

Request for Office of Management and Budget Review and Approval for Federally Sponsored Data Collection

Mobile Proximity Initial User Feedback

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Supporting Statement A

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Attachment A – Federal Mine Safety & Health Act of 1977

Attachment B – 60 Day Federal Register Notice

Attachment C – MSHA Proposal for New Rule for Proximity Detection Systems for Mobile Equipment

Attachment D – Comments on MSHA Proposed Rule for Proximity Detection Systems

Attachment E – IRB Approval/Exemption Letter

Attachment F – Interview Protocol

Attachment G – Fact Sheet on Proximity Detection for Mobile Machines

Attachment H – Mine Recruitment Script

Attachment I – Informed Consent Script

1. **Goal of the study** – To reduce the risk of traumatic injuries and fatalities among mine workers through assessing the current state of proximity systems for underground mobile equipment. The study seeks to address two key questions (1) in which situations do proximity detection systems on mobile haulage hinder normal operation? (2) in which situations do proximity detection systems on mobile haulage endanger miners?
2. **Intended use of the resulting data** – Utilize data to inform the development of technologies, engineering controls, administrative controls, best practices, and training approaches that eliminate striking fatalities and injuries caused by mobile mining equipment.
3. **Methods to be used to collect** – Semi-structured interviews, which take approximately 10 minutes, will be conducted with 250 mine workers. Additionally, researchers will observe a subset of workers as they use mobile equipment with proximity detection to complete their assigned job duties for up to one hour.
4. **The subpopulation to be studied** – This study will focus on mine workers in various maintenance and production roles that work in underground coal mines in the United States. The study does not include a subpopulation.
5. **How data will be analyzed** – Data will be analyzed using descriptive statistics and qualitative methods. Grounded theory will be used to identify themes and patterns in the interview data. The data will be further analyzed using thematic coding.

Supporting Statement A

The Centers for Disease Control and Prevention (CDC) requests OMB approval for a new research project for the National Institute for Occupational Safety and Health (NIOSH) Mining Program for a 12-month period.

The Information Collection Request (ICR) is a task under the National Institute for Occupational Safety and Health (NIOSH), Pittsburgh Mining Research Division (PMRD) project *Optimal Design of Proximity Systems for Underground Mobile Equipment*. The study will be conducted by NIOSH under the Federal Mine Safety and Health Act of 1977, Public Law 91-173 as amended by Public Law 95-164 (see Attachment A). Title V, Section 501 (a) states NIOSH has the responsibility to conduct research “to improve working conditions and practices in coal or others mines, and to prevent accidents and occupational diseases originating in the coal or other mining industry (Federal Mine and Safety and Health Act, 1977, Title V, Sec. 501).”

1. Circumstances Making the Collection of Information Necessary

Striking, pinning and crushing injuries are a serious concern in underground coal mining, especially around mobile equipment. Between 2010 and 2014 powered haulage accounted for 24 of the 110 underground coal fatalities (NIOSH, 2016). During that same time period, MSHA determined that up to nine of these fatalities were striking, pinning, or crushing accidents, which may have been prevented by proximity detection systems on coal haulage machines or scoops (MSHA, 2016a). Following the final rule requiring proximity detection systems on continuous mining machines, on September 2, 2015, MSHA published a proposed rule requiring proximity systems on mobile machines in underground coal mines (MSHA, 2015a; 2015b). Though it is still under development, MSHA reported that by June of 2015, 155 of approximately 2,116 coal haulage machines and scoops had been equipped with proximity detection systems (MSHA, 2016b). However, in recent discussions with NIOSH personnel, some mine operators have disclosed suspending the use of proximity detection systems on mobile equipment due to challenges integrating the systems into daily operations. This has further prompted concerns about how proximity detection systems are being utilized.

Additionally, On January 9 of 2017, MSHA reopened the comment period for equipping underground mobile machines with proximity detection systems. The comment period was reopened for two key reasons. First, the period was reopened to further explore any additional comments which were raised during or following the closing of the original comment period. Second, the period was reopened to allow for comments on a field-report on proximity detection system utilization in South Africa, which was conducted following the original comment period and presented at the June 22, 2016 NIOSH Proximity Detection Partnership Meeting. Some of concerns raised were related to the potential risks that proximity detection systems on mobile equipment may pose for mine workers. The comments included risk such as those associated with performing routine maintenance and troubleshooting tasks, machine movements which may result in pinning, crushing, or striking accidents, and sudden equipment stops which may harm machine operators.

