THE NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH/NATIONAL PERSONAL PROTECTIVE TECHNOLOGY LABORATORY (NIOSH/NPPTL) PUBLIC MEETING

Tuesday, September 19, 2006

DISCUSS Concept Requirements for Certification of Closed-Circuit Escape Respirators (CCER)

Docket Number NIOSH-005

Commencing at 9:03 a.m. at the Key Bridge Marriott, Arlington, Virginia.

P R O C E E D I N G S

MR. BOORD: Okay. I think it's 9 o'clock, so we should start the proceedings. If everybody can take a seat.

That's okay, Christine. We will give you time.

Okay. Good morning, everyone. I would like to welcome you to this NIOSH meeting today to discuss proposed concepts for closed-circuit escape respirators.

My name is Les Boord, for those of you who don't know me, and I am the director for the NIOSH National Personal Protective Technology Laboratory.

As I say, the discussions today are concerning concepts. And our intent and interest is to open dialogue and discussion relative to concepts that we are looking at for closed-circuit escape respirators.

As the disclaimer states, these concepts are being presented for discussion purposes only and do not represent any final determination or policy of the agency. So, again, concepts.

We do encourage discussion, and we want to have those discussions relative to the concepts that we're going to discuss today.

The agenda that we have for today's meeting is as illustrated here, and we will stick pretty closely to the agenda with minor exceptions.

I will cover the first two topics, the welcome and opening remarks, and then a brief discussion on the history and the background of self-contained self-rescuers.

That should pretty much take us up to 10:30 or so, at which time we will have a break. And then we will get right into the meat of the meeting, which is a discussion of the proposed concepts.

We anticipate that that will take us up to lunchtime. And after lunch, we do have a scheduled speaker, who is Dr. Art Johnson from the University of Maryland, who is doing some interesting research concerning self-contained escape respirators.

And following Dr. Johnson's presentation, we will have an opportunity for anyone -- any of the participants and anyone in the audience who may want to address the audience on a specific topic. And at that point, we will go to a break and then wrap up the afternoon with any additional comments and discussions. So that's the agenda that we will follow.

Just a few words about the meeting logistics and how we will try to conduct the meeting.

I think that everybody, if you're in this room, you had to go by the registration table in the hallway. So I would hope that everybody has signed in at the appropriate sheets and process coming in.

It also should be noted that the meeting is being recorded. We have a court reporter, who is up here typing away and capturing everything that we say and will do so also for any questions or any other presentations that are delivered to the -- to the meeting.

As I said, the presentations will follow the agenda. And what we would like to do is, following each of the presentations, we will have an open question and answer.

So we think that the presentations are in sizable chunks that we can get through the presentation and then open it up to questions and discussion.

When we get to the questions and discussion part of each of the presentations, the protocol that we would like to follow would be for anyone who wants to address the presenters or address the audience, to go to the microphone in the middle of the room, announce who you are, the organization that you represent, and then follow through with the comment, and we will try to provide a response to the question.

And then I would call -- note attention to the fact that it will also be transcribed. So the entire meeting will be part of the transcription.

Again, just to make sure everybody is in the right room, the purpose of our meeting today is to present concepts for closed-circuit escape respirators.

During the discussions today, the

technical discussions, we're going to be talking about breathing metabolic simulators. We're going to be talking about ruggedness and reliability concepts. We're going to be talking about safety concepts; requirements for eye protection or concepts for eye protection, components for post-certification testing, and finally a concept for registration.

So the technical discussions that we get to later in the agenda will cover those types of topics which are really embodied in the concept paper for the closed-circuit escape respirator, which, you can see on the screen, is located on our website at that long email address.

But I think the packet of information that each of you received when you registered this morning also has a hard copy of the concept requirements.

So you can feel free to mark it up and tear it and do whatever you want because you can go to the website and get another copy.

I think up front, it would be useful to go through and to address a terminology issue. And the terminology that we're talking about is closed-circuit escape respirator and self-contained self-rescuer.

And the technical basis for these terms and how we are going to apply those terms as we go through our discussions today, is really embodied in 42 CFR, Part 84, Subpart H, which are the current certification requirements for self-contained breathing apparatus.

And if you look into Subpart H of 42 CFR, which I'm sure many of you are already familiar with, the Subpart H is for self-contained breathing apparatus.

Within the certification classification of respiratory protection devices, we have two primary legs. The first is devices that are designated for entry and escape; and the second, which is escape only.

Within each of these, we have basically two different types of technologies that are traditionally used and covered in the regulations.

The first is open-circuit technology, which typically is compressed breathing air. I'm sure many of you are familiar with open-circuit technologies. And secondly are the closed-circuit technologies, where the user is continually rebreathing their own gas, cleansing and rebreathing and supplementing the consumed oxygen.

So entry and escape, open-circuit, closed-circuit.

Under the escape-only classification, we have the same designations. We have open-circuit and closed-circuit escape respirators.

And within the closed-circuit escape respirator classification, we also have a special terminology that's applied to the mining aspects of closed-circuit escape respirators for the mining industry, and that's the self-contained, self-rescuer.

So the technical terminology is we have a CCER, which is the closed-circuit escape respirator, and the SCSR, which is the self-contained self-rescuer, which basically is a subset of the

CCER designated for the mining industry.

The concepts in the concept paper, which is the focus of our discussions today, are really for this component, the closed-circuit escape respirators, under subpart H of 42 CFR, for self-contained breathing apparatus.

So the concept is to literally have a plug-in to 42 CFR which would define the -- replace existing requirements in 42 CFR for closed-circuit escape respirators with the new concepts when we get it to that level.

Again, the concepts that we're discussing today are part of a process that NIOSH is following in consultation with the Mine Safety and Health Administration, MSHA, for developing a future proposed rule on the performance and reliability requirements of closed-circuit escape respirators.

As part of this open dialogue and discussion of our concepts, we have planned two meetings such as this one. And those are the meeting today and a second meeting on September 28 at the Colorado School of Mines.

Our plan will be to, following the discussions today, to have and maintain an open docket to receive written comments. So any of the concepts that we discuss today, you are certainly encouraged to provide follow-through written comments to the docket. And we would like to receive those comments by November 1.

The information on the docket -- access to the docket is as illustrated here. And I think also one of the sheets in the packet of information that you have received has the docket identified and the way to contact the docket.

And then lastly, to further encourage open discussion, we would like to invite anyone to arrange a one-on-one discussion relative to the concepts. And to do that, the contact arrangements are through Tim Rehak, and the phone number and e-mail address, which are also in the packet of information that's provided to you today.

So with that, I think we can start some of the discussions relative to the topic at hand.

And the long-term vision that NIOSH has

for closed-circuit escape respirators is to certainly make and have performance-based requirements for respirators, closed-circuit escape respirators that are simple to use, have a greater capacity or duration than what we are used to today, respirators that have a low breathing resistance, and respirators that are rugged and durable and can withstand the rigors of daily use.

Within the current NIOSH program, to help us try to achieve that vision, the NIOSH program addresses and is addressing many of these issues, increased duration, increased capacity, reduced physiological burden of escape respirators, improvements in ruggedness and durability, and improvements in the capability to provide realistic user training.

That NIOSH program today has basically five components to it:

The first is an activity to seek and facilitate new technology.

The second is continuing evaluation of deployed escape respirators.

The third element in the program is the pursuit of new research topics and new research ideas.

The fourth area is activities that are directed at improving the training support that the Institute can provide to MSHA.

And then the fifth element in that program is the topic of our meeting today, which is new concepts for test and evaluation of closed-circuit equipment.

And I would like to talk about each of those five aspects of the current NIOSH program. And the first of those is the aspect or the element of new technology as applied to these types of respirators.

And I think when we talk about new technologies for closed-circuit equipment, the immediate thought that comes to most people's minds who have been involved in this industry for any amount of time is the possibility for new concepts for oxygen generation, or perhaps new concepts for carbon dioxide removal because those two technical aspects are really the heart of a closed-circuit apparatus.

So many of us think of new ways to generate that oxygen and produce that oxygen, or new ways to scrub out and eliminate the CO2. And we should. And we certainly need to be looking for those new technologies, but it shouldn't stop there.

I think that our quest for new technologies to be introduced into these types of respirators needs to be much greater. We need to be looking at things like new technology for carbon monoxide removal. We need to be looking at new technologies for the materials and the many materials that are used to comprise a closed-circuit escape respirator, many materials, elastimers, metals, chemicals, the whole array of different types of materials that are used in the design and manufacture of this type of equipment.

And we know that the technologies and the frontiers for new materials development is ripe. And we know that there are many, many advancements being made in new materials technologies.

So when we look at closed-circuit escape respirators and the ability to introduce new technologies, we need to be aware of and seeking to provide these new materials to that basic piece of equipment.

And materials that are used for storing the chemicals or storing the oxygen source, there's a lot of work that has been done in recent times in pressure vessel designs and pressure vessel technologies.

Years ago, the primary mode for storing pressurized oxygen or pressurized breathing air was a steel cylinder. Then technology went to high tensile steel pressure vessels.

Then we had the introduction of aluminum materials and composite, fiber-wound aluminum materials. Then we go into the carbon-wound cylinders. To the point now where some of the new technologies, there are no metals. You actually have new technologies applying plastics as the liner for the compressed gas, and the strength is imparted through the carbon filaments that are used to wrap the liner.

So I think materials for storing the chemicals and high pressure vessels, but we also need to be looking at technologies as they apply to how we test and evaluate the equipment.

Today, during the discussions, we're going to be talking quite a bit about metabolic breathing simulators.

Thirty years ago, that was really an innovative concept. Okay? And that concept has been developed and refined to the point where it is ripe to be looking at those new technologies for testing and evaluating the equipment that we certify.

But not just metabolic simulators. We need to be looking at other technologies as they apply to laboratory testing as well as to field level testing. So technologies for testing, I think, are important.

We also should be look at technologies as they apply to the training methods and the training materials that are used to support the use of the equipment in the field.

We need to import and gain experience from technologies in other areas that can be used to train the users and the people who are required to inspect this type of equipment on a daily basis.

And then finally, technology as it applies to the service and maintenance aspects of closed-circuit escape respirators.

So what are we doing in regards to trying to develop some of those technologies and work to identify some of those technologies?

And in that regard, in the spring of 2005, NIOSH entered into a collaborative agreement with the National Technology Transfer Center to conduct a series of workshops to look at those very issues that I just mentioned, to look at and to facilitate and to learn what new technologies there are that can be applied to closed-circuit escape respirators.

As a result of that collaboration, we have had a series of workshops where people have been invited to talk about and introduce their technologies.

Two of those workshops were held in 2005, in June and December of last year. We had a third workshop that was held in July of this year. And we're planning to have a fourth workshop, and we intend to continue that quest for new technologies to be applied to these types of products.

So NIOSH's role is to seek and identify those technologies and also to work to facilitate the introduction and utilization of them into the equipment that we certify.

The second element of the ongoing NIOSH program is the long-term field evaluation program, which was initiated more than 20 years ago.

That program, as many of you I'm sure are aware, was introduced by the U.S. Bureau of Mines. And it's the purpose of that program or the intent of that program to conduct laboratory tests to evaluate self-contained self-rescuer performance.

A little bit later in the discussions today, I will go through the evolution of how that program has grown.

But the way we currently see the program being conducted and implemented is to be testing a minimum of 200 escape respirators per year. And, in addition to doing those laboratory tests on the respirators, we will also employ the other audit activities that the certification program has for looking at the continuing performance of an approved respirator.

And those components of our program are a certified product investigation program, where we have problem investigations with documented corrective actions, and we also have manufacturer site audits that are performed to ensure that the quality program that the respirator was initially certified to is being maintained by the manufacturing process.

In the case of self-contained self-rescuers, the NIOSH program is targeting manufacturing site audits on an annual basis.

And the summary of all those activities will be captured in an annual report discussing the results of the long-term field evaluations for that period of time.

That leads us to the third item that I mentioned, which is the topic of research. And in the research arena, there are two areas of research that are currently being pursued.

And the first of these is what we refer to as a hybrid self-rescuer. And it's interesting to note that the concept for this research was actually identified at one of the workshops that we had in 2005.

And basically, the hybrid concept is a combination of the operational characteristics or operational system of a self-contained self-rescuer. So it would have an oxygen supply and CO_2 removal. That oxygen supply could either be a KO_2 chemical-based system, it could be a compressed gas, compressed oxygen, or it could be a chemical chlorate system.

So it takes that self-contained technology and combines it with the traditional technologies for filter self-rescuers. And traditional technologies are those that utilize hopcalite for CO, carbon monoxide, removal.

But we also would encourage the introduction of other new technologies for carbon monoxide removal, such as CO oxidation catalysts, to achieve the cleansing of the CO from the ambient air.

The advantages to this type of research would be a greater capacity for protection.

The challenge is that that greater advantage for protection, or that greater extended protection also introduces some challenges. And the challenges are, How do you determine which mode of operation you're in? Okay. If you're in an oxygen-deficient environment, you certainly need to be using the self-contained portion.

If you're in a CO environment where oxygen is present, then you can utilize the filter self-rescuer.

So the challenges are addressing those types of issues; okay, sensing CO, sensing for oxygen, determining when you use it, and, if there are any operations or secondary operations, to switch between the two.

So I think several challenges that certainly warrant the research activity.

A second research topic that is being addressed is what's referred to as a dockable self-rescuer.

And the dockable concept is to utilize both a short- and a long-duration self-contained self-rescuer that could be coupled together to provide extended protection.

The operation in this type of system could either be a chemical based, or a compressed gas based system. So, again, on the chemical side, it could be either KO2 or chlorate system. Compressed gas could be a compressed oxygen system.

The advantages, again, we see the advantage to provide extended protective capacity; okay.

A dockable concept would eliminate the requirement or the need to have multiple donnings of a single self-contained self-rescuer, or CCER. And it could potentially allow for a smaller, lighter system that's belt carried and eventually coupled to a greater capacity unit that is stored.

But those advantages, again, just as in the case of the hybrid system, certainly introduce challenges, and they're not insignificant challenges.

As you can well imagine, the docking operation, to actually connect two self-contained self-rescuers together, would need to be performed in a contaminated environment. So you want to be able to do it in that harsh environment without breaching the breathing circuit.

So we need to be able to maintain the integrity of the breathing circuit when that coupling takes place.

And then, in addition to that, you have the usual concerns in aspects of the reliability of the mechanism and the simplicity of the operation of coupling the devices.

A schematic, a potential schematic for such a dockable system is illustrated on the slide here.

And in this illustration, we are showing a short duration or a ten-minute type of a CCER that is operating on this system that is a closed-circuit system. So the user is exhaling into the unit and inhaling back from the unit.

But typically, a short-duration system may employ what's referred to as a pendulum breathing system, which means it's exhaled through the system, through the chemical generator and into a breathing bag, and then inhaled directly back to the user.

And that type of a short-duration system could then be coupled to a longer duration chemical supply or oxygen supply, I should say, system that is being stored and coupled into the system to perhaps change the breathing loop from that of a pendulum, back and forth, to a loop system, whereby the user is exhaling into the system, through the chemical generator, into a breathing bag; and then on inhalation, through a separate line or a separate channel into the breathing zone.

So our research activities are looking at the concept for dockable self-contained self-rescuers.

The fourth element that we have in the current NIOSH program is to provide training support.

And in these areas, we are collaborating very closely with MSHA, as we always have done, to develop training modules on the inspection, care, and use of self-contained self-rescuers.

And we have taken those modules and further enhanced them to look at the training modules for multiple donnings, so that, as a user is progressing from one point to the other, he may be able to -- or he may be trained on how to go from one SCSR to another.

And then our continuing support with MSHA to pursue live training with self-contained self-rescuers.

So the laboratory at NIOSH is actively engaged with MSHA to try to help and address the training issues relative to these types of respirators.

And the fifth and final component to the NIOSH program is, again, the topic of the meeting today, and that is the development of concepts for closed-circuit escape respirators.

It's interesting to note that this activity was started several years ago. We had, I think, two public meetings in April of 2003.

Since the time of those public meetings, this work has continued at the staff level to prepare the concepts for the process of rule making.

And in view of the incidents of this past year, we have decided to reopen the discussions relative to the conceptual requirements for closed-circuit equipment. And that's the purpose of this meeting today, which we will go into quite a bit of detail on some of those requirements a little bit later.

And with that, what we are going to do is switch to the history presentation.

And at this point, I will ask does anybody have any questions on the information that I just covered?

(No questions from the audience.)

