

**ATTACHMENT 14**

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**COMMENTS TO PROPOSED RULE ON APPROVAL TESTS AND  
STANDARDS FOR CLOSED-CIRCUIT ESCAPE RESPIRATORS**

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# Expectations Training for Miners Using Self-Contained Self-Rescuers in Escapes from Underground Coal Mines

Kathleen M. Kowalski-Trakofler, Charles Vaught, and Michael J. Brnich Jr.

Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, Pittsburgh Research Laboratory, Pittsburgh, Pennsylvania

*National Institute for Occupational Safety and Health researchers conducted a study to investigate the human response issues related to wearing a self-contained self-rescuer (SCSR). The goal was to develop training to educate miners on what they could expect from their units during an escape. Subjects included miners who had experience wearing SCSRs, manufacturers, and researchers. Results identified nine key areas of concern: (1) starting the unit, (2) unit heat, (3) induction of coughing, (4) unit taste, (5) difficulty in breathing while wearing the unit, (6) quality of the air supplied, (7) nose clips, (8) goggles, and (9) the behavior of the breathing bag. In addition, researchers reviewed the literature on human response under duress. This article describes the expectations training program, which comprises the findings of the SCSR study and what is known about the normal human response in an emergency. The authors present background on SCSRs and the SCSR switchover procedure mandated in the recent federal Mine Improvement and New Emergency Response Act of 2006, which provided the impetus for the expectations training.*

**Keywords** disaster, escape, mining, self-contained self-rescuer, training

Address correspondence to: Kathleen M. Kowalski-Trakofler, NIOSH-DPRB, P.O. Box 18070, Pittsburgh, PA 15236-0070; e-mail: kkwalski@cdc.gov.

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## INTRODUCTION

Self-contained self-rescuers (SCSRs) provide the wearer with a 1-hr oxygen supply as mandated by U.S. government regulations. SCSRs were developed in the late 1970s and deployed in U.S. mines in the early 1980s for use by coal miners during emergencies, such as fires, explosions, or gas inundations in which the ambient atmosphere becomes toxic. As their name implies, SCSRs are meant to serve one purpose—to allow a miner to self-rescue by escaping the mine. They are not intended to be used for other purposes, such as fire fighting. As with other oxygen-supplying apparatuses such as the closed-circuit breathing units worn by mine rescue teams,

SCSRs are fairly complex devices and thus require detailed analysis.

There are two types of SCSRs produced and sold. Both are closed-circuit breathing apparatuses; that is, the units do not exhaust CO<sub>2</sub> but remove it from the breathing circuit internally. One type of SCSR stores O<sub>2</sub> as a compressed gas and uses a chemical bed of lithium hydroxide (LiOH) to absorb CO<sub>2</sub> as the miner exhales. It is started by opening a valve on the oxygen cylinder that fills a breathing bag. The other type uses potassium superoxide (KO<sub>2</sub>, a solid chemical that reacts with moisture in the breath) to generate O<sub>2</sub>, with LiOH used to remove much of the CO<sub>2</sub> from the breathing circuit.

This study focused on the problematic use of SCSRs by miners who attempted to escape the Wolf Run Mining Company's Sago Mine in West Virginia following an explosion. The particular SCSR used by miners at the Sago Mine was a combination unit in terms of providing oxygen. The initial oxygen is provided by a small compressed oxygen cylinder that yields 7 to 8 liters of oxygen. When the oxygen cylinder is activated, the wearer receives an initial supply of oxygen that is sufficient until the potassium superoxide begins to generate oxygen. If the oxygen cylinder fails, the device can be "cold started" by the miner expelling several breaths to inflate the breathing bag. A SCSR's complexity requires some level of training by miners to ensure correct use. Figure 1 depicts miners wearing compressed oxygen SCSRs during a mock escape drill. Federal mining regulations require that every person entering an underground coal mine in the United States has to be furnished with an SCSR.<sup>(1)</sup>

In 1981, SCSR devices were introduced into U.S. mines. Although much time, effort, and money had gone into the development of these engineered devices, very little effort was spent in teaching people how to use them. More recently, self-rescuer training was included as one of several mandatory courses in Title 30 *Code of Federal Regulations* Parts 48 and 75.<sup>(1)</sup> Specifically, SCSR training was implemented into the broader, required course on self-rescue and respiratory devices, such as respirators. However, this course was one of 12 covered during a single 8-hr day. It called for instruction and demonstration in the use, care, and maintenance of self-rescue