Previously, NIOSH conducted a pilot study on proximity detection systems on mobile equipment used in underground coal mines. The pilot study involved determining the required stopping distances and times for mobile equipment. Findings from the pilot study identified a need for additional research related to the performance of proximity detection systems on mobile equipment. Even though the pilot study and related, subsequent studies offer findings which may potentially complement findings from the proposed study, these studies were not specifically designed to focus on human factors. Conversely, the proposed study focuses on human factors influencing the safety and effectiveness of proximity systems installed on underground mobile equipment.

As a part of the NIOSH Pittsburgh Mining Research Division (PMRD) project *Optimal Design of Proximity Systems for Underground Mobile Equipment*, a project which resulted from the pilot study, researchers are looking to assess the current state of these systems being used by industry. In conjunction with performance based testing, researchers are examining the human factors aspects of the systems and their implementations.

Overall, researchers are looking to determine the critical use cases for proximity systems on mobile equipment in underground mines. More simply, researchers are looking to answer the following questions (1) in which situations do proximity detection systems on mobile haulage hinder normal operations? and (2) in which situations do proximity detection systems on mobile haulage endanger miners? Researchers are also interested in determining what factors should be considered related to human machine interfaces when implementing proximity systems on mobile equipment in underground mines. Specifically, researchers hope to answer the following questions (1) what is the expected behavior of a proximity detection system on mobile haulage? and (2) what are the desired user features of a proximity detection system on mobile haulage? With a final rule in the works and these systems already in use, timely answers to these questions are vital. Therefore, researchers are following a usability approach in looking at performance and preference features of the current systems (Dumas, 1999, Tullis, 2008).

Researchers are looking to assess the effectiveness, efficiency, and satisfaction of the current system users. Specifically researchers are hoping to determine key positive and negative features of the current systems as well as factors that affect miners' ability to use the products as they relate to these three main usability metrics. These results are intended to be an initial investigation into the human factors of proximity systems on mobile haulage.

2. Purpose and Use of Information Collection

The information collected from the 250 semi-structured interviews with mine workers will be utilized to achieve one overarching objective and two intermediate outcomes. First, the key objective is to use the collected data to inform the development of technologies, engineering controls, administrative controls, best practices, and training approaches to eliminate striking fatalities and injuries caused by mobile and stationary mining equipment. Second, the collected information will result in the following two intermediate outcomes.

- (1) To provide recommendations, which can be referenced by MSHA during the development of the final rule for proximity for mobile equipment in underground mines. The recommendations will focus on reducing or eliminating injuries and fatalities resulting from mobile equipment strikes. Based on proposed timelines for the final ruling on proximity for mobile equipment, recommendations will need to be provided prior to September of 2018.
- (2) To provide recommendations, which can be used by mobile equipment and mobile proximity manufacturers and/or underground coal mine operators. The recommendations will focus on reducing or eliminating injuries and fatalities resulting from mobile equipment strikes. The goal is to provide recommendations to support manufacturers and mine operators prior to September of 2019.

Data will be collected through a maximum of 250 semi-structured interviews. To ensure the convenience of the mine workers and allow researchers to observe the way proximity is used for mobile equipment, the interviews will be conducted at the mine sites. In order to capture a variety of perspectives, various members of the section crews will be invited to participate. Minimally, the following crew members will be recruited.

Production Crew	Maintenance Crew
Ram Car Operator	Ram Car Operator
Continuous Miner Operator	Maintenance Worker
Section Foreman	Section Foreman

During the interviews, mine workers will be encouraged to share their experiences working with current proximity detection systems on mobile haulage equipment.

Participants will only complete one interview, where typical interviews are expected to take approximately 10 minutes. Following the interviews, participants may be observed as a group for up to one hour while completing regular job duties. However, the observations are optional and will not require any additional time from the participant. Furthermore, the observation is at the pleasure and availability of the associated mine company. Since the observations involve watching the mine workers perform their regularly assigned job duties, they are not expected to create a burden for employers and mine workers.

