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NATIONAL INSTITUTE  
FOR OCCUPATIONAL SAFETY AND HEALTH  
NATIONAL PERSONAL PROTECTIVE TECHNOLOGY LABORATORY  
PUBLIC MEETING

Tuesday, December 2, 2008

Commencing at 8:32 a.m. at the Hyatt  
Regency, Pittsburgh International Airport, 1111  
Airport Boulevard, Coraopolis, Pennsylvania.

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MR. SZALAJDA: Okay. I think we are going  
to go ahead and begin the meeting today.

Again, welcome. First, I would like  
introduce Les Boord, the Director of the National  
Personal Protective Technology Lab, who will have a  
few opening remarks.

7 MR. BOORD: Good morning. I would like to  
8 welcome everybody to the stakeholder meeting today.

9 And I think -- could you put it on -- I  
10 guess that's as good as it gets. Okay.

11 Anyway, I would like to thank you for  
12 attending the meeting today as we try to live up to  
13 the vision and mission that we have identified for  
14 the laboratory, which is to -- I want to get it up  
15 there.

16 Anyway, live up to our vision and mission,  
17 which is to be a leading provider of personal  
18 protective technology information and to prevent  
19 work-related injury, accident, and death through the  
20 advancement and application of personal protective  
21 technology.

22 And that really does feed right into the 3

1 meeting today. On the agenda and as we go through  
2 the course of the topics and discussions today,  
3 there is actually four key things and four primary  
4 topics that we are going to be discussing with you,  
5 presenting and discussing with you.

6 Two of those topics pertain to our  
7 efforts, our laboratory and personal protective  
8 technology program efforts to update and revise  
9 standards, respirator standards in 42 CFR.

10 Actually, one of them pertains the powered  
11 air-purifying respirator requirements currently in  
12 42 CFR. And the second one actually addresses  
13 performance requirements for the air fed respirator  
14 ensemble suit, which has been a long-standing

15 discussion that we have had within the program.

16           So two of the topics are directly related  
17 to respirator certification standards.

18           Another topic that we are going to talk  
19 about today is related to the end-of-service-time  
20 alarms for self-contained, primarily open-circuit  
21 self-contained breathing apparatus. And this is a  
22 topic that has generated a lot of interest within

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1 the fire service industry and touches directly on a  
2 requirement in 42 CFR.

3           And then the fourth topic is more of a  
4 strategic topic for us. And it's a discussion that  
5 we are going to have relative to the action planning  
6 steps that we are taking following a National  
7 Academy Institute of Medicine evaluation of our  
8 program.

9           So four very important topics that have an  
10 impact on our program and have an impact on you as  
11 well, as manufacturers and users of personal  
12 protective equipment and respiratory protection  
13 products.

14           Our objectives today in presenting and  
15 discussing these issues is really to present the  
16 information, present our viewpoints, talk about our  
17 logic and our rationale for establishing concept  
18 performance requirements, but also to listen and  
19 learn.

20           It's very important for us to hear from  
21 you, the stakeholders, manufacturers, users, and  
22 other subject matter experts relative to the

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1 concepts and topics that we are going to talk about.

2 The format of the meeting today I think is  
3 a little unusual in that we are going to have a  
4 combination of presentations and posters, which is a  
5 repeat of the process that we established in our  
6 August meeting.

7 But in addition, I think we also have a  
8 live link with -- the proceedings of the meeting are  
9 actually going to be broadcast to several other  
10 participants remotely.

11 So that's new feature for these types of  
12 meetings, which really helps us to broaden and  
13 expand the reach of what we do.

14 Again, our objectives are to present,  
15 listen, and learn.

16 In 2008, we have had four meetings of this  
17 nature where we have done similar activities. In  
18 March we had a meeting to discuss personal  
19 protective technology program activities at NIOSH.  
20 That was an institute-wide PPT presentation. So we  
21 had quite a few posters and discussions relative to  
22 research across the Institute.

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1 In August, we had a stakeholder meeting  
2 discussing closed-circuit self-contained breathing  
3 apparatus, supplied-air respirators, and other  
4 topics such as the 40-millimeter thread connector on  
5 our CBRN air-purifying respirator standard.

6 In the first week in November, we had a  
7 no-fit test respirator workshop, which was also of

8 high interest and had a lot of participation. And  
9 then the meeting today to talk about the topics that  
10 I have already mentioned.

11 As we look into the coming year, in 2009,  
12 we anticipate and -- we don't anticipate. We have  
13 actually identified March the 3rd as the date for a  
14 PPT program institutewide stakeholder meeting. That  
15 meeting I think is actually scheduled at this  
16 location.

17 So that meeting is on March 3 of 2009 at  
18 the Hyatt. Again, an institutewide personal  
19 protective technology program stakeholder meeting.

20 You might ask, well, why March? Well,  
21 that actually fits into our strategic planning  
22 cycle. So one of the key elements is the

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1 stakeholder input and feedback that we get on our  
2 programs, the viability of what we are doing, and  
3 new emerging ideas. And we do take that information  
4 and factor it into our strategic planning process  
5 when we identify our actions to continue programs  
6 and institute new start programs.

7 So March 3.

8 Additionally, in 2009, I would anticipate  
9 that we will have another stakeholder meeting to  
10 talk about standards development, again, to help us  
11 formulate ideas on respirator standards to revise  
12 and update 42 CFR, at least one meeting to do that.

13 And then there will probably be one or two  
14 other public meetings that are geared to those  
15 standards that are moving -- have moved a little

16 further along the line and they are actually in the  
17 rulemaking process.

18 So I think 2009, we can look forward to  
19 between three and four stakeholder meetings where we  
20 will ask and get your input.

21 So with that, I told Jon that I wouldn't  
22 take too long, and I will wrap it up. I would like  
8

1 to thank you for being here, and I will turn the  
2 meeting back over to Jon.

3 Thank you.

4 MR. SZALAJDA: We will get this worked  
5 out.

6 Technology is always -- I think it's the  
7 metal stand, so we will try to work through this.  
8 Is there still a lot of feedback? All right. How  
9 about that? Is that better? All right.

10 Again, good morning. My name is Jon  
11 Szalajda. I am the branch chief for the Policy and  
12 Standards Development Branch for NPPTL.

13 Next slide, please.

14 As Les had mentioned, we really look to  
15 these public meetings to be information sharing  
16 opportunities. You know, one, it's a good forum,  
17 you know, for us as standards developers to share  
18 information with stakeholders and to give you an  
19 idea of what our thought process is and where we  
20 think we are going, you know, with regard to the  
21 evolution of a standard, you know.

22 And it's very important, you know, when  
9

1 you look it how we -- John, could I get the second  
2 slide and then the public meeting objectives?

3 There you go. Thank you.

4 I think it is very important, you know,  
5 when you look at the process that we can't develop  
6 standards in a vacuum.

7 You know, and I think the term I have  
8 heard lovingly and, having worked for the government  
9 for a while, is, you know, a bunch of policy lunks  
10 sitting at a table coming up with requirements that  
11 nobody can meet.

12 And I think that's something that we are  
13 really trying to avoid, you know, how we address the  
14 evolution of personal protective technologies that,  
15 you know, the standards are necessary to give  
16 manufacturers benchmarks where they can build  
17 equipment to.

18 And it is also important to get the  
19 feedback from the user community, you know, the  
20 people that actually use the equipment, as least as  
21 far as what types of performance attributes are  
22 necessary for the equipment and then moving forward

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1 and trying to provide the proper protection.

2 Next slide, please.

3 As far as our meeting format today, it is  
4 like anything else. I think it's a dynamic process.  
5 You know, we try to have a couple of meetings a  
6 year, and every time we try to do something a little  
7 bit differently because, you know, you people get,

8 you know, comatose by too many PowerPoints. And  
9 sometimes by the end of the day, you are pretty well  
10 fried, and the feedback isn't what it should be.

11 And so what we have tried to do is to come  
12 up with a more of an interactive process to  
13 encourage feedback and encourage dialogue between  
14 the researchers as well as the stakeholders.

15 And to do that, one of the things that we  
16 integrated into the August meeting was the concept  
17 of having posters to allow stakeholders to have  
18 one-on-one or small-group discussions with the  
19 researcher to talk about a specific aspect of the  
20 potential standard.

21 And I think overall, that was very -- the  
22 feedback that we got from the last meeting, that was<sup>11</sup>

1 very well received. But there were some comments,  
2 at least as far as how to capture that in relation  
3 to the information that is given in the  
4 presentation.

5 So I think with what we will see today is  
6 still the same use of the poster format, but the  
7 presentations that will be delivered immediately  
8 following the poster session will provide an  
9 overview of the material that's on the poster and,  
10 again, allow an opportunity for dialogue following  
11 those types of presentations.

12 The other thing that we are working with  
13 today -- and I hope that you will bear with us on  
14 this -- is this the concept of using LiveMeeting.  
15 And we have at least eight different sites are



16 linked into the meeting today with numerous people  
17 at each site being able to have to the opportunity  
18 to hear the presentations as well as see the  
19 presentations as they are delivered.

20 And we think this is a tool that we are  
21 going to try to make more use of in the coming years  
22 because of the aspect of the economy and the

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1 restrictions on travel budgets and things of that  
2 nature, to be able to allow a remote interface for  
3 interested stakeholders that may not have the same  
4 opportunity to travel that others may have, but  
5 still, you know, provide a forum for their voice to  
6 be heard.

7 Next slide, please.

8 Some of the housekeeping things that we  
9 need to address, hopefully everybody registered on  
10 the way in. The registration desk is outside.  
11 There's materials, the presentations as well as some  
12 other handouts, that are available for your  
13 consumption today and to take home with you.

14 Also, the fact this meeting is being  
15 transcribed. The poster discussions are not being  
16 transcribed, but the discussions that are taking  
17 place in this room will be. That transcript will be  
18 available through the NIOSH website in the future.