MR. BOORD: Okay. What I would like to do now is cover a little bit and provide a little bit of background into some of the history relative to self-contained self-rescuers as we know them today.

And, as the overhead here illustrates, prior to 1981, in mines, the respirator that was used for escape purposes was the filter self-rescuer, which we talked a little bit about that technology a few moments ago.

And prior to this time frame, prior to 1981, in the mid to late '70s, a lot of the ground building research for use of self-contained self-rescuers was conducted.

A lot of that research was done at the University of -- Penn State University in the physiology department, to really look at the technologies of closed-circuit systems and applying them to escape respirators.

And I say to look at the technologies of closed-circuit systems because those technologies have been used for a lot of years; okay.

The Navy has used closed-circuit systems since the 1930s. The OBA, the oxygen breathing apparatus that was the primary breathing device used onboard ship for firefighting was a closed-circuit chemical-based oxygen breathing apparatus.

In that research period, in the mid to late '70s, the work was really focused and the research was focused on taking those technologies and condensing them down into escape respirators.

And, again, as you might imagine, with that rich background in oxygen breathing devices, the Navy, the U.S. Navy was quite active in developing those escape respirators.

Early developments were for 20-minute and ten-minute escape respirators. And those Navy developments actually led into the concepts for mine escape self-contained self-rescuers, which actually started with the ten-minute and the 60-minute development.

So in the time prior to 1981, the real building blocks of the research for these escape respirators was established.

In 1981, we have the introduction of the first generation of self-contained self-rescuers.

And those respirators were a joint MSHA and NIOSH approval under the requirements of 30 CFR, which eventually evolved into 42 CFR, Part 84.

But the illustration on the side actually depicts the evolution of these types of devices. The filter self-rescuer is the device illustrated on the left. The first generation of closed-circuit self-contained self-rescuer from the early '80s is shown on the right. And then typical second generation unit is in the middle.

So with the introduction of self-contained self-rescuers, in 1983, the long-term field evaluation was started. And that program was actually started by the U.S. Bureau of Mines. And it was started by sampling 50 escape respirators per year.

In 1989, the evolution of the units evolved to the second generation, which is typically shown by the middle unit, second generation SCSRs, which may have been smaller and lighter in weight.

Then following this evolution and the work that was done in the U.S. Bureau of Mines -- which was later absorbed into NIOSH and into NPPTL in 2001.

And during that time, the long-term field evaluation expanded from the original 50 units per year to a 200-unit testing -- testing 200 units per phase.

In 2003, we started the development of concepts for new requirements. As I mentioned, last year, we initiated the workshops within NTTC, collaboration to pursue new technologies. And then, of course, we have the incidents of 2006. We have the MSHA Emergency Temporary Standard, the Miner Act, and the activities relative to the research.

Down through the years, the typical lessons that we have learned is that in a mine incident, a mine tragedy, or even a tragedy onboard ship, escape is the primary survival mode. And in some cases, what we have learned is that perhaps one self-contained self-rescuer -- more than one self-contained self-rescuer is needed for escape. And this theme really introduces the aspect of capacity versus duration.

Under the current requirements for certifying self-contained self-rescuers, we are identifying and using a time rated performance standard. So it's a 60-minute certified self-contained self-rescuer.

What we're really after is the capacity and the ability to provide life support, oxygen and CO_2 elimination to the user.

And we also know that from physiological studies, that the actual capacity that a person needs, the actual breathing and life support that a person needs is dependent upon the person, dependent upon the person's size, their age, their physical fitness, and also their familiarity and comfort in using the piece of equipment.

And we certainly know that escape, escape in a mine situation, or escape in most situations, is not an easy scenario; okay. You can certainly expect the escapee to encounter obstacles and have to travel rough distances, steps, and other hazards.

Currently, the NIOSH approved array of self-contained self-rescuer is illustrated on this slide. And we have the Ocenco 60-minute unit. We have a Draeger 60-minute unit, a CSE 60-minute, and a Mine Safety, MSA, 60-minute unit that are NIOSH certified as second generation, so to speak, self-contained self-rescuers. And we also have a ten-minute Ocenco NIOSH approved self-contained self-rescuer.

Typical components for a self-contained self-rescuer are as illustrated here.

We talked a lot about the oxygen storage, so you need a container to supply that oxygen. Typically, the system will utilize a breathing hose with a mouthpiece for the interface with the user, and a nose clip and goggles for further protection, a breathing bag or a mode -- a system of compliance for breathing that acts as a compliant reservoir for storage of the breathing gas.

As we have already said, typically, the systems are either chemical based or compressed oxygen. From a chemical-based point of view, we have potassium superoxides. We have CO2 removal, using either, in the same chemical, KO2, potassium superoxide, or chemical-based systems may utilize a chlorate oxygen generator and a separate chemical for removal of CO_2.

Compressed gas systems are typically compressed oxygen with a chemical-based lithium hydroxide scrubber for eliminating the CO_2.

Again, typical schematics for self-contained self-rescuer are illustrated here. The one on the left would illustrate a chemical-based, or a KO_2 system, whereby the KO_2 is both generating the oxygen and eliminating the CO_2.

And this schematic illustrates a loop system, so exhale through the system, through the chemical, into the compliant breathing bag and back to the user.

The system on the right is schematically very similar. It utilizes a chemical lithium hydroxide scrubber and a compressed gas, compressed oxygen system to supply replenished oxygen to the breathing circuit.

Down through the years, the work that has been done on self-contained self-rescuers and closed-circuit escape respirators certainly has been done in cooperation with the many stakeholders that are represented in the room today, and others, as illustrated here, the BCOA, NMA, United Mine Workers Association, United Steelworkers, the U.S. Navy, and certainly the manufacturers of this type of equipment.

It's also worthy to note that the co-approver on closed-circuit escape respirators for mining applications is MSHA.

So the long-term field evaluation program that is currently used by the laboratory to evaluate closed-circuit equipment, as I said, was actually established more than 20 years ago. And this illustration shows and identifies that history of work that has been done and the publications that have resulted.

And you can see that the 19 -- in 2002 was for Phase 7. And we currently have the Phase 8 and Phase 9 work, which is in the preparation stages.

So what types of things have we traditionally seen in the long-term field evaluation program, and what is that evolution? I think this slide kind of summarizes that for perhaps the first generation of this type of equipment.

And if you just go around clockwise, starting here, we have experiences with primarily mechanical integrity of the components when they're subjected to the daily rigors of a mine environment. On the right-hand side, we have seen issues relative to the materials and aging the materials that are used in the design and fabrication of the devices.

On the left here, we have experienced issues of chemical bed degradation. So when subjected to the rigors of daily carrying and the ruggedness of the user applications, we have seen and experienced chemical -- degradation, the chemical breaking down and creating powder.

And then lastly, we have seen and experienced situations of chemical migration into the breathing circuit.

The designs of the chemical-based systems are to contain the chemicals so that they don't get into the breathing circuit that the breathing gas passes through. But on the inhalation side, that they are -- typically the chemicals are prevented from being inhaled. And we have seen situations where the chemical does migrate to the inhalation side.

In the second generation of self-contained self-rescuers, we have seen issues and problems, again, relative to breathing hose materials and aging and degradation of those elastimers.

We have seen, again, mechanical integrity type exposures. The second unit is a unit that has actually been pried open from the daily rigors of use. And when a unit is -- a chemical-based unit is open like that, that actually breaches the system. It's stored to prevent it from ambient air and moisture getting in because moisture is one of the reactants utilized with chemicals. So an open unit like that should be removed from service.

We also have an illustration of mechanical stresses that have been experienced as evidenced by a dent in one of the canisters on a closed-circuit self-contained unit. And again, chemical migration into other areas of the breathing circuit.

And finally, an example of the potential rough handling that these types of devices can be subjected to and should be removed from service.

Also, as part of this evolution of investigation, we have seen new technologies introduced into the self-contained self-rescuers.

Some of those are indicators, high temperature indicators, to indicate when a unit has been stored in an area greater than what it's designed for, or testing devices that are utilized to determine fill level tests to look for bed degradation, degradation of that chemical. And we have several different devices that are utilized for those types of inspections.

The conclusions, are from the long-term field evaluation and the history of that program, is that the SCSRs that pass the inspection criteria, the field level inspection criteria, should provide for safe life support.

And that typically that there is some performance degradation observed through all the different types of SCSRs.

Again, the objective that we have for the long-term field evaluation program is to compare the performance of deployed SCSRs to new self-contained self-rescuers.

The method that's currently used is a collection at the mine or a collection at the site with a field level inspection that is brought back to the laboratory. The units that are brought in for testing are replaced with new units.

In the laboratory, they are again inspected according to the criteria appropriate for the specific SCSR, and the long-term field evaluation test is performed. And those activities are culminated in a report that summarizes the investigations.

The long-term field evaluation testing, as I say, it's a laboratory testing program that has two components to it. The first is a metabolic simulator, which basically simulates the metabolic activity of a human being relative to oxygen consumption and CO2 generation.

So a metabolic simulator and a human subject test on a treadmill.

And typically, the parameters for conducting the test are as illustrated in the tabulation, which basically is an oxygen consumption rate of 1.35 liters per minute and a CO2 production rate of 1.15 liters per minute.

Now, I won't go into the details on the rest of this, but that information is available to you. And those are the parameters that we use for the LTFE, which are distinctly different from the testing that's utilized today to certify an apparatus.

The NIOSH certification today, to establish a 30-minute, a ten-minute, or a 60-minute respirator, is Man Test No. 4. So it's actually done using a human test subject.

And the test subject goes through a process and a series of different exercises. Some of those may be walking on a treadmill. Others may be encountering and negotiating an overpass carrying a 50-pound sack. So it's those levels of activities that are used today to establish a certified unit at a specific duration.

The complex illustration that you're looking at now is -- I think will actually be useful to you when we get into some of the discussions on the concepts a little bit later.

But what this illustration does is it makes a comparison of the current Man Test No. 4 and the oxygen requirement and the CO2 of -- the physiological oxygen and CO2 requirements for a human being.

And if you look at the axes here, you basically have zero here, time based along the horizontal axis, up to 60 minutes. And this is typical of a Man Test No. 4 for a 60-minute duration.

And here, along this axis, we have percentage numbers. And those can be either oxygen percentage, the oxygen consumption that the user requires, or the CO2 elimination in percentage.

So we have -- the scale here ranges from zero to three. And then as you progress along the line of activities for 60 minutes, you have different activities that are illustrated.

Starting out, when you begin any of the Man Test No. 4 series, it starts with a rest period. And that rest period is basically used to connect the person to the test sampling mechanisms and to obtain an initial reading of the oxygen and CO2 properties of the respirator. So it typically starts with a stand period.

Now, important to note here is that this activity is in the range of an oxygen consumption of about .35 to .5 liters per minute. So when you're standing or sitting in your chair, that's typically the oxygen consumption rate that you're experiencing, and that's illustrated on the graph.

In Man Test No. 4, the first level of activity that the person goes into is actually a walk on a treadmill.

So right at this point, the person starts to walk, and the oxygen consumption rate increases and continues to increase throughout the walking exercise, and transitions into the second exercise, which is climbing a laddermill.

So you actually see the oxygen, physiological oxygen requirement for a user going through this series of exercises for Man Test No. 4.

As I say, walking. And you will find, throughout the course of that test, you will find several time periods where the test subject is standing still for the sampling capability, or walking on a treadmill, climbing the ladder, pulling weights, or climbing over the overpass. So you see those generation of oxygen requirements.

The CO_2 elimination requirements, or the CO_2 production requirements for the user, are also illustrated in the yellow. So the green illustration is oxygen requirements. The yellow is the CO_2 production.

Now, again, it's important to note, because I think in the later discussions this will be more meaningful, the maximum up here is 3.0 liters per minute.

So typically, when that person goes through the laddermill, they have -- they're at about 2.6 to 2.7 liters per minute oxygen requirement.

So this is Man Test No. 4.

The green line imposed on the chart here is the constant metabolic simulator load that's used in the long-term field evaluation.

So when we use the machine today under long-term field evaluation, we're not subjecting it to the dynamics of different activities, but we're constantly stressing it at a given rate of 1.35 liters per minute.

It's a complex chart, but I think those numbers may become more interesting with the later discussions.

So the purpose of the long-term field evaluation is to obtain data to compare the performance of deployed SCSRs. Again, evaluations are based on experimental protocols and not the certification protocols. We're using a metabolic simulator at a constant utilization rate versus the Man Test No. 4 activities.

The process that's used, typically, in the long-term field evaluation is -- today, is a process -- what we refer to as a process of discovery.

The units are retrieved from the field, without a real systematic way to do it. It's not a controlled sampling process. Problems during the testing are discovered, and problems are addressed through the certified product investigation process.

And, again, we're comparing new to field-deployed SCSRs. And that program has resulted in the introduction of practical new improvements to self-contained self-rescuers, and have also fit into the concept requirements that we're going to be discussing today.

So, again, the results, the test results alone cannot be used as a predictor of successful escape from a mine or a successful escape from any environment.

So it really comes down to reliability. Reliability is, Will the SCSR work; has it been handled properly; and how old it is? Is it within it's service life requirements? Are the SCSRs properly being inspected and removed from service when certain degrees of damage are experienced by the equipment? And are the people that are checking the units on a daily basis being properly trained in how to do that?

Some of the actions that we have resulting from long-term field evaluation that we think are prudent to carry forward are certainly an inspection of all field deployed self-contained self-rescuers.

In the concepts that we discuss today, we're going to talk about registration, concept for registration of closed-circuit escape respirators; training, training relative to multiple donnings, and training with live apparatus.

It's really important to be able to experience what it's like to wear a closed-circuit escape respirator and have to do a physically stressful activity.

And then going forward, the expanded scope of the long-term field evaluation, to link it to the other auditing activities within NIOSH for product investigations for manufacturing site audits and also to have timely outcomes in an annual report.

With that, I will at this point, before we get into the technical discussions, ask if there are any questions on that information?

(No questions from the audience.)

MR. BOORD: Okay. I think there are no questions.

I think what we will do is we will start right in with the technical discussions. And we will go for approximately 30 to 45 minutes, and then we will take a break. And then we will come back and revisit the balance of those discussions.

Tim Rehak and Bob Stein will discuss the technical requirements.

And Tim will lead off.

MR. REHAK: Good morning. My name is Tim Rehak.

And along with Bob Stein, we will go through our proposed concepts for certifying closed-circuit escape respirators.

As Les mentioned earlier, one disclaimer that we have to say is these concepts are being presented for discussion purposes only and do not represent any final determination or policy of the agency.

Even though we're proposing new concept standards for closed-circuit, the following sections of 42 CFR, Part 84 will still apply to the certification. These are all of Subpart A through E, which covers the general provisions through quality control, along with all of Subpart G, the general construction and performance requirements, and also paragraphs 84.50, 51, and 52, Subpart F.

Okay. The concepts -- included in your packet information, you have our proposed concept requirements for the certification. These are all of the different sections that are covered in the paper.

I would just like to point out the highlighted areas where we feel -- the major differences between the new proposed standards and the existing regulations.

They cover capacity tests. Here, we're going to be rating the CCERs by volume of oxygen versus duration, along with performance tests. Environmental treatments are going to be mandated now just to ensure the closed-circuit apparatus are rugged and durable, along with post-certification testing and voluntary registration.

MR. BOORD: Yeah. I think what we -- it seems like this would be an appropriate time to take a break. And I apologize for going into the presentation, but it seemed like a lot of folks are ready for a break.

So let's take a break and be back -- we will resume at 10:20 and get into some of those technical discussions.

Thank you.

(A recess was taken.)

MR. BOORD: Okay. If we can take your seats, and we will resume.

MR. STEIN: For those of you who don't know me, my name is Bob Stein.

I work at NPPTL with Les and Tim and the others doing the presentation today. And I want to take this opportunity to thank everyone for being here and allowing us to present these technical concepts to you. And, you know, we want to open this up for discussion to -- as much as necessary if there's any doubt or misunderstanding about what's being presented throughout the slides.

This gets more into the meat, if you will, of the proposed changes to the technical requirements for closed-circuit escape respirators.

And we will throw this slide up here again simply for illustrative purposes and to kind of bring forth, again, that what is being proposed to be changed are only those technical requirements that would apply to closed-circuit escape respirators.

Again, to go back over -- and Les gave a very thorough explanation of how this fits into the overall scheme. But currently, in 42 CFR, Part 84, Subpart H contains the technical requirements for all self-contained breathing apparatus, the four different categories that have been pointed out in this graphic, that being closed-circuit and open-circuit technologies, whether they would be used for entry and escape or escape only. Everything is covered there.

