

# Health and Safety in Oil and Gas Extraction

## Reducing the exposure of oil and gas workers to health and safety hazards

### Introduction

Hundreds of thousands of people work in oil and gas extraction in the United States;<sup>1</sup> ensuring their health and safety is a major concern for employers, regulators, trade associations, industry groups, and local communities. Work in this industry involves physical labor, 24/7 operations, heavy machinery, hazardous chemicals, often-remote locations, and all weather conditions, resulting in an elevated risk of physical harm and the need for special protections to reduce this risk.

### Physical Safety: Fatalities

From 2007 to 2016, more than 1,000 workers were killed in oil and gas extraction operations, a fatality rate six times higher than the average rate for all U.S. workers (21.6 vs. 3.5 per 100,000 workers).<sup>2</sup> Transportation events were the leading cause of death during this time period, making up 42% of all fatalities; most of these were the result of motor vehicle crashes. Worker fatalities also resulted from contact with objects/equipment (25%), fires/explosions (14%), exposure to harmful substances/environments (9%), and falls (8%). While the industry's fatality rate remains high, it decreased by 36% between 2003 and 2013 – a period during which the industry workforce was growing rapidly – suggesting that safety efforts may be yielding positive results.<sup>3</sup>

### Chemical Exposure: Health Hazards

While fatal work injuries have been well studied, less is known about other health hazards. Since 2010, the National Institute for Occupational Safety and Health (NIOSH) has conducted field studies in partnership with industry to better identify chemical exposure hazards.<sup>4</sup> The major hazards identified through these studies were respirable crystalline silica dust during hydraulic fracturing and exposure to hydrocarbon gases and vapors when manually sampling oilfield tanks:<sup>5</sup>

**Silica dust** – Large quantities of silica sand are used during hydraulic fracturing. Loading and transferring this sand at the well site generates respirable-sized silica dust particles in concentrations that may exceed occupational exposure limits.<sup>6</sup>



Silica dust clouds from delivery trucks loading into sand movers at a hydraulic fracturing site. Inhalation of this silica is a major hazard associated with oil and gas operations. Image credit: Michael Breitenstein, National Institute for Occupational Safety and Health.<sup>7</sup>

Other processes that generate silica dust at the well site may include drilling with air and mixing cement to construct or plug a well. Inhalation of silica dust is associated with silicosis, other respiratory issues, and potentially other adverse health effects.<sup>8</sup> NIOSH recommends monitoring worker exposure and, when necessary, controlling exposure with engineering controls and improvements to work practices and procedures.<sup>9</sup> New Occupational Safety and Health Administration (OSHA) standards for silica take effect on June 23, 2021 for hydraulic fracturing operations, which are expected to implement engineering solutions that limit silica exposure.<sup>10</sup>

**Hydrocarbon gases and vapors** – Tanks holding crude oil or produced water are common in the oilfield. These tanks may be manually measured and sampled, which may expose workers to dangerous levels of hydrocarbon gases and vapors given off by these liquids. Between 2010 and 2014, at least nine oilfield workers died as a result of this exposure. In response, NIOSH and OSHA published a hazard alert related to manual tank gauging, which recommends using alternative systems to measure and sample



Worker gauging an oilfield tank. Tank sampling is one of the main ways in which oilfield workers may be exposed to harmful vapors. Image credit: Photo courtesy CDPH and NIOSH.<sup>12</sup>

tank fluids without opening the tank hatch, as well as training workers and not permitting employees to inspect tanks alone.<sup>11</sup>

Other hazards include **hydrogen sulfide** gas (which occurs naturally in oil and natural gas and is extremely hazardous when inhaled); **noise** (from heavy machinery, for which OSHA sets maximum limits and required hearing protection<sup>13</sup>); and **diesel exhaust** (from drilling rigs and other equipment – while diesel exhaust is not specifically regulated, OSHA sets exposure limits for many of the most harmful air pollutants found in diesel exhaust<sup>14</sup>).

### Long-term Health Hazards

Oilfield fluids contain a wide range of hazardous chemicals. While some can have immediate health effects (such as hydrogen sulfide gas, which can kill instantly at high concentrations), others may have longer-term effects (such as benzene, which is carcinogenic<sup>15</sup>). However, few published studies exist that track the long-term health consequences of working in oil and gas extraction, making it difficult to draw conclusions about specific long-term health risks.

### Ongoing Mitigation Efforts

OSHA sets and enforces workplace standards for all industries, including oil and gas extraction. All operations are required to obtain or provide Safety Data Sheets for all hazardous chemicals and materials,<sup>16</sup> describing the associated risks and providing

guidance and recommended procedures for minimizing exposure and addressing accidents.

In addition to the work from OSHA and NIOSH described above, the size and inherent risks of the oil and gas extraction industry mean there are a variety of ongoing efforts to research health and safety risks and implement solutions:

- Co-ordinated by NIOSH, the National Occupational Research Agenda (NORA) Oil and Gas Extraction Sector Council brings together representatives from industry, trade associations, academia, and major insurance companies to guide and conduct research on health and safety in the industry.<sup>17</sup>
- Trade associations such as the American Petroleum Institute (API),<sup>18</sup> the Association of Energy Service Companies,<sup>19</sup> and the International Association of Drilling Contractors<sup>20</sup> have programs that provide and update health and safety guidelines, convene meetings to share developments, and promote innovation and improvement in working conditions across the industry.
- The National Service, Transmission, Exploration & Production Safety (STEPS) network is a volunteer-run organization that brings together operators, contractors, trade associations, and educators to share best practices, discuss incidents, improve communications, and develop projects to work on specific issues.<sup>21</sup>

### References & More Resources

For a complete listing of references, see the “References” section of the full publication, *Petroleum and the Environment*, or visit the online version at: [www.americangeosciences.org/critical-issues/petroleum-environment](http://www.americangeosciences.org/critical-issues/petroleum-environment)

Mason, K.L. et al. (2015). Occupational Fatalities During the Oil and Gas Boom – United States, 2003-2013. Centers for Disease Control and Prevention, Morbidity and Mortality Weekly Report, 64(2), 551-554. <https://www.cdc.gov/Mmwr/preview/mmwrhtml/mm6420a4.htm>

National Institute for Occupational Safety and Health – Oil and Gas Extraction Program. <https://www.cdc.gov/niosh/programs/oilgas/default.html>