Assessing Fatigue and Fatigue Management in U.S. Onshore Oil and Gas Extraction

(Information Collection Request)

Request for Office of Management and Budget Review and

Approval for Federally Sponsored Data Collection

Section A

Project officers:

Alejandra Ramirez-Cardenas and Imelda Wong

Centers for Disease Control and Prevention (CDC)

National Institute for Occupational Safety and Health (NIOSH)

Western States Division

P.O. Box 25226

Denver, CO 80225-0226

Phone: 303-236-5957 and 513-533-6847

E-mail: nxa5@cdc.gov and kwn0@cdc.gov

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- **Goals of this study:** 1) Identify occupational and non-occupational determinants of fatigue in U.S. Oil and Gas Extraction (OGE) workers; 2) Identify worker and organizational factors to consider when developing and implementing fatigue management strategies in the OGE industry; and 3) Describe how fatigue mitigation strategies are currently being used in the onshore OGE industry.

- **Intended use of the resulting data:** To guide the development of targeted interventions, training, and educational materials.

- **Methods to be used to collect:** This study uses a multi-methods study design consisting of an observational longitudinal field study and qualitative research methods.

- **The subpopulation to be studied:** Land-based OGE workers in the United States and scientific researchers who are subject matter experts in occupational fatigue.

- **How data will be analyzed:** Quantitative data will be analyzed using multivariable analyses with Generalized Linear Mixed Models. Qualitative data will be analyzed using several phases of qualitative coding (e.g., initial, focused, axial, and theoretical) to separate, sort, and synthesize the information to identify patterns and respective themes.

A. Justification

A.1 Circumstances Making the Collection of Information Necessary

The Centers for Disease Control and Prevention (CDC), National Institute for Occupational Safety and Health (NIOSH) seeks approval from the Office of Management and Budget (OMB) to conduct a study involving oil and gas extraction (OGE) workers. This is a new Information Collection Request (ICR), with approval requested for three years post-approval date. Data will be collected by NIOSH under Section 20(a) (1) of the Occupational Safety and Health Act (29 U.S.C.669) (Attachment 1).

Work-related fatigue has been described as a complex hazard stemming from a variety of occupational and non-occupational factors. Fatigue can impair workers' alertness, affecting their ability to safely perform tasks and has been associated with increased risk for work injuries, motor vehicle crashes (MVCs), and long-term adverse health outcomes. [1-4]

Fatigue is an important contributor to the high rates of occupational fatalities and MVC fatalities among OGE workers. The nature of work in the OGE industry includes long workdays, erratic work scheduling, hazardous exposures, and physically demanding work, which have all been associated with fatigue and adverse safety and health outcomes. [4] However, there is still much that needs to be explored regarding OGE worker fatigue. Understanding factors contributing to OGE worker fatigue will help develop effective, targeted fatigue mitigation strategies.

There are no published studies that have specifically identified and described the determinants of fatigue among U.S. onshore OGE workers. The few studies that have examined fatigue in the OGE industry have focused on offshore workers, despite 97% of the OGE work occurring onshore. [4-10] While both onshore and offshore workers face difficult working conditions and long work hours, many onshore workers have the added burden of long commutes and driving long distances to and between remote well sites. These factors further extend the workday and may increase fatigue risk for workers. Fatigue Risk Management Systems (FRMS) have been identified as a comprehensive approach to managing fatigue. While FRMS has only been formally implemented in transportation subsectors such as aviation and railroad, components of FRMS (e.g., hours of work limits) may have been implemented by certain OGE companies. [11, 12] Learning how FRMS have been implemented will allow us to share information across the OGE industry so that other organizations can adopt similar practices.

The proposed research will examine occupational and non-occupational determinants of fatigue" among U.S. onshore OGE workers. We will also identify worker and organizational factors critical to fatigue management in the OGE industry and explore how fatigue mitigation practices, such as FRMS, are currently being used by participating OGE companies.

This study addresses NIOSH Strategic Plan intermediate goal 7.13:

- Intermediate Goal 7.13 (Fatigue, Work organization, substance use/misuse): Employers, workers, professional organizations, and accrediting bodies use NIOSH information to prevent injuries associated with work organization factors that contribute to fatigue, prescription drugs (including opioids), illicit drugs, and substance use/misuse in the oil and gas extraction sector.