19 We were hopeful, I guess, after the August  
20 meeting that the information would be posted  
21 quickly. And I think, actually, it just came up,  
22 the materials that were covered as well as the

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1 transcript were just made available within the past  
2 several days. So we can't give you a promise on  
3 when the transcript will be available, but it will  
4 be available on the website in the near future.

5 In terms of the agenda, which I will talk  
6 about in a minute, we will go through the items as  
7 identified in the agenda, and I will spend a little  
8 more time on that with the next slide.

9 We also wanted to address your feedback,  
10 at least as far as the format of the meeting as well  
11 as the content of the presentations and the  
12 location, those types of details. That survey will  
13 be provided to you. We will be collecting that this  
14 afternoon during the wrap-up at the end of the day.

15 If you do need to leave early for whatever  
16 reason, if you could complete the survey and turn it  
17 in at the registration desk, I would appreciate  
18 that.

19 And, again, with the -- the concept with  
20 the LiveMeeting, for those meeting participants that  
21 are involved remotely, or participating remotely,  
22 what we would like to do is to only take questions

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1 at the time when we are having the  
2 question-and-answer and public comment period. At  
3 least that will make it a little easier for us at  
4 this go-round instead of trying to answer the  
5 LiveMeeting questions as the meeting is going on.

6 So those remote participants will have the  
7 same opportunity to provide comments as the people  
8 that are actually sitting here in the room.

9                   And also, during the meeting, during the  
10 public comment periods, there is an opportunity for  
11 stakeholders to provide presentations on the topics  
12 at hand.

13                   I know at least with the  
14 end-of-service-life indicator topic, that there are  
15 two individuals who would like to provide  
16 presentations. If those people could see me at some  
17 point during the meeting, that we can get the -- if  
18 you actually have slides, we can get them loaded  
19 onto the computer and get a copy of them for the  
20 docket, that would be appreciated.

21                   Also, with regard to some of the other  
22 logistics that aren't in the slide, for lunch today<sup>15</sup>

1                   there will be an a la carte lunch that will be  
2 available for purchase right here outside the door.  
3 I'm not sure what the fee is, but I think it is  
4 sandwiches and salad and that type of thing, which  
5 will be available for purchase. Also, there is a  
6 restaurant in the hotel on the other side of the  
7 lobby. So there's two options for you to consider.

8                   I think given the time frame, you know,  
9 and the location, it may not be feasible for people  
10 to get too far off site to go elsewhere. There is  
11 at least one other restaurant in the airport that's  
12 on this side of security that I'm aware of.

13                   Also, for the local people, there are  
14 parking passes for complimentary parking. If you  
15 didn't get one when you registered, they are  
16 available at the registration desk. So please

17 either see Tess or Judy at some point during the day  
18 so you can get your parking pass.

19 Next slide, please.

20 with regard to the agenda, these are the  
21 topics that we are going to address. And as Les had  
22 mentioned, I think with regard to the activities and  
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1 the Policy and Standards Development Branch, you  
2 know, we are focusing on using a modular approach to  
3 update the Code of -- excuse me, the Federal  
4 Regulations Part 84, which provide performance  
5 requirements for respiratory protection devices.

6 I think when you look historically at the  
7 evolution of the PAPR, we have been working on this  
8 for several years now, beginning with the --  
9 addressing the requirements for the chemical,  
10 biological, radiological, and nuclear requirements  
11 for Emergency Responders and First Receivers.

12 And we have been in this process I guess  
13 specifically looking at this module for about  
14 three-and-a-half years with regard to trying to  
15 identify the appropriate performance requirements  
16 for this type of system.

17 And I think, at least with regard to this  
18 type of presentation, this will be the last time we  
19 talk about the PAPR, at least in this type of forum  
20 before we actually get to rulemaking.

21 Les had mentioned our involvement with the  
22 National Academy of Sciences, and our Associate  
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1 Director for Science, Maryann D'Alessandro, will  
2 give us an overview this afternoon regarding our  
3 action planning efforts that have been undertaken to  
4 look at response to the National Academy's review of  
5 our program.

6 And I think this is a very critical time  
7 with regard to the program because I think, you  
8 know, with the current changes that we are seeing in  
9 the government, that there may be opportunities  
10 coming forward when you look at the evolution of  
11 regulations and also this type of technology.

12 I mean, when you look at issues, you know,  
13 with regard to the threat of terrorism, it's still  
14 there, as well as concerns in the healthcare  
15 industry with regard to preparing for a possible  
16 pandemic influenza, that there's a lot of  
17 visibility, you know, within the community with  
18 regard to the need for personal protective  
19 technologies.

20 And I think as we go forward in sharing  
21 with our stakeholders our plan to address the  
22 recommendations from the National Academy, it will

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1 provide an opportunity for stakeholders, again, to  
2 give us feedback with regard to the path that we  
3 would like to go on, at least with regard to being  
4 able to address the recommendations for the  
5 direction of the PPT program.

6 Also, this afternoon, we are going to talk  
7 about the air-fed ensembles, and this is an evolving  
8 area for NIOSH. I think historically when you look

9 at respiratory protection, and you think -- it is  
10 sort of -- I kind of give it the analysis of putting  
11 the pegs in the right slot on the board.

12 when people historically think of what we  
13 do, you know, you have certain classes of  
14 respirators, and things fall into those classes.  
15 well, the air-fed suits don't have a class, not  
16 necessarily. And that -- you know, when you think  
17 about respiratory protection, you are thinking about  
18 something on your face that protects you from the  
19 outside environment.

20 well, in this case, for the ensemble, the  
21 ensemble is that thing that is protecting your face  
22 from the outside environment, which is a little bit  
19

1 of an evolution for us with regard to how to address  
2 the development of those types of requirements.

3 And we are going to spend some time this  
4 afternoon to address things that are going on in  
5 other standards development organizations as well as  
6 initiatives within NIOSH to develop a specific  
7 subpart for this type of technology and also to be  
8 able to address or hear from one of our  
9 stakeholders, the National Aeronautics and Space  
10 Administration, at least with regard to -- as a  
11 standards development organization, how they  
12 approached the problem in coming up with the  
13 standard for an ensemble that they use in their  
14 day-to-day operations.

15 Next slide, please.

16 So a little bit about the process, and I

17 think -- it's always worthwhile, I think, for me to  
18 note, you know, than when -- as an outsider, when  
19 you look at these types of forums, that this is  
20 really the precursor to going into the actual  
21 rulemaking process.

22           The more dialogue that we have -- you guys  
20

1 must going crazy because I can hear the feedback up  
2 here.

3           The more dialogue that we have at this  
4 point prior to the rulemaking part of the process,  
5 the more efficient we become.

6           You know, the more problems that we can  
7 iron out, the technical questions, technical issues,  
8 philosophical, administrative issues that we can  
9 iron out ahead of time prior to the rulemaking, the  
10 more -- I don't want to say streamlined, but the  
11 less problems that we will have with regard to the  
12 overall rulemaking process.

13           You know, because the rulemaking process  
14 is lengthy. And when you look at the overall  
15 process from the time that we actually start a rule  
16 to there's a change in the regulation, you are  
17 looking at a period of 18 to 24 months, and that's,  
18 you know, after we think we have agreed on what the  
19 performance requirements should be.

20           You know, so I think when you look at  
21 how -- the approach that we are taking and cutting  
22 up -- in the modular approach and how we are cutting  
21

1 up Part 84 into sections and then fleshing out these  
Page 15

2 types of requirements ahead of time, I think that  
3 only helps us to try to stay within those rulemaking  
4 time frames. And, you know, hopefully it minimizes  
5 the amount of dialogue that would have to take place  
6 on a more formal basis during the rulemaking  
7 process.

8           So to that end, as you see us developing  
9 standards over the next several years, I think you  
10 will see this type of process that's on the slide  
11 that identifies the types of activities that the  
12 branch will undertake in the development of proposed  
13 performance requirements.

14           You know, one of the things that I think  
15 has been very effective for us with regard to being  
16 able to share our ideas is the concept paper that we  
17 have used in the past with other standards  
18 development efforts where, you know, we will list  
19 performance requirements and occasionally the test  
20 procedures as far as, Here's the types of things  
21 that we envision that need to go into the standard.  
22 And this gives at least a piece of paper for us to

22

1 share with the stakeholders so we can get the  
2 feedback on those types of topics.

3           Also, in this type of forum, you know,  
4 where we have stakeholders come in and be able to  
5 talk with the researchers gives us another  
6 opportunity to get that type of feedback.

7           And, again, I think with the last public  
8 meeting and then, as you see, going forward, there's  
9 going to be more use of the actual NIOSH webpage,



10 the docket, which is maintained by our sister  
11 division in Cincinnati, as well as the document for  
12 comment pages, which gives us a more of a formal  
13 repository for the information that is discussed at  
14 these meetings as well as the feedback that we get  
15 formally, you know, with regard to the performance  
16 requirements that are being addressed.

17 And, again, these are all things that take  
18 place prior to the rulemaking.

19 Les had mentioned we have several things  
20 currently going through the process. With regard to  
21 the quality assurance module and the closed-circuit  
22 escape module, we were optimistic that there would

23

1 be something available in the public forum that we  
2 could at least mention for you to look at.

3 But I think at this point, I can safely  
4 say that, if you keep attuned to the Federal  
5 Register notice, there should be something with  
6 regard to those proposed rules coming out in the  
7 near term for public discussion.

8 You know, looking at the process from  
9 there, at some point, that once the two proposed  
10 rules are published in the Federal Register notice,  
11 we will be scheduling public meetings to further  
12 discuss and obtain any feedback on the proposed  
13 rules during 2009.

14 One item that isn't an agency review is  
15 our Total Inward Leakage requirements for filtering  
16 facepiece respirators and half-mask respirators,  
17 which is going through the process. And we expect

18 at some point in 2009, that will be out for public  
19 comment as part of the proposed rule as well.

