

Tech News

nology

Milestones in Mining Safety and Health Technology

OFFICE OF MINE SAFETY AND HEALTH RESEARCH

No. 553

August 2015

Interactive BG 4 Training Software Reinforces Skills for Benching Mine Rescue Breathing Apparatus

Summary

An effective training tool, the BG 4 Benching Trainer software, now helps to reinforce the critical skills that mine rescue team members must possess to accurately “bench” closed-circuit breathing apparatus. This software supplements traditional hands-on training through a 3D interactive environment in which rescue personnel can practice benching a virtual Draeger BG 4 apparatus. Knowledge of critical benching skills helps in maintaining the integrity of breathing apparatus and in keeping mine rescue team members safe during mine emergencies.

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Background

Hands-on training is the traditional method for teaching individuals how to bench a BG 4 breathing apparatus. Mine rescue team trainers typically work with new rescue team members to teach them the process of benching a closed-circuit breathing apparatus. Once they receive initial training, trainees demonstrate their proficiency by benching an apparatus from start to finish. After completing the initial training, benchmen practice benching a breathing apparatus during regular monthly mine rescue training sessions. Benching competitions at



Figure 1: Mine rescue instructor shows trainees the BG 4 Benching Trainer software.

mine rescue contest events are another method of evaluating trainee competency. Despite the proven value of training with an actual breathing apparatus, a need exists to reinforce benching skills when an actual apparatus is not available due to the logistics of providing the equipment and scheduling classroom time. Through feedback from mine rescue trainers and team members, the National Institute for Occupational Safety and Health (NIOSH) determined that a critical need exists for new approaches to benchmen training. To address this need, NIOSH developed the BG 4 Benching Trainer software. The new software serves as a supplemental method of introducing new mine rescue team members to the Draeger BG 4 apparatus and guiding them through the benching process in a 3D interactive environment. Trainers can use the software to teach trainees (see **Figure 1**) about the differ-

ent parts that make up the apparatus, the potential flaws in each part, and how to install the parts. Although not a substitute for hands-on training, the software allows rescue team members to practice benching a BG 4 apparatus outside of traditional training sessions with the help of realistic 3D models. NIOSH developed this software as part of a suite of training applications using 3D interactive environments for teaching critical thinking skills to miners. Other applications in the suite include Underground Coal Mine Map Reading Training (<http://www.cdc.gov/niosh/mining/works/cover-sheet1825.html>), which was released in 2009, and Mine Emergency Escape Training (planned for 2016).

About the New Software

NIOSH software developers designed the BG 4 Benching Trainer module to emulate the BG 4 benching process, allowing

users to interact with realistic 3D apparatus parts within a 3D interactive environment. The software places the trainee in front of a virtual table where all of the BG 4 apparatus parts are shown. The trainee selects parts from the virtual table one at a time with each part gliding into view for closer inspection. **Figure 2** shows the breathing air bag being inspected through the software. The trainee inspects each individual part for flaws with the inspection tools provided in the software. Most apparatus part flaws are visual and require an attention to detail to find, just like in the real-world benching competitions where judges introduce actual flaws in breathing apparatus parts for benchmen to find. In the software, apparatus part flaws range from a ripped breathing bag to missing O-rings. When a trainee finds a flaw, they can swap it for a replacement part as they normally would in a real-life mine rescue benching contest. Once fully assembled, the trainee can test the BG 4 for leaks using the virtual RZ tester. **Figure 3** illustrates the BG 4



Figure 2: The breathing air bag selected for inspection within the software.



Figure 3: A completely assembled virtual BG 4 attached to the RZ tester unit within the software.

completely assembled within the software and attached to the virtual RZ tester. The software generates a score sheet for the trainee, which the trainer can use to review a trainee's performance and provide post-training feedback.

The portability of downloading the software onto a PC allows mine rescue team members to practice benching techniques without the need to use an expensive, live apparatus. This provides greater training flexibility and more opportunities to become familiar with the apparatus outside of hands-on training sessions.

Field Test Results

Thirty mine rescue team members participated in the field test evaluation of the software. Participants had an average of 1.85 years of apparatus benching experience. Experience levels ranged from zero to seven years, with nearly 67% of trainees having one year or less of benching expertise. Following each field test session trainees filled out a post-training questionnaire to provide feedback regarding their training experience and opinions on the effectiveness of the software. Mine rescue team members and benchmen who participated in the testing provided mostly positive feedback:

- 87% agreed that the training software reinforced knowledge and skills learned through previous mine rescue training.
- 84% agreed that the training software made them more confident in having the ability to correctly bench a BG 4 during a real mine emergency.
- 71% agreed that the training software helped to prepare them for a benching competition.
- 94% agreed that the training software motivated them to learn about benching a BG 4.
- 94% agreed that training in a virtual environment is a good supplement to training in a real-life environment.

How to Obtain the BG 4 Benchling Trainer Software

The software is now available for download at no cost from the NIOSH OMSHR website at <http://www.cdc.gov/niosh/mining/Works/coversheet1877.html>.

For More Information

For more information on **BG 4 Benchling Trainer software**, contact Jason Navoyski, JNavoyski@cdc.gov, **412-386-5041**, or the Health Communications Coordinator (OMSHR@cdc.gov), NIOSH Office of Mine Safety and Health Research, **626 Cochran's Mill Road, Pittsburgh, PA 15236**.

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DHHS (NIOSH) Publication No. 2015–225

