

# Insight to Action

Liberty Mutual Insurance | Energy

## Occupational Disease Exposures in the Oil and Gas Industry:

Bringing Safety to the Surface



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Occupational disease (OD) exposures threaten businesses in any industry but are particularly important to address in the oil and gas industry.

Because workers routinely operate and interact with heavy machinery, hazardous materials, and chemical byproducts, energy companies should be diligent to provide for the safety of their workers. Not only do ODs result in high-severity workers compensation claims, but violations of OD-related regulations can result in large fines and negative publicity — costing a company future business.

Violations of OD-related regulations often result in fines by the Occupational Safety & Health Administration (OSHA) that are typically in the **\$10,000 to \$100,000** range.<sup>1</sup>



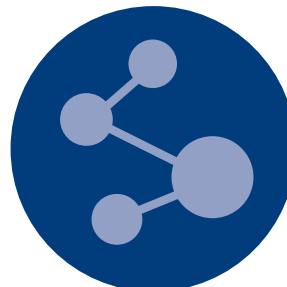
## Assessing Occupational Disease Exposures

When identifying and evaluating OD exposures, the key initial questions to ask are:

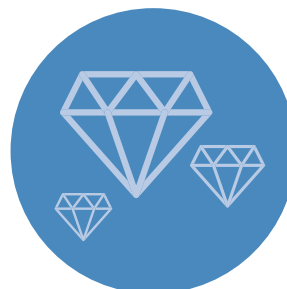
- What substances/agents are the employees exposed to?
- What is the extent of the overall exposure? This includes the number of part-time and full-time employees exposed; the number of hours per day exposed; the tenure, age, and turnover rate of exposed employees; and the length of time the employer has used these substances/agents.
- What controls are in place and how effective are they?
- Is there a medical surveillance program? What monitoring is done and how often? If the employer suspects a worker is suffering the adverse effects of exposure, what action does the employer take (e.g., chest x-rays, appointment with company physician, etc.)?
- Does the employer conduct pre- and post-hire medical evaluations? This is important due to the “last injurious” provisions of many states’ workers compensation laws.

## Five Critical Occupational Disease Exposures in the Oil and Gas Industry

**Volatile organic compounds (VOC)**



**Silica**



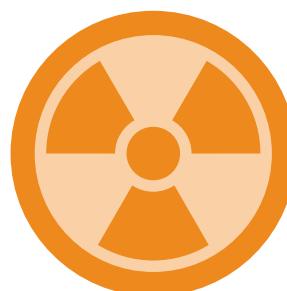
**Diesel exhaust**



**Noise**



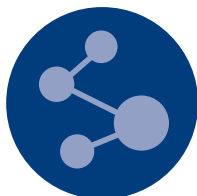
**Naturally occurring radioactive material (NORM)**



## Five Critical Occupational Disease Exposures and Risk Reduction Tactics

### VOCs

**Description:** VOCs, such as benzene, toluene, ethyl benzene, and xylene (often referred to as a group as BTEX), are emitted as vapors from the naturally occurring components of crude oil. Inhaling VOCs may result in short- and long-term adverse health effects. Acute exposures to high levels of BTEX have been associated with skin and sensory irritation, central nervous system depression, and irritation of the respiratory system. Chronic exposure to these compounds may negatively affect the kidneys, liver, and blood-forming systems. Workers exposed to high levels of benzene in occupational settings may have an increased occurrence of leukemia. Benzene is listed as a confirmed human carcinogen by the American Conference of Governmental Industrial Hygienists (ACGIH®) and the Environmental Protection Agency (EPA).



**Exposures:** VOC compounds tend to vaporize and become airborne easily. Vapor and mist may enter the body through ingestion, inhalation, and skin absorption. High-exposure tasks include preparing oil-based drilling mud; sampling drilling fluid returned from the wellbore; cleaning solids control equipment; gauging storage and flowback tanks; and purging tanks, flow lines, and pipeline using xylene and toluene-containing solvents.

#### Recommended tactics to help reduce risk:

- At hydraulic fracture oil well sites producing natural gas, use “green completion” to capture the natural gas that escapes into the air.
- Find and repair leaks, also known as “fugitive emissions,” which can occur at an oil well site.
- Route emissions from pneumatic pumps to control devices.
- Use automatic flowback sampling devices.
- Eliminate visual mud tank inspection by substituting remote sensors.
- Substitute water-based muds for oil-based drilling fluids where possible.
- Conduct biological monitoring, including medical surveillance, blood and urine testing, and lung function testing.
- Use VOC detection technology such as optical gas imaging equipment and organic vapor analyzers to identify high concentration areas at the well site.