Under what is being proposed, the technical requirements for only closed-circuit escape would be extracted from that section. So in other words, any of the other types of self-contained breathing apparatus would still be evaluated under the existing Subpart H requirements.

However, if it's a closed-circuit escape apparatus, this is where we want to start down the path of evaluating them according to what is being proposed and what you will see here today. So hopefully, that's clear.

SCSRs kind of hang in there because, while they could be either an open-circuit or a closed-circuit device, as we know them and as they're called in places where they're used, they generally fit into the category of being closed-circuit devices.

So if those -- as we move forward, if what's in the proposal would stand and go forward as it is, if tomorrow somebody wanted to evaluate an open-circuit escape respirator, it would still be evaluated under the existing requirements, closed-circuit escape, and the new requirements. And I don't mean tomorrow literally. I mean that figuratively. Let's move on a little bit.

This actually has occurred over a rather long period of time because one of the biggest challenges in evaluating any kind of closed-circuit respirator, be it for escape or entry, is the mechanism for evaluation.

Historically, how do we do this? We do this with human subjects. And the reason being that it's very difficult to have any other method to simulate those activities or those functions that the person applies to the respirator in use because the person challenges the respirator by extracting oxygen from it, by emitting carbon dioxide that needs to be taken care of, and all the ventilation things that are going on -- and I'm sorry it's not more technical than that -- all the ventilation requirements that are going on as that physiology is occurring.

So how is it that we provide for this for human subjects. And human subjects are -- have been measured, evaluated in many different ways over the years so that the physiological demands are somewhat well known. But the challenge, again, is, you know, how do we do this and take the human subject out of the equation.

Because there is variability in human subjects. You know, when you bring somebody in for testing, you don't know what their body weight is going to be, necessarily, whether -- you know, many other individual attributes of that human subject.

And at least in part, we would like to be able to replace the human subject with some type of measurement technology that is indifferent. And that is where breathing and metabolic simulators come into place.

And when we talk about research, this is quite a long research effort at evaluating breathing and metabolic simulator functioning, performance, and so forth. Because when you use the two things together, when you use the respirator and the simulator together, it's difficult to extract one or the other from that equation. It takes a lot of work to get down to the point where you have confidence in the simulator technology so that you know that part remains constant.

A lot of this work is going on, and you heard Les's part of the presentation in terms of long-term field evaluation.

Over the years, this has been part of the evaluation of using simulator technology to, you know, evaluate the respirators that come back after they're being sampled, of applying some loading to them in order to take a look at their performance.

In terms of the certification, again, currently, human subjects are used to evaluate the apparatus. This is part of what we would like to replace.

Not entirely. You will see, as the presentation goes on, there are aspects of certification that we still feel we will get the bast value or the best knowledge out of relying on human subjects, in terms of the interface with the respirator, in terms of some other aspects that a simulator just won't be able to evaluate.

We also believe that this will lend aid to the certified product investigation program where we're trying to make those pre- and post-evaluations of respirators.

This provides the opportunity, the ability, to make that pre- and post-evaluation under more or less the exact same conditions, something that's not too -- you know, it's a little dicey with human subjects sometimes, trying to make that post-evaluation in the very same method by which the pre-evaluation was made at the time of certification.

I want to stress, even though this slide has attributes named, it has components named, it has instructions named, these are very specific things that would be proposed in the new requirements. Not all of them exactly new. Some of them done currently through policy, but that it's proposed that they would be called out specifically in the requirements.

These are the things that you might refer to as design oriented, if you will. There's no attempt under the proposed requirements to constrain design. We're indifferent to that. And they're being proposed as performance requirements. This is what we want to see. This is what we want to evaluate. How well does it work, not to demand that it has to look this way or that way.

However, there are some aspects of it that need to be called out, we feel, in terms of when we see a new design, something to be evaluated. We will be looking for, will be requiring nondestructive test methods where appropriate.

You heard it mentioned this morning about the integrity of the chemical scrubber bed or the chemical oxygen supply bed where that is pertinent to the performance of the apparatus, as it is currently.

Of course, we don't know what kinds of designs we may see in the future. But where that is pertinent to the performance, we want to see nondestructive test techniques supplied so that you could evaluate units in the field in a nondestructive manner, self-contained self-rescuers, closed-circuit escape apparatus.

Because they are escape apparatus and because of the complexity of them, they're provided to the users in sealed containers.

Many of you, I know, are aware of this, but for those who may not be, because you cannot inspect the internal components of them prior to use time, if the chemical bed is an issue, we want to be able to take a look at that in some manner to know that it's still the way it was when the unit was made.

And to this end, because they are sealed devices, tamper resistent or tamper evident casing so that, as the unit is supplied to the user, if it is inadvertently opened, if it is opened for any other reason besides deployment and use, that needs to be evident to the user so they can take those respirators out of any place where they're going to be relied upon for an escape.

We want to know ahead of time if somehow that respirator has been violated.

In terms of its internal components, this could be a very innocent thing where sometimes, you know, if a respirator has been opened, you may find the components are even missing out of the inside of it, and we would want this be to evident to the user prior to them needing it for escape.

Eye protection. In the form of goggles, some other way to protect the eyes. In most cases where you would have escape from nonbreathable atmospheres -- I shouldn't even say most. However, it's quite conceivable in a large majority of them that you would have things that would be irritating to the eyes.

And there are eye protection included in many of them. It's not required in the current standard. And this is proposed that this would be required, that eye protection would be included because it's a necessary thing to be able to escape, that you be able to protect the eyes, which is an alternate source of entry for chemical contamination. And maybe even more importantly, for the users' comfort.

We realize that, not in all cases, that they may not be in situations where they can even see if they have goggles on. However, it would be less of a burden having to do so with your eyes not watering or being irritated by the other things that might be present. So this is something that's proposed as being required.

Attributes. Certainly, the -- and Tim spoke of this earlier, the general construction requirements that are an existing standard, that are in 42 CFR, Part 84, will still stand, that the units must exhibit good construction. Also, that they must not constitute a hazard as they're being placed in different environments where they might come in contact with organic combustibles, so forth. We don't want to see them impose an additional hazard that's not already there.

And this has been evaluated -- and you will see later in the presentation specifically what we're talking about -- you know, bringing oxygen into the presence of fuel sources.

Instructions. Again, this is currently covered and they're -- all the units have instructions.

However, it's proposed that it be spelled out, that the instructions include certain aspects of cautions, limitations of how the unit is to be inspected, which all have a bearing on the service life of the unit. And also about training for use and so forth, that this would be spelled out and be required under the standard.

This is really the biggest technical change that's being proposed. It's the use of breathing and metabolic simulators to evaluate the breathing apparatus, replacing the human subject in the equation, making this machine the yardstick rather than a human subject.

So how do we go about doing this?

And we had that slide that Les talked about earlier that shows the oxygen demand and the CO_2 production characteristics of a human subject in performing Man Test 4 as opposed to what a constant work rate test looked like.

You had on there a highly varying line, many ups and downs, and also the very flat line that's that constant demand rate.

And it's felt that a constant demand rate test will be used for the evaluation of the capacity of the device.

The concept of now measuring these in terms of the oxygen that's included rather than the duration, this is a kind of continuing source of confusion for a lot of applications, is when we select a device, what is it that we're really concerned about in terms of how it's protecting the individual?

And it's felt that it would be better to offer this in terms of capacity rather than duration.

The duration is going to vary according to what the subject, what the escaping person is going to do during the escape.

So it could always be different than what is evaluated in the laboratory.

It's evaluated under fixed and known

conditions in a laboratory. However, in the real world, when people use it, they could be using it at a higher demand rate or a lower demand rate, which could result in a different duration.

So by banding them in terms of capacity, it's felt that in the deployment strategies, where they're used, that that eye towards knowing how much oxygen is going to be provided will be better applied ahead of time rather than by getting the notion out to people that, Well, it's a fixed amount of time. And then for no apparatus is it ever exactly a fixed amount of time.

You also see the concept of performance testing being included. I guess I didn't need to point that out.

Performance testing will be a variable work rate test in order to put the apparatus through its paces, challenge it at different work rates because we know that escapes, whatever would be done with it in a real world, will not always place a constant value stressor on the unit. It's going to vary.

And so we want to know that the unit can perform over a range of consumption rates, work rates, and so forth, as well as it can over a constant work rate.

So by evaluating it in these two methods, using both the breathing and metabolic simulator and repeating it using human test subjects, that it will give the best snapshot, the best evaluation picture of what that respirator is capable of doing.

In addition to backing up the evaluations done by the simulator, there are also aspects of interface between the unit and the person that can be assessed no other way than to actually try it on a person.

So you see, where under human subject tests we get these additional benefits of evaluating them for, when we say qualitative evaluations, how well does it present itself to the user?

Does the user find it easy to don, easy to wear, and so forth. Things like the neck strap, if it was too narrow, you tested that on a machine; the machine is not going to complain about the pressure that the neck strap is putting on their neck. Human subjects can denote that while they're putting it through its paces, and say, This is very uncomfortable, those kinds of things.

So where it says qualitative evaluations, that's exactly the kind of feedback you get from human subjects that you wouldn't get from a simulator.

Similarly, under wearability because, when you're using one of these respirators, you're not always walking in an upright manner. You might be crawling. You might be climbing a ladder. You might have to bend over. You might have to do a lot of things.

And we would want to be able to evaluate the use on a human subject in different postures and attitudes to assure that the design of the respirator accommodates actual people wearing the device, that they wouldn't encounter situations in which the respirator would perform poorly simply because in a breathing metabolic simulator test where it never moves around, you wouldn't see that.

In the wearability test that's proposed, this is where this would come out.

These kind of things are currently assessed in 42 CFR, 84, because there are human subject tests specified for all of these evaluations. And we want to be able to maintain and perpetuate those good aspects of human subject testing in the new testing routine and what's being proposed.

Getting on to a little more specific application. During the capacity tests, these are proposed as the acceptable stressor ranges.

The current human subject testing evaluates the devices during rest periods. And why does it do this?

Because you can't very effectively have some kind of continuous monitoring to follow the subject around the room through all the exercises that are spelled out in 42 CFR, 84, in the Man Test tables.

In the new testing regime, the devices will be evaluated continuously during use, whether on a simulator or whether on a person.

And being that you're able to monitor in the different fashions, different stressor levels are proposed because you will see more in the way of excursions and high work rates at various times during the use of the apparatus.

So the far right column, if you will, on this table, proposes excursion limits in a kind of short-term range.

To say that it would be acceptable to allow the average inhaled concentration of carbon dioxide to be as high as 4 percent, the average inhaled concentration of oxygen to be as low as 15 percent, peak breathing pressures to be within that range of minus 300 millimeters water gauge up to 200 millimeters water gauge on the exhalation, or positive side, and wet-bulb temperatures as high as 50 decrees C. Okay.

Now, it's not expected, however, that acceptable devices would hover at this range during their entire working duration.

So since we're able to monitor

continuously -- and I need to mention, too, that the way it's proposed, it would be one-minute averages throughout the course of the test. These would be the values selected to compare against what's in the far right-hand column.

And, however, you're also able to develop an average over the course of the entire test, and those averages would be compared against the values, as you see in the center column, where it would be necessary to keep the average inhaled carbon dioxide below one and a half percent, the average inhaled oxygen above 19 and a half percent, peak breathing pressures in the entire swing to be within 200 millimeters water gauge, and wet-bulb temperatures not to exceed 43 degrees C over the average of the entire test.

Because, you know, it would be conceivable, since this is technology driven, that somebody could possibly design an apparatus to stay in that far right column. That's not what's desired. It's desired that it would stay more or less like in what that center column is, allowing, however, excursions to occur, knowing that at the higher breathing rates, when you approach something like 3 liters a minute oxygen uptake, that you might hit some of those excursion ranges.

Previously, since it's not monitored during those ranges of work, those periods of work aren't evaluated, but they would be under the proposed tests.

And of course, I need to stress again, these are the proposed stressor limits. This is what's up for comment and whatever feedback that we would get on this proposed testing and evaluation standard.

Okay. Moving on.

The capacity tests. This might be backpeddling just a little bit. I have already talked about the capacity being measured in terms of a constant work rate test over the -- whatever capacity of oxygen, of life support is being provided in the apparatus, being evaluated primarily with the breathing and metabolic simulator in an as-received condition. So when we would get units in for evaluation, some of them would be evaluated as new; some of them would be evaluated after a series of environmental treatments.

This is also something that's newly proposed in this concept is that these environmental conditioning treatments would be applied to a certain number of the devices, and they would be tested on the breathing and metabolic simulator after being exposed to them.

Not so for the human subject on a treadmill. Those would be also as-received units. After passing the first round of breathing and metabolic simulator tests, it is conceived or proposed that they would also be evaluated on human subjects in a way that very much mimics what's being done on the breathing and metabolic simulator.

Where it's a constant work rate, the human subject would be imposing a constant work rate on the apparatus. Where it's proposed as the performance test, a variable work rate, a human subject would also be mimicking that same thing on a treadmill.

The last bullet on there has been added. This is where we get tied in a little bit, and it was mentioned earlier on about MSHA being co-approvers on these types of apparatus.

And we do have one issue where SCSRs are called for in another regulation. That, of course, being 30 CFR, 11, which calls them SCSRs.

And it comes up to an issue, if what's being proposed, is it at least as protective as what was available in the past? Where a one-hour SCSR was called for in the requirements, how do you assure that a Capacity 3, which is supposed to be a one-hour apparatus, in some way of thinking about it, would provide at least that much protection.

So for those units that would be so approved or to go underground to satisfy those 30 CFR requirements, it is proposed that two of those units be evaluated against the existing Man Test 4 requirements as they are in the current 42 CFR, 84.

So that adds another element of evaluation only in those apparatus that are intended to satisfy 30 CFR, 11, requirements.

Closed-circuit escape apparatus, as it has been mentioned earlier, are used in a variety of settings. This isn't the only setting they're used in. And for other settings, that's not seen as a requirement. It's not an issue of how they would be satisfying another, say, like OSHA standard or so forth.

Okay. Moving along.

Looking graphically, now, at capacity test concepts. This is a constant work rate test, but depending on the capacity of the apparatus, it would be -- it is proposed, that the demand placed on the apparatus be somewhat higher for lower capacity devices than it is for higher capacity devices.

And those might seem counterintuitive at first. But when you actually look at the physiological demands that can be placed on an apparatus, what you find is, for a short duration kind of escape, if a unit is, say, in that first range, in the Capacity 1 range, is given to a user, it should be planned at that escape or that activity is going to be of a shorter duration.

A person can sustain a higher work rate over a shorter duration, over -- the average over whatever that duration is or that capacity of oxygen, as it's proposed here, than what they can for a longer period of time.

So it is proposed that those containing, say, between 30 liters of oxygen and about 60 liters of oxygen would be stressed at two and a half liters a minute average uptake rate over their capacity.

And what this also does, though, is it stresses the scrubbing capacity of the device at a higher level. And also the ventilation is at a higher rate, so it would be revealed as to whether that higher ventilation rate that could be sustained over that shorter duration of time may make a difference in the breathing pressures that are seen.

Higher ventilation, typically, will elicit higher resistances, and, also, the respiratory frequency being higher.

This steps down as you go up through the capacity. As we approach the band that's like approximately 60 to 80 liters, it steps down to around 2 liters a minute average with a 1.8 liter a minute CO2 output, 44 Ve, 20 respirations per minute.

And then when we move on up to something that looks more like a current one-hour apparatus, the Cap 3, something that would contain at least 80 liters of oxygen.

Looking at the existing average work rates that are used, again, going back to that evaluation -- that slide that illustrated the current Man Test 4 as opposed to the constant work rate evaluation that has been investigated for a long time.

That 1.35 liter a minute oxygen uptake rate is what is proposed. And also the CO2 production rate is now down to 1.15 liters per minute, 30 Ve, and 18 breaths per minute.

Again, the idea is that over a longer period of time, a person cannot sustain as high a work rate as they can during a shorter duration.

Okay. I'm going to move on.

Performance tests. Now we move into the

other realm. Once we have established a capacity for the device, according to the proposed tests that we have discussed about previously, now, we go into a variable work rate test to put the unit through its paces.

Not all escapes, not all of whatever is going to be done with it, obviously, is going to be done at a constant work rate.

