

Appendix A - Two-Way Trapped Miner Communication Systems

PA Gov. Mark Schweiker signed an Executive Order on Sept. 4, 2002, as a direct result of the Quecreek Mine inundation, establishing the Commission on Abandoned Mine Voids and Mine Safety. The mission of the Commission was ... *“to investigate and document the hazards posed by abandoned mine voids in particular the flooding of adjacent operating mines, and to make recommendations regarding the accurate locations voids and avoidance of other hazards associated with mining.”*

The following sidebar was extracted from their report:

Page 31 - Sidebar 5: **“Two-Way Trapped Miner Communication Systems”**

“The former U.S. Bureau of Mines conducted pioneering research in the 1970’s on the propagation of radio waves through tunnels and directly through the earth of detect and locate trapped miners. A body of knowledge was developed on the advantages and limitations of communication systems ranging from VF (300-3000 Hz) to UHF (300-3000 MHz). Early attempts by the Bureau of Mines showed that VF signals around 1 kHz could be transmitted through more than 1000 ft of overburden. An Australian mining industry research initiative resulted in the commercial availability of a “paging” system for UG mines. The Personal Emergency Device (PED) communication system is the “through-the-earth” transmission system that enables communication of specific messages with individuals UG, no matter their location, and without dependence on cables or wiring UG. It functions with a carrier wave frequency of 1,000 Hz, and employs a frequency-modulated signal for transmitting messages entered to the transmitter from a personal computer. Messages can be directed to an individual, to a group, or to all UG personnel. Then a message is received, the cap lamp flashes and the miner can then read the message from the LCD on top of the lamp battery.

There are currently 17 PED systems installed in U.S. coal mines and one in a metal/nonmetal mine. The first successful evacuation of miners attributed to the PED occurred during the Willow Creek mine fire, in Helper, Utah, on November 25, 1998. The paging system was activated when one miner saw flames and telephoned the dispatcher to evacuate the mine. The PED system allowed a mine-evacuation plan to be safely carried out before the mine passageways filled with smoke. All 46 UG miners escaped in approximately 45 minutes. While very successful, the system is not bi-directional (two-way). Thus, although miners can be directed from the surface station to evacuate an area, the miners have no means of notifying the surface station of their status or anything else.

Transtek, Inc. demonstrated a prototype of their wireless through-the-earth two-way voice communication system at NIOSH’s Lake Lynn Experimental Mine in August of 2000. The UG antenna consisted of two 50-ft diameter loops placed in E-drift near the fan portal. An identical antenna was placed 300-ft above on the surface near the fan house and was offset from the UG antenna by several feet. The voice communication signal (hand sets fixed to each loop) exhibited good clarity at both UG and surface locations. Work is continuing in this area, and Transtek is planning another test within the next few months.

Other two-way systems have been proposed and built utilizing VF and medium frequency (300-3000 KHz) to solve the problem under varying conditions. Newer digital technologies for AM radio may open up possibilities for improved medium frequency systems, which depend on wires already in place.

While the technical problems and potential solutions for emergency two-way communications are reasonably well understood, there are no commercial systems which will operate in all situations, and only a small number of companies selling custom systems. Further, there are no “handbooks” which would allow a designer to put together a guaranteed working system in any specific mine. Each system needs to be custom designed and tested for a specific mining environment and its particular functional requirements. The lack of practical engineering designed coupled with a small potential market¹ limits the availability of commercial systems, rather than a lack of basic technical knowledge. What is needed are demonstrations under real world conditions which could lead to practical guidelines.”

¹ According to MSHA, there were 1007 UG mines in the U.S. in 2001. MSHA data indicates that only 200 of these mines employ 50 or more workers. This number rises to 500 for mines employing 20 or more.