20 Things that we envision going into the  
21 rulemaking process in 2009 are our modules for  
22 closed-circuit SCBA, which we discussed at the

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1 August 20th public meeting as well as the proposed  
2 rule for the PAPRs, which we are going to be  
3 discussing today.

4 And then in 2010, we expect to introduce  
5 modules for supplied-air respirators, also a prior  
6 public meeting discussion, as well as the air-fed  
7 ensembles.

8 And, again, the approach is to  
9 methodically to go to Part 84 and do two modules a  
10 year until the regulation has been updated.

11 And I think that strategically and at some  
12 point in the future, we will discuss the framework  
13 for how we are going to address the other parts of  
14 Part 84, and at least as far as get some stakeholder  
15 feedback with regard to priorities on the other  
16 aspects of Part 84, that we should be able to  
17 address.

18 Next slide please, John.

19 Just a couple of things to mention,  
20 though, with regard to how to submit -- formally  
21 submit input. Each of the topics that we are  
22 discussing today has its own specific docket. The

25

1 PAPER is a Docket 008 A. And what the "A" specifies

2 is that it captures the information that we are  
3 discussing today as well as any comments that were  
4 received to the document for comment that was posted  
5 in November on the NIOSH website.

6 Next slide, please.

7 For the personal protective technology  
8 action planning that you will hear about this  
9 afternoon, Docket 0146 is set up for that.

10 Next, please. For the air-fed ensembles,  
11 0148.

12 And then for the end-of-service-life  
13 indicator for self-contained breathing apparatus, 34  
14 A, again, the "A" signifying the fact that we are  
15 capturing the information from this meeting.

16 And I think just one thing to mention,  
17 that if you do go to the NIOSH website, in the upper  
18 right-hand quadrant of the webpage, you will see  
19 there's a little block, and there's a link that says  
20 the docket, or NIOSH docket.

21 If you click on that, there's a listing of  
22 all -- or the majority of the dockets where NIOSH 26

1 has collected information, not only on personal  
2 protective technologies, but also other technologies  
3 where NIOSH is playing a research role in addressing  
4 an occupational safety and health issue.

5 If you were to go to the docket now, there  
6 would be a Docket 008 as well as a 034 where NIOSH  
7 has posted information that has either been  
8 presented at public meetings or has been received  
9 from stakeholders with regard to those topics.

10 And so with that, does anyone have any  
11 questions regarding the overview?

12 At least in terms of taking questions  
13 during the course of the day, what we would like you  
14 to do is to come to the mic, introduce yourself, who  
15 you are with, and then state your question.

16 And John Perrotte will be collecting  
17 questions from the LiveMeeting during the comment  
18 periods, so he can address them as well for each of  
19 the specific topics.

20 I think one thing I just wanted to mention  
21 in general as John is bringing up the PAPR overview,  
22 this afternoon, when we talk about the air-fed

27

1 suits, we looked at the volume of information that  
2 needed to be presented. And I think the approach  
3 that we may take in that forum is let the presenters  
4 go through each of their topics.

5 And then at the end of the four  
6 presentations that we are covering for the air-fed  
7 ensembles, then we will take questions at that time  
8 instead of taking them immediately following the  
9 presentations for the individuals.

10 So any questions on the conduct of the  
11 meeting? Okay.

12 All right. Well, we will move into the  
13 powered air-purifying respirator overview.

14 And one of the things that I thought was  
15 interesting in the feedback that we received from  
16 the other meetings that kind of led us on to the  
17 poster path was it was real nice to get a management

18 overview on where the associated manager with a  
19 particular project sees that project going, that is  
20 still having the opportunity talk to, you know, the  
21 people who actually do the work, who have actually  
22 fleshed out the performance requirement as well as

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1 are working with developing the test procedures for  
2 certification, so that when the standard does become  
3 part of the regulation, that there's a way to test  
4 it, and there's an understanding of the technology  
5 that goes behind the equipment as well as the  
6 technology that goes into the certification process  
7 for the testing.

8           And so I'm -- at this point I'm really  
9 happy to give that top-level overview. And I think  
10 with regard to what you are going to hear in the  
11 poster session as well as from the researchers, I  
12 think you are going to see the culmination to a long  
13 road and looking at the evolution of the PAPR  
14 standard.

15           And I think one of the things that is kind  
16 of historically when you look at the PAPR, you don't  
17 want to say it was forgotten, you know, when Part 84  
18 was updated in 1995. But, again, it wasn't -- there  
19 wasn't a strategic emphasis, at least in terms of  
20 with regard to those types of requirements, that the  
21 focus was more on the requirements for filtering  
22 facepieces. And things regarding to the PAPR were

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1 addressed, but not, you know, into a category where  
2 the system had its -- at least this type of

3 protection had its own subpart.

4 But I think what we will see in 24 months  
5 or so from now is that we will have a specific  
6 subpart section for the PAPR which addresses this  
7 type of technology.

8 And, you know, from my perspective, having  
9 come from an air-purifying respirator type of  
10 background, this really looks to be the evolving  
11 edge of air-purifying technologies, that there's a  
12 lot of things that powered air provides, or powered  
13 air-purifying respirators provide with regard to  
14 comfort and protection that you don't necessarily  
15 get with the traditional gas mask air-purifying  
16 respirators technologies.

17 And I think when we see that going  
18 forward, that the -- these requirements will  
19 hopefully, you know, be broad enough that it will  
20 make the PAPR even more popular in use with the  
21 workers that need this type of protection.

22 In terms of our meeting, following the

30

1 overview, I will take a couple of questions. We  
2 will break. We will go to the posters next door.

3 The posters are arranged to talk about the  
4 things that we will hear later on this morning with  
5 regard to flow rates as well as concepts for gas and  
6 vapor testing as well as aerosol testing, especially  
7 when we are looking at the high flows, potential  
8 high flows for the PAPRs.

9 And then also to give you an overview of  
10 where our research branch has gone with the

11 end-of-service-life indicators that could be  
12 integrated into these types of systems. And I think  
13 that has been a very dynamic project over the past  
14 several years, which I know some manufacturers may  
15 be more aware of than others.

16 But I think with regard to the potential  
17 inclusion of this type of requirement into the  
18 standard, I think it is beneficial for all of the  
19 stakeholders involved to get an understanding of  
20 what that technology entails as well as, you know,  
21 some discussion as far as how it can be integrated  
22 into the devices. And then prior to lunch, we will

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1 have the public comment period.

2 So from an overview, these are the types  
3 of things that I'm going to spend a few minutes  
4 talking about, probably a little more, you know,  
5 with regard to the requirement development and the  
6 flow rates and a little less with regard to the gas  
7 life and aerosol testing and the end-of-service-life  
8 testing.

9 Because I probably would be out of my  
10 league in a hurry, and I would sooner defer, you  
11 know, detailed discussions on that to my colleagues  
12 that know a lot more about those subjects than I do.

13 Next slide.

14 I think one of the discussions that we  
15 have had internally with regard to the PAPRs is to  
16 really try to focus on how we develop requirements  
17 that provide the user, provide the worker, the  
18 appropriate protection for what they need.

19                   And the thought is that we wanted the PAPR  
20 standard, or the concept for the PAPR standard to be  
21 specific enough that we established a baseline  
22 across the board that all PAPRs would need to meet 32

1 certain base requirements, but yet have the standard  
2 be dynamic enough that it was going to be able to  
3 encompass a wide range of protections that a  
4 respirator user could choose an appropriate  
5 protection for their specific application.

6                   And historically, when you look at  
7 PAPRs -- and some of the user feedback that we have  
8 gotten has been along the lines of, you know, the  
9 PAPR is great, but some of things that you test for  
10 are beyond, you know, the scope of what we need. We  
11 don't need to have this Nth level of protection. We  
12 can get by with something that's a little bit lower,  
13 that's more appropriate for, you know, our  
14 particular application.

15                   And along with that, you know, the  
16 challenge came along with, well, if you are looking  
17 at trying to make this standard all encompassing to,  
18 you know, be able to address the wide range of  
19 technologies, how do you develop the requirements so  
20 that when people come up with a new idea, that it's  
21 something that the standard is amenable to being  
22 able to take that new technology and evaluate it and 33

1 be able to compare it to that base of requirements  
2 that we need to establish but, yet, you know, be



3 able to provide features that may be desirable for a  
4 particular worker, you know, or a particular  
5 application.

6           So that was sort of the overview, at least  
7 as far as where we thought we needed to go. And so  
8 it really wasn't a simple cut-and-paste of a bunch  
9 of requirements or a bunch of aspects from other  
10 standards into a new standard, but it was really we  
11 tried to think about how we evolve -- you know, what  
12 we put in the regulation to the point that we  
13 provided a home for the widest possible range of  
14 technologies that provide workers with options to  
15 choose the protections that they need for their  
16 particular site.

17           Next slide, please.

18           When you look where we have come, there  
19 was -- the last concept paper that we posted was in  
20 December of 2007. And I think we kind of realized  
21 at that point that we had probably reached a point  
22 of saturation in the stakeholder community because

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1 the amount of feedback that we got with regard to  
2 that concept paper was very light. I think we  
3 actually had three responses to the docket with  
4 regard to that particular -- that particular concept  
5 paper.

6           But we have had, you know, discussions on  
7 a one-on-one basis with stakeholders at forums such  
8 as this or other conferences around the country or  
9 people that talk with us on the phone or come into  
10 visit us at our site out here in Pittsburgh.

11           The other aspect that I think that we need  
12 to consider and what we have put out on the document  
13 for comment pages is I think our last evolution of  
14 thought with regard to what we think the performance  
15 requirements should entail.

16           And what we are looking to do from that  
17 very brief document is to at least stimulate some  
18 thought in the stakeholder community with regard to  
19 some of the aspects of the performance of these  
20 types of systems that we would like to get your  
21 feedback on, not only in the session today, but to  
22 give you an opportunity to revisit these things back

35

1   in your particular workplace and give us, you know,  
2 your ideas, whether you think we are on the right  
3 path with these concepts or if there is other things  
4 that we should be addressing.