Again, we're sticking with it will be continuously monitored. They will be done on a breathing and metabolic simulator in an as-received condition. They will be done on a breathing and metabolic simulator after environmental treatments. And they will also be done by human subjects on a treadmill, where the human subject will be going through their paces on the treadmill to elicit the same kinds of work rates that are proposed for the performance test on a simulator.

And this hopefully will help to illustrate what I'm talking about.

It's proposed that the performance test would look something like this.

We would have -- start off with a high demand, a peak demand work rate for the first five minutes where it would be required that the unit would be able to provide three liters of oxygen per minute of use, CO_2 production rather high, 3.2 liters per minute, and a high ventilation rate of 65 liters per minute, high respiratory frequency of 25. Okay.

If you recall looking at the prior Man Test 4 diagram, and that was very -- did illustrate very well, like what the current test does, is when you first don the apparatus, when you're fresh, you put it through rather demanding paces, taking it up to as high as three liters a minute oxygen uptake.

You know, this is something that could be expected from a person. This is something that ought to be expected from the unit in terms of what is proposed here for testing.

After going through this for five minutes, the next portion or band of the test steps down to where the demand is lowered to two liters a minute of the O_2, 1.8 liters a minute CO_2 production or scrubbing capacity, a Ve of 44, and a respiratory frequency of 20, and this being sustained for 15 minutes.

And then at the tail of the test, taken down to a ten-minute stretch at half a liter a minute, which is nearly sedentary. It's a very low work rate, something that maybe, after going through that first part, a person may even want to sit down, something like that, and we want to see that it continues to work.

And it's not so much about -- really, I want to stress, it's not so much about what a person could do. It's what the apparatus can do.

Because by jacking it up to a very high work rate and then tapering it off very quickly like this, it says something about the efficiency of the apparatus. Is it going to dump a lot of oxygen overboard? Is it going to be wasteful of the consumables that is has? But can it sustain life at those levels? Because it's not an unreasonable scenario in terms of what a person can do.

Graphically, it looks simply like this.

It's stepping down, very simple thing. The person can mimic this on a treadmill, where you're at a high speed, maybe a combination of high speed on somewhat of an elevated incline on the treadmill, then relaxing that somewhat, and then, at the end, relaxing it even more.

If the device would contain more than this much oxygen, what's being taken up. And I think it's 30 -- no. I shouldn't say because I have lost it off the top of my head.

The oxygen is consumed during the cycle. If the device contains more oxygen than that, it would simply be repeated. You know, it would be taken back up to the high work rate again and stepped down through it, until the device is completely exhausted. And those same kinds of stressors would be monitored during the whole course of the evaluation.

Okay. Those are all the things that are proposed for the simulator, proposed for human subjects to mimic what the simulator is doing. And now we're getting more over into the kind of qualitative evaluations and looking at what is being proposed as a wearability test.

Currently, in 42 CFR, 84, Man Test 3 puts the unit through a lot of different orientations on a human subject.

It's possible that a person would have to crawl. It's possible that a person might even have to lay down, you know, for whatever reason, they get exhausted; they need to lay down for a bit.

The current Man Test 3 evaluates the apparatus in those different orientations.

Is something going to happen to it during that time that's going to cause it to lose its gas supply? Many other aspects of performance, along with the human interface. Can the person accommodate the device? Can the device accommodate the person?

And in order to retain those kinds of evaluations, it would be proposed that this test is there, specifically there to ensure, first, that it can be easily and quickly donned, again, a human interface kind of thing.

Is it laid out and presented to the user in a way that they can readily don the device to ensure that, during any reasonably anticipated activity -- and we feel that all these activities could reasonably be anticipated -- is it going to perform, that it wouldn't physically harm the user, significantly hinder them, and that it would continue to provide an adequate and uninterrupted supply of breathing gas, that's as well as scrubbing capacity, too.

And those are the kinds of activities that would be proposed for that wearability test, for just a brief duration, just to put it through its paces and assure that it can continue to maintain life support in all those different kinds of attitudes and orientations.

Now we get down to talking a little bit more about what these environmental treatments would like look.

Essentially, this is an opportunity to expose the device to some environmental extremes, and then -- with the idea that it's going to be tested afterwards to make sure that that evaluation more or less matches the as-received evaluation.

So there will be some -- there will be some tested pretreatment as well as post treatment.

What do these treatments consist of? Extreme temperatures. The unit is heated and held at a high temperature for a duration of 16 hours.

It is also proposed that it would undergo a cold soak during that time.

Oh, I'm sorry. I got the times wrong. It's 48 hours at the high temperature, 16 hours at the low temperature.

Physical shock in terms of dropping the unit, one meter on each axis. One meter is about belt height.

Vibration. In the vibration scenario that is proposed, it's something that's along the lines of what's in MIL Spec 810.

MIL Spec 810 talks about -- or is meant to evaluate equipment that would be sent over the road in various types of vehicles. The type of vibration spectra that's selected for these tests is more akin to tracked vehicles.

Mining does represent some of the most severe challenges in terms of vibration spectra that are seen in any of the applications for CCERs.

And so this is felt to be appropriate for all CCERs, that they would be exposed to these kinds of environmental challenges and then tested afterwards to assure that they continue to meet the same kinds of performance requirements, performance levels that were established in the as-received tests.

Additional testing, these things are not -- well, some of them are new. And they have been done before on apparatus, but this is proposed as a way to codify these tests in places where they're applicable.

In the early '80s, when SCSRs, as we know them, CCERs were first placed into mining use, the question did occur, What happens when you have this oxygen source in proximity to fuel sources essentially everywhere. Everywhere you put them in a mine, they're going to be in close proximity to enormous quantities of fuel.

You know, what kind of things might we expect?

And so all of the first generation technology that you saw in the history presentation, some of the larger apparatus, as well as the new ones, were within these bounds of approximately 200 liters of oxygen, whether that's stored chemically, whether that's stored as a compressed gas, storage temperatures not exceeding roughly 3,000 PSI.

And this is in the Bureau of Mines days.

These devices were subjected to a range of testing and evluation to essentially, you know, let's promote this and see what happens when they're severely abused in the presence and proximity of fuel sources.

And in the photograph at the top, and I want to point out, in that area right in there, you see a little bit of an orange fireball.

This is being run through a feeder breaker, where the unit is being struck by a pick and broken open in such a way that the oxygen containing chemical or compressed gas or whatever is directly exposed to the fuel in the presence of an energy source that would be great enough to cause an ignition.

And indeed, you can cause an ignition. But what was found during the testing is that the ignitions are relatively a self-limiting event, that they don't get out of hand, that they can be contained by the application of water, rock dust, commonly available materials.

And historically, these things have happened. And there has never been a report of one that was unmanageable. And the kinds of things that happen are the kinds of things that were tested and evaluated for.

During the series of tests, not only were they run through feeder breakers, they were run over by tracked vehicles in the present of coal dust, and we have had reports from the field of such a thing happening.

I'm trying to think what else.

Even subjected to gunfire during our

tests. Fortunately, I can report, I don't recall an incident where any of them have been subjected to gunfire.

But it was during these evaluations where the oxygen containers were struck directly by a high velocity projectile to see what kinds of things would happen, and no untoward incidents.

Obviously, the apparatus is completely ruined. You know, the container is completely violated in those cases, but they don't present an additional hazard of any type, nothing that can't be contained.

So these would be proposed.

In any cases where the capacity of the device exceeds those kinds of levels, if it's going to contain more than 200 liters of oxygen, if technology comes in that says, We're going to provide gaseous oxygen, but at a storage pressure greater than 3,000 PSI, these kinds of evaluations would be repeated on those devices to evaluate them and assure that you didn't get untoward events with the new higher capacity technologies.

So within bounds, they -- many devices were tested. It's working. Their operational principal that those devices would be acceptable according to the fact that they don't contain more oxygen than that or that they don't present a greater ignition or explosion hazard.

If you get outside of those bounds, it's proposed that those evaluations would be repeated.

Also, excuse me, because we're talking about including eye protection as a requirement within these proposed standards, we're talking about also evaluating them, that it won't be sufficient simply to provide eye protection, but that they will need to meet these requirements for dust impermeability, gas impermeability, have some expectations of durability and also fogging.

However, we're relying there on standards that are established elsewhere, either ISO or EN standards.

So they wouldn't be unfamiliar to many of the manufacturers, perhaps not any of them, you know, where they have had goggles or some other type of protective eyewear already subjected to those types of challenges that are proposed here.

Post certification testing. You heard it discussed this morning in terms of what we commonly refer to as, perhaps, long-term field evaluation, which has been exploratory in nature.

It's proposed now, as a condition or requirement certification, that designs would be evaluated in the field as a matter of continuing compliance with the respirator standard.

So the idea would be very similar to what you have seen proposed. That we would still test new and deployed for both capacity and performance, as proposed in this concept; okay.

The failure, either pre or post, could result in revocation of approval or remedial actions, as the case may warrant; okay. That the program would also be conducted, as it is now, in terms of NIOSH providing the replacement units for those that are drawn in from deployed situations for evaluation.

Also, a requirement that the device

manufacturer, or the approval holder, needs to provide the new units to provide the make-up units.

In other words, if it comes down to a situation where we can't continue to conduct the long-term field evaluation tests in cadence or in tempo with the requirements, that that would be grounds for not allowing those units to remain in service any longer.

So it would be an ongoing concern.

And this is -- obviously, these, in being a requirement of certification as proposed, this is quite different from what is currently done.

Not that there aren't remedial actions taken currently, if issues are discovered. Those kinds of things do occur. It's just simply not spelled out that way in the standard.

And I believe this is where I switch over. There are only a few more slides, and I know there might be questions and comments.

What I would ask is if you could allow Tim to finish up with these last couple of slides, and then I'll get back up for any questions pertaining to what I presented, and Tim will cover any questions that he presented.

So, thank you.

MR. REHAK: Okay. The last topic that I'm going to talk about is a proposed voluntary registration that -- and this is our concept.

The purpose behind this is to provide us with a database on the information on how many of each of the different type of units are out there, and also where they're located at.

This will help support our post-certification testing and evaluation, which we conduct in the long-term field evaluation.

Basically, this information, this database will enable us to quickly and effectively react to any field complaints, whether it's through risk communication or if there's a recall that needs to be conducted on a certain type of respirator.

I know in the past, when we're looking at recalls, some of the first questions we receive is, one, how many units are affected by this, and where are they all located at. And right now, it's kind of haphazard whether we know all this information or not.

And the only thing the manufacturer is required to do as part of this proposed voluntary registration is to provide procedures on how to register your units and to give the users the reasons behind why we're looking at doing this.

Okay. This is a proposed registration website that we had a summer intern develop for us. And since the mining sector is the largest civil deployment of SCSRs, we started first with the mining industry.

And the web page was developed basically to try to make it as easy as possible for the user to register their respirators.

So we had inputted from the MSHA website all the information on the existing mines out there and their ID.

So the initial time a mine would be registering their equipment, they would have to go onsite, put the contact person name, who was responsible for the SCSR, and how we're able to reach them, by phone number, email address, mailing address, et cetera.

And to make it as easy as possible, all you have to do is put the type of unit. We have a pulldown menu for this along with the pulldown menus for manufacturers, the date, the month, and the year.

Later on, at the break, or at lunchtime, or at the end of the presentation, it's on my laptop where I could go through it and show you how easy it is to use it.

And basically, what it gives us, it gives us basically a database where all the units are. So we could pull up from this registration, if we wanted to look at where all the M-20s are located at, we could go to that file. If we wanted to know, you know, each of the different manufacturers, we could get that information from the database that we would be creating through this website.

And finally, how the new proposed concepts and standards will affect new and previously approved closed-circuit escape respirators.

First, manufacturers and distributors could continue to sell their CCERs with current approvals for three years after the effective date of this proposed standard. And finally, closed-circuit escape respirators with current approvals could remain in use for six years, again, after the effective date of the proposed standard.

And that's all we have to cover with our concept.

My questions for Bob and I, feel free.

MR. STEIN: Question, comments, how do you want to handle this?

MR. REHAK: Again, for questions, please go up to the microphone, give your name, your affiliation, and the question you have.

MR. HEINS: Bodo Heins from Draeger Safety.

As long as you have the slide on there, how do you come to the six years?

Because usually, at the moment, is ten years for the SCSRs.

MR. REHAK: Well, basically, we're trying to get the new technology as soon as possible into the workplace and replace the respirators.

MR. HEINS: Okay. You are talking about the physiological burden of the units. What do you mean with this?

Is it carrying the unit the whole time, or is it using the unit?

Because you can remember, I suggested several times to have smaller units with higher allowed breathing resistance, higher allowed inhalation temperature.

MR. STEIN: So those questions, or the way you posed that, I think, are in terms of actually using the apparatus; correct?

MR. HEINS: It's what I expected, yes.

But if you look to the practice, most of the miners are wearing the unit several years without having to use it.

And only for the few minutes they have to use it, they wear a unit which is much heavier than necessary, if you would allow higher breathing resistances, for example.

MR. STEIN: Well, in some sense, Bodo, you saw the one table that is allowed for in terms of the excursions that are permitted under the proposed testing.

So you possibly could achieve what you're talking about in terms of, you know, how they're being tested and evaluated, that it would allow for that to happen, to occur.

But, again, we're looking for ones were that doesn't go too far the other way.

In other words, if you allowed that to get too far out of hand, it may not be practical for users to use those devices.

So we feel what is proposed is reasonable along those lines. It's that kind of compromise between what you're saying and between trying to keep them performing -- you know, we want them to perform well for the user.

We're -- obviously -- this is all proposed, and we're obviously open to comments and input along those lines.

So if you -- as you go through this and

you have an opportunity to sit down and see a paper, if you know how you want to comment towards it, or if you see specific issues, those comments are welcome, as well as even an alternate proposal for how you think it should go.

MR. BOORD: If I could add a point of clarification, too.

I think, Bodo, to the original question you had, the physiological burden that we have been referring to is the physiological burden while using the device, not the physiological aspects of carrying it, small or large, or whatever.

MR. HEINS: Yes, I understood that. But what I wanted to point out, in my opinion, it's not the right way.

You should change it into physiological burden to carry it --

MR. BOORD: To carry it.

MR. HEINS: -- the whole time when he has to work because he has to carry a much heavier and bigger unit than necessary.

MR. STEIN: Well, again, these are -- how do I want to say this?

This permits smaller apparatus, certainly in terms of, say, like a Cap 1 apparatus, where you would be providing less consumables.

This looks specifically at the respirator performance. Somewhat -- what you're referring to is somewhat governed by deployment issues, which this doesn't address.

You know, this isn't looking at deployment. This is simply looking at how the respirator is approved.

MR. HEINS: Okay. Next point.

As you are pointing every time to the units, but I'm missing something that you have to convince the miners that they are carrying a life saving unit.

If you look to the units, which we sometimes get back or see in the market, they handle it like a piece of coal and not as a life saving unit.

And even if you require training, it's not the same as to convince them what the unit is.

MR. STEIN: Yes. And I mean, I will just acknowledge that it is very important that the users have a good feeling for, you know, what the apparatus can withstand, what it can't withstand.

And currently, I'm not quite sure that there's anything proposed that would go outside of the realm of training in order to convince users, you know, what's necessary, what do they need to be looking for, what do they need to be aware of in terms of knowing when they should retire an apparatus, you know, and get another one.

MR. HEINS: Next point is the automatic metabolic breathing simulator. I think we are coming from the difficulty having subjective tests with Man Tests. We are now come into the difficulty to have a specific ABMS by NIOSH.

It's scientifically very well done, but in my opinion, it's too high.

Why it's not possible to use a normal breathing machine with breathing curve only to check for approval.

MR. STEIN: Well --

MR. HEINS: I know from the other standards how difficult it is and how much data will be brought into the simulator.

And it's, again, very difficult to repeat for a manufacturer. The only possibility would be to -- to -- what's the name for that? To double your machine to come to the same results.

For example, the software which is used for that, we do not have it.

MR. STEIN: Oh, okay.

MR. HEINS: So it's very subjective for it to come to the same results.

MR. STEIN: Well, I would ask a question.

I mean, I don't think some type of simulator technology is not outside the realm of any of the current manufacturers, I don't believe.

MR. HEINS: It's a scientifically perfect machine, but is it necessary to use it for certification of a unit?

MR. STEIN: Well, as proposed, we feel that it is. Obviously, that's a subject that's open for comment, as are all of the subjects.

But currently, it's in response to looking at, you know, how do you improve the state of the art in terms of testing technology? Breathing metabolic simulator provides that kind of unambiguous answer.

