Occupational Ozone and Oil & Gas Development: Information for Workers & Employers in Wyoming

**Background**

Ozone (O₃) is a colorless to blue gas with a sharp, pungent odor. The odor threshold of ozone occurs in the approximate range of 0.01-0.05 parts per million (ppm), which is below the occupational permissible exposure level of 0.10 ppm. Thus ozone is considered a substance with good warning properties in the workplace. The primary route of ozone exposure is inhaling the gas, which may result in coughing, shortness of breath, lung inflammation, and aggravation of pre-existing lung diseases. Ozone gas may also irritate a person’s eyes, nose and throat.

Controls for ozone in the workplace focus on exhaust ventilation and direct fresh air supply. Respirators may be used when engineering controls are not feasible, such as when working in tanks, or during emergency situations.

Ozone occurs naturally in the Earth’s upper atmosphere where it functions beneficially. However, elevated ozone at ground level may be a harmful air pollutant. Ground level ozone is formed when certain air pollutants react chemically in the presence of sunlight. For example, Wyoming’s Upper Green River Basin (UGRB), which includes Sublette County and parts of Lincoln and Sweetwater Counties, has periodically observed elevated ground level ozone in the winter, relative to surrounding areas. It is believed that oil and gas industrial activities generating ozone precursor emission and coupled with specific weather conditions in the UGRB are the underlying causes of these elevated ground ozone levels.

**How Much Ozone Exposure is Okay?**

Exposure science is not able to provide one certain answer to this question. The variability of exposure duration, exposure concentrations, individual health status and other factors mean ozone exposure affects different people in different ways. However, various scientific studies have helped established the following OSHA Permissible Exposure Limit (PEL) and NIOSH Ceiling Recommended Exposure Limit (C-REL) for ozone in workplace settings. The EPA also has set an ambient air quality standard to be protective of public health.
Comparison of Permissible or Recommended Ozone Exposure Levels for Ambient Air and the Workplace

<table>
<thead>
<tr>
<th>Agency</th>
<th>Ozone Exposure Limit or Standard Definitions</th>
<th>Current Ozone Exposure Limit or Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental Protection Agency (EPA)(^i)</td>
<td>As of 2015, the ambient air quality standard averaged over 8 hours (3-year average of 4(^{th}) highest daily maximum 8-hr average concentration). Measurements are obtained with environmental ambient air monitoring devices.</td>
<td>0.070 ppm 8 hour average</td>
</tr>
<tr>
<td>Occupational Safety and Health Administration (OSHA)(^ii)</td>
<td>A Permissible Exposure Limit (PEL) for General Industry is averaged over an 8-hour work shift in a 40-hour work week (Time Weighted Average or TWA). Measurements are obtained with personal breathing zone monitors worn by workers.</td>
<td>0.10 ppm 8 hour TWA</td>
</tr>
<tr>
<td>National Institute for Occupational Safety and Health (NIOSH)(^iii)</td>
<td>A Ceiling Recommended Exposure Limit (C-REL) is an upper limit value which NIOSH advises should not be exceeded at any time. Measurements are obtained with personal breathing zone monitors worn by workers.</td>
<td>0.10 ppm Ceiling REL</td>
</tr>
</tbody>
</table>

\(^i\) The EPA sets air quality standards for ambient/atmospheric air. The Wyoming Department of Environmental Quality (DEQ) works to ensure these standards are met.

\(^ii\) The Occupational Safety and Health Administration (OSHA) sets minimum health and safety standards for most workplaces. Wyoming OSHA works to ensure these standards are met.

\(^iii\) The National Institute for Occupational Safety and Health (NIOSH) is a branch of the U.S. Centers for Disease Control and Prevention (CDC). They are not a regulatory agency. Rather they conduct research and compile scientific evidence to help inform workplace safety and health policies and practices, including the establishment and revision (when necessary) of OSHA standards.

Although the EPA and OSHA ozone measurement methods are not directly comparable (ambient air vs. personal breathing zone monitors), the level of EPA’s 8-hour average ambient air standard for ground-level ozone of 0.070 ppm can be interpreted as more protective than OSHA’s 8-hour TWA permissible limit of 0.10 ppm. EPA standards are intended to protect all of the public’s health, including members of the community more susceptible to health effects who would not typically be part of a worker population, such as the elderly, children or individuals with compromised health. Ambient air quality standards are established to help protect these at-risk populations.