### Silica

**Description:** Exposure to silica is a widespread OD risk. Repeated exposure to inhaled crystalline silica dust can cause silicosis, an incurable lung disease. In the U.S., from 1968 to 2002, silicosis was alleged to be the underlying or contributing cause of death for 16,305 workers. This is a chronic OD exposure, meaning that it can take many years before silicosis is identified as the disease causing a worker's symptoms.



**Exposures:** Silica exposures may occur during the hydraulic fracturing processes used for oil and gas well development. If not properly controlled, the exposure is greatest for workers involved in loading, unloading, transporting, and storing sand. Other tasks that potentially expose workers to crystalline silica dust include cementing operations and abrasive blasting using sand, such as river sand, which contains crystalline silica components (e.g., quartz and cristobalite).

#### Recommended tactics to help reduce risk:

- Use water mist for dust suppression and use amended water (e.g., containing chloride and magnesium salts) to reduce dust generation on roads into and at the well site.
- Use a less hazardous non-silica proppant (e.g., ceramic and resin-coated).
- Use local exhaust ventilation to capture and collect fugitive dust emissions.
- Use passive enclosures at points of dust generation (e.g., install stilling curtains around the bottom sides of the sand movers).
- Minimize distances between the transfer belt conveyors and blender hoppers.
- Replace transfer belts with screw augers on sand movers.
- Mandate the use of cam-lock caps for fill ports on sand movers.
- Monitor workers to determine their exposure to crystalline silica (e.g., conduct breathing zone air sampling wherever workers are engaged in activities that use “frack” sand).
- Use equipment with built-in dust collection systems that pass the material through a filtration system.
- When respirator protection is needed, require workers to wear NIOSH-approved respirators. Per OSHA 29 CFR 1910.134, Respiratory Protection Standard, all respirator wearers must be included in a Respiratory Protection Program (RPP) that includes:
  - Identification and evaluation of respiratory hazards in the workplace
  - A medical evaluation to determine the employee's ability to use a respirator, proper selection, and fit testing
  - Training, including cleaning and disinfecting, limitations and capabilities of the respirator, and proper storage and maintenance procedures
- Implement engineering controls such as centralized dust collection systems.



## Five Critical Occupational Disease Exposures and Risk Reduction Tactics

### Diesel exhaust

**Description:** Diesel exhaust contains toxic air contaminants and is regarded as a human carcinogen by the World Health Organization. Exposure to diesel exhaust can have both acute (short-term) and chronic (long-term) health effects. It may cause coughs, headaches, lightheadedness, and nausea and aggravate chronic respiratory conditions such as emphysema and asthma.

**Exposures:** Workers can be exposed to diesel exhaust from vehicles present at work sites and diesel fuel-powered generators, pumps, welders, and other process equipment.

#### Recommended tactics to help reduce risk:

- Pipe diesel exhaust away from work areas.
- Perform routine maintenance on diesel engines.
- Designate areas that are off-limits for vehicle traffic and engine operation.
- Use cleaner-burning engines.
- Use special fuels or fuel additives, such as biodiesel.
- Install diesel-oxidation catalysts.



### Noise

**Description:** Oil and gas operations often expose workers to noise that can result in various levels of hearing loss that can impair work performance and disrupt communication with co-workers and others. Overexposure to noise may also cause cardiovascular and other serious health problems.

**Exposures:** Virtually any oil and gas exploration and production operation produces noise that, without the proper safeguards and controls, can affect workers' health. Prime examples include prolonged exposure to the noise produced by drills, generators, trucks, diesel- and gas-powered engines, and high-pressure pumping equipment.

**Recommended tactics to help reduce risk:** The key to preventing hearing loss is to remove the noise. When that's not possible:

- Provide and require the use of hearing protection by all employees working with or near generators, power tools, drills, heavy equipment, air compressors, trucks, and other noise sources.
- Develop and enforce a hearing conservation program that includes noise assessments, engineering controls, audiometric monitoring of workers' hearing, appropriate use of hearing protection, worker education, recordkeeping, and program evaluation.



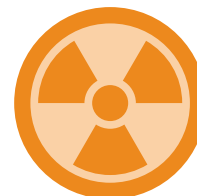
### NORM

**Description:** This material, such as uranium, thorium, and radon, is present in oil- and gas-bearing formations, including shale, granite, and sandstone. The primary adverse health concern about NORM is the possible inhalation or ingestion of scale particles contaminated with radioactive material, such as radium-226. This material may become airborne during the handling, cleaning, welding, cutting, or reaming of pipe and equipment (e.g., pumps) containing radioactive scale. Employees inhaling NORM over several years could develop bone or other cancers from the exposure.

