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Working Hours, Sleep, & Fatigue Forum

Abstract for Oil and Gas Extraction Sector

U.S. Oil and Gas Extraction Workers: Fatigue, Sleep, and Working Hours (Extended version)

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Key messages:

1. The U.S. oil and gas extraction (OGE) workforce works long hours and has an elevated fatality rate. . While fatigue has been shown to be a significant health and safety risk in other industries, minimal research on worker fatigue has been conducted in this workforce.
2. Regulations intended to manage fatigue among OGE workers are limited to hours-of-service (HOS) regulations, which apply only to drivers of large trucks. However, international OGE operators and the U.S. petrochemical industry recognize the workplace health and safety risks posed by fatigue and have developed guidance documents to help employers manage these risks.
3. Research is needed to quantify the impacts of worker fatigue and to examine the interactions between on- and off-the-job risk factors for fatigue in the U.S. OGE industry. Technologies and other interventions that can identify and manage fatigue need to be evaluated in this workforce, particularly among small companies with the assistance of intermediaries.
4. Further collaboration between researchers and OGE partners could lead to significant improvements in understanding the impact of fatigue and shiftwork on OGE workers and in implementing effective fatigue risk management (FRM) for both large and small companies.

In 2017, the U.S. oil and gas extraction (OGE) workforce was composed of 428,444 workers from oil and gas operators, drilling contractors, and a wide range of other contractors providing support activities to bring new oil and gas wells into production and to service existing wells [BLS 2019a]. Onshore and offshore OGE workers often face difficult working conditions from exposure to a wide range of physical and chemical hazards, including working at heights, around large and heavy moving equipment, and around potentially flammable and toxic gases, vapors and particulates, depending on the magnitude and duration of exposure(s). Despite a significant decrease in the worker fatality rate between 2003 and 2013, the average annual rate for the OGE workforce was about seven times that for U.S. workers during this time period [Mason et al. 2015]. An elevated motor vehicle fatality rate has also been documented in OGE, where falling asleep at the wheel has been identified as a contributing factor in crash reports [Retzer 2013]. The contributions of sleep, fatigue, and working hours to occupational injury and illness in the U.S. OGE industry are largely undocumented.

The average U.S. worker works 34.5 hours per week, but oil and gas operator employees (34% of the OGE workforce) work 41-43.9 hours per week on average and workers engaged in drilling and oil and gas support activities (66% of the workforce) work 45.8-49.5 hours [BLS 2019b]. Overtime work hours have been associated with poorer perceived general health,

increased injury rates, and increased mortality [NIOSH 2004]. One study found that for North Sea offshore workers, sleep hours were negatively associated with overtime hours and job demands and positively associated with job control and supervisory support [Parkes 2017].

Oil and gas operators rely heavily on contractors to conduct drilling and well servicing operations. Contractors may support multiple operators at the same time, resulting in the potential for competing work demands, long work hours, and insufficient rest time. Thus, contractor companies' management must be actively involved in managing fatigue risk for their employees. OGE work is also characterized by 24/7 operations during some phases of well development. As a result, most subgroups of OGE workers work in 12-hour shifts, including operator field staff, drilling and completions contractors, and offshore workers. These workers also often work in "rotations," where 12-hour shifts are worked consecutively for 2 weeks or longer, resulting in 84-hour work weeks [Mehta et al. 2017]. Shift schedules (i.e., swing, rotating, and night shifts) vary from company to company. Unexpected events sometimes occur during drilling and completions of new wells, leading to extended shifts. Other factors that increase fatigue risk for OGE workers include physical demands, redundant work activities, and the need to stay alert and ready to respond in critical situations [Lerman et al. 2012]. Economic forces that drive the industry are cyclical and unpredictable; when activity increases rapidly, understaffing, more overtime, longer rotations can result. Many onshore well sites are remote, requiring workers to drive long distances before, during, and after shifts on rural roads which often lack safety features [CDC 2008]. Long commutes further extend work days. Offshore workers may also have long commutes between their residence and the location from which they are transported to rigs [Di Milia et al. 2012, Mason et al. 2015]. Remote sites, onshore and offshore, have created a need for short- or long-term accommodations where off-duty workers can eat, rest, and sleep. Conditions in these accommodations may not support proper sleep, rest, and overall health.