Additionally, a recent NIOSH literature review outlined what is known on this topic and what research is needed in the OGE industry.[4] The study referenced in this data collection request addresses four of the five research gaps which includes: building knowledge about the prevalence of fatigue; exploring occupational and non-occupational risk factors; identifying areas for future interventions; and increasing the body of knowledge by sharing study results.

A.2. Purpose and Use of the Information Collection

The purpose of this effort is to collect data that will 1) Identify occupational and non-occupational determinants of fatigue in U.S. onshore OGE workers; 2) Identify worker and organizational factors to consider when developing and implementing fatigue management strategies in the onshore OGE industry; and 3) Describe how fatigue mitigation strategies are currently being used in the U.S. onshore OGE industry.

Data collected from this study will be summarized using descriptive statistics methods such as means, medians, modes, and proportions as appropriate, as well as standard deviations, box-and-whisker plots, stem-and-leaf plots, histograms, and other data visualization techniques. Findings from this study will be used to identify determinants of fatigue among onshore OGE operations. Identifying these determinants can help companies implement effective FRMS that will reduce fatigue-related incidents.

NIOSH is committed to the concept of Research to Practice (r2p) (https://www.cdc.gov/niosh/r2p/default.html), meaning that we strive to ensure that NIOSH-generated knowledge is used to create practical interventions to reduce illness and injury among workers. We engage partners (e.g., other government agencies, industry, subject matter experts, the workers themselves) throughout the process. This ensures that we focus on issues that are of importance to the workers of the specific industry and can be translated into practical interventions and activities within that industry.

If this study is not conducted, we would continue to rely on information from the offshore OGE workforce. By doing this, we risk mischaracterizing onshore OGE operations which may place this workforce at an increased risk of fatigue and related sequela.

NIOSH has fully funded this study and is part of the NIOSH budget through Fiscal Year 2025.

A.3. Use of Improved Information Technology and Burden Reduction

Questionnaires (Attachments 3 a-f) will be administered primarily using REDCap, a CDC-approved secured system. Because well sites are often in remote locations without any wireless signals, the REDCap offline application, which is specifically designed to support data collection in field research settings, will be used. Using the REDCap tool to allow respondents to answer survey questions using a mobile tablet device provided by the researchers is anticipated to substantially reduce the time required to collect survey responses and aggregate responses. The sequence of survey questions includes options to skip questions that are not applicable, to reduce participant burden. All survey data will be recorded on the devices while on offline mode and then transferred to a secured CDC password-protected server. Participants will also have the option of completing the questionnaires on paper, based on preference. We are prepared to assist with the survey, upon participant request. All study instruments will be available in both English and Spanish.

Psychomotor Vigilance Task (PVT) tests will be administered using the NASA PVT+ application on electronic tablets (no instrument to attach for the PVT). All data will be recorded on the devices while on offline mode and transferred to a secured CDC password-protected server.

Actigraphy measures will be captured using the Phillips Actiwatch (Attachment 4), a small wristwatch-like device that is non-intrusive and records limb activity as a measure of sleep-wake movement. The actigraphy watch will continuously and passively record during the study period. Data is recorded on the device and then transferred to a secured CDC password-protected server.

Trained NIOSH study team members will be leading focus group sessions and conducting interviews (Attachments 5a-e). Conducting focus groups and interviews allows for richer and more detailed responses than written ones.

A.4. Efforts to Identify Duplication and Use of Similar Information

This effort is not duplicative. In developing this proposal, we conducted a literature search to identify studies focused on fatigue and fatigue risk management among onshore OGE operations. We found there is a paucity of studies on this topic, and most of the current literature is limited offshore OGE operations.[4, 6-10, 13] However, these results are not generalizable to onshore workers because of their less predictable work schedules and the extended daily commutes common among onshore workers.[4] Unpredictable schedules, compounded with long commutes to remote sites, leaves little time for rest and recovery between shifts, placing workers at an increased fatigue risk. As such, current research is not applicable to onshore operations and thus not suitable to use in the development of FRMS.

A.5. Impact on Small Businesses or Other Small Entities

Participation in this study is voluntary. This study will identify significant risk factors for fatigue and will provide options for fatigue risk management. This may help small businesses recognize areas where additional fatigue-mitigation efforts may be neededand provide them with appropriate and practical strategies.

