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Refuge Alternatives for Underground Coal Mines-Request for information

Comment On: MSHA-2013-0033-0019

Refuge Alternatives for Underground Coal Mines Request for information; extension of comment period.

Document: MSHA-2013-0033-0024

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General Comment

Please delete our previous file and replace it with the pdf version below.

Attachments

Response to MSHA RFI 2014 Strata Final

AB79-COMM-9

Strata Response to MSHA RFI

4/2/15

A. Miner Training on Refuge Alternatives, Question 1:

Strata has developed training units that simulate the deployment and operation of the production model refuge alternatives. These units are available for sale or for rent. Strata has sold approximately 60 units and maintains a small number of units throughout the country for contract training. The price of a new training unit is approximately 50-60% of the cost of a production unit. We also offer training services for customers who prefer that avenue.

The service life of the training unit is indefinite but normal wear and tear from constant use has resulted in the creation of replacement components. For example, replacement entry zippers are mounted on a Velcro backing to allow for easy change out.

A. Miner Training on Refuge Alternatives, Question 2:

In addition to the training units, Strata developed training materials including User Guides, Power Point presentations and an instructional video that customers are provided. The training video has been an especially useful tool in the effort to communicate the deployment and operating procedures of the refuge alternative.

B. In-Place Shelters, Question 4:

An in-place shelter with a known safe respirable atmosphere and highly reliable communications can be used as a "muster" station, an SCSR change-over station and a longer term refuge alternative if escape is not possible. The in-place shelter must have a continuous entry two-way airlock system to eliminate contamination of the room's atmosphere while allowing miners to quickly enter and exit the shelter as they are instructed or they determine it is safe to continue the evacuation of the mine. The respirable atmosphere will allow miners to remove SCSR's and communicate while making a plan for escape. The in-place shelter will have many of the attributes of the Strata Airdoc™ change-over-stations used extensively in Australia.

B. In-Place Shelters, Question 5:

The preamble to the Part 7 rule discusses the 15 psi design requirement for overpressure on the refuge chambers. The Preamble cites a Department of Defense weapons standard of 13 psi as the 100% lethal threshold. Although it is not clearly stated, the inference is that the 15 psi overpressure threshold was adopted as a reasonable design criteria since any pressures over this level will not have survivors capable of reaching the refuge chamber. Again, we have to assume the 15 psi requirement for refuge room walls and doors has been extended from the same preamble comments and not based on any

other criteria. The question of post-explosion integrity of SCSR's seems to be an unrelated question and should be directed more to **30 CFR § 75.1714-4**.

Current SCSR's are not required to be cached in explosion proof enclosures so, in our opinion, SCSR's behind a 15 psi wall will be better protected than conventional cache' d units.

We do believe **30 CFR § 75.1714-4** should be reviewed to allow for a properly constructed built in-place refuge room that can be entered safely from adjacent escapeways. Balancing of pressure differentials and other potential mine specific conditions need to be addressed in a mine-by-mine risk analysis and the entry doors/airlocks designed accordingly. We do not see a need for a borehole from the surface as a respirable atmosphere can be attained with already approved refuge alternative Breathing Air components. We believe that SCSR caches, shared by two escapeways, and protected by a 15 PSI enclosure whether by a BIP room or portable change over station, similar to the Strata Airdoc™, would provide adequate SCSR protection for shared SCSR caches and provide an opportunity for changeover in clean air and the opportunity for escaping miners to regroup and communicate among each other. We believe the current "hardened room" requirement for shared SCSR caches as described **30 CFR § 75.1714-4** to restrictive.

B. In-Place Shelters, Question 6:

Although we are not a mine operator, we believe it is not rational to provide a simple distance for all mines. Too many variables such as mine height, belt-worn SCSR duration and mine configurations make it impossible to predict a single distance for all mines.

B. In-Place Shelters, Question 7:

The biggest advantage of a second refuge alternative would be redundancy. There, however, could be confusion as to which chamber to go to in an emergency.

B. In-Place Shelters, Question 8:

Advantages: 1) Provides unlimited supply (in hours) of breathable air. So, 96 hours would no longer be the deadline for rescue. 2) Breathable air, in sufficient volume, can eliminate the need for CO2 scrubbing systems in the room. 3) Breathable from the surface can be configured to continuously purge a refuge room prior to deployment. 4) Breathable air from the surface can, in some set ups, eliminate the need for an airlock. 5) Some cooling and/or dehumidification can be provided by compressed air from the surface. 6) Borehole will allow a wired communication connection to the room with wireless (Strata Commtrac™) as a secondary system to broadcast underground.

Disadvantages: 1) surface access due to right-of-way issues, terrain, environmental concerns, inclement weather and mine depths may not make this feasible at all mines.

Strata recommends a simple powerless back-up Breathing Air supply system in the refuge room. This should consist of a supply of oxygen cylinders and a powerless CO2 scrubber sized for the maximum number of occupants and for 96 hours.

B. In-Place Shelters, Question 9:

The door and entry system needs to include an airlock or system to reduce the amount of carbon monoxide carried into the refuge room with the miners entering. The door system needs to allow a large number of miners to enter continuously.