The NIOSH Ceiling REL of 0.10 ppm, which NIOSH recommends not be exceeded during an 8-hour work shift, is more protective than the OSHA PEL, as the OSHA PEL allows ozone exposure to exceed 0.10 ppm for brief periods of time during an 8-hour work shift as long as the average exposure over the shift remains less than 0.10 ppm. It is very common for NIOSH to publish recommended exposure limits that are more protective than OSHA standards. OSHA standards are the minimum safety and health standards employers must legally abide by, but some will strive for more protective recommendations of NIOSH and other occupational health and safety organizations.
Ozone Monitoring in Wyoming

Air contaminant exposure is generally measured or described in two contexts - as ambient air in a community or as the personal breathing zone of an exposed worker. The ambient air throughout Wyoming is monitored by the Wyoming Department of Environmental Quality (DEQ).\(^5,6\) The Wyoming Air Quality monitoring network features live images and air quality conditions from monitoring stations throughout the State, available online at [www.WyVisNet.com].\(^7\) Ambient air monitors that record this data are intentionally placed in locations where the general community population would be exposed to the air being measured.

There are no state or federal air monitoring programs that routinely measure breathing zone exposures among workers; data on occupational breathing zone exposures typically come from research studies or technical consultation surveys initiated by employers. Authors of this report were unable to find any published research specific to ozone exposure in occupational settings comparable to oil and gas fields.

Understanding Health Effects

Due to differences in health status, immune function and other factors, individuals will likely have different physical effects from different levels of ozone exposure. Some people may have no symptoms or effects, while others may experience symptoms with even brief, low-level ambient exposure. Please refer to the Wyoming Department of Health Ozone Information webpage for more information on health effects.\(^8\)

Assuring Ambient Air Quality

The Clean Air Act requires air quality to meet national ambient air quality standards.\(^9\) In Wyoming, the Department of Environmental Quality - Air Quality Division is responsible to assure ambient air quality standards are met. The Air Quality Division is not responsible for workplace air quality standards (Wyo. Stat. Ann. § 35-11-1104(a)(iii)).

Preventing Occupational Exposure

Under OSHA’s General Industry Standards, employers are responsible for identifying and mitigating workplace hazards such as ozone. OSHA provides sampling and testing guidelines for occupational ozone exposure.\(^10,11\) Employers or workers seeking to develop an ozone monitoring program should explore technical support available through the Wyoming Department of Workforce Services and other agencies.\(^12\) Many resources are free and confidential, such as Wyoming OSHA Consultation and Wyoming Workers’ Compensation Safety & Risk (WCSR) Consultation. These programs can assist with monitoring for occupational ozone exposure, as well as developing and implementing exposure prevention protocols.

This document was prepared in collaboration with the Wyoming Department of Environmental Quality and the Wyoming Department of Health.
References and Links to More Information:

1. CDC NIOSH Ozone Topic Page: [https://www.cdc.gov/niosh/topics/ozone/default.html](https://www.cdc.gov/niosh/topics/ozone/default.html)
3. CDC NIOSH Occupational Health Guide for Ozone: [https://www.cdc.gov/niosh/docs/81-123/pdfs/0476.pdf](https://www.cdc.gov/niosh/docs/81-123/pdfs/0476.pdf)
8. WDH Ozone Information: [https://health.wyo.gov/publichealth/infectious-disease-epidemiology-unit/disease/ozone/](https://health.wyo.gov/publichealth/infectious-disease-epidemiology-unit/disease/ozone/)
9. EPA Summary of the Clean Air Act: [https://www.epa.gov/laws-regulations/summary-clean-air-act](https://www.epa.gov/laws-regulations/summary-clean-air-act)
11. OSHA Chemical Sampling Information: [https://www.osha.gov/dts/chemicalsampling/data/CH_259300.html](https://www.osha.gov/dts/chemicalsampling/data/CH_259300.html)