5           Next slide, please.

6           And the one thing -- and I always have to  
7 laugh because, you know, when -- for those of you  
8 who know me, I came primarily out of the Department  
9 of Defense before I came to NIOSH.

10           And with DoD, you know, a widget was a  
11 widget, you know, or a mask was a mask. And I never  
12 really truly had an appreciation for how critical  
13 terminology is until I came to work for NIOSH, at  
14 least as far as when you look at how people perceive  
15 things and how people look at terminology to provide  
16 specific definitions with regard to what particular  
17 devices are and what they do.

18           And so to that extent, I'm apologizing up

19 front because there's some things I know I'm going  
20 to waddle through here in the next five or ten  
21 minutes that may not be exactly correct. But at  
22 least I wanted to give you my thought on how, you

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1 know, we envision seeing things evolve.

2           And one is the subject of work rates,  
3 which has been a discussion for several years now  
4 with regard to the performance of PAPRs.

5           And I think for the purposes of what you  
6 are going to hear today is the translation of work,  
7 of an individual worker's work, and speaking of that  
8 in terms of respiration flow rates.

9           So you are going to hear discussions today  
10 about expressing work in terms of liters per minute,  
11 which is solely focused on looking at how we will  
12 test these types of devices once we get to the  
13 certification stage.

14           And, again, we have recognized not only  
15 the research that we have done internally within  
16 NIOSH, but also research that has been done in the  
17 international standard community with ISO and taking  
18 a look at this problem -- or taking a look at this  
19 topic and looking at the evolution of international  
20 standards for respiratory protection and how to  
21 address this topic, you know, with regard to  
22 expressing work rates.

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1           And, also, we have seen over the years  
2 significant comments from stakeholders, not only  
3 manufacturers, but also users, with regard to being

4 able to have capabilities, have respirators that  
5 have certain capabilities that may be beyond what an  
6 individual worker can sustain over long periods of  
7 time.

8           Also, along with this, as far as looking  
9 at the range of potential users and, you know, from  
10 the standpoint that, depending on the application,  
11 everyone works differently. There's a wide  
12 difference between, you know, somebody working in  
13 chip manufacturing where you are wearing a  
14 respirator to protect the chip from you versus a  
15 responder working on a rubble pile wearing this type  
16 of respirator that may be doing heavy labor.

17           So the thought was, well, how do we  
18 leverage all of this information into requirements  
19 that manufacturers can build equipment to as well as  
20 opportunities for people to select the respirators  
21 appropriate for their workplace. And that's what we  
22 are looking at in terms of using work rates as a

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1 tool to be able to expand the product market for  
2 PAPRS.

3           Next slide, please.

4           So one of the things that, again, that I  
5 would welcome your comments on is the terminology  
6 for how we describe these things. And at least for  
7 talking purposes, the way that this was envisioned  
8 is that really you could break PAPRS down into two  
9 categories. And the focus at this point really was  
10 to address how we would evaluate the PAPRS in a  
11 laboratory setting.

12                   So when you think of a category, which we  
13 call breath-assisted, which is PAPRs which operate  
14 at a lower flow rate, you know, 11, 25 or 40 liters  
15 per minute that basically provide a degree of  
16 powered air, but not necessarily at very high  
17 levels, but more of a sedentary, lower type of work  
18 rate.

19                   And sort of the vision here, when you look  
20 at these types of systems, these are more the --  
21 and, you know, people can laugh. It is also a  
22 baseball cap with a blower. It's not necessarily 39

1 that you are looking for a high degree of  
2 protection, but you are looking to provide a certain  
3 degree of protection as well as a certain degree of  
4 comfort.

5                   And the thought being, you know, when you  
6 look at these types of applications, you know,  
7 health care I think is one venue that jumps out, you  
8 know, you know, with regard to systems that provide  
9 powered air, but maybe not the significant degree of  
10 protection that you may want to see in other areas.

11                   We have also looked at the standpoint from  
12 what we call positive pressure. And we have talked  
13 about this in other forums at least as far as, well,  
14 how are you going to measure positive pressure.

15                   I think the thing that we all -- or at  
16 least that we have acknowledged internally, is that  
17 when you look at the concept of positive pressure,  
18 we are focusing on what you can repeat in a  
19 laboratory setting.

20                   we acknowledge that probably once you get  
21 into use, you know, whether you can maintain  
22 positive pressure or not is a whole other issue. 40

1     But the thought being that, you know, when you look  
2 at the description that this is more of a higher end  
3 technically complex type of system where you are  
4 looking to actually, you know, operate at a higher  
5 flow rate and maintain, you know, positive pressure  
6 in a laboratory setting where you are not going  
7 negative during the breathing cycle.

8                   I think along with that is, you know, with  
9 these type of the scriptures is looking at, you  
10 know, linkage of these types of categories with  
11 inward leakage.

12                  And I think along with inward leakage,  
13 even though I think, you know, we have said in other  
14 forums that inward leakage doesn't equal assigned  
15 protection factor, we are working with OSHA to look  
16 at the recognition of our laboratory respirator  
17 protection level testing as a test that applicants  
18 can go to and have their systems evaluated and use  
19 that data to get an assigned protection factor from  
20 OSHA.

21                  And so the thought process is, if you look  
22 at these types of -- at this type of categorization 41

1     for PAPRs, you know, the lesser inward leakage could  
2 be addressed for systems that provide lower flow  
3 rates, where the higher inward leakage requirement

4 is for the systems that maintain positive pressure.

5 And I think the interesting thing is when,  
6 you know, when you look at this from a requirements  
7 standpoint, I think the technologies that we have  
8 today will fit within this type of categorization.

9 And I think the linkage there is when --  
10 between the two categories is a 40 liters per minute  
11 from the standpoint of we know that current  
12 technologies that we have evaluated and certified,  
13 you know, will meet that type of criteria.

14 It's the other ends of the spectrum, when  
15 you look at the lower flow rates and the higher flow  
16 rates, that there may need to be technological  
17 evolutions to come up with systems that address  
18 those types of requirements.

19 Next slide, please.

20 At least as far as with regard to the gas  
21 and vapor testing, historically, or at least over  
22 the past 15 years or so, when an applicant comes in

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1 for certification, there's a minimum performance  
2 requirement that is set that we are going to test  
3 the canister at a certain flow rate for a certain  
4 amount of time, and we are going to look for a  
5 certain amount of breakthrough. And this is the way  
6 that all canisters and cartridges are judged.

7 And while that provides a degree of  
8 consistency, you know, with regard to the approach  
9 for certification, what does that really tell us  
10 with regard to the performance of the canisters or  
11 cartridges?

12                   And one of the ideas that has been  
13 explored within the ISO community and one of the  
14 things that we have been considering over the past  
15 several months is an alternate to that type of  
16 approach, which is to use the wheeler relationship  
17 for gas and vapor testing to be able to assess the  
18 canister capacity and efficiency at multiple flow  
19 rates.

20                   And Dr. King will have a poster in the  
21 poster room next door as well as a presentation to,  
22 you know, discuss this topic in a little bit more

43

1 detail, but I think the thing that shows promise  
2 with regard to this approach is that it allows the  
3 capability to be able to project how a canister or a  
4 cartridge will perform at higher flow rates without  
5 necessarily having to do the test at those higher  
6 flow rates that, you know, you do get a linear  
7 relationship by testing at other flow rates, and you  
8 can be able to project how the system will perform  
9 at very high rates or very low rates. And Bill will  
10 discuss that in greater detail later.

11                   Next slide. End-of-service-life  
12 indicator, Jay Snyder will be having a poster  
13 session talk about research that has been going on,  
14 you know, in this area over the past several years.

15                   And one of the things that when you look  
16 at this type of technology, it gets into, what does  
17 it usually take to take technology to the next  
18 level. You know, and to some -- in some instances  
19 you can argue, well, the market will drive that, but



20 maybe sometimes the market needs a push.

21 And one of things that -- one way to give  
22 that push is through the use of standards. And one 44

1 of the things that we have really -- that I would  
2 like to get your feedback with -- regarding  
3 end-of-service-life indicators is an idea that we  
4 have to make this a mandatory requirement for  
5 certain types of PAPRs, not for all PAPRs, but for  
6 PAPRs that may -- you know, that we consider may be  
7 the more technologically advanced when you look at  
8 some of the products that are on the market that  
9 could be considered in the positive pressure  
10 category.

11 And the focus here really being on looking  
12 at two types of protections, one in the organic  
13 vapors and then the other acid gases where, you  
14 know, over the past several years, not only within  
15 NIOSH, but also within other stakeholder  
16 organizations, a lot of research has gone into the  
17 feasibility of these types of technologies.

18 And the thought is at this point, you  
19 know, that by the time the standards is released,  
20 that the technology may be mature enough to be able  
21 to consider this as a requirement for these types of  
22 systems.

45

1 Next slide.

2 And then you know we are getting serious  
3 when we talk about implementation. And I think the  
4 long-term aspect of any standard is being able to

5 see how you put this -- put these requirements into  
6 place.

7           And from a new requirement -- the  
8 new-requirement standpoint, I think at least our  
9 initial thoughts are this is pretty cut and dry,  
10 that, you know, the module will go through the  
11 process.

12           we will have an opportunity to -- the  
13 proposed rule will be published in the Federal  
14 Register notice. There will be an opportunity for  
15 stakeholder feedback. We will have public meetings  
16 as necessary to discuss the rule.

17           And then, you know, following the  
18 reconciliation of comments and determination if  
19 there's a need to have additional discussions, the  
20 process will go into the final stages, and the new  
21 rule will be promulgated.

22           At that point, after the rule is posted 46

1 and published in the Federal Register notice, in 30  
2 days we will start accepting applications on a  
3 first-in/first-out type of basis.

4           Other consideration is, well, you know,  
5 for a new product, that is I think fairly  
6 straightforward. What do we do about things that  
7 are already in the field or that may already be in  
8 an inventory or a pipeline coming down right before  
9 the new rule is introduced.

