Information Collection Request for:
"EMERGENCY SELF-ESCAPE FOR COAL MINERS"
Supporting Statement B

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B. Collections of Information Employing Statistical Methods

Statistical methods (e.g., epidemiological approaches or representative sampling) are not being used for this pilot study to collect information for Emergency Self Escape. Data will be collected via interviews, focus group sessions and observation. Statistical data, in the sense of quantitative data available for descriptive numerical summary or other analysis, will not be collected via these methods. However, validity of the information that is collected (such as critical task identification, task decomposition via Hierarchical Task Analysis (HTA), and Cognitive Task Analysis (CTA)) will be ensured via content validity. Content validity ensures the relevance, representativeness, comprehensiveness, and technical quality of results via the careful, documented, and verified processes used to generate those results (Lennon, 1956; Messick, 1995).

1. Respondent Universe and Sampling Methods

Sampling will not be used to identify or select participants for the study. Studying human factors in underground coal mines does not lend itself to random sampling. Organizations who choose to participate likely see some longer term benefit (e.g., potential for increased productivity, performance, worker well-being, etc.) as a trade off for short-term cost (e.g., decreased productivity) in allowing access to their miners and their mine sites. The state of the industry has only exacerbated the pressures on coal mines to focus on production to remain profitable. For these reasons, convenience sampling is a requirement for investigating human factors related to coal mine health and safety management systems.

Two representative mines will be recruited to participate in the study and employees will volunteer to participate. Both a large (Federal #2, Patriot Coal) and small mine (Crawdad #2, Red Bone Mining) were identified as appropriate for this initial study, possessing the management and safety roles expected by NIOSH. Each has agreed to participate in the study. Both participating mines are situated in northern West Virginia in the Appalachian coal region, where the vast majority of coal mines are worked (McWilliams, Lenart, Lancaster, & Zeiner, 2012) and much of underground coal in the United States is mined (over 20% in West Virginia, and Kentucky alone; U.S. Energy Information Administration, 2013). Regardless of geographic region, all underground coal mining utilizes one of two (or both) existing mining methods – both of which are represented in our sample. Red Bone utilizes continuous mining (room and pillar) exclusively, while Federal No. 2, utilizes both longwall and continuous mining methods. Miners in these mines are demographically similar (e.g., in terms of age, ethnicity, and education) to the population of coal miners in the U.S. (McWilliams et al., 2012).

It is important to include both a large and a small mine in this study, since the mine size can affect many mine procedures, including self-escape. Some of the mine differences stem from resources and staffing: A small mine has no dedicated safety manager or trainer; these roles are carried out part time by mine workers who also have other responsibilities. Fewer resources also means less ability to invest in safety equipment/training. Small mines may not have experts at a corporate office who can assist in case of emergency, and are in fact likely to have less experience in disasters across the smaller number of miners. (Mallett, LG, Brnich, MJ, & Vaught, C (1994). Available tools and technology (communication and tracking systems, in particular) can vary widely across mines. Parallel OMSHR investigations are currently under way to identify variations in several components of the self-escape system (e.g., the role of the responsible person, emergency response plans, communication and tracking systems, etc.) for consideration in later development of competency training and assessment methods.

2. Procedures for the Collection of Information

Statistical methods will not be used to collect data for the research study. Two representative mines will be recruited to participate in the study and employees will volunteer to participate. Facilitated focus groups and interviews with participants will be used to collect the required information for this study.

This research study utilizes a multiple-method approach, that includes collecting data through the use of a) semi-structured interviews, b) focus groups, and c) unobtrusive observation of regularly scheduled, MSHA-mandated emergency escape drills. The timing of research activities involves:

1. Initial Interviews
2. Initial Task Analysis Focus Group
3. Unobtrusive Observations
4. Hierachical Task Analysis Focus Group
5. Cognitive Task Analysis Interviews

Interviews. There will be two types of semi-structured interviews conducted with participants: 1) initial interviews, and 2) Cognitive Task Analysis (CTA) interviews. Each initial interview will ask questions regarding the typical process of emergencies, emergency worker roles, and existing training capabilities. It will take place in an office setting on the surface of the mine site.

CTA is type of task analysis, one that focuses on the cognitive processes of the worker as the work is accomplished. Interview based CTA prompts workers to "think aloud," to uncover information about such cognitive processes as what cues/information is being attended to, decision-making, information recall, and problem-solving. CTA is a valuable adjunct to more traditional task analysis and KSAO specification, because it illumines additional important aspects of the job that influence successful performance. Each CTA interview will take place in an office setting on the surface of the mine site.