Coverage of OGE work by federal work hours regulations is limited. The Occupational Safety and Health Administration has no maximum work hour regulations for private industry that would cover OGE workers on either the well site or the road. The transport of oil and gas after extraction is covered by federal HOS regulations that set maximum driving hours and duty hours during a work shift or over several shifts, require breaks during a shift, and require a minimum number of off-duty hours between shifts [Hours of service of drivers, 2013]. Additionally, heavy vehicles specifically designed for the oilfield are exempt from compliance with HOS regulations [Hours of service of drivers, 2013]. Further, HOS regulations cover only vehicles weighing 10,000 pounds or more; they do not apply to light-duty vehicles, which are widely used in the OGE industry. Other federal legislation and regulations address fatigue and HOS for other workers involved in the transport of oil and gas: rail workers [Federal Rail Safety Improvements (P.L. 110–432)] and pipeline control room workers [Transportation of natural and other gas, 2017].

Research suggests that the HOS approach alone does not adequately manage fatigue. Individuals do not experience fatigue uniformly, and HOS regulations do not consider the point in the individual's circadian cycle when work is taking place, nor do they address sleep quantity or quality outside work hours [Dawson and McCulloch 2005, Lerman et al. 2012]. Further, researchers have noted that effective FRM requires shared responsibility by companies and workers, a comprehensive fatigue risk management system (FRMS), and integration of FRM into other occupational safety and health (OSH) management systems [Dawson and McCulloch 2005, Gander et al. 2011, Lerman et al. 2012]. Federal aviation regulations require commercial carriers to implement a FRMS [Flight and duty limitations, 2012], but no other industry has similar requirements. After the 2005 Texas City refinery explosion, petrochemical industry stakeholders developed a voluntary standard which calls for the use of a comprehensive FRMS [ANSI/API 2010]. FRMS components as defined in the standard include balance between workload and staffing, shift scheduling, fatigue training and sleep disorder management, environment and workplace design, and monitoring of fatigue and fitness for duty. Other FRM resources have been developed by the International Petroleum Industry Environmental Conservation Association (IPIECA) and International Association of Oil & Gas Producers (IOGP), an organization composed primarily of large companies [IPIECA/IOGP 2007, 2019]. However, beyond member companies, these organizations have limited reach in the U.S., and the current guidance does not integrate FRM recommendations for the well site and the road. For these reasons, additional guidance is needed for the U.S., particularly for onshore operations.

OGE-specific research is needed in several areas:

- **Determining the impacts of fatigue in OGE:** If upper managers are to be convinced to implement voluntary FRM, OSH professionals need to be able to quantify the human, operational, and financial consequences of fatigue. Criteria for identifying fatigue episodes and the role of fatigue in safety-critical incidents are needed.
- **Challenges to adoption of FRMS in OGE:** Although FRMS implementation is seen as a best practice, research demonstrating its effectiveness is lacking, including the return on investment for these systems. Further, research is needed to characterize barriers to successful implementation. For companies, barriers may include conflicts between FRM and operational priorities, resistance to the cost of increased staffing levels, and challenges in engaging contract companies in FRM. For workers, barriers may include resistance to prioritizing sleep over other activities in off-duty time and reluctance to forego opportunities for extended overtime work or to change longstanding work schedules

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- **Interaction between on- and off-the-job risk factors and behaviors:** Research to date has not fully considered the range of factors that may predispose OGE workers to fatigue, notably sleep quantity and quality during off-duty time (whether at a residence or on-site housing), and the nature, length, and timing of commutes.
- **Use of technology to identify and manage fatigue:** OGE has been an early adopter of safety technologies such as in-vehicle monitoring, and the OGE work environment would be conducive to field evaluations of technologies to identify and manage fatigue. These solutions might include in-vehicle technologies or "wearables" such as smart watches, and they might be designed specifically for the industry or adapted from existing consumer products.
- **Increasing the diffusion of FRM information for OGE:** The reach of voluntary FRM standards and guidance documents is largely limited to the large companies (primarily operators) who have put the resources into developing them. Research is needed to identify the intermediaries (for example, insurers or industry associations) who can reach smaller companies, particularly contractors who support drilling and well servicing, and to test the effectiveness of educational, policy, or technological interventions.

Potential for positive impact of OGE-focused research on fatigue, sleep, and work hours is substantial. Despite the presence of federal HOS regulations that apply to several segments of the industry, large companies have recognized that more is needed to effectively manage fatigue, and they have collaborated on consensus guidance over a period of years. Further collaboration between researchers and OGE operators and contractors can lead to development of action-oriented recommendations to mitigate fatigue throughout the OGE industry.

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