10           So the current thought process is that  
11 manufacturers and distributors can continue to sell  
12 inventory for up to three years after issuance of

13 the new requirements.

14           You know, and along with that, you know,  
15 we acknowledge there may be changes that might need  
16 to be done for a variety of reasons on the existing  
17 products so that we will consider modifications and  
18 extensions of approval to those products for two  
19 years after the issuance of the rule.

20           And the fact that, you know, if you have a  
21 PAPR system that it already meets Part 84  
22 requirements, it can remain in operation as long as

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1 it is still supportable by the manufacturer, that  
2 there will be no obsolescence of systems that have  
3 already been fielded.

4           Next slide.

5           And then these are the types of things  
6 that we are hopeful to get feedback from you today.

7           Again, you know, the concept as far as the  
8 three categorization of PAPRs and whether or not,  
9 you know, breath-assisted or positive pressure is  
10 the right way to categorize these things. You know,  
11 is there a better way to categorize it if we talked  
12 about it in terms of inward leakage, say, for  
13 example, that -- and using that as a measuring stick  
14 that differentiates one type of system from the  
15 other.

16           Also, you are going to hear in the poster  
17 discussion as well in the presentation how we are  
18 going to address work rates in terms of the process  
19 for evaluation.

20           The linkage of the categories of

21 breath-assisted and positive pressure with LRPL  
22 testing and inward leakage requirements, what do you  
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1 think about this, the approach of using the wheeler  
2 relationship for gas and vapor testing in lieu of  
3 the traditional approach for our canister and  
4 cartridge evaluation.

5 And then also feedback on the development  
6 of the end-of-service-life indicator for organic  
7 vapors and acid gases.

8 Next slide, please.

9 And then as far as the information to  
10 formally submit it, you know, the formal comments to  
11 the docket using 008 A, and that will focus us on  
12 the things that we are discussing today. And what I  
13 would like to do, at least as far as this point, to  
14 take any questions.

15 I would rather, at least at this point,  
16 leave it on the implementation, take questions on  
17 the implementation strategy for the system and any  
18 of the administrative types of questions regarding  
19 this.

20 If you have specific questions with regard  
21 to the work rate discussion or the things that you  
22 will see in the poster room, I would prefer to take  
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1 those questions after you have had a chance to  
2 either participate in the poster session or hear the  
3 presentations from the researcher.

4 So with that, if there are any

5 administrative questions with regard to PAPR or, you  
6 know, with regard to the implementation, I would be  
7 happy to try to address those right now.

8 Bob, there's a little switch.

9 MR. SELL: Bob Sell, Draeger Safety.

10 One question concerning, would you be  
11 issuing a final written concept document at some  
12 point in time so people can review the exact text?

13 MR. SZALAJDA: That's debatable, I guess.  
14 And I think a lot of it is going to depend on the  
15 nature of the comments that we receive.

16 You know, from the standpoint that, you  
17 know, we got -- we received so few comments, you  
18 know, with regard to the December paper, and  
19 depending on the nature of the feedback that we get  
20 today, we may issue another -- not a full concept  
21 paper, but maybe an additional flesh-out of what we  
22 discuss today on the document for comment page. But  
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1 in terms of a comprehensive update of all of the  
2 requirements, we are probably not going to do that.

3 MR. SELL: Okay. From our opinion, or  
4 from Draeger's opinion, we would like to at least  
5 see something fleshed out like that.

6 MR. SAVARIN: Mike Savarin, SPERIAN.

7 We would just like some clarification on  
8 the implementation.

9 We had in the first -- in the second  
10 bullet there, where you had product approvals under  
11 previous requirements, manufacturers can sell the  
12 product for three years after the rule is

13 promulgated, but then PAPRs with current approvals  
14 will not be obsoleted.

15 You clarified that by saying the  
16 manufacturer could still support them. What exactly  
17 do you mean by support?

18 MR. SZALAJDA: Well, I think -- I'm sorry.  
19 At least, let me take that one first.

20 I think when you look at support as with  
21 regard to logistics, spare parts, maintenance, you  
22 know, those types of parameters --

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1 MR. SAVARIN: So you couldn't sell another  
2 blower to the person then, to the -- you know.

3 MR. SZALAJDA: I think if you are looking  
4 at it from the standpoint of it's a spare part,  
5 okay, if -- you know, if you have a system that's  
6 under warranty, for example, when you have a  
7 component that fails and can be replaced under  
8 warranty, that, you know, that would be conceivable.

9 I think the thought is at some point, when  
10 you look at the application of these types of  
11 systems in the workplace, you know, there's -- at  
12 some point, there's going to be a line which the  
13 economics get out off whack, at least with regard to  
14 whether it's cost effective for the manufacturer to  
15 continue to support items that may have been in the  
16 field for ten, 12 years versus, you know, let's try  
17 to move people into a new technology and whether or  
18 not users are willing to pay, you know, for that  
19 premium.

20 You know, so we figure that's probably an

21 area where the market is going to kind of determine,  
22 you know, how long a manufacturer may want to, you 52

1 know, support a particular product versus, you know,  
2 how long a user is willing to pay for it.

3 MR. SAVARIN: Thank you.

4 MR. SZALAJDA: All right. I think at this  
5 point what we will do is -- it's about 9:35. We are  
6 about ten minutes ahead of schedule.

7 we will break. The posters are  
8 adjacent -- in the room adjacent to us. If the -- I  
9 guess if the researchers can go and man their  
10 posters, we will run the poster session until 10:15.

11 At 10:15, we will reconvene in this room,  
12 and then we will go through the individual  
13 presentations with regard to the topics on the  
14 posters.

15 All right? Thank you.

16 (A recess was taken while stakeholders  
17 viewed the posters in the Poster Room.)

18 MR. SZALAJDA: Okay. I think we are going  
19 to start in about a minute, once we get the speakers  
20 up here. We are going to go ahead and get started  
21 again.

22 At this point, we will move through 53

1 several presentations that are going to cover the  
2 information that was in the poster session. So at  
3 this point, if you didn't get a chance to get to a  
4 particular poster, you will have an opportunity to  
5 hear the information that was contained on the

6 poster.

7           when you go through the topics, the first  
8 presentation will be by Rich Vojtko, who is a  
9 relatively new engineer within our laboratory. He  
10 has been with us, at least as far as a federal  
11 employee, since the earlier part of this year, but  
12 he has supported the program as a support contractor  
13 for several years prior to joining NPPTL.

14           So with that, Rich will talk about the  
15 evolution of the work rates to where we are today.

16           MR. VOJTKO: Thank you. As Jon said, I'm  
17 going to be covering the PAPR work rate revolution  
18 -- or evolution. Nothing so drastic.

19           we have broken down the evolution into  
20 three stages. First of all is the method that we  
21 currently use to approve PAPR for flow in which we  
22 measure the flow within a sealed chamber. And this

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1 is at a constant flow, and it either passes or  
2 fails.

3           During the December 21, 2007 draft of the  
4 PAPR standard, we developed three work rates and a  
5 positive pressure requirement that is measured at  
6 the maximum manufacturer specified work rate. And  
7 that's specified by the manufacturer out of a  
8 discrete number of work rates that we have already  
9 defined within the draft.

10           The final stage is the additional work  
11 rates that Jon has already brought up, and the idea  
12 of breaking that down into the breath-assisted and  
13 positive pressure classifications.



14           we also aren't sure what approval  
15 requirements would be used to determine pass/fail  
16 for flow or pressure or whatever for breath-assisted  
17 class, so that's something else we would appreciate  
18 input on.

19           Next, John.

20           Beginning with the current requirements,  
21 that's basically the laboratory setup that is used  
22 to measure flow for a PAPR. The respiratory inlet 55

1 covering is mounted on the headform within the  
2 chamber, and the blower is located on the outside  
3 with the hose sealed around the chamber. A vacuum  
4 blower then removes air from the chamber, and that  
5 flow is monitored on the dry test meter showing  
6 there.

7           Not yet, John.

8           We then monitor the pressure differential  
9 using the electronic manometer on top of the box to  
10 determine that we have a constant -- not yet.

11           That we have constant -- or a balanced  
12 flow between the PAPR blower going in and the vacuum  
13 blower on the outlet. And that way we know that the  
14 flows are even, and we have measured the flow.

15           Now the next slide.

16           The flow rates that have been established  
17 are 115 liters per minute for a tight-fitting PAPR  
18 and 170 liters for the loose-fitting.

19           Based on the work that I'm going to  
20 continue to describe here, these flows are capable  
21 in most cases of maintaining positive pressure in

22 the breathing zone of a PAPR respiratory inlet

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1 covering at the -- what we have defined in the  
2 current draft as the moderate work rate, which  
3 corresponds to a breathing rate of 40 liters a  
4 minute.

5           Next one, John.

6           Moving along to the work rates that were  
7 proposed in last December's concept paper, we had an  
8 original objective in proposing multiple work rates  
9 in terms of improved protection so that we would  
10 have sufficient air flow for the user to not have to  
11 overbreathe a PAPR and would then maintain positive  
12 pressure in the breathing zone and have a higher  
13 level of protection without any negative pressure  
14 differentials across components to the atmosphere.

15           It would also have greater flexibility so  
16 that we could establish comfort for the user, both  
17 at the high end so that there would be enough air so  
18 the user, again, doesn't overbreathe, and also at  
19 the low end. If someone has a fairly light duty  
20 task, they would have something that's not  
21 cumbersome, easy and light to wear, and they would  
22 be willing to wear to afford them the protection.

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1 And it would also afford cost savings for employers  
2 who would then be more willing to implement this  
3 protection.

4           This is a table that's based on one that's  
5 in that December concept. It's got a little added

6 because it is just taken here out of context of the  
7 standard itself.

8 We are saying here that the work rates are  
9 sinusoidal wave form, and we are expressing the work  
10 rate as respiration rates. And I have also shown  
11 the peak flow, which is based on, again, the  
12 sinusoidal work rate.

