Testimony
Before the Subcommittee on Employment and Workplace Safety, Committee on Health, Education, Labor, and Pensions
United States Senate

"Two Years After the MINER Act: How Safe Is Mining Today?"

Statement of

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For Release on Delivery
Expected at 10:00 a.m.
Thursday, June 19, 2008

Introduction

Good morning Madam Chair and other distinguished members of the Subcommittee. My name is Jeffery Kohler and I am the Associate Director for Mine Safety and Health Research at the National Institute for Occupational Safety and Health (NIOSH), which is part of the Centers for Disease Control and Prevention (CDC), within the Department of Health and Human Services.

I am pleased to be here today to report on NIOSH's progress under the Mine Improvement and New Emergency Response Act of 2006 (MINER Act) (P.L. 109-236) and the related supplemental appropriations that Congress provided to facilitate the development and diffusion of critical safety technologies in underground coal mines. In previous hearings and briefings we have discussed the challenges of bringing improved communications, tracking, oxygen supply, and other technologies to bear on improved mine safety. On March 14, 2008, I met with Richard Stickler, Acting Assistant Secretary for Mine Safety and Health, and we agreed to develop guidance that can be provided to the mining community by January 2009 on performance-based criteria for acceptable communications technological alternatives. Today, I would like to focus on our progress and the new technologies that NIOSH has developed to make mines safer, and better equip miners to safely escape from a fire, explosion, or other catastrophic event.

NIOSH Mandates under the MINER Act

Office of Mine Safety and Health

NIOSH has completed or implemented all of its mandates under the MINER Act. Specifically, we have established the Office of Mine Safety and Health Research as required by Section 6(A)(H). As authorized by the Act, the Office is strengthening NIOSH's focus on evaluating safety and health technologies, while maintaining a balanced research program to address overall mine safety and health issues.

Research Contracts

We have established an on-going contracts and grants program to fund the development and adaptation of safety technologies for mining applications, as mandated in Section 6 of the Act. Under this program we have evaluated 62 proposals, and of those, 13 were of sufficient merit to warrant funding under the guidelines of this program, and we are excited about their prospects. Two examples are:

- the development of a spray-on liner to significantly strengthen mine seals, a process that is being adapted from a current military application;
- the development of a through-the-earth[1] two-way voice communications system, which is based on a technology developed by the military;

[1] A "through-the-earth" communications system is one with a signal that propagates through the layers of the earth between an underground transceiver and a transceiver on the surface.

Interagency Working Group

We established an on-going Interagency Working Group consisting of a broad range of federal agencies with an interest in technology, as directed by Section 6 (a)(h)(3)(C) of the MINER Act. Although no technologies have been identified for direct transfer to mining, several benefits of this collaboration among federal agencies are occurring. Notable examples included the following:

- NASA and the Naval Research Lab have provided valuable input into our work on refuge chambers;
- the U.S. Army Communications-Electronics Research, Development and Engineering Center (CERDEC) is working with us on adapting communications and tracking technologies; and
- we are working with the Department of Energy's geothermal research program at Sandia National Lab to examine the possible adaptation of rescue drilling technology.

Refuge Alternatives

We completed research and testing on refuge alternatives, and submitted a report to the Senate Committee on Health, Education, Labor, and Pensions and the House Committee on Education and Labor addressing the utility, practicality, survivability and cost of refuge alternatives. We also conducted testing on refuge chambers at our Lake Lynn Experimental Mine. This report to the two committees provides a scientific basis for the Mine Safety and Health Administration (MSHA) on the use of refuge alternatives in underground coal mines. The report concluded that refuge alternatives have the potential for

saving the lives of mine workers if they are part of a comprehensive escape and rescue plan, and if appropriate training is provided. Moreover, the report stated that the benefits of refuge alternatives and the specification of specific alternatives are sufficiently known to merit their commercialization and deployment in underground coal mines. We are continuing to work with MSHA, labor, industry, and manufacturers to facilitate the implementation of refuge alternatives in the underground coal industry.

