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MSHA
Office of Standards, Regulations, and Variances
1100 Wilson Blvd.
Room 2313
Arlington, VA 22209-3939

Reference: MSHA Request For Information RIN 1219-AB44

Gentlemen,

In response to your Request For Information, I would like to submit my comments pertaining to reference to section C, Self-Contained Self-Rescuers (SCSR). From 1995 to 1996 I worked on the mechanical design team for a prototypical Oxygen Concentrator. The recent highly publicized tragedies in the mining industry brought to light how that technology may be made useful as an emergency breathing device for trapped miners. This was discussed with the patent holder and we would be very interested trying to further develop the original idea in order to make it useful as a SCSR. To better describe my thoughts I will address the questions as stated under Item C of your Request For Information:

1. *Is there more effective technology to protect miners than the SCSRs currently available? If so, please describe.*
Two of the most prevalent technologies in use today for SCSRs are that of either chemical reactions or molecular sieves. A molecular sieve is essentially a re-breather that separates unwanted constituents of air and allows oxygen to pass through. Usually, this is a passive operation device that does not actively cycle air to isolate the oxygen. One of the obvious solutions to a better SCSR is to have an active molecular sieve system that creates more airflow through the sieve allowing for more efficient collection of oxygen. The technology for these types of systems currently exists in the form of Pressure Swing Adsorption Oxygen Concentrators.

There is currently a patented technology for a Rapid Cycle Pressure Swing Adsorption Oxygen Concentrator. The abstract of this patent reads as such:

A rapid pressure swing adsorption oxygen concentrator is provided having a plurality of at least three sieve beds cycled in sequence such that each is pressurized during one segment of a cycle and depressurized during a plurality of segments of a cycle while the other sieve beds are being sequentially pressurized. Preferably, approximately six sieves are provided and pressurized in sequence, with each being pressurized for approximately 60 degree of the cycle and depressurized for from about 270 degree to 300 degree of the cycle. Each sieve is thereby pressurized for about one to two seconds and depressurized for about five to ten seconds. By utilizing the ability of the sieve material to adsorb faster than it can desorb gas, high output of up to 96% pure oxygen results with a low sieve volume and low power consumption.

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In short, the current technology of Pressure Swing Adsorption Oxygen concentrators can be made smaller and lighter along with less power requirements for operation. The final production size could possibly be made small enough to be carried with the miner at all times.

The ability of a Rapid Pressure Swing Adsorption Oxygen Concentrator to operate in a fully contaminated atmosphere needs to be researched. The addition of highly compressed or liquid oxygen to provide make-up air where the oxygen has been completely depleted could greatly enhance the usefulness and duration of such a unit. This on board Oxygen combined with O2 sensing controls that could automatically switch between Oxygen Concentrating and Oxygen releasing could greatly extend the duration of oxygen.

2. *Should an SCSR be developed that provides more than one-hour duration of oxygen?*
In mines with far reaching panels or low seams, where the time needed just to walk out under normal circumstances can be more than one hour, it is imperative that longer duration SCSRs be required. In adverse conditions where breathable air cannot be available for long periods, having oxygen is essential to sustain life. In extreme accidents, miners can become trapped for days, not hours.

What duration is feasible considering that miners must carry the SCSR?
The duration of a Rapid Pressure Swing Adsorption Oxygen Concentrator in a contaminated mine atmosphere would have to be determined. As stated previously in item 1, this technology could possibly become small enough to be worn on a miner's belt but its duration is determined by its size and the potential inclusion of make-up oxygen. Many factors including atmosphere, sieve size, battery size, etc go into determining it's ultimate duration.

Would it be desirable to require smaller and lighter SCSRs with less oxygen capacity to be worn on miner's belts while at the same time requiring longer duration SCSRs to be stored in caches?
It is practically infeasible to provide a SCSR small enough to be worn on a miner's belt that can provide breathable air for long durations extending days. I believe the best solution would be to develop the longest duration portable SCSR possible while having larger cached Rapid Pressure Swing Adsorption Oxygen Concentrators. The cached Oxygen Concentrators could be sized to be worn like a backpack with multiple oxygen outlets so that a group of miners could team up and walk out together. Much larger fixed Rapid Pressure Swing Adsorption Oxygen Concentrating stations could be developed to generate compressed oxygen on demand in order to fill Self Contained Breathing Apparatus Bottles.

3. *MSHA standards require each mine operator to make available an approved SCSR device or devices to each miner. Should mines be required to maintain underground caches of SCSRs for miners to use during an emergency, or should each miner have access to more than one SCSR?*
As stated above in item 2, I believe that it is imperative to provide for enough breathable air as feasible for the worst conditions currently faced. As with any occupation as inherently dangerous as mining, not all potential scenarios can ever be fully anticipated or regulated for. Each type of mine situation needs to be analyzed for factors; such as cave-in potential, explosion potential,

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depth, height of seam, width, number of and location of escape ways, etc. and the best solution for maximum safety developed. As with all things in nature, one solution usually does not fit all.

4. *SCSRs are currently required to be inspected at designated intervals pursuant to 30 CFR 75,1714-3. Should SCSRs be inspected more frequently than the current requirements?*
This should defiantly be set per the manufacturers requirements for safety. With a Rapid Cycle Pressure Swing Adsorption Oxygen Concentrator type SCSR, this could almost be done every time a SCSR is worn into a mine. A quick check of the battery power combined by actually running the concentrator and sensing the oxygen output could be completed in just a couple of minuets.

5. *SCSR service life is determined by MSHA, NIOSH and the devices manufacturer. The service life can range from ten to fifteen years depending on the type of SCSR. Should the service life of SCSRs be reduced to five years or a different time limit?*

I have no comment on the service life of the current SCSRs. The service life of the proposed Rapid Cycle Pressure Swing Adsorption Oxygen Concentrator type SCSR would have to be determined based upon the shelf life of the sieve material, the ruggedness and construction of the mechanics, the life expectancy of the battery, etc.

I appreciate the opportunity to present this technology to you. As members of my wife's family are currently working in mines in West Virginia and Pennsylvania, the issue of mine safety strikes close to home. I hope that my comments and opinions are found useful and if you find merit in this idea, please feel free to contact me.

Respectfully,

David Scott Murray

MURECO Ltd.