You know, what the particular simulator is, you know, or how it functions, I suppose, is still open to that kind of discussion. But, of course, we would want to see what it is and how it would be justified to be different than what's currently available.

I mean, obviously, we know our simulator very well. That's the one we have the most experience with. So we would want to see any other simulator perform according to what we know.

MR. HEINS: Okay. And last point for me, I hope.

MR. STEIN: Keep going. You're doing well.

MR. HEINS: Eye protection. In the past you didn't require anything.

MR. STEIN: Okay.

MR. HEINS: Now, you are requiring eye protection, which is good. But as far as I remember, they mention standards. These standards are for eye protection which are worn a whole working day and not only used for an hour for escape.

So the requirements for durability and scratch test are much too high, I think.

MR. STEIN: Okay. I know what you're saying, but, yet, you still have to deal with the issue of them being in the apparatus for a long period of time. I mean, you, yourself mentioned that.

So while they might not kind of be subjected to the same kind of day in, day out use, that they are still subjected to that kind of day in and day out whatever they encounter in the apparatus during the long deployment phase before they're actually used.

But, again, these subjects are open to excellent. Where it might be felt that they're too severe or where something else would be better suited, please, let us know.

MR. HEINS: Okay, thank you.

MR. STEIN: Uh-huh, thank you.

MR. KOVAC: I have a comment on simulators. I'll do it here at this mic.

And I guess I'll identify myself. John Kovac, NIOSH, NPPTL.

Effective standards are based upon good experimental science. And the touchstone of experimental science is repeatability and reproducibility. That's exactly what simulators give you.

Second, in the proposed concepts, you have what amounts to a program, a set of instructions as to how to execute those tests on a simulator.

How you achieve that simulation, what quality of machine, what mechanism is used to do the simulation we're indifferent to provided that you can execute the program that we give you instructions for.

So we're surely not advocating the NIOSH simulator where it says SACO (phonetic) derivatives or whatever.

Lastly, even in the absence of a simulator, we tell you that you can calibrate human test subjects to achieve the same end. Okay. That seems well within the grasp of any of the manufacturers. We do that already. You know how to calibrate test subjects and do just that.

So in the main, no one is left out of the mix in terms of being able, at their own facility or at -- to execute these tests. And we tell you how to do it as a program.

You have to construct the means for executing that program, whether it is mechanism or whether it's a human subject calibrated to achieve the same.

And by doing it the way we're suggesting -- and, mind you, we are open to alternatives. But by doing it in the way that we're suggesting, we're segregating life support performance from issues of human factors.

We're segregating what looks like a prototypical escape, namely egress, uninterrupted and unimpeded egress at a constant work rate from the ability of a device to function over different loadings.

So in the main, we go back to the notions of repeatability and reproducibility, and we think that's a better way of guaranteeing it.

We think that manufacturers are not necessarily constrained to use simulators, as we talk about them, to implement those programs on whatever mechanism or human subjects that they choose.

And lastly, we think it gives a better understanding of the life support capabilities of the devices. And, hence, the end user is better served with a device in their hands in that nature.

So, you know.

MR. RUECK: Klaus-Michael Rueck from Draeger Safety.

You didn't mention it in your presentation, but in the CCER draft, there is information recommended from the supplier which chemicals the CCER should give you the protection.

And you mentioned the unit have life (phonetic) and NIOSH pocket guide list. And we think, as a supplier, or even for the standard, there should be a minimum requirement against which chemicals the devices should protect you.

So we would propose that there would be six or eight or ten different chemicals which are named for every unit that is used.

So it couldn't be happen that there is a manufacturer who makes only a device against actual -- so the minimum requirement should be CO, H2S, NOH (phonetic), perhaps CO2 and some burning -- chemicals which are produced at burning.

MR. STEIN: Products of combustion, understood.

MR. RUECK: Yes.

MR. STEIN: Understood.

MR. RUECK: Yes. So minimum six to ten different.

Another point would be the ranges and values we would like to discuss over.

You define range from 500 millimeter water column, minus 300 millimeter up to 200 millimeter. And we think that's a very, very wide range.

And during the escape of perhaps one hour, to breathe against such big resistance, we think we should -- this we should make a little bit lower or significantly lower because, due to the respective fit in Europe or South Africa, the standard is higher with this.

So we would propose data range of 200 millimeter water column.

MR. STEIN: That's in there.

MR. RUECK: Yes.

MR. STEIN: That's in there.

Over the life of the test, it couldn't -- if it -- over the life of the test, if it was constantly at minus 300 and plus 200, it wouldn't pass.

It has to be on average over the life of the test a 200-millimeter swing.

MR. RUECK: Okay. And then perhaps the temperature range for KO2 devices, you defined -- in general, you defined 43 degree as the average maximum.

We think for KO2 devices, it's a little bit -- perhaps a little bit critical to achieve this value lower than 43 degree over the whole range. And we would propose three to five degree higher value for the average.

MR. STEIN: Okay. Again, the interplay, if I may -- if I may talk to that point, the interplay between the excursion that's allowed and the average over the life of the test may address the point you're making. May. But that's open to, you know, your further evaluations and comments back.

MR. RUECK: Okay. Then another point, you define the capacity will be calculated out of seven units, should be an average out of seven units, but you don't define the standard deviation.

And we calculated how much can it be, what -- in the tests, we find results of deployed units from 12 minutes up to 68 minutes.

MR. STEIN: Uh-huh.

MR. RUECK: And that's a very high

standard deviation, more than 50 percent.

And you should define minimum standard deviation which should be achieved to -- value lower than 20/25 percent should be defined as a maximum standard deviation.

So because it's -- it shouldn't be allowed to have a unit for 40 minutes and the other for 80 minutes, and then it's 50 percent.

So you should define a critical -- more critical value for the deviation.

The next is in Section 6, paragraph -- the -- no. The Table 3.

You start the test cycle with a peak value. And due to the respect to the three-on-three (phonetic) donning procedure, normally the three-on-three donning procedure should try the escaping miner in a calm position. You shouldn't -- you should not escape and panic.

So -- and we think these -- beginning with the peak rate would be -- and immediately panic and running from the place of chemical exposure or burning exposure.

And for that reason, we proposed to start with a second -- with a step zero perhaps, three or five minutes with a lower breathing rate, and then come to the highest rate, and then steps.

So it would be a four -- cycle with four different values, perhaps at 30 liters per minute for three or five minutes.

And perhaps -- that's later.

MR. STEIN: Just to respond to the one item that you mentioned, the statistical application.

As it's currently proposed, it's not a statistical application. I mean, it would be actually requiring that the number of devices tested, that they would all perform minimally at that level in order to achieve that capacity.

So the points that you make are good points, but it's not conceived of currently that that would even be an issue because, if any of the tested devices would go under that measured capacity, it wouldn't be certified for that capacity. Okay?

MR. HARRIS: Hi. I'm Randy Harris with the West Virginia Miner's Health, Safety, and Training office.

We're not particularly interested in the manufacturing. We're more interested in emergency breathing systems. So some of my concepts don't move towards a particular device.

Eye protection. Generally, the goggles that are -- are generally found at the event, laying on the ground because they have all got goggles on now.

When you go back and look at these goggles, one of the things I would like to recommend is that you include in your wearability study some concept of actually trying to put goggles over -- the four of us all have glasses on.

MR. STEIN: Uh-huh.

MR. HARRIS: The goggles are useless.

The one manufacturer that does have a device that's supposed to fit over your goggles, if you try to open up one that's more than three years old, the goggles are so squished that they don't --

they never warm back up, and they don't form a seal, so they -- you know, for smoke protection, they're kind of useless.

So we need to do something with goggles.

The thermal exposure was one of the indicators up there.

MR. STEIN: Yes.

MR. HARRIS: They provide basically instantaneous temperature warning, which is good. We have had people walk by salamander heaters and ruin their unit in just walking by.

Now, whether that actually created enough heat within the mass of that SCSR to accomplish anything or not, I have no idea. I rather doubt it.

But we need some type -- if, as we're now starting to see, that thermal loading of these devices is important, we need some other kind of indicator than a little red dot on the outside.

All we know is that little piece of brass raised above whatever temperature they got it set at, not that the mass of the chemical inside in that unit, or in the case of the other units, the bottles, actually raised to some temperature.

So we need to look at temperature indicators for thermal loading, something other than what's out there now. And all you have got in your discussions is you have something.

I think it's important that we have discussions and encouragement of manufacturers to come up with something that's more valuable than what's currently out there.

The chemical bed physical integrity that was mentioned by Les earlier -- and you kind of talked about it a little bit because you had the little shake testing up there.

You know, I think we all recognize that the physical integrity of the chemical bed is important. But what we really need is we need something that provides some degree of assurance to that escaping miner that what he has got on his belt or now hanging around his neck is actually going to work.

The fact that it passed a shake test 89 days ago doesn't necessarily provide any reassurance right then.

We need something that talks to the likelihood that the chemical bed, in the case of the chemical bed, will actually do what it's supposed to do when you're using it.

So a shake test is fine. It says it's not all broke up in little pieces, or it's not all turned into a rock.

MR. STEIN: Uh-huh.

MR. HARRIS: But it doesn't necessarily have any indication about whether it's actually going to work or not that's communicable, that can be communicated to that miner.

The tamper resistant thing, I mean, that's self-evident. But I think one of the site issues that was brought up by our Draeger friend over here -- and I have heard others talk about -- is although we think these things should be -- we realize how critical these things are and we know how delicate they are, yet most of the miners don't -- they treat them like their lunch pails.

They're supposed to be on their belts.

They're not. They're on a hank of rope, and they get thrown in the machines with everything else. And at lunch break, they get thrown on top of the power centers.

We had one operator last week that lost four units in one shift because the guys took lunch break and set them on top of a piece of diesel equipment while it was running.

No matter what we, as people working on these things, think they should be treated, that's not the way they're being treated.

And I guess my comment is that when we're talking about casings and the physical enclosures --

MR. STEIN: Uh-huh.

MR. HARRIS: -- we need to recognize the way these things are actually going to be used.

Even though we're going to train them to take better care of them, we need to recognize that they're probably not going to be used that way, and work with manufacturers to come up with solutions that will increase the likelihood of survivability.

The same kind of thing goes on the

moisture indicators. They're very nice, little blue dots, make you feel warm, nice, and fuzzy. But when they get wet, they change color. When they get dry, they change back.

And if you did -- if you, indeed, have got a bad seal problem, it's just as likely to change to the moisture indicator as it is to later dry out and change back again.

And what we really want to know is has there been moisture in the chemical bed.

So is there a way, that, as we're working through indicators, again --

MR. STEIN: Uh-huh.

MR. HARRIS: -- we take the indicators back to our core issue, in this case, it's has that chemical bed got wet and started reacting --

MR. STEIN: Uh-huh, uh-huh.

MR. HARRIS: -- versus is there moisture in the caps or in the cases.

MR. STEIN: Uh-huh.

MR. HARRIS: There was some discussion of excursions.

MR. STEIN: Uh-huh.
MR. HARRIS: I have a question on your excursion charts.
You have got some numbers, a couple of them that kind of distress me on CO2 and O2, but -- and pressure.
But what you don't have is what's the duration of these excursions?
You said you're doing minute averages.
MR. STEIN: Uh-huh.
MR. HARRIS: Is it a 60-second excursion?
If it goes below 15 percent oxygen for 61 seconds, is that now a failure?
MR. STEIN: If it would go below 15 percent oxygen, as it's proposed, that would be unacceptable.
MR. HARRIS: Yeah, well, we like that.
MR. STEIN: Okay.
MR. HARRIS: The AMBS, we absolutely agree with our friend John back here that repeatability is absolutely essential.
There's so much variability in trying to

do human testing that we just don't know how you can possibly work it out. I don't know how you guys have survived all these years trying to find these people that would actually do these tests and do them the same way every time..

But we also agree, quite honestly -- and I hadn't thought about it until you brought it up -- we agree with our Draeger friend here because we have been working with some of these manufacturers, too.

And if you're going to -- more than like John said, you're going to have your criteria up there --

MR. STEIN: Uh-huh.

MR. HARRIS: -- you need to have a users group amongst all these people and share these codes.

I mean, it needs to be open source code or something so you guys all use the same thing.

It's really not fair to the manufacturers to try to develop these things, using what they think to be the right protocol, and then get into your machine and find out that they have got a wrong number somewhere, and they -- it's a little something that you guys can't pass your machine.

MR. STEIN: Okay.

MR. HARRIS: There was also brought up the immediately dangerous to life and health issue.

We have somewhat of a concern with -- that hopefully will be resolved with your excursion numbers.

Currently, units will go below the oxygen level or above a CO2 level for some period of time.

And, you know, I understand a lot of the reasons why you want people not to panic at the beginning. But the reality is, you know, if there's a fire down the entry, and I'm trying to get out, there ain't nothing going to do is going to make me very calm. So I'm going to be panicking.

So I'm not going to be able to sit down and take it easy for five minutes. Because in five minutes, quite honestly, my butt is going to be outside.

We need to consider that when we're

setting up all of these parameters, the realistic, not only physiological, but psychological conditions of the miners in the immediate aftermath of an emergency.

MR. STEIN: Uh-huh.

MR. HARRIS: Because if you go back and look at all of the studies done of survivors of mine fires and explosions, they had to make some very crucial decisions in that first period of time.

They can't afford to be below the absolutely maximum amount of oxygen we can give them or to have C02 levels such that it impairs their cognitive ability, especially during that first period of time.

That very first period of time is all critical.

Now, by the time they get to the second or third unit, it's a prolonged escape and they're changing out. No. 1, they will have got some experience, as I'm sure Mr. Miller, from -- what is his name, from Pennsylvania is going to tell us, that the more people get to use these things, the better they are at using them.

MR. STEIN: Uh-huh.

MR. HARRIS: So by the time they get to the second or third one, they're going to be experienced.

MR. STEIN: Uh-huh.

MR. HARRIS: But that very first time, they may have never actually put one on under an emergency with a fire at their back, and they're going to make mistakes.

So we need to make sure that they have all of their faculties.

Instructions. I think, you know, it's great that you got it in there. However, I think the instructions need to be expanded.

The one thing that really needs to be in all these instructions is an articulation of every conceivable failure mode for that SCSR, in the instructions, with what to do when it does that.

MR. STEIN: Uh-huh.

MR. HARRIS: I mean, you can't put a miner out there, in an emergency, and never -- and have him believe that there is no case under which this device is going to fail.

And then when it does fail, or it doesn't work the way it's supposed to because he didn't do something right, to know how to correct it.

MR. STEIN: Uh-huh.

MR. HARRIS: I think we need to have some discussion of failure modes in there.

And the other thing is I think there needs to be a discussion of how to extend a breathable air supply on these units.

These units all have some amount of breathable air by design. How can we get back to the physiology stuff that John always talks about? How do we train people to recognize how to moderate their physical demands?

Now, like I just got done saying, they're going to be -- they're going to -- their natural instinct is going to be to get out --

MR. STEIN: Uh-huh.

MR. HARRIS: -- and they're going to use as much oxygen as they can to get out.

But how do you then train them to do whatever they need to do?

We need as much emphasis put on after donning that we have on donning.

MR. STEIN: Uh-huh.

MR. HARRIS: Right now, it's all on donning. It needs to be -- we need that amount of energy put into after donning.

The other thing we also need is we need to have detailed instructor's manuals for the instructors.

We need to have lessons plans for the instructors, background material, information on physiology, respiratory systems, all that stuff so that when somebody is getting up do an instruction, a trainer, a certified trainer, that that person has some amount of information behind them.

MR. STEIN: Uh-huh.

MR. HARRIS: You know, in the military, you know, when you go in and you'll train somebody on an M-16 rifle, the person training that has more than the person that's taking the course. They have some kind of background information.

MR. STEIN: Right.

MR. HARRIS: The service life concept, I'm not sure that it's appropriate, and the reason is because not all mines only use a unit once a day.

A lot of mines, especially the smaller mines, will use a unit three times a day because they will, say, pass the same unit from shift to shift.

MR. STEIN: Uh-huh.

MR. HARRIS: So what -- in that case, the effective life of a ten-year unit may actually be 30 years because they have used it three times every day -- well, actually, if you do it that way, it may last three months.

But, you know, we need to go back and revisit this whole service life issue and figure out how we can address service life in a way that is reflective of the actual use of the unit.

And besides, you have got units that are put in a nice aluminum cache that's all foam lined. Those units are most likely going to last longer than a unit that's on a piece of equipment that's vibrating up and down the entry all day long.

