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Mine Safety and Health Administration
Office of Standards, Regulations and Variances
1100 Wilson Blvd., Room 2313
Arlington, VA 22209-3939

Re: RIN 1219-AB44
Encl: (1) Low Frequency ElectroMagnetic Systems (LFEMS) for Mine Safety

Subj: Availability of Communication and Control Technology for Use in Mine Safety

1. Innovative Consulting, Inc. (ICI) has been working under contract for the Naval Surface Warfare Center – Panama City (NSWC-PC) in the development of Low Frequency ElectroMagnetic Systems (LFEMS) for communication with and between underwater entities. This is particularly challenging because sea water is very conductive and radio frequencies do not penetrate the sea water. Similar communication problems exist when trying to communicate with trapped miners.
2. The attached document discusses the characteristics of a LFEMS and some of the advantages LFEMS can bring to problems in mine safety.
3. ICI and NSWC-PC are presently preparing a Cooperative Research And Development Agreement (CRADA) to jointly pursue development of LFEMS for a broad range of uses. The ability of LFEMS to penetrate rock and other underground materials make it an excellent choice for use in mine safety.
4. ICI seeks your comments and direction on how we may serve your needs, the safety needs of mine workers and the mining industry.

Victor S. Newton
Project Leader

Distribution:
Mr. John Sojdehei, Naval Surface Warfare Center – PC, Code A64

LOW FREQUENCY ELECTROMAGNETIC SYSTEMS (LFEMS) FOR MINE SAFETY

General Information:

LFEMS provide two-way communications by encoded voice and text messages. These messages are sent by low frequency electromagnetic fields and can penetrate earth and rock to significant depth. This technology has been demonstrated by communicating into caves and military bunkers through the overburden to depths of 1500 feet. Loop transmitter/receivers and their antennas can be permanently (or temporarily) installed both outside and at many places (communication centers) inside the mine. The system can easily be tested by simple “watchman-type” keying with the keyed location, its battery condition and other environmental data securely encoded in the sent message. It is envisioned that the communication centers would be the places where breathing gas and other pre-positioned safety and emergency stores are placed.

Pros:

- System enables near-instant two-way communication of voice or text messages from a central control center on the surface to miners at or near communication centers underground. It uses a through-the-earth transmission system. The transmitting antenna can be installed either underground or on the surface. Performance is documented, and a capability demonstration can be arranged.
- Messages from communication centers within the mine can be automatically coded to show the location of the sender and current environmental measurements (temperature, carbon monoxide, etc.) of conditions within the mine. These measurements could be provided from within the mine at the command of the surface communication center. A polling system would automatically sequence through the in-mine centers and print out the data.
- Dangerous environmental conditions within the mine could automatically be sent to the surface communication center to prompt immediate investigation and early intervention.
- All communications are secure from reception by unauthorized recipients. A high degree of communication security is assured by the choice of unique synchronization pulses for use with the system and by other encoding techniques.
- The system is relatively easy to use and its sophistication is invisible to the user. It can convey text messages of two types: 1. Pre-encoded messages that can be selected from a list by pointer knob and a “send” button. Numbers (e.g. number of trapped miners) may be added to the message with a second knob or a number key-pad. 2. A keyboard-typed message of any length.
- System has the potential of providing messages to miners during the early stages of a mine emergency, including evacuation instructions. These voice messages can be output on a loud speaker or lighted display.

- The system can be deployed in an emergency by stringing antenna wire on the surface and/or in the mine, thus enabling one or two-way communication with the surface. Cheap wire for these emergency antennas could be easily pre-positioned.
- The surface antennas could be placed in the mine if surface rights or topology were a problem.
- Much of the technology for the system is U.S. Government property.

Cons:

- The system is not fully developed and is not presently designed for use in explosive atmospheres or to be in compliance with other MSHA requirements.
- Units have not been fully developed to the point that they are easily carried by individuals on a routine basis, but they are suitable to be mounted at permanent or temporary fixed sites, requiring the user to be at the device to communicate.