Emergency Supplemental Appropriations

The Emergency Supplemental Appropriations Act (ESA) for Defense, the Global War on Terror, and Hurricane Recovery, 2006 (P.L.109-234) ($10 million) and the Emergency Supplemental Appropriations Act for U.S. Troop Readiness, Veterans' Care, Katrina Recovery, and Iraq Accountability Appropriations Act, 2007 (P.L. 110-28) ($13 million) provided a total of $23 million to NIOSH to facilitate the development and diffusion of mine safety technology, including necessary repairs and improvements to leased laboratories, among other purposes. To fulfill the mandates of the ESAs and the MINER Act, we have designed research across several related but different tracks, and administered contracts and awarded funds to outside partners with resources and expertise that complement ours. We have moved ahead with a sense of urgency while doing everything we can to assure high-quality research. Moreover, to ensure success, we have applied our scientific know-how and our detailed knowledge of the underground mine environment, and persistence in working through the technical questions that always arise in scientific studies. Now, less than two

years into this three-year effort, we are able to report significant progress, which will ensure that improved technologies will be available as intended by Congress. Notable accomplishments-to-date are summarized as follows.

Oxygen Supply

NIOSH developed the conceptual design for the "next generation" self-contained self rescuer (SCSR), which was developed and tested under NIOSH's research contracts program. The contractor is scheduled to deliver 125 units to NIOSH's certification laboratory late this summer. The manufacturer is estimating commercial availability in the fourth quarter of 2008 or the first quarter of 2009, with a first year production capacity of between 2,000 and 4,000 units. This new SCSR represents the first significant advance in oxygen supply technology in more than 30 years. Although this unit provides performance enhancements over current models, the significant advancement is that it is "dockable." As such, fresh oxygen canisters can be easily exchanged without the need to don a new mouth piece and nose clip. This feature eliminates the dangerous act of attempting to don a fresh SCSR under very stressful conditions in a potentially poisonous environment.

Post-Accident Communications Technology

Research results to date strongly indicate that the technological building blocks for achieving survivable post-accident communications systems for most mines will be available for implementation by June 2009, as required by the MINER Act. Although it is unlikely that any single system or technology will meet the

requirements for most mines, a combination of technologies in any given mine should ensure adequate post-accident coverage and functionality. Moreover, this "building block" approach, as presented in the NIOSH communications roadmap, will serve as a platform on which future advancements in technology can be added.

NIOSH work to date indicates that the emergency communication plan for each mine will need to be tailored to that mine's requirements, and it is likely that the plan will employ some combination of enhanced leaky feeder, mesh, and/or medium frequency wireless systems. The post-accident coverage and functionality provided by these systems could be further enhanced as technology permits with the addition of through-the-earth two-way voice systems, interoperability of systems for increased redundancy, and improved methods for protecting the communications infrastructure from damage. These enhancements are not currently available, but could become available over the next few years. However, significant progress is already being demonstrated in the area of post-accident communications, and much of this progress was facilitated by the funds provided through the supplemental appropriations. Three significant examples are provided below.

Leaky Feeder System

Under contract to NIOSH, an enhanced leaky feeder system has been developed, which allows continued communications even in the event that a section of the system is damaged or destroyed. This system is compliant with

MSHA permissibility requirements, and final approval is pending. A mine-wide demonstration system is being installed in the Loveridge mine in West Virginia. The system includes bi-directional redundancy in the main haulage areas and parallel leaky feeder systems in the working sections to ensure a very high level of survivability in the event of mine explosions. Backup battery power systems that can keep the system operational from 8 to 96 hours after a power failure are included in the design as well.

We have also evaluated methods to expand coverage throughout the mine, and to physically harden the system against explosive forces. Testing to date has shown that burying leaky feeder cable may be an effective way of preventing leaky feeder cable from being damaged. Such extreme measures of protection may be desired in potentially vulnerable locations such as those adjacent to sealed areas of the mine.

Mesh System

Under another contract we are developing a survivable mesh-based system[2], and we are scheduled to evaluate a prototype system at the Sentinel mine at the end of this month. The system incorporates a variety of design features to provide a high level of survivability in an underground coal mining environment, and the initial system design has been submitted to MSHA for approval.

[2] A mesh-based system uses a network of wireless modems (called nodes) that are placed throughout a mine. The signal "hops" from node to node, permitting two-way communication to be sent and received. In the event of a mine accident, if one or more nodes fail the network can reconfigure itself and create a new path for communication signals using nodes that are still functional.