13 And as before, we have broken these down  
14 into 25, 40, and 57 liters per minute for the low,  
15 moderate, and high work rates respectively. And we  
16 have defined tidal volumes and respirations for this  
17 as well.

18 Next one, John.

19 The test protocol that we have envisioned  
20 for this is having, again, the manufacturer specify  
21 the highest work rate from the table for the  
22 intended use of the PAPR and then using a variable 58

1 breathing machine that can accommodate that.

2 The one we have been using for some of our  
3 benchmark testing is illustrated in the picture  
4 there.

5 The PAPR has to maintain positive pressure  
6 in the breathing zone while it is properly mounted  
7 on the headform coupled to that breathing machine at  
8 the work rate.

9 In addition to that, we feel that there's  
10 some additional criteria that must be met for fully  
11 evaluating the PAPR when we have a variable work  
12 rate allowable. And the one I would like to discuss  
13 here is identifying the appropriate air flow for

14 particulate and gas vapor challenge testing.

15           we would like to have a minimum constant  
16 air flow rate that we would use to test canisters,  
17 cartridges, and filters. And something that we  
18 think would, in a worse case for a constant flow  
19 PAPR, maintain positive pressure in the breathing  
20 zone during a machine test.

21           we went on to determine these required  
22 flows experimentally, and we did this for the

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1 moderate and high work rates for the tight-fitting  
2 PAPR and for all three work rates for the  
3 loose-fitting PAPR because last December, when we  
4 issued that draft, we were envisioning not allowing  
5 a tight-fitting PAPR to be approved at the low work  
6 rate. But we can certainly go beyond that with  
7 future work, but -- go onto the next slide.

8           These are the constant flows that we came  
9 up with as a result of that work. And this was,  
10 again, based on positive pressure tests with  
11 single-speed units. And this corresponds to Table 2  
12 in the draft standard.

13           As I stated, there is no low work rate  
14 applicable for the tight-fitting PAPR, and the flows  
15 associated with each work rate are given in the  
16 table there.

17           And we can go on to the next slide.

18           In order to do this evaluation and  
19 experimental determination, we needed to operate  
20 PAPRs at flow rates that aren't commercially  
21 available. So we obtained several samples of two

22 different PAPR blowers and both tight and loose

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1 respiratory inlet coverings that are designed for  
2 those PAPRs. And we varied the input voltage to  
3 control the flow from the blower motor rather than  
4 using the battery packs that were originally  
5 designed for those PAPRs.

6 we began by establishing that we could  
7 operate these over a range without doing any damage  
8 to the PAPRs, and then we varied the voltage and  
9 recorded air flow for each sample.

10 And we did this several times to prove  
11 repeatability. And then we used two different mask  
12 flow -- or air flow measurement techniques, one, the  
13 dry test meter that we currently use for the flow  
14 test, and we used an electronic mass flow meter as  
15 the other, just to eliminate any systematic error  
16 that may be the result of the type of the system  
17 that we are using. And we eliminated that as a  
18 possible source of error.

19 we then plotted the data and correlated it  
20 and found that a second order polynomial fit worked  
21 real well. And we actually used both voltage and  
22 flow as the independent variables so that we could

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1 both predict the voltage needed to obtain our  
2 starting value for flow when we did the experiments,  
3 and then the other way so that we could find a flow  
4 at the voltage we finally settled on that seemed to  
5 give us a little safety margin for positive pressure  
6 throughout the test.

7           This is an example of the calibration  
8 curves that we generated with -- in this case, we  
9 have voltage as an independent variable on the X  
10 axis, and we have the mass flow curve, the dry test  
11 meter curve, and then a composite curve. And these  
12 are actual data points, so you can see there's a  
13 little wiggle in there. But they actually  
14 correlated very well, and we were able to obtain  
15 very good, repeatable data.

16           Once we had the calibration curves for the  
17 voltage versus flow and vice versa, we were ready to  
18 actually do the breathing tests to determine what  
19 flows were required to maintain positive pressure.

20           For this portion of the test, we mounted a  
21 PAPR respiratory inlet covering on a torso, and we  
22 coupled this with the variable frequency and tidal  
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1 volume breathing machine that I had shown before.

2           And then we used -- here in the picture,  
3 these are validyne fast response transducers coupled  
4 with the signal processing units there that can  
5 convert the signals they get from the transducers to  
6 an analog voltage output that we were able to  
7 capture with our LabView software, and we were  
8 obtaining data at the rate of ten points per second.

9           We then monitored and recorded the  
10 breathing zone pressure and the canister pressure  
11 drop.

12           In the previous presentation, we have  
13 shown that we have correlated canister pressure drop  
14 with flow and have been able to use canisters

15 themselves as a pressure element in the system to  
16 measure the flow dynamically of the system as we  
17 would go.

18 And we obtained that correlation at  
19 constant flows using a vacuum blower and established  
20 the flow at each point with a mass flow meter. But  
21 then we can get instantaneous flows at these  
22 ten-per-second intervals to establish a nice curve.

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1 we were able to plot a pressure profile, a  
2 flow profile that we calculated again from the  
3 canister pressure drops. And we averaged all of  
4 those discrete points in the flow to get an average  
5 flow. And the next slide has an example of that.

6 we have time as the X axis. And on top,  
7 the dark blue curve is -- the actual flow is that  
8 sine curve which varies based on the resistance  
9 caused by the breathing machine simulating a wearer  
10 of the PAPR.

11 And the scale for that is on the left, and  
12 then the red curve is our pressure profile and  
13 facepiece. And the scale for that is on the right.  
14 You can see in this case, we stayed above zero.

15 This sample is for a tight-fitting PAPR,  
16 and, as you can see, we had about 110 liter per  
17 minute average here where we were predicting about  
18 115, so I considered that pretty good repeatability  
19 as well.

20 Next slide, John.

21 The conclusions from this testing with  
22 PAPRs on breathing machines at varying work rates,

1 we found that the flow versus voltage correlations  
2 were similar, regardless of whether we used the dry  
3 test meter or the mass flow meter to determine flow.

4 we had excellent repeatability between  
5 samples of the same model and repeat tests of the  
6 same sample as well. And we had excellent  
7 agreement, again, between the predicted flow with  
8 those calculated from the canister pressure drop.

9 Going on with conclusions, the flow  
10 required to maintain positive pressure at both work  
11 rates that we tested for the tight-fitting PAPR were  
12 similar for both PAPR models that we tested. And  
13 the same held true when we tested the loose-fitting  
14 models for all three work rates.

15 Moving on to the material that Jon started  
16 out with earlier, and that's the work rates that we  
17 are now considering for inclusion in the PAPR  
18 standard and the separation into two classes, that,  
19 for discussion sake, we are calling breath-assisted  
20 and positive pressure.

21 we have within that additional work rates.  
22 And, again, these are expressed as respiration

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1 rates. We have inserted the sedentary rate at 11  
2 liters per minute and extremely high work rate  
3 possibilities at 78 and 99. These are based on the  
4 ISO technical specification listed there for their  
5 Classes 1, 7, and 8 for a standard body with that  
6 1.8 meter squared surface area.



7                   Again, we are open to suggestion for what  
8 would be acceptable or good specifications to use  
9 for additional rates.

10                   ISO has other suggestions in terms of  
11 having both the smaller and a larger body size that  
12 they have done work with, and also they have looked  
13 at a two standard -- a span of an increase in  
14 respiration rate well.

15                   So any of these things are something that  
16 we would be considering -- we think would be worthy  
17 of consideration if someone gave us reasonable  
18 argument for any of that.

19                   Next, John.

20                   As far as characterizing those work rates,  
21 the sedentary rate would probably, if we have one,  
22 be a sinusoidal ventilation profile. And we have

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1 not defined a tidal volume or frequency because,  
2 again, we not sure of where exactly we want to be.  
3 And we will wait until we have something more  
4 defined before we get something that is  
5 physiologically reasonable in terms of something  
6 that we can simulate on a breathing machine that is  
7 a reasonable test for human activity.

8                   With the extremely high work rates, we are  
9 not even sure what sort of ventilation profile we  
10 would like to use. And, again, we are open to  
11 suggestion for all of this.

12                   This diagram more or less summarizes this  
13 section. We have taken the PAPR Subpart P and  
14 divided it into that breath-assisted category,

15 which, in addition, as Jon pointed out, would have  
16 an LRPL of around 250.

17           And the positive pressure monitored, I  
18 call it because we may not maintain it consistently.  
19 But one of the things that we want to include in the  
20 positive pressure models is a pressure monitor to  
21 alarm the user when they consistently overbreathe  
22 the unit. And that would have a 10,000 LRPL value. 67

1           In the middle range there, we have 40  
2 liters per minute falling into both, and I think  
3 that's good place for it to be in terms of -- as I  
4 stated before, most of the units out there now would  
5 pass under this 40 liter per minute rate. But in  
6 the positive pressure side of things, they would  
7 have to meet some of our other requirements, like a  
8 pressure monitor. And then in the breath-assisted  
9 side of things, they could probably pass as is but  
10 with a different protection factor than perhaps they  
11 have now.

12           We have lowered the 25 down into the  
13 breath-assisted category. And we also, you can see  
14 on here, have not said anything about either tight-  
15 or loose-fitting units.

16           So, as I stated before, we may change what  
17 we did in terms of defining a flow rate that  
18 correlates to a 25 liter per minute tight-fitting  
19 PAPR, for instance. Again, we are looking for input  
20 on this and on the other end, what we should do with  
21 the very high work rates.

22           Any questions?

1 MR. BARD: (Not speaking into microphone)  
2 Brent Bard, Supplied Air Monitoring Systems.

3 Has the testing taken into the account CO2  
4 at different temperature cycles as well as (not  
5 audible to court reporter.)

6 MR. VOJTKO: None of this testing has.  
7 We do have -- in a separate section of the  
8 draft standard, we do have CO2 dead space testing  
9 defined, tentatively.

