

## **NEW PROGRESS IN NIOSH RESEARCH UNDER THE MINER ACT: CRUCIAL STEP MADE TOWARD BETTER MINE COMMUNICATION SYSTEMS FOR EMERGENCY OPERATION**

In tests completed recently, the National Institute for Occupational Safety and Health (NIOSH) achieved a critical step toward the development of better systems for communicating with underground miners in emergencies.

The tests found that transmissions from a two-way wireless voice communication system were successfully received over a two-mile distance in two underground coal mines, despite twists and turns in the mine tunnels and other physical barriers. To date, in underground mines, such barriers have limited two-way wireless communications to systems that provide only line-of-sight communication - typically, much less than 2,000 feet.

NIOSH is conducting the research under the Mine Improvement and New Emergency Response (MINER) Act of 2006. The MINER Act directs NIOSH to lead U.S. research efforts to improve disaster prevention and disaster response in underground coal mines. The mandate recognizes the long-standing leadership of NIOSH's laboratories in research for preventing injuries, illnesses, and deaths in mining.

"NIOSH will work with partners including labor, industry, and the Mine Safety and Health Administration to build on the success of these tests, and to proceed with the next steps of research that will be needed to get a better communications system into mines in the short-term, while providing a bridge toward further, longer-term improvements," said Jeffery Kohler, Ph.D., NIOSH Associate Director for Mining.

"While these tests **do not yield a final product**, their success tells us that it is technologically feasible to devise a system that communicates over much longer distances inside an underground mine than existing systems," Dr. Kohler said. "The ability to do this without depending upon an established communications network was a fundamental challenge that needed to be met in developing the technology for a mine-wide communications system."

Dr. Kohler said, "Being able to communicate throughout a mine, and not only in limited areas of a mine, is essential for a system that would be needed for two-way communications from the surface with miners trapped underground after a mine explosion or collapse."

The NIOSH tests involved a contract with Kutta Consulting, a private company, using a modified version of a technology originally developed by the company for the U.S. Army. The system broadcasts medium-frequency, analog radio transmissions. As envisioned by researchers as a component of a total system, such signals, once transmitted into the mine, would travel through the mine using metallic objects as conductors. These conductors might include mine rails, electrical wires, water lines,

telephone or monitoring lines, or lifelines having wire cores. By riding on available conductors, the signal can skirt physical barriers that otherwise would block and disrupt it.

The research envisions that the medium-frequency transmissions would interoperate with limited-range communications systems that broadcast in the ultra-high-frequency (UHF) range. Such systems, called “leaky feeder systems” and “wireless mesh systems,” already are used in some mines for short-range communications, and are being installed in others.

Coupling onto UHF networks would have the advantage of building onto those existing infrastructures, so that if a hybrid system performs as intended, it could be put into place more quickly in those mines than a system that would be installed from scratch. In addition, UHF communication devices are smaller than ones that operate on medium frequencies, making them easier for miners to wear or carry. The NIOSH tests found that the medium frequency system could interoperate with a leaky feeder system

NIOSH is proceeding toward next steps of research with Kutta and the U.S. Army. In these next steps, NIOSH will:

- Explore the development of a digital version of the analog system that was tested. A digital system potentially could transmit over even longer distances inside a mine, expanding an emergency communications network.
- Validate the ability of the medium-frequency transmission system to interoperate with different types of UHF systems.
- Develop networks with infrastructures that will survive catastrophic explosions or collapses, or redundant systems using more than one network, in which at least one network is likely to survive a catastrophic event even if others are disrupted or destroyed.

The medium frequency solutions represent one of several technologies that NIOSH is working on, to provide operators with a range of solutions depending on the size and complexity of their operation. More details about NIOSH’s mine communications research roadmap, which defines NIOSH’s plans for collaborative development of survivable mine-wide communications systems, can be found at [www.cdc.gov/niosh/mining/mineract/mineemergencycommunicationspartnership.htm](http://www.cdc.gov/niosh/mining/mineract/mineemergencycommunicationspartnership.htm). More information about NIOSH’s strategic research under the MINER Act to improve mining disaster prevention and response can be found at [www.cdc.gov/niosh/mining/mineract/mineract.htm](http://www.cdc.gov/niosh/mining/mineract/mineract.htm). More information about Kutta Consulting can be found at [www.kuttaconsulting.com](http://www.kuttaconsulting.com). The reference to Kutta does not constitute a commercial endorsement of the company by NIOSH. Information about NIOSH mining safety and health research in general is available at [www.cdc.gov/niosh/mining/](http://www.cdc.gov/niosh/mining/).