A.6. Consequences of Collecting the Information Less Frequently

Data collection of baseline questionnaires, interviews, and focus groups will be conducted once with each participant. Pre-shift questionnaires, post-shift questionnaires, and PVT tests will be performed twice daily for two weeks. Sleep measures using actigraphy will be collected passively during the two weeks. A power calculation was performed to identify the minimum number of participants and observations needed to detect an effect. If this data is collected less frequently or less observations are collected, we may not be able to detect an effect. This would hinder our ability to identify significant risk factors for fatigue in onshore OGE workers and we would thus be unable to provide evidence-based recommendations to minimize fatigue risk in this workforce. There are no legal obstacles to reducing the burden.

A.7. Special Circumstances Relating to the Guidelines of 5 CFR 1320.5

This request fully complies with the regulation 5 CFR 1320.5.

A.8. Comments in Response to the Federal Register Notice and Efforts to Consult Outside the Agency

A. The 60-Day Federal Register Notice (Attachment 2) was published on August 21, 2023, vol. 88, No. 160, pp 56831-56832. No public comments were received.

B. Consultations on the type of information to collect began in 2019 and have continued throughout project planning and protocol development. The following individuals were consulted:
    a. Sean Mecham, Director of Health, Safety, and Environment for Filamar Energy Services, (713) 880-9899, sean@filamarenergy.com
    b. Billy Pruett, Heath, Safety, and Environment Advisor for Pioneer Natural Resources, (972) 969-4526, billy.pruett@pxd.com
    c. Emily Hague, Senior Policy Advisor for the American Petroleum Institute, (202) 682-8260
    d. Kenny Jordan, Executive Director for the Association of Energy Service Companies, No current contact information
    e. Rhett Winter, Director of Government and Industry Affairs – Onshore for the International Association of Drilling Contractors, No current contact information
    f. Gary Gard, Safety Director for Mountain States Pressure Services, Inc., (303) 389-6262
    g. Meredith Towle, Occupational Epidemiologist for the state of Wyoming, No current contact information
    h. Leslie Beyer, President of the Petroleum Equipment and Services Association, No current contact information
    i. Michael Marshall, Coordinator for OSHA's Upstream Oil and Gas Safety Task Force, (202) 693-2179, Marshall.Mike@dol.gov

A.9. Explanation of Any Payment or Gift to Respondents

It is important to maximize response rates and minimize attrition during information collection. Based on the experience of NIOSH teams with OGE Workers [14, 15], tokens of appreciation were important for increasing participation in studies involving OGE workers. Therefore, we feel that offering appreciative tokens to the OGE workers in this study will serve to increase response rates from individual workers and reduce potential attrition. Additionally, this project requires participation in surveys, alertness tests, and wearing actigraphy watches that will take some effort and time from the workers. As such, we would like to demonstrate our appreciation for their participation.

We will offer a token of appreciation (a $50 gift card) to those participants who complete the baseline questionnaire (Attachment 3a or b), at least one pre-shift (Attachment 3c or d) or post-shift questionnaire (Attachment 3e or f) per day, one PVT test per day, and can attest to wearing the actigraphy watch for at least 5 nights during the data collection period. Worker and field-level supervisor participants who complete the focus group (Attachment 5 a or b) or interview (Attachment 5c) will be offered a $10 gift card as a token of appreciation.

Note that if we are on a work site and the company does not want us to distribute these tokens of appreciation to their workers, we will respect the company's decision and not distribute tokens of appreciation.

A.10. Protection of the Privacy and Confidentiality of Information Provided by Respondents

“ISSO determined in conjunction with the CDC Privacy Office that the Privacy Act is applicable. The collection contains PII with demographic information in the survey (i.e., Age, Ethnicity, Race, Gender, Sex and Marital Status).

Research Electronic Data Capture (REDcap) and NIOSH Edge Computing Platform (NCEP) include the in-place technical, physical, or administrative controls (safeguards).