The survivability of a mesh system is highly dependent on the range of the mesh nodes and the ability of the system to reconfigure itself under the circumstances that might be required in a mine disaster. The NIOSH mesh development is intended to maximize the survivability of the system by ensuring that:

- the nodes have maximum range for a given amount of transmit power, thus minimizing the number of nodes, power supplies, and batteries required;
- the system can automatically support alternate communications paths;
- the handsets can support direct communications between them (known as "peer to peer" communications);
- the handsets can act as repeaters for communications to mesh nodes; and
- the system uses low bit rate voice communications for future interoperability with medium frequency or through-the-earth systems.

We are working with MSHA and other stakeholders to examine potential safety issues associated with battery backup supplies that will be required with post-accident communication systems.

Medium Frequency System

NIOSH is working with the U.S. Army CERDEC to modify the Kutta medium frequency communications system for use in underground coal mines. Medium frequency systems have an enormous potential as emergency communications

systems in a post-disaster scenario. We have demonstrated that medium frequency radios have a range in underground coal mines of over two miles through "parasitic propagation." This is a characteristic of the radio energy that allows the energy to couple on to metallic structures in the mine, and be received anywhere along the path of the structure.

There are several advantages of the medium frequency systems. First, active radio elements (radio transmitters or amplifiers) can be spaced a mile or more apart, which means far fewer active elements than are required with leaky feeder or mesh systems thereby reducing potentially vulnerable infrastructure. Second, the parasitic radio propagation paths can be highly survivable, and do not require power. Power lines for instance may be damaged, but could still support medium frequency communications. Additionally, recent NIOSH tests have shown that a buried wire can provide an excellent propagation path with no observable degradation of the radio signal. Lastly, the medium frequency system is being designed to be interoperable with existing MSHA-approved UHF/VHF handsets that are used with leaky feeder systems; this will provide substantial flexibility in designing practical and cost-effective systems. Interoperability with future systems such as mesh systems and through-the-earth systems will be considered as these products become available in the market place.

Initial pre-production models of the analog point-to-point medium frequency products will be received this month, and the delivery of the digital multi-hop

products are expected in August. The system design has been submitted to MSHA for approval.

Technical Study Panel

We participated in the Technical Study Panel on the Utilization of Belt Air and the Composition and Fire Retardant Properties of Belt Materials in Underground Coal Mining, as directed by Section 11(A) of the Act. This Panel was administered by MSHA, and NIOSH provided technical support. The Study Panel's report recommended additional research in the areas of development of guidelines for improved escapeway design in various ventilation situations, ways to reduce air leakage through ventilation controls and use of booster fans in underground coal mining operations. We have initiated a project to address these knowledge gaps identified by the Panel, and expect to have results over the next few years.

FY 2008 Appropriations Act Activities

NIOSH has been directed to conduct a study on the recovery of coal pillars through retreat room and pillar mining practices in underground coal mines at depths greater than 1500 feet, and to submit a report on the study findings to Congress within two years. We initiated this project in January, and are making progress. Two scoping meetings have been held with researchers from West Virginia University and the University of Utah. MSHA Tech Support is collaborating with us, and we have had technical meetings with them. Last month, NIOSH researchers made underground mine visits to collect information for use on this project.

Funding provided as part of the FY08 appropriation is also being used to restore projects focused on other critical mining safety and health problems, including respirable dust control, ground control, and explosion prevention. Methane and coal dust explosions are under investigation at our Lake Lynn Experimental Mine, as we seek improved methods and technologies to prevent or mitigate these potentially catastrophic events. Many of these projects are developing a range of interventions including engineering, training, and technology.

Conclusion

In closing, NIOSH continues to work diligently to protect the safety and health of mineworkers. The MINER Act and supplemental funding for mining research are enabling us to make significant improvements in the areas of communication and tracking, oxygen supply, and refuge alternatives. Moreover, our safety and health research program is addressing the critical areas identified by our customers and stakeholders, and through our research, development, demonstration, and diffusion activities, we are enabling a shift to a prospective harm reduction culture in mining. I appreciate the opportunity to present our work to you and thank you for your continued support. I am pleased to answer any questions you may have.