10 And what was the other --

11 MR. BARD: The temperature of --

12 MR. VOJTKO: Oh, the battery.

13 MR. BARD: -- operational range as well as  
14 -- (inaudible).

15 The reason why I ask is because, of  
16 course, when we get into (inaudible).

17 MR. VOJTKO: we have done some  
18 environmental chamber testing with batteries, and we  
19 have found inconsistent results to be honest when we  
20 have gone to the lowest temperature recommended by  
21 the manufacturer for the units.

22 And we didn't follow up because of -- in 69

1 some cases, because we didn't have enough access to  
2 the environmental chamber for a while as far as --  
3 and we had other tasks to complete.

4 But we did start to see some patterns in  
5 terms of our recharge cycles in terms of letting the  
6 batteries return to room temperature naturally  
7 before we did them and cold soaking them before they

8 were used versus not cold soaking.

9           So we saw a wide variety of performance in  
10 those batteries. And we will define some testing,  
11 and any suggestions you have in terms of  
12 pretreatment -- or preconditioning would certainly  
13 be welcome and something that we could follow up on  
14 with some benchmark testing.

15           MR. BARD: Thank you.

16           MR. SAVARIN: Mike Savarin, SPERIAN,  
17 again.

18           The whole idea here seems to be to offer  
19 enhanced options and classifications of work rate  
20 and, therefore, protection to the users.

21           But I could see that under the additional  
22 work rates expressed as respiration rates, there is 70

1 the proposition to use what they call the ISO  
2 standard man. As you can see, I'm a fine example of  
3 an ISO standard man.

4           what I would like to know is, how does  
5 that compare to the USA standard man? And from  
6 that, from what is quite obviously a case where USA  
7 people have may have a significantly different body  
8 size mass index, what does that do for the intended  
9 protection?

10           MR. VOJTKO: That was, as we stated  
11 before, a starting point for discussion.

12           And as I mentioned, there is a larger man  
13 in the ISO definition. I'm not sure what the actual  
14 definition of it is. But I understand that it is  
15 closer to both Northern European and American -- or

16 North American standard.

17                   And perhaps the two standard errors would  
18 serve us well to hit the high end of the range as  
19 well.

20                   MR. SAVARIN: Yeah. We should consider  
21 strongly including that. Because I don't think we  
22 are doing that here at the moment in the

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1 proposition.

2                   MR. SZALAJDA: I guess -- yeah, let me  
3 help out. Rich here, I guess, kind of went from a  
4 philosophical standpoint.

5                   I think when we looked at the flow rates,  
6 you know, from a conceptual standpoint, we felt that  
7 the 25, the 40, and the 57 were probably going to  
8 encompass 90 to 95 percent of where we anticipated  
9 that was where the majority, the vast majority of  
10 the potential applicants would submit their devices.

11                   You know, and I think in looking at the  
12 ISO criteria, given, you know, the nature of the  
13 people that have been involved in the process, you  
14 know, when you look at the -- you know, from the  
15 worldwide perspective, you know, a lot of the major  
16 players that have been supporting our standards  
17 effort are also supporting the ISO effort.

18                   So, again, it was sort of the leveraging  
19 of, you know, the body of knowledge, you know, and  
20 the fact that, you know, while we think, you know,  
21 for the most part we can cover almost all of the  
22 applications with 25, 40, or 57, we wanted to have,

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1 you know, some of the outer ranges identified.

2 So, you know, for whatever reason, if  
3 somebody wanted to produce something that they felt  
4 they could sell or protection that was needed, you  
5 know, at those extremes, you know, there was a  
6 target of opportunity and the certification criteria  
7 in place where, you know, an applicant could come  
8 in, and then the worker could get the protection  
9 they were looking for.

10 You know, again, as Richard said, you  
11 know, kind of at this point, we want to know what  
12 people think about, you know, using those numbers,  
13 you know, that -- you know, the fact that, you know,  
14 there has been another standards development  
15 organization go through the process, identify that  
16 in the specification, you know.

17 And where possible, we love to use other  
18 people's stuff because it helps make our life easier  
19 and then, you know, develop things as we need to.  
20 And this was a convenient opportunity to, you know,  
21 grasp that information now.

22 MR. SAVARIN: That's fine. Thank you very  
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1 much.

2 MR. PERROTTE: There is a question via  
3 LiveMeeting.

4 MR. SZALAJDA: We will wait on that a  
5 moment.

6 MR. BLAKE: John Blake, Safety Tech  
7 International.

8 My question is in regard to the new  
9 categories as to whether or not under the breathing  
10 machine testing, the requirement for it to remain  
11 positive during the test is still applicable.

12 MR. SZALAJDA: You mean for the  
13 breath-assisted?

14 MR. BLAKE: Yeah, just in general, this  
15 entire new category.

16 You know, what I -- I guess what I'm  
17 thinking about is depending on, perhaps if it were  
18 loose fitting, that you may not be able to maintain  
19 positive pressure under a loose-fitting situation.

20 MR. SZALAJDA: Yeah. That's a good  
21 question. I think that's something that we would  
22 really like to get some stakeholder feedback on when

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1 you look at the concept because the thought is with  
2 the breath-assisted types of technologies, we are  
3 looking at it from the aspect of a lower degree of  
4 protection, you know, and I think acknowledgment of  
5 the fact that you are not always going to maintain  
6 positive pressure. So I think that opens up a  
7 couple of opportunities.

8 You know, one is the fact that you do have  
9 technologies that, you know, people may be more  
10 willing to use. But then it's also incumbent on us,  
11 you know, from the standpoint of educating the user  
12 on what that protection really means, you know, and  
13 the fact that they don't get a false impression that  
14 this is providing the same level of protection as  
15 another device that may be hundreds of dollars more

16 expensive, but it provides a higher degree of  
17 protection.

18 So I see, you know, as the standard  
19 evolves, you know, there is probably a couple of  
20 layers of responsibility that go on that. You know,  
21 one is, you know, how the applicants develop the  
22 user instructions to specifically identify, you

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1 know, the capabilities of the units as well as the  
2 guidance types of products that NIOSH will need to  
3 develop to reflect this categorization, whatever the  
4 terminology may end up being.

5 MR. BLAKE: So you think it is dependent  
6 on the user to make sure the application is  
7 appropriate?

8 MR. SZALAJDA: Right. And I think that's  
9 part of -- you know, that really hasn't changed the  
10 mindset now, at least in terms of a user's  
11 respiratory selection criteria.

12 But I think with the evolution of the  
13 requirement, you know, that it almost has a degree  
14 of responsibility I think in terms of being able to  
15 explain, you know, what this categorization means.

16 MR. BLAKE: Okay. That answers the  
17 question. Thanks.

18 MR. SZALAJDA: I guess we will take one  
19 more, and I guess the LiveMeeting people can either  
20 submit something in writing at this point in time or  
21 in general on, I guess, over the phone.

22 So we have one more question in-house, and

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1 then we will take the LiveMeeting questions.

2 MR. WELLS: Jesse wells, NOVA Chemicals.

3 It is kind of a follow-up on a previous question.

4 For the end user, are you developing or  
5 have you developed any kind of guidances that links  
6 activities to these work rates, or is there going to  
7 be a standard model that we apply to determine, you  
8 know, for our application, you know, what flow rate  
9 do we need?

10 MR. SZALAJDA: Yeah. I think the short  
11 answer to the first question is, no, we haven't done  
12 that yet. But long term, I think part of where we  
13 are looking in terms of -- you know, I will go off  
14 on a tangent for a second because I have the floor.

15 Yeah. Part of what our branch does is not  
16 only does the standards, but also trying to develop  
17 guidance documents to help the people understand  
18 what we mean, you know, in terms of CBRN respirators  
19 or, you know, the criteria that we are trying to  
20 develop.

21 And I think when you look at where we are  
22 going with this, is I really see this being a --

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1 causing philosophical changes in looking at the  
2 system because now, you know, with trying to open up  
3 the standard to embrace a variety of technologies, I  
4 think there is going to be a need to include, you  
5 know, and capture that information so people  
6 understand that for certain types of applications,  
7 depending on what I do, these types of respirators  
8 may be appropriate and help them with that selection

9 process, you know, for the respirators.

10 I think the ISO work is a good start in  
11 that direction because, as part of the development  
12 of that standard, they looked at particular work  
13 activities and used that in terms of building the  
14 different flow rates that are identified in the work  
15 specifications.

16 I think from our standpoint, we would look  
17 at that as a building block. And then, you know,  
18 once we come to some sort of agreement on what we  
19 are going to call these things, then be able to  
20 start building this product.

21 So at the time when the standard is  
22 issued, you know, we will have the support system in  
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1 place to help the users understand what the  
2 different protections mean.

3 I guess with that, John, can you -- my  
4 vision is not good. If you can read the question,  
5 that would be great.

6 MR. PERROTTE: Larry Janssen's question  
7 was: You used the term "more protection" when  
8 talking about PAPR with more air flow, and also  
9 implied that maintaining positive pressure assures  
10 more protection.

11 What data do you have to support these  
12 assumptions?

13 The literature does not support and there  
14 was no extensive discussion of this at the OSHA APF  
15 hearing. Neither air flow nor positive pressure  
16 have been shown to correlate with protection.

17 MR. SZALAJDA: Yeah, I think that's a good  
18 comment. Let me kind of, I guess, address it from  
19 the standpoint of, you know, when we are looking at  
20 defining the capabilities of the system, I think  
21 that's where we are going in the introduction of an  
22 inward leakage requirement.

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1 Because the fact is, you know, when you  
2 are wearing these types of systems, you know, your  
3 protection, the protection you are getting afforded  
4 may vary depending on what you are doing, and we  
5 appreciate that.

6 I think it is -- it falls into the area,  
7 though, when you look at the, you know, coming up  
8 with an inward leakage requirement that hopefully  
9 can be used to translate into an APF, that will be  
10 the decision making part of the process for a user  
11 in trying to determine what the protection is that  
12 they need, whether it's in, you know, with a lower  
13 APF or a lower inward leakage value versus a higher  
14 inward leakage value.