MR. STEIN: Uh-huh, absolutely.

MR. HARRIS: So we need to figure out how we can relate that.

The capacity testing. I think we definitely would agree that it needs to be part of the approval process, but also that it needs to be fully reported out.

When I'm a buyer making a decision, I need to be able to see, not just the little sticker on the back of the unit that this unit has been approved, we need to have access to all of that information.

Because now we're having to making buying decisions, not just about a device, but an entire escape system. And that's what's come out of this whole thing with this cache planning and the lifelines and everything, is we're now, as operators and state regulators --

MR. STEIN: Uh-huh.

MR. HARRIS: -- looking at this as an

escape system.

So we need to know everything we can know about all the elements so we can make decisions about how to put A and B together, the Chinese menu kind of thing.

So just having just the certification at the end of the process is not providing enough information to the buyers to make intelligent buying decisions.

So I think we would like to encourage you to do that.

The minus 300 or the plus 200 millimeters of water is just way too high.

I mean, if you get somebody at 200 millimeters of water, and I put them on a device and crack it down to 200 millimeters, they're going to give up and throw the thing off because they think they're suffocating.

I would contend, in our experience, although limited, is that even at 100, I'm going to have a lot of people just take it off because they think they're suffocating.

You know, to go to minus 300, I think, needs to be revisited. And in general, on all of these things --

MR. STEIN: Uh-huh.

MR. HARRIS: -- we really, really encourage actually going out and not just picking numbers from university physiology departments and phys ed departments.

We need to get new, real, robust data on actual miners, not grad students, in escape mode, in the mines, going out, and rebaseline all this stuff.

Because the last time that some real serious stuff was done like that has been decades ago. And our ability to monitor is so much better now. We need to get some new baseline data.

The registration thing, I know, Tim, I have talked to you about this before. You have got to recognize the fact that most of our mines are in parts of rural America that don't have cell phone service, let alone web service.

And to have something that's truly interactive web based, like I do when I'm in town, ain't going to happen. They just don't have it.

Some of these mines don't even have dial-up service for their modems, you know. So I -- you just need to recognize the fact that the mines aren't located where there's broadband.

And the post unit testing or the changeover --

MR. STEIN: Uh-huh.

MR. HARRIS: -- you know, I think that's a valid point. I hadn't quite thought about it until you guys were discussing it a minute ago.

But if you say three years, let the distributors sell them for three years, that last unit he sells is only good for three more years.

First unit -- you go out and you say okay, now today, we're going to certify everything.

MR. STEIN: Uh-huh.

MR. HARRIS: And six years from now, none of those units are good, but you're going to let them sell them for three more years.

Well, that last unit is only good for three years, so he's not going to sell any of those units.

So I mean, we need to think through the marketing impact sides of that.

I agree with you, we need to get out the latest technology --

MR. STEIN: Uh-huh.

MR. HARRIS: -- and we need to figure out how to encourage new technologies.

We applaud the concept of looking at performance based standards versus design based standards, but we need to do it in such a way that encourages innovation.

And we need to also -- in doing that, we need to look at the impacts of these things on the markets because we want people to want to do this and bring stuff out, so...

MR. REHAK: We did do -- or it was -- economic impact analysis was looked at with this.

MR. HARRIS: Well, I mean, if it takes the usual three to four years to get this approved, you're going to be in all of our -- all of our mines have gone out in the last little bit here and bought thousands and thousands of units that -- with a supposed ten-year shelf life.

MR. STEIN: Uh-huh.

MR. HARRIS: And you look at the failure rate of carry units, which is about 3 percent per year, you take them off. Figure they're going to throw 3 percent of them away every year in their ten years life, about the time you get this out, there's probably going to be somewhere in the neighborhood of two or 300,000 units sitting out there that still have more than six years on their life.

So, you know, I just encourage you to go back and look at all of that because we don't want the manufacturers to get in a situation where they think we're doing them great harm, and they're not going to move forward with us.

Just a thought.

MR. STEIN: Very good. Thank you.

All right.

MR. BRNICH: Yeah, I'm Mike Brnich from NIOSH Pittsburgh Research Lab.

Just a couple of comments, and that is on your SCSR inventory, and I think that is a good idea. We don't have anything out there like that that I'm aware of.

And knowing where these units are, knowing who has them, getting information out to the users in a timely fashion, if there is a problem, I think that's an excellent idea.

To comment on what the gentleman from West Virginia said, I do agree with him.

There are many, many mines out there, small ten-, 12-person operations, out in the middle of nowhere, that are probably doing good if they have a telephone line, let alone access to the internet.

So you know, you might want to look at maybe some of these operators, talk with some of these operators and ask them, you know, if you could do this, what would be the best way for you to do it.

MR. STEIN: Uh-huh.

MR. BRNICH: Another comment, the last couple of months, I have seen some new technologies that are coming out there for inventorying and inspecting SCSRs.

I saw one system just about three weeks ago that utilizes a bar code system with an internal database. You can bar code read your SCSRs, use a stylus to input all of the inspection information, and then download that into a PC.

I also saw some technology this summer that utilizes a personal data assistant to do the same type of inventorying.

MR. STEIN: Uh-huh.

MR. BRNICH: So you might want to take a look at maybe how your database might be able to interface with that type of technology.

But say an operator who wants to register their units, it will save them from duplicative efforts. You know, they would have all their records. They could just then upload them right into your database.

MR. STEIN: Different manufacturers have proposed either bar code or even something as sophisticated, if you will, as an RF, you know, passive RF kind of acknowledgment, you know, within the unit, that it would have information like the serial number and manufacturing date.

MR. BRNICH: Uh-huh, okay.

MR. STEIN: So it would be -- and I would agree that it would be worthwhile.

I mean, we're not trying to thwart anybody, obviously.

MR. BRNICH: Sure.

MR. STEIN: If there is some kind of standard for what kind of database that would go into --

MR. BRNICH: Uh-huh.

MR. STEIN: -- it would be -- that's the thing we will have to deal with --

MR. BRNICH: Right.

MR. STEIN: -- if they provide software, you know, that would be -- and who knows, you know, kind of all over the map.

MR. REHAK: Yeah. This was just one element of it, Mike.

We are looking at trying to make it as

easy as possible for the users to register.

Because if it's going to be hard for them, they're not going to register --

MR. BRNICH: Right, yeah.

MR. REHAK: -- since it's a voluntary -- proposed voluntary registration.

MR. BRNICH: Exactly.

MR. REHAK: So we are willing to work with it. We will work with MSHA people. And it has been discussed.

This would be just one element of the plan, Mike.

MR. BRNICH: Yeah, okay.

MR. STEIN: You may want to mail it in or whatever.

MR. BRNICH: Right.

MR. STEIN: Yeah.

MR. REHAK: I mean, a lot of it might go through MSHA district offices.

MR. BRNICH: That's an idea, too.

MR. REHAK: Sure. So I mean, with the bar code, and if that's the way that district wants to go.

Just as long as -- we're just concerned that we get this database of information.

MR. BRNICH: Well, yeah, exactly.

MR. REHAK: You know, for risk communications, for recalls.

MR. STEIN: And that would be kind of a living thing so that, you know, two months from now, six years from now, it's accurate.

MR. BRNICH: It's accurate, yeah. I agree.

MR. STEIN: Yeah.

MR. BRNICH: Okay. Thank you.

MR. STEIN: Thank you.

MR. SELL: Hi, Bob Sell with Draeger Safety.

A couple of questions. The first one here is probably more hypothetical, but assuming a manufacturer runs out, develops an SCSR, submits it, gets it approved under 42 CFR, and that same device can be certified under the new requirements.

Is there any idea as to maintaining those units in the field to cover Randy's question on the six-year use?

MR. STEIN: So you're saying can't be certified as in technically doesn't meet the new requirements.

I mean, there's no prohibition. You could come in -- if you had a device, a manufacturer has a device that meets existing requirements --

MR. SELL: Correct.

MR. STEIN: -- when these go into place, there's nothing to prevent that manufacturer from resubmitting it to have it evaluated against the new requirements.

MR. SELL: Correct.

MR. STEIN: Okay.

MR. SELL: Now, if the manufacturer meets both old and new requirements --

MR. STEIN: New.

MR. SELL: -- with the same device and no changes, is there an upgrade label we can snap onto the unit?

That's a hypothetical question. That's

all.

MR. STEIN: I'm going to -- that's one of those administrative issues.

MR. BOORD: Yeah, good to consider.

It's a good idea.

MR. STEIN: Yeah. I mean, and that's real hypothetical in saying no changes because if it would work, it would absolutely have to be no changes, as you are well aware.

MR. SELL: Right.

MR. STEIN: Yeah.

MR. SELL: Right.

Under the lenses, and I'm not sure if it's under the durability section. I haven't had a chance to review the ISO document. But is lens impact covered?

MR. STEIN: Yes.

MR. REHAK: I believe so.

MR. STEIN: Lens impact is covered.

MR. SELL: Okay.

MR. STEIN: And I think that's where Bodo was asking the question about might the standard that's proposed not be more than what's needed in this type of situation, you know.

So that's open to comment for sure.

MR. SELL: Okay.

For the Man Testing, are you planning on using MSHA inspectors?

MR. STEIN: There's nothing that specific in there.

MR. SELL: Okay. There's nothing specific, I think, in the current regulation either.

MR. STEIN: No. That's correct.

MR. SELL: But you do use MSHA inspectors.

MR. STEIN: Yeah.

MR. SELL: Are there going to be any donning time requirements, duration, length of time?

MR. STEIN: Yes.

MR. REHAK: I believe it's 30 seconds.

MR. STEIN: Yeah.

MR. SELL: Is it 30 seconds written in there?

MR. REHAK: I believe it's 30 seconds in the concept requirement.

MR. STEIN: Yeah.

MR. SELL: Are you going to evaluate training devices?

MR. STEIN: No. It's not proposed that we would do that.

MR. SELL: Another thing on registration, another possibility could be issuing registration cards as far as the manufacturers are concerned, even though they may not all get turned in, typically, but they could be passed onto an MSHA inspector when he does come on site.

So that may help alleviate that problem.

MR. STEIN: Uh-huh.

MR. SELL: Under the instructions for use, here, you also mention that we're supposed to include the service life plan into the instructions for use.

MR. STEIN: Just the pertinent points of the service life plan for the user, all the condition -- all the required conditions of use, all the required conditions of maintenance that -- you know, anything that would apply as far as the user's perspective goes.

MR. SELL: So the service life plan, as a manufacturer would submit to NIOSH currently, that the user typically does not see, would it still be required?

MR. STEIN: Correct. Correct.

MR. SELL: And -- okay, I think that covers it. Thank you.

MR. STEIN: Thank you.

MR. RUECK: There are two remarks left for me, one because of Randy's information he gave us.

How would you name the units when we meet the capacity, for example, 140 or 150 liters under the test condition? Is it then a Capacity 3, 140, or wouldn't there be identification to see it's a low Capacity 3 or a high Capacity 3 unit?

MR. STEIN: It's not currently proposed that they would be identified in that way, simply if it's greater than the required 80 liters, as proposed, that it would just fall into that category.

And you're right. I mean, it's a subject of, you know, maybe needed knowledge in terms of how you're going to deploy that, that you might want that greater information.

MR. RUECK: Okay.

MR. STEIN: But there's nothing currently proposed to identify that beyond Cap 1, Cap 2, or Cap 3.

MR. RUECK: Okay. Because we think our units are, even today, very good. And for that reason, we would propose to make a significant -- it could be a buying decision if it's 85, or 120, or the 180.

MR. STEIN: Uh-huh, uh-huh.

MR. RUECK: For that reason, you should think about that.

And the 810 standard is a very rough standard for -- yeah, with different frequency tests.

And the experience is that the frequency range from nine to 200 hertz, or from nine to a maximum of 500 hertz, would simulate wearing on a man and transporting by machines.

And higher than 500 to 2,000 is, especially long duration transport in airplanes, for example, units for boarding crews, they should be testing according this 810 because the units are all the lifetime on a plane.

MR. STEIN: Uh-huh.

MR. RUECK: For Man 1 units, we would propose to reduce the 810 to the maximum of 500 hertz, not the full range of 2,000, only to --

MR. STEIN: Okay.

MR. RUECK: And perhaps you can end notch the testing with a low frequency because the low frequency is there, but destroys units in long deployment.

MR. STEIN: May I respond?

MR. RUECK: Yeah.

MR. STEIN: As proposed; okay, those are not meant to guarantee any particular duration of service.

It's meant to be a kind of baseline ruggedness to say that if it's going to be qualified as a CCER under these standards, it needs to be able to do at least that.

If bed degradation is an issue for the device, what is expected under the proposed standard is that there's some way to detect that when it has exceeded to a level that affects the performance.

And that means, while it's not specifically spelled out, nondestructive testing is one acceptable means to do that.

So beyond the required levels of shock and vibration that you see there, if the performance is affected by further shock and vibration, by either exceeding those levels of energy input, or exceeding -- or in terms of time, when it's an actual deployment, what is expected is that that could be revealed through some nondestructive means.

Okay?

MR. HEINS: Okay.

MR. BAKER: Tim Baker with The United Mine Workers of America.

And just a few comments, and I'm sure we will have a whole lot more. You know, we're going to look at this thing, obviously, from a user's standpoint and with the hope that we never have to use them.

But -- and I agree with a lot of the things that have been said. But when we talk about, you know, getting information out on failure modes because -- and I think that's important, you know, what will affect this unit, what should each miner be looking for, and putting that in perspective. I think that is very important because you don't want miners out there thinking this thing is going to work all the time.

But I will be quite honest with you, if you have communicated with a lot of miners, that's not your problem. That's not -- your problem is most miners out there don't believe these units are going to work.

You have a great credibility problem with these units that are out there right now.

You talk to a lot of folks, and the question becomes, in their mind, if I'm carrying this particular unit on my belt and I have been carrying it on my belt and hanging it in my basket and doing those different kinds of things, myself, I have it in the trunk of my car, am I better off to take the unit off the belt and throw it away? Maybe I can run faster.

There is a large gap between what manufacturers perceive as a working unit, what operators buy just to comply, and what miners believe are really out there.

So there is a major problem there.

A couple of things I would like to say about what's proposed. When we talk about registration, it shouldn't be voluntary. We shouldn't be discussing voluntary.

It should be, You bought the unit. Here is your card. The manufacturer sent a card. You're obligated to register this.

Now, working with MSHA, you know, where I come from, whenever you don't follow the regulation, so we will just, you know, we will cite them.

These things -- we need to know where these units are, who has what units, and what the expectation of this employer is.

I mean, what we're doing in many instances, when we talk about small operators, we talk about small operators not having the capacity to do web. We have -- you know, they may not have dial-up.

The problem that we deal with here, in reality is, they're barely following the minimum requirements. And this is not a big deal.

When you don't register, how do I know what units are where? If I have a recall, who am I going to affect?

Let's make it a requirement.

MR. STEIN: Uh-huh.

MR. BAKER: Let's make them have to do something with this, not just buy the unit and you're good enough. You bought enough units, you're okay.

So those are some of the perspectives we look at.

The other things, I think, that we're looking at -- and I'm a little confused, and I'll have to be honest with you -- and you talk about capacity, you talk about duration. We have dealt with duration for so long --

MR. STEIN: Uh-huh.

MR. BAKER: -- that we're comfortable with that.

So I think I'm going to have to get a whole lot more familiar with what you're talking about meets our capacity because miners, by and large, are going to say 80 liters of what?

I mean, I want an hour. That's what I want.

So we're going to have to make this real clear in their minds, too, and obviously in mine because I'm not clear on what we're dealing with here.

There was some discussion that I think I missed some of, when we don and redon.

MR. STEIN: Uh-huh.

MR. BAKER: There's a couple of issues that we need to look at, and they need to be worked out.

First of all -- and I realize that MSHA's regulation says you got to train on every unit you have out there.

We absolutely oppose that.

I don't need a Draeger and a CSE and an Ocenco, and I'm going to go from one place to the next, if I have a three-hour march out, and I have got to know how to don three units.

MR. STEIN: Uh-huh.

MR. BAKER: So we need to look at those things.

And you need to have input with MSHA on those issues, too.

And we need to have units -- I think we should be pushing for units -- and I think you have the ability to do this -- that you don't redon. You change the canister.

Because redonning, let's be honest, if you're in a mining atmosphere that is toxic, that redonning is going to be extremely, extremely difficult.