MSHA's announcement of the proposed rule to require proximity systems on mobile equipment has provided various opportunities for NIOSH to make recommendations to help prevent accidents and improve the practices and work conditions in the mining industry (Federal Mine and Safety and Health Act, 1977, Title V, Sec. 501). In response to NIOSH's and other stakeholders' comments, the proposed study would fulfill the following expressed needs.

- (1) Develop technologies, engineering controls, administrative controls, best practices, and training approaches to eliminate striking fatalities and injuries caused by mobile mining equipment.
- (2) Increase understanding of safety hazards related to proximity detection systems and mobile equipment.
- (3) Develop key insights, which can inform future policies and practices related to mobile proximity detection.
- (4) Support recommendations, which can inform future practices and equipment design related to mobile proximity among mine operators and equipment manufacturers.

There is also the potential for a minor negative consequence with the proposed study. The location where the interviews will be conducted was chosen to minimize the burden to the mine. Interviews will be conducted during normal work hours. However, because the possible locations are onsite, some participants may feel uncomfortable disclosing their experiences or thoughts related to proximity detection systems. In an effort to mitigate this potential challenge, researchers will protect the privacy of the mine workers by ensuring that personally identifiable information is not recorded and that interviews are not conducted in the presence of mine or shift supervisors. The information will also be further anonymized as it will be aggregated across several mine sites.

There is likely no direct or immediate benefits to the miners participating in this study, other than the satisfaction of assisting with research that will increase our knowledge and understanding of proximity detection systems and miners' perceptions of them. The aggregated findings will be shared with the industry in hopes that some of the feature improvements will be adopted, increasing the usability and safety of the equipment for the miners. The activities of this study pose no more than minimal risk to the participants. We are not collecting personally identifiable information. Miners are only being subjected to normal interview procedures and participating in normal work duties.

The health and safety of the PMRD employees will also be taken into account during the interviews and observations. All interviews will be conducted in a safe location that has been inspected for hazards. Furthermore, observations will be conducted from a safe location where a supervisor or other observer would normally stand.

3. Use of Improved Information Technology and Burden Reduction

During the interviews, researchers will ask questions and probe using the interview protocol for 100% of the participants (see Attachment F). Researchers will take written notes during the interaction. The participant will not be required to complete forms or surveys.

The use of technology during data collection is minimal for two key reasons. First, this study involves collecting qualitative data, which requires face-to-face interactions and observations. Second, the interviews will be conducted at mine sites, the crew members' place of employment. Technology may be limited or unavailable at the mine sites, making the use of technologies such as electronic respondent reporting impractical.

4. Efforts to Identify Duplication and Use of Similar Information

Since the ICR is based on a 2015 ruling to require proximity systems on continuous mining equipment, and a proposed ruling requiring proximity systems on mobile equipment, there is limited literature available to support the development of recommendations. MSHA recently re-opened the requested information related to the proposed mobile proximity rule (see Attachment C). In Response, NIOSH sent the following *Comments on MSHA Proposed Rule for Proximity Detection Systems for Mobile Machines in Underground Mines* (see Attachment D),

outlining the past and current research projects related to proximity detections systems for mobile equipment including this research effort (see Attachment D).

5. Impact on Small Business or Other Small Entities

This data collection will involve United States coal mining companies. Coal mining companies vary in size. Many small mines may be classified as small businesses. However, the proposed study will not include any small mines or businesses. For this study, researchers will recruit coal mines which are currently using proximity detection systems for mobile equipment. Based on the MSHA list of qualifying mines, small mines or businesses will not be recruited for the study. To protect the confidentiality of these mine, the list of qualifying mines is not included in this request. However, if necessary, some details regarding these mines can be discussed upon request.

Even though this study does not involve small mines or businesses, efforts have been made to minimize the burden on the participating coal mining companies. Questions on the interview protocol have been held to the absolute minimum required for purposes of the study.

6. Consequences of Collecting the Information Less Frequently

The request is for a one-time data collection. To our knowledge, there are no legal obstacles to the collection as planned.

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

This request fully complies with the regulation 5 CFR 1320.5.

