March 27, 2006

Response to the Mine Safety and Health Administration, Request for Information, RIN 1219-AB44, consisting of two pages.

B: Breathing Apparatus

Extended Time Breathing Air Apparatus for miners and mine rescue teams

The extended time breathing apparatus described below would allow a mine rescue team member to spend a longer time period in working the rescue effort without having to be relieved for lack of breathing air, heat stress or dehydration. This approach would result in longer and more concentrated rescue efforts and a timelier rescue of trapped miners.

2. A new type of breathing apparatus was developed under the Federal Government's Small Business Innovative Research (SBIR) program with contracts from NASA and the Air Force. This is the Supercritical Air Mobility Pack (SCAMP) developed by Supercritical Thermal Systems, Inc. of Longmont, Colorado. This is an open cycle cryogenic air breathing apparatus that can provide full body cooling if required for the duration of the breathing air. Although the major effort has been spent in the development of a one-hour (NIOSH rated) system, a two-hour system can be supplied (2 hour working units have been built) that will meet 42 CFR requirements. The one-hour SCAMP system including the body-cooling suit is significantly lighter than a one-hour compressed air self-contained breathing apparatus (SCBA), and due to the compression of the air with temperature it is also thinner in profile for easier access to confined spaces. The SCAMP system may be located at each mine site, at a pre-positioned cache of specialized mine rescue equipment, or may be transported in by ground or air.
3. The SCAMP apparatus incorporates the best available technology. These cryogenic breathing systems have been in use at NASA/Kennedy Space Center for propellant handling and crew rescue operations dating back to the 60's. It is a proven technology. NASA uses a two-hour system in their SCAPE suit and with the cooling can obtain a full two hours of functionality in Florida's high summer heat and humidity. The SCAMP was designed to be the next generation system for use at NASA/KSC. Specifically, it overcomes problems with any attitude feed, oxygen enrichment and NIOSH approval that were not in the original NASA equipment. The current design of SCAMP has been through testing at NIOSH and did not pass the testing. Although it did not achieve approval at that time, it has had minor design changes incorporated and will pass NIOSH on the next submittal currently scheduled for the spring of 2006. Upon receiving NIOSH approval, SCAMP would be made available as required.
4. The improvements that can be made are in the areas of weight and completeness of configuration such as the addition of a heads-up-display and the addition of many of the bells and whistles including a water supply and a PASS type unit.

D: Rescue Chambers

Stand alone Liquid Air Rescue Chamber or inside a built-in Concept

The major need for the survival of trapped miners is a supply of pure breathing air. At rest, a miner will consume approximately 1.5 lbs of air per hour. Our team could provide a portable container of low pressure liquid air (100 PSI or so) at the mine face where the miners are located. The bulk of the system would be liquid air and the Dewar in which the air is contained. However, the supply of drinking water, face masks, portable breathing units that can be refilled from the Dewar, first aid supplies, an electrical generator, and communications equipment can be added to the transport base with very little extra space or weight. A folded transparent plastic room could also be attached so that it could be deployed locally or inside the safe refuge enclosing and further protecting the miners and equipment/supplies. Extended breathing air supplies/equipment should be made mandatory for coal mines.

1. The equipment should be portable and kept as close to the working miners as is practically possible in the confines of the mine. It may be a trailer, a mine cart or a self-propelled unit. This would reduce the chances of the miners being separated from their extended breathing air supplies and other survival equipment. It could be used as a stand-alone unit in the working area or as a supply unit inside a built-in area; dependent upon the configuration of the mine.
2. It is very difficult to extrapolate the time required for a breathable environment. A person can survive for weeks without food, days without water, but only minutes without air and an indeterminate time in contaminated atmosphere. The normal average air consumption rate for a person at rest will be approximately one liter of liquid air per hour or six gallons per day. Thus a standard 300 gallon Dewar would supply approximately 50 man days.
3. A unit of 300 gallon capacity will support 12 men at rest for about 4 days. It will be less if the miners are using the portable breathing units in efforts to rescue themselves. The 300 gallon Dewar is small compared to most mining equipment so a larger size may be feasible.
4. The number of portable extended breathing air units deployed in a mine would depend on the number and locations of the miners. There may be a variety of sizes so that the size of the unit would vary with the number of miners supported along with site specific requirements.

That concludes our RIN submittal which the personnel at STS feel that they are qualified to comment on. The comments have been brief by design and hopefully will generate further dialogue between MSHA, STS, ASI (our team member in Frankfort, Kentucky), and Dr Don Doerr, at NASA Kennedy (Cape Canaveral).

Thank you for this opportunity to respond.

Respectfully submitted,

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