**Exposures:** Common sources of exposure to NORM are scale build-up on internal pipe surfaces, downhole tubing, and flow lines; scale in produced water and brine storage tanks; sludge in tank bottoms, separators, dehydration vessels, and desalinators; and crude oil pipeline scrapings. Hydraulic fracturing process equipment represents a prime NORM exposure.

#### Recommended tactics to help reduce risk:

- Workers should thoroughly wash their hands and face after working with contaminated equipment; before eating, drinking, or smoking; and at the end of the day.
- Keep the number of personnel in the work area to a minimum.
- If possible, seal or wrap all openings in contaminated equipment in plastic.
- If repair or cleaning activities might produce dust or if loose contamination is suspected, have employees take the following additional precautions:
  - Wear a respirator appropriate for radioactive particulates.
  - Conduct the activities in well-ventilated areas to which access has been restricted.
  - Use plastic ground covers to contain contaminants and facilitate cleanup.
  - Decontaminate gloves, respirators, coveralls, and cleaning towels, or place them in double bags, seal, and properly dispose of.
  - Implement engineering controls such as centralized dust collection systems.



As contractors and employers, you should regularly train your teams on the hazards of working with heavy machinery, hazardous materials, and chemical byproducts. Routinely caution workers to avoid direct skin contact and require them to wear personal protective equipment, including respirators. Prohibit employees from eating or drinking near hazardous materials and encourage them to quit smoking, which can exacerbate the effects of exposure. Finally, implement a worker rotation system to help prevent prolonged exposure in high concentration areas.

## Work With Your Insurance Partner

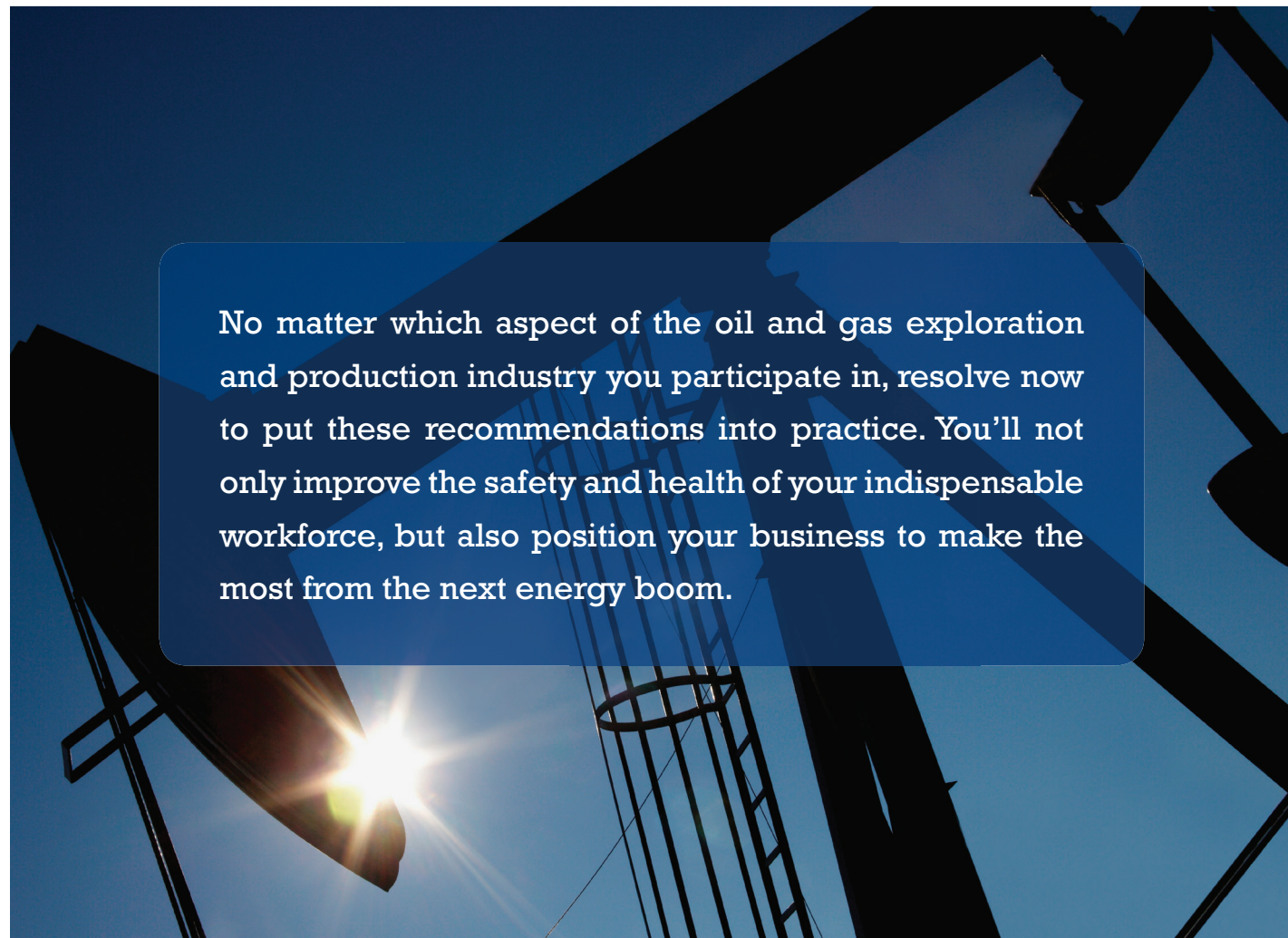
There are myriad ways of helping reduce the risk of OD. The methods listed in this white paper have been compiled based on our decades of work with industry contractors and employers to help improve worker safety and health, and findings presented by researchers, vendors, and others with whom Liberty Mutual collaborates on industry boards and at conferences.