8. Comments in Response to the FRN and Efforts to Consult Outside the Agency

8a. A 60-day Federal Register notice was published in the Federal Register on 09/06/2017 Vol. 82, No. 171, pp. 42096-42098 (Attachment B). No comments were received.

8b. MSHA was consulted on their work related to the mobile proximity proposed rule. Their input was used to develop the protocol and identify mine companies currently using proximity detection systems on their mobile haulage equipment. MSHA has been kept up to date on the progress through formal and informal meetings such as the NIOSH proximity workshop held on March 22, 2017.

9. Explanation of Any Payment or Gifts to Respondents

The 10-minute, semi-structured interviews and observations will be conducted in workplaces with permission from the employer during normal working hours. As a result, the study does not create an extra burden. Participants will not receive payment or gifts for their participation.

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

NIOSH Information Systems Security Officer reviewed this submission and determined that the Privacy Act does not apply. Activities do not involve the collection of personally identifiable information. Furthermore, the name and location of the mine will be removed from all data collection materials. Participants and interviews will be identified by their ID number wherever necessary.

In order to preserve the integrity of the data, hard copies of observation and interview notes will be scanned immediately following the return from the field. Where and if necessary mine information will be redacted. The data will be transcribed from the hard copies or scans as necessary so it can be coded and quantified. Summary features and counts will be stored in the appropriate software applications on an encrypted, password protected computer and/or a limited access shared folder. Hard copy data forms will be kept in a locked cabinet in the principal investigator's locked office at the secure NIOSH Pittsburgh site until all data has been summarized,

analyzed and verified. Prior to the finalization of the report, all interview and observational notes will be destroyed with the use of a paper shredder. Personally identifiable information will not be collected. The data will be used to summarize what features users most like, dislike, and prefer about mobile proximity systems currently in use. Descriptive statistic will be used to summarize the data. The following steps outline the data collection process.

Data Collection Process

- (1) Through professional networks, mine sites will be recruited to participate in the research project.
- (2) Prior to data collection or the interview, mine workers will be asked for their consent.
- (3) At a designated area at the mine site, workers will participate in semi-structured interview, which will last approximately 10 minutes.
- (4) During the interview, the researcher will take notes, but not record the workers name or any personally identifiable information.
- (5) Observations may be conducted. During the observations, field notes will be recorded.
- (6) Following the interviews and observations, all information will be kept secure. Researcher notes will not be made available to mine management personnel. Results will be shared based on the larger group, not individuals.

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

IRB Approval

The proposed research project has been reviewed and approved by the NIOSH Human Subjects Review Board (HSRB). Modified approval was received on May 25, 2017. The protocol was determined to be an exempt category of research involving human subjects. Please see the attached copy of the approval letter and exemption determination (see Attachment E).

Sensitive Questions

This data collection does not require participants to answer questions of a sensitive nature.

12. Estimates of Annualized Burden Hours and Costs

12a. The proposed research study involves conducting one-time, semi-structured interviews and optional observations of regularly assigned job duties with a maximum of 250 mining crew members. To help ensure the sample is representative of the production and maintenance crew, researchers will work to recruit workers in a variety of roles including, but not limited to, ram car operator (production and maintenance crew), continuous miner operator (production crew), section foreman (production and maintenance crew), and maintenance worker (maintenance crew).

To recruit the mines, operators will be contacted. To standardize the process, the researcher will use the mine recruitment script to provide the operator with information on the study (see Attachment H). The recruitment conversation is expected to last 15 minutes (i.e., 15/60 hours). The total annual burden for mine recruitment is estimated at 3 hours. The total annual burden was calculated based on contacting all of the 12 underground coal mines, which currently use proximity detection for mobile equipment. However, since mines will be recruited through professional contacts and networks, researchers do not think it will be necessary to contact all 12 mines to achieve recruitment objectives.

Each respondent will only be asked to participate in one interview, which will last approximately 10 minutes (i.e., 10/60 hours) depending on the depth of the participant's responses. Most interviews are expected to last 5 to 10 minutes. The total annual burden for the interviews is estimated at 42 hours.

