

Tech News

NIOSH MINING PROGRAM

Milestones in Mining Safety and Health Technology

No. 561

November 2017

Hazard Recognition Challenge Invites Mineworkers to Test Their Knowledge of Workplace Hazards

Summary

The Hazard Recognition Challenge—a web application developed by the National Institute for Occupational Safety and Health (NIOSH)—gives mineworkers the opportunity to test their knowledge of hazards in a virtual work environment. This challenge provides mineworkers a unique opportunity to practice workplace examinations in a safe location by using a personal computer or handheld device. After completing the challenge, mineworkers receive feedback on their performance along with supplemental information that can be used to increase knowledge of worksite hazards.

*By Jonathan Hrica, MS,
and Brianna Eiter, PhD*

Background

Workplace examinations are not only required by federal regulations [Examination of working places, 2017], but are an essential practice used to keep mineworkers safe. Each day, mineworkers conduct routine workplace examinations at their worksites with the goal of finding hazards and mitigating them before they cause injury or death. To help the industry prepare its workers to perform more effective workplace examinations, NIOSH is conducting studies to better understand how and why mineworkers recognize workplace hazards.

In one study conducted at NIOSH's [Virtual Immersion and Simulation Laboratory](#) (VISLab), researchers created a search task within a virtual work

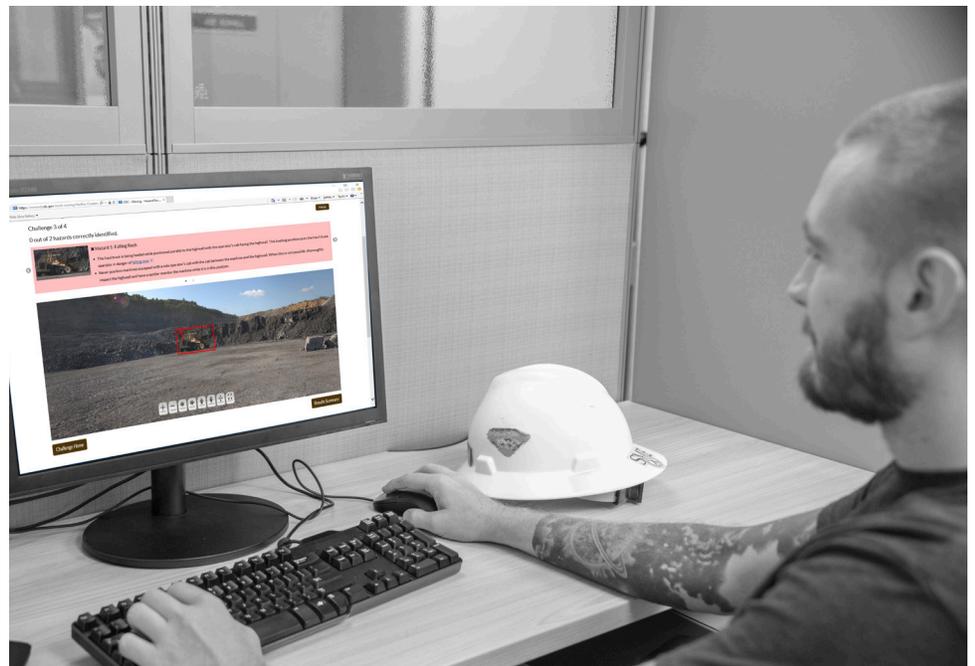


Figure 1: A user virtually searching for worksite hazards via the Hazard Recognition Challenge.

environment to study how workers with varying years of work experience identify hazards. Participants, who included safety professionals, mineworkers, and student volunteers, were instructed to search the environment for hazards as if they were performing a real workplace examination. During the search task, safety professionals identified 61% of all hazards, which was more than the other three participant groups, but suggests there is room to improve hazard recognition skills for all levels of experience [Eiter et al. 2017].

After completing the search task, all participants in the laboratory study sat down with the researchers to talk about the hazards they identified and those they missed. The purpose of this discussion was to identify factors that affect hazard recognition. Many participants reported that performing the search task and receiving feedback improved their knowledge of mine site hazards. From this

observation, NIOSH developed the Hazard Recognition Challenge (see Figure 1) to bring the experience of the VISLab to a larger audience.

Creating a Realistic Virtual Environment

NIOSH researchers developed a virtual work environment to study hazard recognition. To do this, they created 32 panoramic images of a surface limestone mine which were projected onto 10-foot screens in the 360° theater within the VISLab. Because a goal of this research was to give participants a realistic and immersive experience, several steps were taken to create images that were true to life and represented hazards found at a real surface limestone mine.

First, Mine Safety and Health Administration (MSHA) fatal reports and nonfatal days lost data were studied to identify examples of the different types of hazards mineworkers are exposed to during their workday. Next, subject matter experts (SMEs) with extensive experience in surface mining were consulted to determine the mine site locations where panoramic pictures should be taken and what hazards should be included at these locations. NIOSH researchers then created storyboards—visual and verbal representations used to plan pictures ahead of time—to anticipate which hazards could occur at specific locations. To ensure realism, efforts were made to stage the majority of hazards; those that were impossible or unsafe to stage were created through photo editing. Finally, SMEs reviewed the panoramic pictures and confirmed that they accurately represented hazards that could happen at a surface limestone mine.

