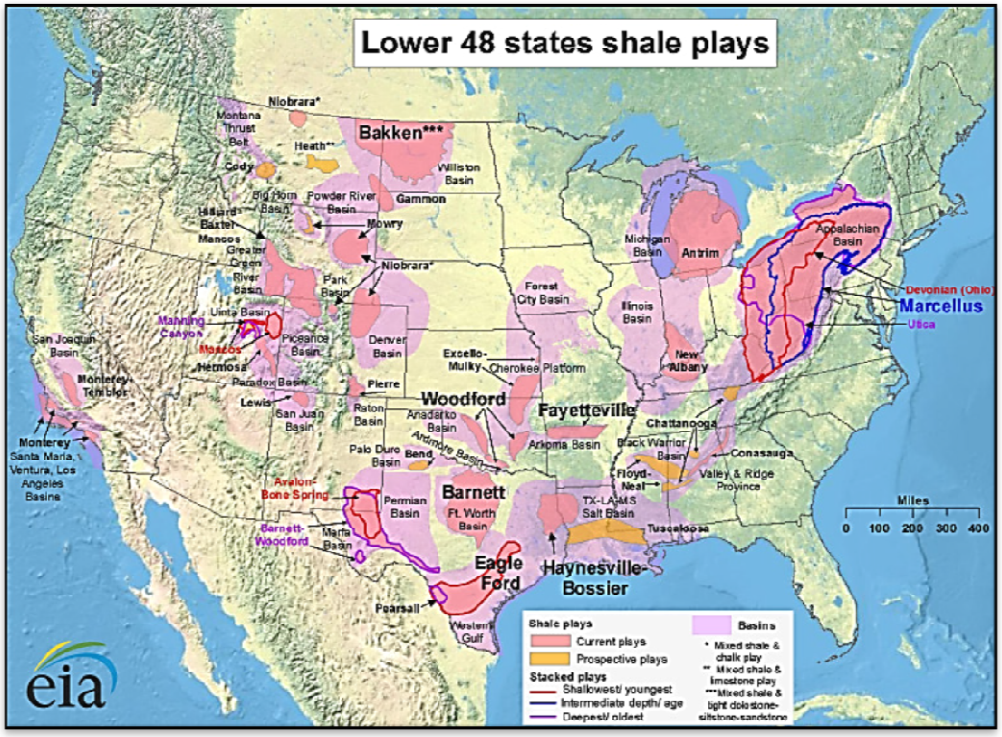
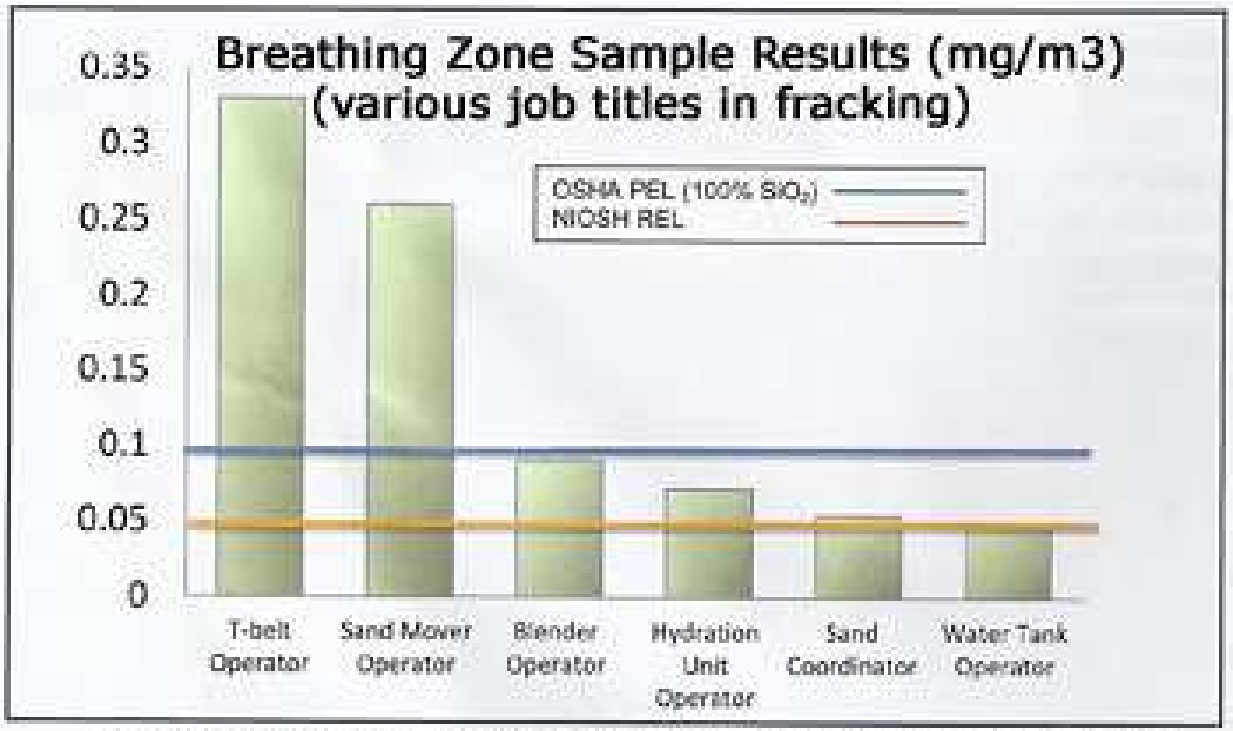


***Photo credit*: Energy Information Administration**

NIOSH Field Studies

- **Of the 116 samples collected:**
  - 47% **greater than** calculated OSHA Permissible Exposure Limit (PEL)
  - 79% **greater than** the NIOSH Recommended Exposure Limit (REL) of 0.05 milligrams per cubic meter
  - 9% of **all** samples 10 or more times the PEL
  - 31% of **all** samples 10 or more times the REL

NIOSH Field Studies



Eric Esswein and Ryan Hill: "Keeping Up with the Oil and Gas Rush." *The Synergist*, AIHA, Falls Church, VA, June/July 2013. p. 26.

