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To: zzMSHA-Standards - Comments to Fed Reg Group
Cc: 'Kathleen Trakofler'
Subject: RIN 1219-AB79
Attachments: Refuge Writeup to Send.docx

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Attached please see comments regarding refuge alternatives training. Thanks.

Charlie Vaught

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Comments on RIN 1219-AB79 Submitted by

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At least some of the questions in MSHA's RFI should have been asked and answered before refuge alternatives were ever put into the mines. Others should have been answered by now through controlled studies. The rest are issues we don't know enough about to have an opinion on. But we want to briefly address three key issues that we have researched over a joint 40 plus years:

1. Motor task training
2. Decision making
3. Human expectations under stress

1. Motor task training Regarding what constitutes appropriate training for refuge alternatives, we are repeating history. The industry went through these same sorts of issues with self-contained self-rescuers and that experience should be an object lesson.

When SCSRs were introduced into the mines, the associated training was inappropriate and ineffective. No one saw its inadequacy because that training wasn't put to the test until the Wilberg disaster, which strongly suggested the victims hadn't known how to even put their SCSRs on. Then we had to play catchup, and as everyone knows, that took a long time. In a nutshell here's what we did with SCSRs, and, to be clear, the same principles apply to refuge alternatives or anything else that requires people to perform a physical task:

We started by conducting task analyses – what do people need to do, how do they need to do it, and where are they having problems? Given that data we then developed what we thought would be an efficient training procedure that dealt with the donning problem. Having a protocol that looks good on paper, however, doesn't mean it will work in the real world. You can't know that until you put it to the test and perform strict evaluations – the more critical the task, the more rigid the evaluations should be. That required the development of an effective evaluation instrument, which we were able to accomplish. Only then did we have something that we could put to the test.

We trained literally hundreds of miners in our procedure and evaluated every step (and misstep) in each one's performance. All that data showed us clearly what worked and didn't work, what kind of remediation was needed and where to direct our remediation efforts. At that point, we were in a position to address the two aspects of motor task training that there is absolutely no way to get around: ***the need for hands-on practice and the fact that people forget what they learn very quickly.***

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It is an axiom of adult education that adults learn by doing. Lectures and demonstrations are simply not very effective ways to teach grownups. And, of course, that is doubly true for motor tasks. So we focused on trying to understand the most productive ways to provide practice – what worked in certain situations, what didn't, and what was least disruptive given all the different circumstances in which practice might take place. It is actually very important to minimize disruption in order to maximize the value of the learning that is going on.

Then, there is the “forgetting curve” to contend with. It is an established scientific fact that peoples' process of forgetting is always curvilinear. One can get a rough approximation of what the forgetting curve looks like by imagining half a rainbow flipped 90 degrees. An individual begins to forget what he or she has been taught immediately, the retention level degrades steeply at first, and then tends to flatten out when there isn't much left to remember. Our task with the forgetting curve was to establish how often practice needed to be repeated in order to keep the curve from bottoming out between training sessions.

Here's what we came up with in regard to SCSR donning training: If we taught miners hands-on how to put the devices on, had them attempt the procedure while we evaluated them, provided whatever remediation was indicated by the evaluation, and then had them practice until they got it right without assistance, we could keep skill retention at a reasonable level for several weeks. That's how we arrived at the recommendation that SCSR training be integrated into quarterly drills, thus causing a minimum of disruption while at the same time providing a reasonably good training outcome. The problem is that what we found workable for SCSRs can't be expected to transfer whole cloth to what might be needed in the way of effective training for refuge alternatives. This can only be established by doing the same sort of homework to develop **and test** a realistic training protocol for refuge alternatives as was done for SCSRs. One thing is for certain, though. That has to be done first.

However, to reiterate, there are four things we know up front: 1) miners can't learn to deploy and operate refuge alternatives without actually doing the tasks involved; 2) the skills they develop won't be retained without repeated practice; 3) unless there are controlled studies that we're unaware of we don't know the best ways to provide that practice; and 4) we don't know how often to give the practice once we figure out what it should consist of (though once a year isn't likely to work any better for refuge alternatives than it did for SCSRs).

2. Decision making – whether to stay or whether to go The introduction of refuge alternatives added a whole other dimension to the escape problem. Before their advent, the focus was on self-rescue, and there was a system in place to facilitate that effort – hands-on SCSR training four times a year, drills, lifelines, caches, etc. Now there is an alternative that miners are told to choose only as a last resort. Admonishments such as that don't mean anything because they are subject to a host of interpretations. Should I give up trying to get out only if my egress is physically blocked, when I encounter smoke, if my buddy's SCSR isn't working (or is believed to be not working), when the group I'm in turns back, or when whoever's in charge tells me to?

While miners have generally been taught that self-rescue means just that – rescue yourself, the fact is that if they are in a group they tend to stay in the group. That brings up issues of leadership, “group think” and numerous other factors that weigh on the decisions made in an emergency. In other words, a group decision is not necessarily one that an individual would make, but the person is likely to go along (sometimes against his or her better judgment). Now miners have two elemental choices, and it becomes doubly important to address in training some possible complications that might arise because of it. Probably one that stands out the most is what happens if the group splits. Researchers at the Office of Mine Safety and Health Research developed two paper-and-pencil simulations that address the question. In one scenario, part of a crew enters a refuge alternative while others decide their best chance is to try to get out of the mine. In the other, a crew splits because a couple of them are injured and cannot keep up. The refuge alternative is used as a place to put those miners while everyone else continues their evacuation.

So, what should miners be taught about what constitutes an “only resort” or whether there are some alternative ways to think about refuge alternatives? Those sorts of questions need to be worked out if they haven’t been already, and reflected in systematic training programs.

3. Human expectations under stress Once miners have made the decision to enter a refuge alternative, we know generally some of the things research has shown will happen, but as with the motor task element specifics can only be determined through methodical study. Here are some things to think about:

First, people don’t “panic.” Research on human expectations under stress has increased significantly, especially after 9/11. We know that the majority of people do not “panic” as panic is defined as a behavior. The best example of this was the behavior of the passengers on U.S. Airways Flight # 1549 that landed in the Hudson River in New York City. Passengers later reported high anxiety which is a normal feeling in such a circumstance. Some used the word “panic” inappropriately. Yet, if you watched the TV footage it appeared that by-in-large passengers behaved appropriately for the situation. The behavior of the miners at Quecreek is another example of an anxiety producing situation where the escaping miners got out of the mine and those needing rescue executed appropriate behaviors.

What do we know about how miners will react over a period of time in a refuge alternative? Research has shown that people in confined spaces, especially without light, are likely to experience significant psychological issues (especially as time elapses). The physical discomfort of the position the miners must maintain during that time is also a consideration. With refuge alternatives there is a lot of variability dictated by such things as seam height, type of device, etc. This variability, along with an individual’s psychological makeup, will have a direct bearing on whether the decision to enter a refuge alternative will have a positive outcome.

In sum, the content of training should be well-researched and documented by educators and content experts, especially in a life and death situation.