If you have walked for 30 minutes or 45 minutes, and you get to that area where you have got to redon, and you're in that toxic atmosphere, you could have just walked 45 minutes and be found dead that far down the road for redonning.

These things aren't going to be that easy to put on and off.

I mean, let's be honest. We have had them for years. And I carried an Ocenco for a long time, and now I carry a CSE. I want to don it once, if I have to don it.

So we need to look at that technology, and you have the ability to drive that technology. You're going to push that.

So we need to look at those particular issues, also.

And I'm not going to be too brutal, but panic is -- I mean, listen. I have not been in an explosion, but I have been in a mine where there's a fire. And I have been in a mine where there's a massive roof fall.

I can run pretty fast, and I'm pretty scared, I'm going to be real straight up honest with you. You're going to go as fast as you can for as long as you can.

Rest periods, when you do the testing, I'm not -- if I have an hour of march out, it's going to be a forced march. There's not going to be time for rest. That unit has got to produce oxygen to get me from the deepest penetration to the surface as fast as I can go.

So I understand when you start saying, well, you know, you're going to start out rapidly, which you should.

MR. STEIN: Uh-huh.

MR. BAKER: But then you kind of taper off, and at some point, you're going to rest.

There's not going to be any rests. I mean, these guys are going to march out.

There's going to be a couple of exceptions, I think, if another fellow miner needs a hand, you're going to stop and you're going to help him. I mean, that's almost a given.

The only other thing that I can think of is if you see a situation where escape is cut off, that's where you're going to have rest, if you cannot get out.

Other than that, I mean, I think that clearly the individuals who have escaped the mine fire in West Virginia, I mean, they were marching from the time they put those things on until they got as far away from it as they could.

So these durations maybe need to be longer whenever you're really going to be using this unit a lot.

The concerns, I think, we have is a lot of these units are being passive as they are.

We're concerned that they just don't produce enough to keep this individual functioning properly, and we need to look at those things.

And we need to look at the technology because, quite frankly, miners aren't comfortable. Miners are absolutely not comfortable.

The operations that I have been to recently, the confidence level is really zero. It really is. And that's a shame, but that's where it's at.

Part of that problem, I think, is

25-year-old technology; okay. And they're looking at it saying, you know, how reliable is that and why haven't we moved forward?

The other thing I would guard against is we have got all these operators going out and buying all these units. They're not going to want to buy new units in three years, five years.

They're going to say, I have got a ten-year unit. Why did I have to go out and buy all these extra units and store them? You know, this technology has got to move as fast as we can get it, and operators are going to resist. There's no doubt in my mind.

We have invested heavily. We have invested greatly in increasing productivity. But in units like this and other health and safety issues, we get by with just the minimum. So we have got to push these -- we have got to make these things as rigid as possible.

And I hate to say that. I'm not -- I have never been, and I don't think in many instances, we are in favor of anything but prescriptive requirements.

Because if you don't require something and you don't say, Here's the rules, if you just say Well, you can kind of do this or you can kind of do that, you know, we will make it based on moving forward, and you don't say, This is a requirement, operators have a tendency not to follow those requirements.

And that's the history -- unfortunately, that's the history of the industry. That's a history that's never changed.

So as you go through this, you need to tighten these things up and make everything as prescriptive as possible.

It helps the manufacturers out. They know what they're going to produce. It holds the operator's feet to the fire. I know what my guys are going to get.

And that's pretty much what I have to say at this point. We will have, I'm sure, broader comments later.

But we do appreciate all the work that you guys do, and we do look to you in these instances to push the regulatory agency to do the right thing.

I know sometimes you don't have the ability to get them to move much, but you're the guys who are going to push them.

Thank you.

MR. STEIN: Thank you.

Yeah. I mean, I think -- and Tim, you do -- I mean, many of the comments, quite a few of them, are directed to or have relation to the deployment practices, which is not in our purview. I mean, there's not that much.

I mean, I do understand what you're saying, like about driving refreshible kinds of technology. And that, as you heard earlier, I think, one of the efforts underway in research is to come up with like a dockable unit where you wouldn't have to break the circuit in order to replenish it and keep going.

So hopefully that will kind of address that need. That's what we're looking at.

MR. BOORD: Okay. What we will do now is

we will take our lunch break.

And according to my watch, it's ten minutes after 12. So let's plan to be back for continuation at 1:15.

So that's an hour and five minutes. Thank you.

(A recess was taken.)

MR. BOORD: The next presenter on the agenda is Dr. Art Johnson from the University of Maryland Biological Resources Engineering Department.

And Dr. Johnson is going to share with us a research project that he is working on in the area of the self-contained self-rescuer.

So with that, Dr. Johnson.

MR. JOHNSON: Thanks, Les.

I want to talk to you this afternoon about two studies that we did actually a couple of years ago, and I wanted to give you the results from those. I think they're very relevant to what we have been talking about here.

And let's see.

Those two studies, one of them has been published in last December's Journal of ISRP, International Society for Respiratory Protection. The other one has been accepted by the American Industrial Hygiene Association for the Journal of Occupational Environmental Hygiene.

So as we know, self-contained self-rescuers provide oxygen for emergency escape, and they're supposed at least to last at least 60 minutes, give 60 minutes of oxygen supply.

We also know that some of them contain chemical-generated oxygen.

Let's see, there's also extra symbols on here which aren't showing up right.

But, anyway -- and you know that there's potassium superoxide that reacts with water to produce oxygen. And also that when you scrub the carbon dioxide out of the potassium hydroxide, that it produces more water and then eventually then adds to the oxygen supply.

So the thing about it is that the SCSR wearers are supposed to walk at a controlled pace so that the oxygen supply does not outpace the rate of oxygen used.

Now, we know from what we have heard today and throughout my lab and so on, everybody fails to totally agree with this. But the fact is that at a certain point, your ventilation exceeds the oxygen used. And so, therefore, above the anaerobic threshold, or above the ventilation threshold, the ventilation is so much greater than the oxygen used that you end up generating oxygen that you don't get to use.

So at high work rates, then, breathing air is too great, and the generation capacity is used up at a much faster rate. And the extra oxygen, then, is wasted to the atmosphere. These we knew ahead of time from the manufacturer's specifications.

So the two studies that we wanted to undertake because, at least at that point we had not seen anything out in the literature that related to what happens, first of all, if you use these SCSR at paces higher than they're supposed to be used at, and, second of all, whether or not or how far -- how much distance does that translate into for 60 minutes worth of oxygen generation capacity.

So the first study that we had relates to how far one can walk while wearing a self-contained self-rescuer.

There are often distances from the mine entrance to the working face greater than the distances, perhaps, than you can expect. And so therefore, we were interested in knowing what that distance ought to be. So the goal, then, was to determine this distance when the SCSRs were used as intended.

And just to let you know where we ended up here, the average distance was 3.7 miles. And that would allow, then, an estimate for the distance to place additional SCSRs in caches on route.

So the way we got these results, we used CSE SR100 SCSRs, and -- well, let's see. I won't go there.

But anyway, the question here is 60 minutes of oxygen, at what distance, what does that -- what distance does that translate into.

And, again, the average result, then, is 3.7 miles, although we will find out a little that that's not necessarily the most critical distance.

We used 14 volunteer subjects for these. And, yes, they were students, and, no, they weren't grad students, but they were even lower down on the totem pole than grad students, and that is undergraduate students in a lot of cases.

They had a health assessment form. Their maximum oxygen uptakes were in the average range of fitness levels.

We used a treadmill at zero percent grade, and the speed was determined by the subjects. In other words, they were able to change their own speed, and they were told to walk as long as possible.

So we used these SR100s. And there's one subject right there who probably doesn't look like your typical miner using the SCSR.

The results from this test, then, showed that the maximum distance was 5.7 miles. The minimum distance was about 1.3 miles, and the average was about 3.7 miles.

The times that these SCSRs were operable for were 30 minutes to 94 minutes, with an average of 65 minutes.

Now, the 30 minutes was -- and if I go back, that relates to the person who only went 1.3 miles, and it points up a very important point. And that is, when people are first presented with these units, they don't know how to use them exactly well.

They use them, and they try to judge what they can -- how well they can perform using these devices.

But this one subject that went 1.3 miles in the 30 minutes was retested. And with the retesting, he or she -- I don't know exactly which -- but that subject went for 45 minutes, so obviously made some adjustments in the meantime.

However, that 1.3 miles in the 30 minutes was used in the averages because we didn't retest anybody else, and so we wanted to make it consistent. So we kept the result -- the data analysis consistent.

These are the performance data for the subjects. Probably it's a little small for some of you in the back to see, but I wanted to make sure that you saw what all the performance data looked like.

The times are in the second column from the left, and the distance are in the third column from the left, there in the center.

And you can see that most of the subjects went fairly long distances, except, if you take out the 1.3 miles there, then, for the most part, you have subjects who mostly went three, four, and in some cases, over five miles.

The termination reason also is given there, including insufficient air, which was determined by the fact that the subjects felt like they couldn't get any more air out the devices, and sometimes the air was too hot. And, as a matter of fact, the air got so hot, or the devices got so hot that we had to put towels underneath the devices because otherwise some of the subjects were being burned in the chest area.

So they got very, very hot.

Now, there's a quandary here that you have to realize. If you were going to make some sort of a regulation relating to how -- what distance you are to put caches of these devices, do you base it on the average, or do you base it on the minimum here?

Well, the average is 3.7 miles, and the minimum is 1.3 miles, so there's quite a bit of difference.

And if you have untrained people wearing these devices, then you probably want to use the 1.3 miles as the critical distance. On the other hand, if you trained the people, perhaps it's going to be closer to the 3.7.

So there's -- well, we also found out that there's no correlation between speed and distance walked because here is a couple of slides showing the times and the treadmill speeds that were actually used by the subjects.

So in this one, right here, you can see that the subject started out at about 3.8 miles per hour, increased it, and then decreased it, and then really decreased it a lot towards the end when the oxygen wasn't as available.

On the other hand, this particular subject remained relatively constant until exactly the end, in which case there was also a decrease because these devices tend to produce the oxygen at a lower rate at the end of their service life.

You can also notice that this device actually almost went to 70 minutes.

Now, some of the complaints that the subjects had were that, first of all, the unit gets very hot, and the inhaled air gets uncomfortably warm.

We inhaled fine gritty material at times, high resistance, especially towards the end. And there's difficulty keeping the nose clip on, especially for those with smaller noses like the people from Asian decent.

The mouthpiece was also uncomfortable.

Now, granted that these weren't emergency situations, but in this respect, these subjects were similar to what you would expect from miners who had never seen these devices before and never worn the devices before because they didn't exactly know, except for the fact that they were instructed to walk as far as possible, how to actually walk with these devices.

So the conclusion that we reached from this study is that there should be additional SCSRs stationed at locations along the route, which I understand now is the regulation.

Extra SCSRs should be available to carry from the beginning of the escape. And that's because you never know whether or not those devices are going to be used the way they're intended to be.

So those are the conclusions from the results.

We also know from the study that training is very important.

Potential wearers should know about device limitations. They should know about the fact that the resistance is going to go high. They should know that there's going to be a little gritty material in the devices. They should know that they're going to get very hot, at least for this type of SCSR.

And we recommend, also, that potential wearers should practice with the units and become familiar with the SCSR and aware of the complaints listed. And we would anticipate that additional practice would increase performance times and distances.

Now, that was the end of the first study.

The second study was, well, what happens to these devices when you use them the way they're not intended to be.

As we looked at it in the last study, they were supposed to be used below the ventilation threshold where the ventilation and oxygen consumption are proportional to one another.

Above the ventilation threshold, the air that you're breathing -- you start hyperventilating. The air that you're breathing in and out is going to be extremely high compared to the oxygen usage. And the higher the air is, the more oxygen that's going to be generated from these devices.

Since now you're generating oxygen at a rate faster than you could use, we will be wasting a lot of oxygen generating capacity of these devices.

So at high speeds, how long, and will these devices last? Well, let's look at that.

So we had one volunteer subject.

Let's see. That should say V.02 max, and that "N" sign should be a dot, is about three liters per minute. And that's roughly average for young people or middle-aged people.

I think that it decreases with age, so my guess is that with miners, for instance, that might come down into the high twos or the mid twos.

Again, treadmill walking at zero percent grade, and we had five testing sessions, each at different intensities. Because, again -- and we didn't repeat these tests, by the way, because again, these devices are expensive, so we only used the minimum number.

Well, we used 65, 70, 75, 80, and 85 percent of the maximum oxygen consumption.

Now, at 65 percent, one would expect, for instance, that normally you could walk for, let's say, an hour to two hours.

But at 80, 85 percent of maximum oxygen consumption, normally, if you were working at that intensity, which is pretty high intensity, you're talking about somewhere between five and 25 minutes, normally unencumbered.

So this subject was instructed to exercise until fatigue happened or until the equipment limitations were reached. I do have to say, too, that this subject was one who had participated in a previous study, and so was familiar with the device.

The results from this study were that performance times decreased relatively linearly as oxygen consumption increased.

No performance time reached the 60 minutes that was required for the SCSR, and all work rates were too high for the SCSR to keep up with.

The cause of exercise termination was reported, in most cases, to be lack of supply of oxygen from the SCSR.

This is what the experimental data looked like. At 65, 70, 75, all the way up to 85 percent of V.02 max, the performance time decreased. So at 85 percent V.02 max, the amount of oxygen that was supplied for this particular subject was supplied only for about six and a half minutes. The minute volume is in that other column.

But you can see the severe penalty that can be paid for using these devices at very high work rates.

We also took rating of perceived exertion, so we looked at the subjective indication of the subject and how hard -- the difficulty of work.

And at termination, the RPE, which is the rating of perceived exertion, showed ratings in the neighborhood of 19 to 20, which indicates that that's the maximum amount we expect them to perform.

No matter what the experiment, if they really go to fatigue, their ratings of perceived exertion are going to be roughly in the neighborhood of 18, 19, and 20.

The rating of perceived exertion is

roughly proportional to the heart rate divided by ten, so that a termination RPE of 20 is roughly equivalent to a termination heart rate of about 200.

So she was really going, that subject was.

At six minutes, however, you do see a distinction in the RPEs. At 85 percent of V.02 max, the subject indicated that the work was really hard, and at 65 percent, wasn't too bad actually.

And the other indicator that we have here is breathing apparatus comfort scale, which we use a lot in our respirator research. And the lower this breathing apparatus comfort scale is, the BACS, the more uncomfortable the respirator is.

And you can see there that, for the most part, the rating of this SCSR was extremely uncomfortable. But at six minutes, there was a distinction between what the subject seemed to indicate was the feeling of the comfort of this device at one work rate compared to the other work rate.

Now, what we did was -- and let's see, now, this is really messed up -- is we calculated the performance time based upon Kamon's formula, and I'll read it for you.

It says, The performance time is equal to 120 times the ratio of the maximum oxygen consumption divided by the actual oxygen consumption, minus 117, and that's in minutes.

So the time penalty that we calculated here was equal to the performance time that was calculated from the Kamon formula minus the performance time that we actually measured.

The distance walked was the measured performance time times the treadmill speed. And the oxygen used was the oxygen consumption times the performance time as we measured it.

So when we calculated these things out and then showed the measured values, the oxygen consumption here is on the left-hand scale. And on the bottom scale is the performance time.

And the results are roughly linear. Over a wider range I think probably we would expect to see a hyperbola there. But over this range that we're talking about, we were able to, for the most part, draw a straight line through the results.

And you can see the Kamon formula, which would be the indication of how long the subject could perform at that particular oxygen consumption without the encumbrance of an SCSR.

That's given by the inclined line to the right. And the inclined line to the left is actually the measured performance times.

So it's the difference between those two lines in the horizontal direction that gives you the difference in the performance times at the different oxygen consumptions.

And you can see, it's roughly a constant penalty. But it does indicate that there's a lot of penalty paid for using the SCSR.

So we do agree that in an emergency situation, panic is likely to ensue. And that panic is likely to lead to increased work rates.

The penalty, however, for the increased work rates is that, No. 1, the SCSR becomes much more uncomfortable. The effort becomes more difficult. We have much lower amount of accessible oxygen and much shorter performance time.

So, therefore, if possible, the SCSRs should be used at low rates of work where the oxygen used is matched by oxygen generation.

The conclusion we reach from this study is that there's an inverse relationship that exists between performance time and exercise intensity. We confirmed that the SCSR must be used as intended, and there's a large penalty expected if the SCSR is used outside its range.