Research Electronic Data Capture (REDcap) and NIOSH Edge Computing Platform (NCEP) System Security Plan (SSP) defines the process for handling security incidents. The system’s team and the Cybersecurity Program Office (CSPO) share the responsibilities for event monitoring and incident response. Direct reports of suspicious security or adverse privacy related events to the component’s Information Systems Security Officer (ISSO), CDC helpdesk, or to the CDC Security Incident Response Team (CSIRT). The CDC CSPO reports to the HHS Computer Security Incident Response Center (CSIRC), which reports incidents to US-CERT as appropriate.”

The information collected for the study will be maintained or stored under strict access controls limited to the local project leader/manager or his/her designate. Under no circumstances will an individual be identified using a combination of variables such as gender, race, age, and/or other descriptors. Once the targeted number of respondents is reached or the data collection period is completed, data collection will end so that the number of respondents will not exceed the target number of respondents specific to each data collection instrument.

Participation in the activities of this study is strictly voluntary. Participants will be informed of their right to refuse to participate, end participation at any point, or skip questions. They will also be informed of the purpose of the study and potential uses of the data. The participants will not be asked to disclose any private business information.

REDcap and NIOSH Edge Computing Platform (NECP) include the in-place technical, physical, or administrative controls (safeguards).

A.11. Institutional Review Board (IRB) and Justification for Sensitive Questions

A.11. IRB Approval

The proposed data collection was reviewed and approved by the CDC-NIOSH Human Subjects Research Board (23-NIOSH-04) (Attachment 9).

A.11. Sensitive questions

The Baseline Questionnaire (Attachment 3a,b) contains questions that may be sensitive in nature, including questions regarding health and personal habits, demographics, fatigue, and elements of the work environment. The focus group (Attachment 5a,b) and the interview guides (Attachments 5c-e) ask about personal experiences with fatigue during work and the implementation of company policies. All responses are voluntary, and participants may refuse to provide a response to a particular question or set of questions. Because some questions are sensitive in nature, data will be treated in a secure manner and will not be disclosed, unless otherwise compelled by law. Responses will be aggregated to a level that ensures responses will not be identifiable.

The potentially sensitive questions are needed to identify factors critical to fatigue management in the onshore U.S. OGE industry so that recommendations specific to this workforce can be developed. To effectively mitigate the fatigue risk for onshore OGE workers, NIOSH needs an understanding of the determinants of fatigue for this workforce. Therefore, it is important to collect data regarding health and personal habits, demographics, fatigue, elements of the work environment, and personal experiences with fatigue during work. An understanding of determinants of fatigue, and their association with objective measures of alertness (i.e., PVT scores) and sleep (i.e., actigraphy), will allow NIOSH to develop recommendations to mitigate fatigue risk for OGE workers.

A.12. Estimates of Annualized Burden Hours and Costs

A.12.A. Estimates of Annualized Burden Hours

The estimate of burden hours is based on a pilot to field test study tools. During the pilot, fewer than 9 onshore OGE workers answered questionnaires, participated in simulated interviews, took PVT tests, and wore actigraphy watches. Data collected during the pilot was not saved or used to conduct any analyses. The average time to complete each instrument was recorded in Table A.12.A. We anticipate a total of 80 participants will complete the field study, 40 will complete the focus groups and interviews (from the same subset from the field study), and 10 will complete the leader interviews. If this annualized over 3 years, it equates to 30 respondents per year. The approximate total burden is an annualized 135 hours. There is no cost to the respondents aside from their time.

Table A.12.A: Estimates of Annualized Burden Hours

Type of Respondents	Form Name	No. of Respondents	No. of Responses per Respondent	Average Burden per Response (in hours)	Total Burden Hours
Aim 1) Field study				**Total Burden hours = 339 hours**	
Land-based OGE workers	Baseline Questionnaire	80	1	15/60	20
Land-based OGE workers	Daily Pre-Shift Questionnaires	80	14	3/60	56
Land-based OGE workers	Daily Post-Shift Questionnaires	80	14	3/60	56
Land-based OGE workers	Psychomotor Vigilance Test (PVT) – no form	80	28	5/60	187
Land-based OGE workers	Actigraphy*	80	1	15/60	20
Aim 2) Worker focus groups and field-level supervisor interviews				**Total Burden hours = 55 hours**	
Land-based OGE workers	Worker Interview Guide	30	1	1.5	45
Field-level Supervisors	Manager Interview Guide	10	1	11	10
Aim 3) Leader interviews					**Total Burden hours = 10**

Type of Respondents	Form Name	No. of Respondents	No. of Responses per Respondent	Average Burden per Response (in hours)	Total Burden Hours
Health and Safety Leaders	HSE Interview Guide	7	1	1	7
Subject Matter Experts	SME Interview Guide	3	1	1	3
Total					**404**

*Actigraphy watches will collect data passively and will not require participant effort except for training and fitting of the watch.