About the Hazard Recognition Challenge

The Hazard Recognition Challenge is a web application viewable on a personal computer or handheld device. The application uses the same panoramic images used in the VISLab and gives mineworkers the opportunity to perform a virtual workplace examination at four locations at a surface limestone operation. Each of the included images contains multiple hazards, and the goal is to find as many hazards as possible within the scenes. Once the challenge starts, the user is taken to the first location—the shop (see Figure 2). The user can search the work location by panning and zooming the field of view around the 360° image.

During the search task, users click or tap on any hazards they find. A marker appears on the selected hazard, but users can easily remove the marker if they made the selection in error. Users have up to two minutes to complete the search task in each challenge, and when they finish they advance to the next location.

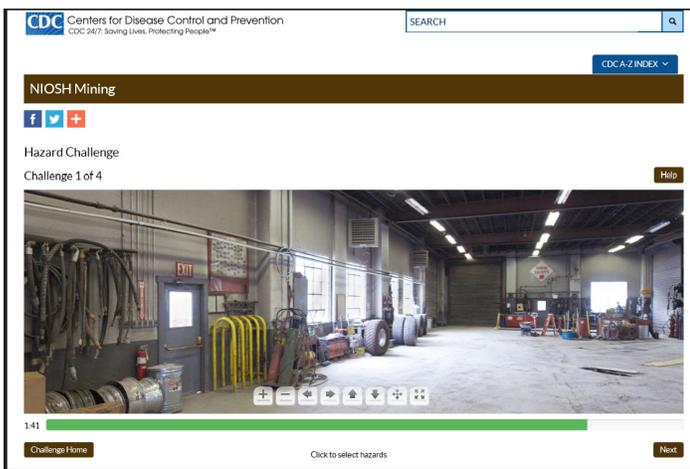


Figure 2: Hazard Recognition Challenge 1—the shop.

After completing the challenge, a results page (see Figure 3) shows where users clicked, which hazards they identified successfully, and which hazards they missed. This page also gives a brief explanation of each hazard along with supplemental information such as relevant accident and injury narratives, hyperlinks to “tools you can use” during training, and hyperlinks to relevant MSHA standards.

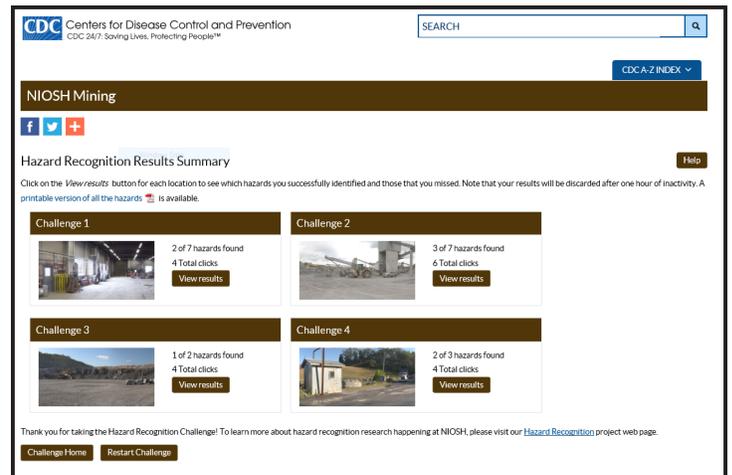


Figure 3: Hazard Recognition Results Summary page.

After completing the challenge, users can use the supplemental information to learn more about each hazard. If the challenge is done in a group setting, this supplemental information can be used to start a discussion about a specific hazard or a type of hazard. For example, reviewing hazard results in a group setting may prompt discussion among workers about similar hazards found at their own mine site, and reveal ways that workers can better protect themselves.

How to Access the Hazard Recognition Challenge

The Hazard Recognition Challenge is accessible on the NIOSH Mining website at: <https://www.cdc.gov/niosh-mining/HazRec/>.

References

- Eiter BM, Bellanca JL, Helfrich W, Orr TJ, Hrica J, Macdonald B, Navoyski J [2017]. Recognizing mine site hazards: [Identifying differences in hazard recognition ability for experienced and new mineworkers](#). In: Cassenti D (ed.), *Advances in human factors in simulation and modeling*, AHFE 2017. v 591. Springer. [Examination of working places](#), 30 CFR 56/57.18002 (2017).

For More Information

For more information on the Hazard Recognition Challenge, contact Jonathan Hrica, (412-386-5237, JHrica@cdc.gov), Brianna Eiter (412-386-4954, BEiter@cdc.gov), or the NIOSH Mining Program (mining@cdc.gov).

To receive NIOSH documents or for more information about occupational safety and health topics, contact:



1-800-CDC-INFO (1-800-232-4636), 1-888-232-6348 (TTY), or request information at the CDC website at www.cdc.gov/info, or visit the NIOSH website at www.cdc.gov/niosh.

DHHS (NIOSH) Publication No. 2018–104

Disclaimer: Mention of any company or product does not constitute endorsement by NIOSH.