Remember, you're not alone in your desire to help protect workers from exposures that can lead to OD — your workers and your insurance carrier are motivated to help.

By working with your carrier to identify OD risks, and then strategizing ways to control them, you'll reap the benefit of your carrier's vast experience working with many

contractors just like you. Your carrier can describe how your peers overcame similar challenges and provide industry benchmarks you can use to evaluate your current conditions and mitigation efforts.

With more than 80 years of industrial hygiene expertise, Liberty Mutual Industrial Hygiene Services consults with companies to help them develop business strategies to integrate health and safety processes while reducing OD exposures. The exposure assessment process may include qualitative risk assessment, which results in a "risk rating" that is used to prioritize risks and allow companies to focus efforts on the most severe exposures. Once priorities are established, consultants help companies formulate risk reduction controls and measure the effectiveness of each control and program, generating a continuous cycle of improvement.



No matter which aspect of the oil and gas exploration and production industry you participate in, resolve now to put these recommendations into practice. You'll not only improve the safety and health of your indispensable workforce, but also position your business to make the most from the next energy boom.

For more information on occupational diseases and managing risks in the oil and gas industry, go to [libertymutualgroup.com/business](http://libertymutualgroup.com/business) or contact your territory manager, account executive or underwriter.

## Contributing Editors

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**Richard Newton, CIH**, is responsible for the development and management of products, tools, and service delivery approaches for Liberty Mutual Insurance's industrial hygiene subject matter experts. Mr. Newton's 30 years of risk control experience include extensive involvement in qualitative risk assessment, noise assessment and control, and the comprehensive practice of industrial hygiene. He is accountable for the technical oversight of consulting services delivered by 26 industrial hygiene consultants in all U.S. divisions of Liberty Mutual Commercial Insurance.

## Liberty Mutual Insurance

As solution-driven underwriters with specialty expertise, Liberty Mutual Insurance delivers integrated products and services to help you address your energy risks. We understand the exposures distinct to the energy industry and our dedicated practice is designed to address even the largest and most complex risks. By partnering with Liberty Mutual Insurance, you'll receive a dedicated energy team serving the particular risk-management needs of the industry, underwriters located in regional offices who exclusively handle energy risks, and a broad range of products tailored to your clients' size and individual risk profile.

1 [osha.gov/topcases/bystate.html](http://osha.gov/topcases/bystate.html)

2 Global Burden of Disease Study 2013 (GBD 2013), which estimated yearly deaths for 188 countries between 1990 and 2013.

3 Centers for Disease Control and Prevention, Morbidity and Mortality Weekly Report, "Silicosis Mortality, Prevention, and Control - United States, 1968 – 2002," available at [cdc.gov/mmwr/preview/mmwrhtml/mm5416a2.htm](http://cdc.gov/mmwr/preview/mmwrhtml/mm5416a2.htm).

4 For more, see <http://www.irmi.com/online/insurance-glossary/terms/last-injurious-exposure.aspx>.

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The information in this white paper is advisory only. There is no guarantee that following the outlined steps will prevent injury. We assume no responsibility for a customer's safety activities nor for implementing corrective measures. Whether a safety measure is necessary depends on the particular facts and circumstances of the workplace.

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