A.12.B. Estimated of annualized burden costs

The annualized cost to the respondents is segmented in Table A.12.B, with total respondent cost estimated at $10,869.97. The Bureau of Labor Statistics (BLS) National Occupational Employment and Wage Estimates - Current Employment and Wages from Occupational Employment Statistics (OES) Survey for May 2022 was used to estimate the average hourly wage rate (https://www.bls.gov/oes/current/oes_nat.htm).

Table A.12.B: Estimated Annual Burden Costs

BLS OES Occupational Code	Type of Respondents	Form Name	Total Burden Hours	Mean Hourly Wage Rate	Total Respondent Cost
Aim 1) Field study					**Total Cost = $8,776.71**
47-5000	Land-based OGE workers	Baseline Questionnaire	20	$25.89	$517.80
47-5000	Land-based OGE workers	Daily Pre-Shift Questionnaires	56	$25.89	$1,449.84
47-5000	Land-based OGE workers	Daily Post-Shift Questionnaires	56	$25.89	$1,449.84
47-5000	Land-based OGE workers	Psychomotor Vigilance Test (PVT)	187	$25.89	$4,841.43
47-5000	Land-based OGE workers	Actigraphy	20	$25.89	$517.80
Aim 2) Worker focus groups and field-level supervisor interviews					**Total Cost = $1,538.35**
47-5000	Land-based OGE workers	Worker Interview Guide	45	$25.89	$1,165.05
47-1011	Field-level Supervisors	Manager Interview Guide	10	$37.33	$373.30
Aim 3) Leader interviews					**Total Cost = $554.91**
11-1000	Health and	HSE Interview	7	$62.04	$434.28

BLS OES Occupational Code	Type of Respondents	Form Name	Total Burden Hours	Mean Hourly Wage Rate	Total Respondent Cost
	Safety Leaders	Guide			
19-0000	Subject Matter Experts	SME Interview Guide	3	$40.21	$120.63
Total					**$10,869.97**

A.13. Estimates of Other Total Annual Cost Burden to Respondents and Record Keepers

There are no additional cost burdens to respondents or record keepers.

A.14. Annualized Cost to the Federal Government

Table A.14. Annualized Cost to the Federal Government

Expense Type	Expense Explanation	Annual Costs (dollars)
Direct costs to the federal government		
	CDC Project Officer (GS-12, 1 FTE)	$121,153
	Travel	$15,000
	Equipment	$7,000
	Supplies	$1,000
	Other (Tokens of appreciation, printing, shipping)	$10,000
Cooperative Agreement or Contract	IPA Agreement with the University of Colorado	$26,000
	TOTAL COST TO THE GOVERNMENT	$180,153

A.15. Explanation for Program Changes or Adjustments

This is a new a new data/information collection.

A.16. Plans for Tabulation and Publication and Project Time Schedule

We plan to publish study results in both peer reviewed and non-peer reviewed journals (e.g., trade publications). Our projected timeline for the project is detailed in table A.16-1 below.

Table A.16.1

Activity	Time Schedule
Develop database to collect questionnaire responses	During OMB Review
Outreach to oil and gas companies to identify potential participants	During OMB Review
Data Collection	1–18 months after OMB Approval
Data Cleaning	6–20 months after OMB Approval
Data Analysis	20–30 months after OMB Approval

Publication	30–36 months after OMB Approval

A.17. Reason(s) Display of OMB Expiration Date is Inappropriate

The display of the OMB expiration date is not inappropriate.

A.18. Exceptions to Certification for Paperwork Reduction Act Submissions

There are no exceptions to the certification statement.

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15. Wingate KC, et al. *Self-reported exposure to hazards and mitigation strategies among oil and gas extraction workers in 3 U.S. states*. Journal of Occupational and Environmental Hygiene. 2022; **19**(10-11):676-689.