Participation in observations will be optional and conducted at the discretion of the mine operator. A maximum of 70 group observations will be conducted, each lasting up to one hour. Researchers will be escorted by mine

personnel to a designated location for the observations. During the observation, 7 to 13 section workers will be observed completing their standard job duties. Since the observations are optional and will not require any additional time from participants, annual burden was not calculated for this activity. For all efforts related to this project, the total estimated annualized burden is calculated at 45 hours. Table 1 provides a summary of the total burden hours for all activities.

Table 1. Estimated Annualized Burden of Hours

Type of Respondents	Form Name	No. of Respondents	No. of Responses per Respondent	Average Burden per Response (in hours)	Total Burden (in hours)
Mine Operators	Mine Recruitment Script	12	1	15/60	3
Crew members	Interview Protocol	250	1	10/60	42
Total					45

12b. Based on the mean hourly wage for general and operations managers, the hourly wage for mine operators was estimated at \$69.77 (Department of Labor and Statistics, 2016). This figure was used to calculate a total respondent cost of \$104.66. The mean hourly wage for all coal mining occupations is \$28.55 (Department of Labor and Statistics, 2016). This figure was used to calculate a total respondent cost of \$1,190.54 for conducting the semi-structured interviews and \$499.63 for conducting observations. The total estimated annualized burden cost is \$1,794.83. Table 2 provides a detailed outline of the annual burden and total respondent cost.

Table 2. Estimated Annualized Burden Costs

Type of Respondents	Form Name	No. of Respondents	Avg. Burden per Response (in hours)	Total Burden Hours	Hourly Wage Rate	Total Respondent Costs
Mine Operators	Mine Recruitment Script	12	15/60	3	\$69.77	\$209.31
Crew Members	Interview Protocol	250	10/60	42	\$28.55	\$1199.10
Total						\$1,408.41

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

This data collection does not involve other annual cost burdens to respondents or record keepers. 1

14. Annualized Cost to the Government

Data will be collected over a 12-month period. The estimated annualized cost to the Federal Government over the 12-month data collection period is \$33,186.80. Hourly rates for CDC/NIOSH employees were obtained from the 2017 General Schedule Locality Pay Tables (U.S. Office of Personnel Management, 2017).

Data will be collected, analyzed, and reported on by CDC/NIOSH employees. Data collection is estimated to require 320 hours. Data analysis is estimated to require 300 hours. Writing and reporting findings from the study is estimated at 160 hours. Total cost for data collection, analysis, and reporting is estimated at \$23,186.80. Additionally, two CDC/NIOSH employees will be required to travel for data collection, which will cost approximately \$10,000. The annualized cost reflects these associated cost for the five employees designated. The total annualized cost to the government for a one-year period is \$33,186.80.

Table 3. Annualized Costs to the Government

Personnel	Hours	Hourly Rate	Data Collection, Analysis, and Writing Cost	Travel Costs	Total
Mechanical Engineer (GS 12-1)	350	\$35.42	\$12,397.00	\$5,000	\$17,397.00
Mining Engineer (GS 7-1)	310	\$19.97	\$6,190.70	\$5,000	\$11,190.70
Assoc. Service Fellow/Behavioral Science (GS 12-1)	120	\$35.42	\$4,250.40	N/A	\$4,250.40
Mining Engineer (GS 7-1)	5	\$19.97	\$99.85	N/A	\$99.85
Lead Behavioral Scientist (GS 14-1)	5	\$49.77	\$248.85	N/A	\$248.85

Total Cost	\$33,186.80
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15. Explanation for Program Changes or Adjustments

This is a new data/information collection.

16. Plans for Tabulation and Publication and Project Time Schedule

All activities for the project are expected to be completed within 12 months. One year of clearance is being requested for research activities. Table 3 outlines the project schedule.

Table 3. Project Timeline

Project Time Schedule	
Activity	Time Schedule
Recruitment/ Mines contacted to schedule interviews	1-2 months after OMB approval
Data collection/Conduct interviews	2-5 months after OMB approval
Qualitative Data Analyses/Thematic coding and descriptive statistics	6-8 months after OMB approval
Publication/Dissemination	9 months after OMB approval

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

The display of the OMB expiration date is not inappropriate because no written materials will be given to participants. Expiration date can be added to IRB consent, but written copies are likely to be refused due to data collection location.

18. Exceptions to Certification for Paperwork Reduction Act Submissions

There are no exceptions to the certification.

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