B. In-Place Shelters, Question 10:

The pre-fabricated refuge chamber is portable and can be readily moved to accommodate the needs of the mining operation.

An in-place shelter in a shallow mine can be fitted with a low cost surface blower (fan) via a large diameter borehole. Deeper mines and mines feeding rooms via a slope, will need to utilize more expensive surface compressors operating at higher pressures. On a "per miner" basis, Strata believes the blower systems can be more cost effective than a portable chamber while the compressor systems can be cost competitive with portable units, especially when compared to large occupancy rooms.

With regards to maintenance costs, our inflatable chambers are virtually maintenance free due to the fact that they are completely sealed until deployed. The 2013 re-fit program highlighted damage to the units from routine handling and moving. On average, the repair costs per unit averaged \$556 per refuge alternative divided by the five year cycle.

B. In-Place Shelters, Question 11:

With a surface compressor system and air piped into the room, a pressure regulator could be used to keep the room at a positive pressure. The compressor would automatically kick on if the pressure fell below a specified level.

TSL's (thin skin liners) could be sprayed on the interior surfaces of the room to reduce naturally occurring seepage of methane into the room.

The room's atmospheric conditions could be monitored and purged, as required, rather than mandating constant ventilation.

B. In-Place Shelters, Question 12:

Purging a large volume room from 400ppm CO to 25ppm requires nominally four times the room volume in stored compressed air. This is not practical. Strata has developed a high volume air powered CO scrubber that both scrubs and purges but even this approach requires a large number of air cylinders.

C. Escape Methodology, Question 17:

The hood concepts being researched move the sealing surface from the face to the neck. This approach, combined with the positive pressure (or demand valves) reduces the risk associated with a poor fitting facemask.

C. Escape Methodology, Question 18:

In-place shelters with a properly designed continuous entry airlock can theoretically be spaced further apart than conventional refuge chambers since the queue time at a conventional chamber will be reduced allowing less safety margin in the duration of the SCSR/SCBA.

D. Replacement of Brass Fittings, Question 19:

Strata replaced all high pressure brass valves and fittings with valves and fittings constructed of corrosion resistant materials such as monel and stainless steel. The corrosive agent, responsible for the stress corrosion cracking and suggested dezincification, was not identified in the OSHA report. As a result, it is impossible to conclusively determine whether the corrosion was caused by the "mine environment" or some other corrosive substance, introduced to the brass components. In view of the uncertainty of the source of the corrosive agent, we would recommend periodic inspections of the refuge alternatives to insure the integrity of the refuge components. Strata has also implemented features designed to minimize and/or detect internal high humidity conditions that could contribute to the advancement of corrosion.

F. Apparent Temperature, Question 22:

Strata's inflatable refuge alternatives provide a means for "passive" cooling. The inflatable design inherently has a large heat transfer surface area per occupant to dissipate heat and to provide a surface to condense vapor inside the inflatable structure. There are limits, of course, to the amount of cooling that can be provided using this method.

For higher mine temperature applications, Strata has submitted a battery powered air conditioning unit to MSHA for approval in coal mines. The application is pending.

A Strata competitor has sold a liquid CO₂ based cooling system into several mines as an intrinsically safe alternative cooling system. While this technology provides known cooling as high pressure liquid CO₂ is expanded to a gaseous CO₂, it too, has limitations. In fact, if the storage temperature of the liquid carbon dioxide is above 87° Fahrenheit, its critical point, it cannot exist as a liquid and therefore is useless as a refrigerant.

F. Apparent Temperature, Question 23:

Outside air will need to be conditioned as it is delivered to the refuge room. This conditioning may include drying, cooling or heating. In addition, carbon monoxide contamination from surface equipment near the inlet to the compressor system is a potential hazard. CO removal or, as a minimum, a CO diversion system that senses the CO in the air and shuts down the equipment or diverts the air stream

until it is determined to be clean. We offer such a system on our non-coal chambers that are connected to mine air.

H. Additional Requests for Information, Question 28:

Strata requires periodic inspections, as a condition of warranty, and recommends periodic inspections to insure the integrity of the refuge alternative. Some customers have chosen to have Strata inspect their chambers on 6 month intervals. It is vital that the individual, conducting the inspection, have an intimate knowledge of the refuge alternative, design and operation thereof, as well as a thorough understanding of the system components. Additionally, the inspector should have a thorough knowledge regarding the operation and deployment of refuge alternatives in order to be able to identify potential obstacles to properly deploying the refuge. The inspector needs to have an understanding of conditions that would require the RA to be taken out of service. The examination conducted should include the following:

- Identification of potential deployment obstacles.
- Evaluation of the chamber enclosure and notation any potential physical damage that could compromise the operation of the RA.
- Verification that components (Air Monitors, strobe lights, etc.) are in place, functional and current.
- Verification that all compressed air and oxygen bottles are on and within designed pressure requirements.
- Verification that no adverse conditions exist within in the chamber, high moisture levels, evidence of corrosion, evidence of internal damage, etc.
- Verification that supplies & equipment are within recommended service life.