OSHA & NIOSH's Current Suggested Measures

- **Use alternative proppants where feasible**
  - E.g., sintered bauxite, ceramics & resin-coated sand
  - **ALWAYS** evaluate health hazards associated with alternative proppants

- **Where infeasible:**
  - Monitor worker exposure
  - Prevent exposure
  - Inform workers of hazards

OSHA & NIOSH's Current Suggested Measures

- **Monitor** air to determine if worker exposures to silica are below OSHA's calculated PEL
  - Consult with trained occupational safety and health professional
  - Institute protective measures to keep exposures below NIOSH REL

The Dorr-Oliver Cyclone collects respirable particles. ***Photo Credit*: Diamond Concrete Polishing**

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OSHA & NIOSH's Current Suggested Measures

- **Short-term engineering controls and safe work practices:**
  - Cap unused fill ports
  - Apply fresh water to well site and roads
  - Limit time spent in high exposure areas
  - Reduce sand transfers

Sand transfer operations. ***Photo credit*: Hulcher Services**

OSHA & NIOSH's Current Suggested Measures

- **Engineering controls and work practices requiring equipment changes:**
  - Seal areas where dust is released
  - Use enclosed booths or cabs
  - Replace transfer belts with screw augers on sand movers

Screw auger with retrofit assembly. ***Image credit*: NIOSH**

OSHA & NIOSH's Current Suggested Measures

- **Engineering controls and work practices requiring equipment changes:**
  - Use dust control technologies

***Image credit*: Frac Sand Dust Control LLC**

OSHA & NIOSH's Current Suggested Measures

- **Engineering controls and work practices requiring equipment changes:**
  - Use baghouse assemblies on back of trucks

***Image credit*: NOV Appco**

OSHA & NIOSH's Current Suggested Measures

- **Respiratory protection:**
  - Use when engineering controls and work practices are not feasible

NIOSH-approved filtering face piece.
***Photo credit*: OSHA/NIOSH**

NIOSH-approved half-face respirators.
***Photo credit*: OSHA/NIOSH**

OSHA & NIOSH's Current Suggested Measures

- **Training and monitoring:**
  - Provide information and training to workers about hazards of silica
  - Monitor those exposed to silica

Course Schedule

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***Image credit*: OSHA**

OSHA's Proposed Rule

- **Title:** Occupational Exposure to Respirable Crystalline Silica
- **Date Proposed:** September 12, 2013
- **Legal Authority**: Occupational Safety & Health Act (OSH Act) § 6(b)
- **Current Status:** Docket of proposed rule reopened for submission of post-public hearing comments & briefs

Timetable for Compliance

Effective Completion Date	Requirement(s)	Who
December 1, 2013	Train employees on the new label elements and safety data sheet (SDS) format.	Employers
June 1, 2015* December 1, 2015	Compliance with all modified provisions of this final rule, except: The Distributor shall not ship containers labeled by the chemical manufacturer or importer unless it is a GHS label.	Chemical manufacturers, importers, distributors, and employers
June 1, 2016	Update alternative workplace labeling and hazard communication program as necessary, and provide additional employee training for newly identified physical or health hazards.	Employers
Transition Period to the effective completion dates noted above	May comply with either 29 C.F.R. 1910.1200 (the final standard), or the current standard, or both.	Chemical manufacturers, importers, distributors, and employers

***Source*:** § 15:7 Hazard Communication (29 C.F.R. §§ 1910.1200 and 1926.52), Occup. Safety and Health Law: Comp. & Prac. (2014).

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OSHA's Proposed Rule

- **Overview:**
  - Set PEL of 50 µg/m^3
  - Promulgate two standards to cover:
    - General industry & maritime
    - Construction

- **Which standard would apply to hydraulic fracturing industry?**
  - General industry

OSHA's Proposed Rule

- **Major provisions applicable to hydraulic fracturing industry:**
  - Protect workers from exposures above PEL of 50 µg/m^3
    - Use dust controls
    - Provide respirators
  - Monitor workers exposed to 25 µg/m^3
  - Limit workers' access to areas with potential for exposure above PEL
  - Offer periodic medical exams for workers with exposure above PEL
  - Train workers to limit exposure
  - Keep records of workers' exposure and medical exams

Trends in OSHA Enforcement of Silica in Hydraulic Fracturing Industry

Enforcement of Hydraulic Fracturing Industry Under General Duty Clause

- **Citations for employee exposure to struck-by hazards:**
  - Hazard: Missing anti-whipping restraints
    - *Control measure*: Install anti-whipping cables or flexible hose connections
  - Hazard: Unsecured open-end of bleed-off valve discharge line
    - *Control measure*: Secure line at wellhead, end of flow line and at intermediate intervals

Enforcement of Hydraulic Fracturing Industry Under General Duty Clause

- Hazard: Employee injured by high pressure release caused by rupture of pipe
  - *Control measure*: Ensure in-line valves are open

- **Citation for employee exposure to fire hazards:**
  - Hazard: Fire and explosion from off gassing of hydrocarbon vapors
    - *Control measure*: Ensure discharge of oil or gas to atmosphere in safe area on downwind side of well

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