Focus Groups - Task Analysis. There will be two types of focus groups conducted with participants: 1) initial focus groups, and 2) Hierarchical Task Analysis (HTA) focus groups. Task analysis can be accomplished in a variety of ways, but one of the most rigorous, and the one producing the richest results, is conducted via a facilitated focus group session. Experienced workers act as Subject Matter Experts (SMEs), and a facilitator uses a structured approach to elicit from them the tasks they accomplish. Workers typically find such focus group quite engaging, because they are serving as experts and talking in a novel way about something they do every day. A task analysis generates a list of tasks typically accomplished by workers in a specific role or set of roles. Tasks statements are written so that they clearly specify the task in the language of the worker. Once tasks are identified, the knowledge, skills, abilities, and other characteristics (KSAOs) needed to perform those tasks can specified. Using the same facilitated focus-group approach, SMEs consider each task in turn, and indicate what KSAOs are required to accomplish that task successfully. HTA is a type of task analysis technique that breaks down critical, larger tasks into the sub-tasks needed to accomplish it.

Focus group sessions will require approximately 12 hours of time total but will be executed in smaller blocks of time. Scheduling of the focus groups will be flexible and adaptable to meet the needs of the participants and the mine. Participants will not be required to participate in all three sessions of the focus group. The number of sessions a participant participates in will depend on his/her availability, willingness, and expertise. Focus groups will take place in an office setting on the surface of the mine site.

Unobtrusive Observations. Unobtrusive observations of regularly scheduled mandated emergency escape drills will be conducted at each mine site. The number of miners that will be observed and the location of the observations will be dependent upon the time, location, and type of drill being conducted. Researchers will not participate in the drills, nor will they influence miners' behavior or alter the mine environment in any way during their observations. Observation checklists will be used to capture relevant information during the unobtrusive naturalistic observations of self-escape drills.

3. Methods to Maximize Response Rates and Deal with No response

Statistical methods will not be used to collect data for the research study. Two representative mines will be recruited to participate in the study and employees will volunteer to participate. We will provide project background information and participant criteria to mine management, and ask mine management to provide a list of the mining personnel meeting the criteria, including their position titles, emergency roles, and years of experience, and contact information (telephone number). From the list of potential participants, we will utilize the demographic information provided by the mine to identify a subset of "ideal" potential participants. The subset will be selected with the goal of obtaining a participant sample that is highly experienced and knowledgeable about the emergency roles and procedures within the mine. The reason that it is important to use experienced and knowledgeable participants is that they fill the role of subject matter expert in the facilitated focus groups discussed above. Only SMEs have the experiential background to act as information sources that permit the generation of a complete, relevant, and accurate picture of critical tasks, required knowledge and skills, and job-related cognitive processes and demands, We will contact potential participants via telephone and utilize the study recruitment script to describe the study and obtain initial agreement to meet with researchers at the mine site.

4. Tests of Procedures or Methods to be Undertaken

Two representative mines will be recruited to participate in the study and employees will volunteer to participate. The interviews and focus groups will be conducted in a standard manner, stressing quality and representativeness of outcomes, so that the content validity of results will be ensured. A review of the literature and meetings/phone calls with representatives of the mines as well as consultation with our mining expert enabled us to gather the information to develop the data collection materials.

5. Individuals Consulted on Statistical Aspects and Individuals Collecting and/or Analyzing Data

Statistical methods will not be used to collect data for the research study. Two representative mines will be recruited to participate in the study and employees will volunteer to participate. Mines are required by the Code of Regulations to have certain types of equipment and procedures (e.g., refuge alternatives, escapeway maps, quarterly evacuation drills) but the actual application of those regulations may differ. By conducting this research with a large and small mine we will identify how potential differences in physical conditions (e.g., height of mine tunnels), number of miners, roles of escape team miners, type of mining process (i.e., long wall vs. room and pillar), technology and equipment (e.g., transportation vehicles, breathing apparatus), and communication systems, can affect self escape requirements. The two mines we anticipate participating in this study have different mine heights, have different number of personnel (>250 vs < 50), use different conveyance mechanisms (vehicles vs walking), use different types of mining processes, and use different equipment.

The individuals conducting interviews or facilitating focus groups are trained in all aspects of job and task analysis. They have extensive expertise in facilitating knowledge elicitation focus groups and conducting interviews. These individuals also will collect, document, collate, and analyze the results, and are trained and experienced in qualitative analysis and summation.

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