So the overall conclusion from these studies is, or are, in emergency situations, if possible, don't panic. I know. I know that's not possible, but nevertheless, if it's possible, if, with training, perhaps this could be overcome.

Use the SCSR as intended at low work rates.

Train, train, train. We need lots of training.

Become familiar and aware of the SCSR limitations, what you can actually expect from these devices rather than what's actually told you.

And if possible, additional SCSRs should be stationed at locations along the route, and/or additional SCSRs should be available to carry from the beginning of the escape.

So I'm not sure that we have told you anything that you don't know in this study, but what we have done is we have confirmed it.

This showed you that if you use the SCSRs at their intended rates, that the devices themselves do not seem to cause the limitation of the work rates until you get to the end of service life for the SCSRs, which lasted in most cases at least the 60 minutes that was required.

We also know from these studies -- and we have measured -- the fact that if you use the SCSRs at high work rates, that the amount of oxygen that's available and the distance that you can walk is a lot less.

So, again, I don't know if it told you anything new. But in this case, we have actually made the measurements so you have some data to work with.

Thank you.

And if there's any questions, I would be glad to answer them.

MR. KAY: Mike Kay with Ocenco.

I just want to make sure I understand the data you presented here.

You took 14 new units, these were not deployed?

MR. JOHNSON: These were new units; that's correct.

MR. KAY: And you had --

MR. JOHNSON: Actually, it's 15 because we tested one.

MR. KAY: You had fit young test subjects.

MR. JOHNSON: That's correct.

MR. KAY: In ideal circumstances, on a treadmill, in a laboratory.

MR. JOHNSON: That's right. And I -- and the temperature inside the laboratory was comfortable.

MR. KAY: Right.

MR. JOHNSON: That's correct.

MR. KAY: 40 percent failed to get the rated 60 minutes under these ideal conditions.

MR. JOHNSON: That's correct.

MR. KAY: All right. Are you going to be testing units that maybe have been in service for some amount of time to see if there's any degradation in the performance?

MR. JOHNSON: Well, perhaps we could, but you know, we weren't supplied these units, so we didn't test them.

MR. KAY: And just to make a point, the test subject that got 30 minutes, now he has been trained, he knows what to expect, got 45 minutes the second time he went through.

MR. JOHNSON: Yes.

MR. KAY: All right.

MR. JOHNSON: Yeah. I would take from that the message that if somebody is faced with having to wear one of three devices for the first time, then it's a shot in the dark.

That you have to try to see how far you can go, but you really don't know until you have actually done it whether you're doing it correctly or not.

So that's the message I would get from these subjects, plus the one that we retested, yeah.

Was that it?

MR. KAY: Yeah.

MR. JOHNSON: Okay. Thank you.

I guess the other question that probably could come up is, Well, could we test miners?

And let me just tell you about a very practical issue here. And that is, in order to be able to use data from older people, especially miners out in field, we have to pass all this through our Institutional Review Board. And they don't like you using data from human subjects without that approval.

So -- and it would be very difficult for us to conduct a test without physician -- without a physician present, from older people, especially ones who perhaps show symptoms of some diseases, without, you know -- so, anyway, what I'm saying is it becomes a big deal.

Anything else?

MR. HEINS: Bodo Heins from Draeger Safety.

You're right. What you found out in your research we already knew. But all manufacturer are following the existing standards. So that means that under this special conditions, the unit has to last 60 minutes.

Your conclusion would be that we would have to provide much bigger units to perform longer time in any conditions, and that is not really what is required now.

MR. JOHNSON: Not necessarily.

I think we're talking apples and oranges here a little bit because the apples are that in order to be certified, they have to be certified for 60 minutes under the test conditions that they're certified in.

We're talking about actually used by subjects who didn't necessarily know exactly how to use these devices. So that's the oranges.

Now, I would bet that if we were to retest these same subjects again the second time, that more of the devices -- I'm not guaranteeing all of them -- but more of them would last at least the 60 minutes.

But we really don't know that out in the field when we certify a device because we don't certify it with a human wearing it. So I think it's a little bit different.

Hopefully, all of the devices, even the Draeger devices would last the 60 minutes. But given the fact that the people would wear them to start off with, without any additional instruction except how to start them up, they might not last 60 minutes.

MR. HARRIS: I'm going to have to quit following you. You're too tall. I didn't mess up your microphone, did I? Okay.

Two questions, Art.

One of them is, I'm working on a protocol design to do something similar.

MR. JOHNSON: Okay.

MR. HARRIS: And you're right about

getting it through your internal review committee, and I'm going through that process now with one of the universities, and it's quite honestly a pain somewhere on my anatomy.

But the one thing that is obvious is that miners do have preexisting conditions.

MR. JOHNSON: That's correct.

MR. HARRIS: And a couple of them that have come into -- as we're going through this protocol and looking at the health of our miner population, is exposure to small particulate matter over time, even though it's below the thresholds for regulatory concern, has resulted in significant degradation of respiratory ability in our folks.

The hospital I'm working with is in Huntington, West Virginia, and they basically service this whole southern Appalachian region.

And they're telling me that the kind of conditions they're seeing in the healthy miner are not too afar from what they're seeing from the smoking non-miner as far as respiratory ability goes.

At some point in time, we need to figure out how to correlate -- if we can't actually test all this stuff on miners, thus we need to figure out how we write the correction factors between whatever healthy population we're using and our miner so that we can use the healthy population, because they're easier to use, but apply the correction factors to get closer to the miner population.

And I don't know how to do that.

MR. JOHNSON: I don't either. But I'm going to tell you one interesting fact, and that is you said that the respiratory conditions of smokers and miners are equivalent.

And many years ago, there was a study that talked about the effect of cigarette smoking and the carbon particles that came from the cigarette smoke.

The carbon particles, I guess, actually acted as adsorption surfaces for all the contaminants that were in the atmosphere. And probably, that's the same thing happening with the small coal particles that get trapped in the lung. It makes it even worse.

MR. HARRIS: Yeah. And I did most of my inhalation stuff in the nuclear business, so we were dealing with very small particles there. And well below the -- basically we looked at things below one micron in the nuclear world. And so I understand some of the problems there.

But my point is, I think we need to figure out how to solve this correlation issue, otherwise this issue is just going to keep coming up over and over again.

The other thing is, it gets back to the comment that Mike made is, I really think we need, at some point, to go back and look at this whole -- to revalidate the baseline behind Man Test 4.

We need to say is, indeed, that the right set of exertions, you know. If Man Test 4 is the standard -- and that's what these guys are all designing to, to be able to pass that -- but yet when we put them on -- like you did -- and I have no idea whether your population is representative of our miner population -- but they could not achieve the same results.

Then does Man Test -- does that as much discuss what you did, does that call into question the Man Test 4 thing? And does Man Test 4 need to be revisited and revalidated?

So I don't know.

I won't put you on the spot to answer that.

MR. JOHNSON: Oh, no. Yeah, I'll reserve my comments on Man Test 4.

Let me just say that we prefer constant work rates because we know what's happening there.

If you will vary work rates, what happens is that there are a number of different limitations to work. Respiration is one of them. Cardiovascular problems is another one. Thermal is another one.

And if you vary the work rates a lot, you actually end up going through all of those, and you don't know exactly -- at least from our experimental testing, you don't know exactly what is causing the problem.

So what we usually do is we usually stay at a constant work rate. And if we want to test for, for instance, heat stress, we will go at 65 to 70 percent of V.02 max. That allows the heat to build up in the body long enough so that the rectal temperature or the internal temperature gets high enough so people have a lot of heat stress.

And if we want to test for respiratory stress, we go onto 80, 85 percent of the V.02 max because that stresses the respiratory system more than anything else.

And if we wanted to go to cardiovascular, then we even go a little higher than that.

So that's why we, in our tests -- but we don't have to certify anything. All we have to do is come up with the scientific results. So that's a little different situation, again.

But what I'm saying here is that -- and again, we have done a laboratory test. And, again, it was a very comfortable environment for these people to be in, but you have to start some place, and I think that's the place to start when you can control the conditions.

Then you get into more uncontrolled later.
I think that's about it.

MR. BOORD: Okay. Are there any other questions for any of the presenters at this time?

Okay. If there's no questions, is there anyone who would like to address the meeting? Any additional comments? Anybody who would like to add?

MR. HARRIS: What happened to the long-term field study discussion?

MR. BOORD: We did speak about the history of the long-term field evaluation and the thoughts of the program going forward.

MR. HARRIS: What about the overview of 8 and 9?

MR. BOORD: As we mentioned, the 8 and 9 is in the process of being prepared. It's going through a final review, which is part of the NIOSH procedures for technical publications.

MR. HARRIS: And how long has that been in review?

MR. BOORD: I don't know exactly how long it has been in review, but that is the established process that we're following.

And in the -- I might add that that review process is really -- it's a procedure and a process within NIOSH to ensure the quality of technical documents and publications that we produce.

So that is a normal part of that process.

MR. HARRIS: But haven't these documents been done for four years?

MR. BOORD: I don't believe the documents have been done for four years, no. No.

Some of the data may have been processed during that period of time, but the review process has certainly not been for that type of time frame.

MR. HEINS: Bodo Heins, again.

What's your time frame according to the standard? When will it become valid, and how are the two new units, the hybrid and the docking unit, to be included in there because it could probably be the same time frame.

MR. BOORD: The time line for the research activities, those are being pursued through RFPs, requests for proposals.

And I think those are -- the announcement for those proposals was actually made available, I believe, about a week ago, September 15.

So that is an ongoing process.

Relative to comments in the open docket on the concepts that we have discussed today, we're going to keep the docket open until November 1.

At that point in time, we will receive comments and review the comments and decide on continuing actions there.

So I can't really, you know, precisely nail down what that continuing process will be.

MR. HARRIS: I see.

MR. BOORD: The only thing I can say at this time is November 1 is our next threshold.

What I would like to do is -- are there any other questions, any other comments?

MR. HARRIS: I just have a brief comment.

And because we're looking at tests that are way down the road or, you know, we're going to close the docket in November, and Lord knows, you know, when we're really going to get something out.

I mean, these issues, in my opinion, are extremely critical, and I think they are in your minds, too. And maybe what we need to do is expedite the process here.

Because, as I discussed with some other folks, what I see are some major investments that are, you know, now occurring or going to occur on current technology.

And we're going to have new requirements and new certifications, and that may be some time down the road. But you're going to have a whole lot of money invested by employers, who are then going to resist through whatever means they can resist and say, Listen, I just bought units that have a shelf life of 15 years, and I'm not doing to spend another $12 million on units.

So while we look at this situation, maybe what we need to do is focus on whether it's an emergency temporary standard, or whatever we need to focus on to look at a situation and say, Here is what we're looking at. We have held the meetings. We have got our comments. And maybe we can run through this process as quickly as possible because what I foresee are employers spending a lot of money and then resisting any more expenses.

And what I heard from the professor kind of makes me wonder what's going on because he's talking about the units, as you breathe, the units -- you generate more oxygen than you need and you basically waste the oxygen.

But what we're hearing in the field and from some of these people, that doesn't appear to be what they're describing. They're actually describing a situation where they're starved for oxygen and it feels like they're suffocating. So it's kind of the opposite of what I'm hearing from what he reported out.

So, you know, I don't know how those two mesh, but we do need to look at those.

The other thing I would suggest -- and I didn't mention it before. I had forgotten -- was there should be a mechanism where you test a certain number of deployed units every year. And I think you proposed that.

But I also think there's a responsibility on the part of operators to have some obligation to replace their own units.

This is not a grant from the federal government that says, We're going to take ten of your units and we will replace them. They have an obligation here, too.

So as you look at that process, maybe what you need to do is say to the operator, We're going to test a certain amount of these every year. We're going to spread it around, and it's going to be random, but when we take five of your units, go buy five. I mean, I don't think that's asking for a whole lot. That puts the burden back on them.

So there are some issues I think we need to look at. But I think, as this thing winds up, the real critical -- the real critical issues, I think, are time.

And in essence, what time is going to be is the money invested. And maybe, as we move quickly forward, we can defeat some of this what I heard earlier about how these units are treated, you throw them here, you throw them there. And we have all done it. And I did it whenever, you know, I worked there.

But I think that's, in fact, part of the mindset, not only of that miner, but of that operator because this isn't production.

You know, get rid of the self-rescuer. Put it over there. Let's go. We have got to go get coal.

And so if there's an investment, routinely, even if it's just five, ten, 15 units a year, and it's more than what they're doing now, maybe it reflects on -- or gives them some incentive to be a little bit better trained.

And training is something, or lack thereof, is something we need to look at.

I have not donned an SCSR in years, but when we did, when we went through retraining, we didn't -- not everybody in the class could don it. So I think there's a real need, you know, to do that. And we are in support of underground smoke testing and that kind of stuff.

But those are things I think we need to look at.

I think we need to move this process -- or to be quite honest with you, as unfortunate as it is, the further we get from Sago, the further we get from Alma, and the further we get from Darby, the less incentive there's going to be for people to participate in any of this.

They're going to sit back with the status quo. They're going to say, It's good enough. That's all they need. And in some instances They're just miners. It'll be fine.

So we need to move the process.

Thanks.

MR. BOORD: Thank you.

Any other comments?

MR. KAY: Mike Kay, Ocenco.

I think we need to be real deliberate and make sure science is backing up this process and not have a knee-jerk reaction and change the fundamental certification process to make it look like something is being done.

I agree with what Mr. Harris said. We need to get back to the basics, establish a new baseline.

If we're going to change the CFR, do it on science. Do it on research. It's the only way we're going to effect a change down the road.

These proposals have been out since 1999. I believe they were published even earlier than that, actually.

I think this is a good process. This is a good review, but let's not move too quickly and not solve the problem.

Thanks.

MR. BOORD: Thank you.

MR. HARRIS: I'm sorry. I got -- Les, we can't not be putting this stuff out, you know. And I understand the situation that's going on. I mean, we got all these reviews on this and that, but we have got stuff from '99. We have got stuff from 2001.

We're making decisions now, today, you know.

If there's going to be another accident, it's going to happen. And if we're sitting on a frigging report because it hasn't gotten through some public review, I just -- I don't know how we're going to sleep at night.

We cannot allow these things to sit. We have got to get the information out.

We're scientists, damn it. You put the data out and let people argue about it. You don't wait to through political review processes. We have got to get over this.

And it's not just this report. We're running up against it all over the place. And we have got to stop this, damn it.

We're scientists and we're safety professionals, and we have got to start acting like it. And if it pisses off our top political bosses, then it does, but we have got to move out on this.

MR. BOORD: Any other comments?

I put this chart back up on the screen. I just wanted to talk about -- just as a comment here.

During the process of the discussions, we have heard a lot in the concepts that we have looked at for capacity and for performance evaluations.

We have talked about different terms, and I just wanted to kind of draw it all back to this chart here, which is the Man Test No. 4, and, again, the axis here in the numbers that we're looking at.

This is a typical Man Test No. 4 in 42 CFR, using the current prescribed tasks.

The maximum that we see up here is 3.0 liters per minute oxygen consumption.

Now, if you take this type of data and then project that into the concepts that have been discussed, whereby the performance evaluations -- evaluation concepts are being discussed at the 3.0 liters per minute as a starting point, and as that initial thrust in the tested evaluation, I think that kind of puts things into perspective relative to the physiology of how the tasks are coming together for rating.

So at that point, if there are no further presenters or discussions or topics, I think we are at a point where we can wrap up the meeting.

I think each of you have received a list of the attendees for the meeting. I think that was passed around during the lunch break.

Also, there are satisfaction forms, I think, which were also passed out. If you could process those and hand them in. You can leave them on your table or hand them to the registration desk, that would be great.

And then finally, the presentations that we went over today will be posted on the NPPTL website. And those should be available for access, I believe, I'm going to say in about a week. So they will be posted.

And with that, I will ask any further questions, comments?

Okay. Thank you all for attending and participating in the discussions.

(Whereupon, the proceedings in the above-captioned matter were concluded at 2:15 p.m.)

CERTIFICATE OF REPORTER

I, Joseph A. Inabnet, do hereby certify that the transcript of the foregoing proceedings was taken by me in Stenotype and thereafter reduced to typewriting under my supervision; that said transcript is a true record of the proceedings; that I am neither counsel for, related to, nor employed by any of the parties to the action in which these proceedings were taken; and further, that I am not a relative or employee of any attorney or counsel employed by the parties thereto, nor financially or otherwise interested in the outcome of the action.

Joseph A. Inabnet
Court Reporter