15 And I think that's kind of where we want  
16 to go because, I mean, part of the issue that we  
17 need to resolve is the comparison between, you know,  
18 how things are done in the laboratory versus how  
19 things are done in the workplace.

20 And, you know, part of the process is when  
21 you look at doing the certification test, trying to  
22 come up with repeatable criteria that, you know,

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1 give us confidence that the device will perform as  
2 intended.

3 But I think when you look at the evolution  
4 of the inward leakage requirement, I think that's  
5 where, you know, we can start, you know, helping  
6 develop information which leads us to supporting  
7 developing APF criteria that OSHA can assign for a  
8 particular technology.

9 Any other LiveMeeting questions?

10 Okay. I think we will move on to the next  
11 presenter, which will Bill King.

12 And while they are exchanging the mic, I  
13 didn't want to say it was like a coming-out party  
14 for the Policy Branch, but I think historically, if  
15 you have been coming to these meetings, you have  
16 seen a lot of the same faces over the years.

17 And one of the things that came out of our  
18 National Academy recommendations was, you know,  
19 looking at re -- our process was looking at  
20 resourcing the Policy and Standards Development  
21 Branch, you know, to help us develop the modules and  
22 bring them, you know, forward in the rulemaking

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1 process. So today you are going to see a lot of the  
2 new faces in the Policy branch.

3 And Bill King has been with us for about a  
4 year and a half at this point in the Branch, and he  
5 is going to discuss the wheeler relationship and  
6 some thoughts with gas and vapor testing.

7 MR. KING: Can you hear me? Sounds pretty  
8 good.

9 Good morning. Yeah, what I wanted to do  
10 was really first go over the proposed changes for  
11 the PAPR gas/vapor test requirements. Because in  
12 addition to the flow dependence, there are a couple  
13 of other important things we proposed.

14 The first is to discontinue equilibration,  
15 that is preconditioning requirements. That is we  
16 will only carry out as-received cartridge tests or  
17 canisters, tested.

18 We did these at two levels, that is the RH  
19 of the challenge air. Three tests at 25 percent RH  
20 and three samples at 80 percent RH for a total of  
21 six.

22 And of course, one additional item is we 82

1 want to propose using cyclohexane for the organic  
2 vapor test.

3 Most of you probably recognize the initial  
4 assumptions, basically following the lead of the  
5 CBRN test plan that was previously used.

6 What we want to do here, however, as well,  
7 is specify minimum test capacities along with  
8 maximum breakthrough concentrations for efficiency  
9 and the challenge concentration for each gas and  
10 vapor.

11 One thing you will notice if you inspect  
12 our poster out there is that these are generally  
13 unchanged from the as-received service life  
14 requirements that are currently in effect.

15 One thing we are proposing to change is to  
16 discontinue the current allowance for multiple gas

17 type approvals where the minimum test requirement  
18 currently specified in terms of time is halved for a  
19 multi-type gas approval. And there's the paragraph  
20 in the CFR that you can refer to.

21 So those are changes unassociated with  
22 variable flow rate.

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1 The last one is tests performed to assess  
2 multiple work rates.

3 And so what we are proposing is we can, if  
4 we choose, to test the different test flow rates as  
5 opposed to specifying a specific flow rate, as is  
6 done in the current test.

7 Here are some examples for cartridges.

8 The corresponding larger tables are out on the  
9 poster, but currently, this is where we are at.

10 A couple of things you can see here is  
11 for -- in this column here for a gas. We have  
12 specified, again, a challenge concentration, a  
13 maximum breakthrough, and a minimum test capacity.

14 That is in liters at room temperature and  
15 pressure for the gas concerned.

16 So that's -- of course you can calculate  
17 from the -- what these are, by the way, to reflect  
18 the current -- is calculated from the current test  
19 concentrations, the -- to the minimum test time,  
20 what those volumes were.

21 What I have included here in the last  
22 column is the testing at 170 liters per minute.

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1 This test is carried out at 170 liters per minute

2 under these conditions. You would achieve a  
3 capacity of 8.16 liters for ammonia in 60 minutes.

4 well, I include this to reflect the fact  
5 that we have -- more for internally, we have  
6 adjusted these concentrations and conditions such  
7 that we have consistent service lives at set  
8 conditions.

9 One last thing, there is a bottom line for  
10 unlisted contaminants. This is in the current draft  
11 that you see. I include it here for your comment,  
12 is to -- for one that's not listed in the table, you  
13 would calculate the challenge concentration by  
14 taking four times the IDLH, which, again, there are  
15 some issues, which IDLH. We will cover that later.

16 The REL. And, again, this would be for a  
17 60-minute test, here simply multiplying by .0408  
18 times the IDLH will give you the capacity in liters  
19 for this proposed contaminant.

20 In the next slide, I have the  
21 corresponding examples of canister test capacities  
22 and maximum breakthrough and challenge

85

1 concentrations for canisters.

2 As you -- of course, we have preserved,  
3 again, the standard half percent per 12-minute  
4 capacity, which is -- runs throughout all of the  
5 current regulations. So you can see that is applied  
6 here, again, probably -- with the exception of  
7 carbon monoxide, which there is a specific extant  
8 test requirements for it.

9 So we see that the capacities are

10 generally 6.9 liters throughout.

11           Okay. So the next slide, we cover the  
12 three test flow rates that were called out in the  
13 December draft, that is low, moderate, and high  
14 rate. The test rates would be 115, 170, and 235  
15 liters per minute.

16           So as it was originally proposed, that  
17 these work rates, you would -- the tests would be  
18 carried out at one of those flow rates depending on  
19 the maximum work rate that you would specify in the  
20 approval.

21           What we are looking at here has -- based  
22 on work that has been done -- well, it is a pretty 86

1 well-accepted relationship.

2           We go to the next slide, we see that --  
3 what we find is that the time to breakthrough, that  
4 is to a given breakthrough -- and I didn't include  
5 all of the meanings of these. It is actually on the  
6 poster.

7           But breakthrough to a given set of  
8 conditions of challenge and breakthrough  
9 concentration -- that's the time to breakthrough --  
10 is in inversely proportional to the test flow rate,  
11 Q.

12           So we say that time to breakthrough is  
13 inversely proportional. And that's fairly well  
14 understood. It has been fairly well characterized  
15 for a lot of systems.

16           And if we take a look at that, what we  
17 have done here is look at some -- using organic



18 vapor tests, the next slide. I have some data for  
19 current PAPR cartridges, where we have done just  
20 that.

21           what we have done is taken -- now,  
22 remember, we are talking about doing three samples 87

1 at each -- three as-received samples at each of the  
2 two humidities, challenge humidities.

3           So what we can do is, instead of doing  
4 each one of those at one flow rate, what we have  
5 done here is, in this test, this is, I believe it's  
6 235, 170, and 115 liters a minute. Remember, this  
7 an inverse relationship here.

8           So what we see is that we have a  
9 relationship with service life that's directly  
10 proportion to the inverse of that flow rate.

11           So what it allows us to do is to take data  
12 obtained from these three done at three different  
13 flow rates.

14           Of course, now we can extrapolate that.  
15 And that's what I have done with this third sample.  
16 I took it to higher flow rates to show that this  
17 does carry down. Again, .2 here would be 300 liters  
18 a minute, and you can look at higher flow rates.

19           Again, we can certainly test there, but as  
20 a convenient way of consistently looking at this  
21 data, running of these three tests gives us reliable  
22 assessment of where -- the maximum flow rates that 88

1 this cartridge or canister can perform as we don't

2 see immediate penetration. That's what this tells  
3 us here.

4           When we have zero service life, that is  
5 this line intersects the X-axis here. If it's on  
6 the positive side here -- which I don't have the  
7 origin. I apologize -- it would mean that there's  
8 flow rate at which you would get instantaneous  
9 breakthrough with this cartridge.

10           So it allows us to assess the higher flow  
11 rates without too much effort from one -- so when  
12 you have multiple approvals and things like that for  
13 different flow rates, we can get a consistent basis  
14 on which to judge them all.

15           If we go to the next slide, again, what we  
16 really wanted to do was assess capacity. And if we  
17 take that data from that previous slide and assess  
18 the capacity, we see that we can get consistent --  
19 even though we have done it with different flow  
20 rates, they are reasonable estimates of the capacity  
21 for these.

22           And, again, remember, these are run to a 89

1 fixed penetration under fixed conditions.

2           So it's one way we can certainly do this  
3 and not do them at specific flow rates. We can do  
4 two or more different flow rates and still get  
5 capacity data.

6           Okay. The next slide, I believe -- yeah.  
7 One thing I have assessed as well was taking a look  
8 at the tests -- again, these are the tests we are  
9 proposing.

10           we have done them with cyclohexane and  
11 with carbon tetrachloride on three different current  
12 PAPR canisters.

13           And what we see is -- I didn't include it,  
14 but the average difference here is about a minus 5.8  
15 percent. And that's pretty much in line -- that  
16 is -- the cyclohexane tends to run 5, 6 percent of  
17 service life shorter than the carbon tet test, which  
18 is very consistent with all of the data that exists.

19           Terry and Murray did a survey of that a  
20 couple of years ago, and their -- that was right in  
21 line with the average difference that they found for  
22 all of the studies they looked at. So that's what 90

1 we are seeing here, is roughly a 5 percent  
2 difference.

3           On the next slide, I think I have  
4 summarized things. Yeah, the current requirements  
5 are conserved as proposed capacities. Okay. That  
6 is we have gone from specifying the service life by  
7 challenge, concentration, and service time to simply  
8 a capacity, again, at a fixed concentration and  
9 penetration to give us efficiency.

10           Cartridge/canister test plan reflects  
11 current respirator use as compared to the  
12 equilibration approach. I would like your thoughts  
13 on that.

14           And can we -- we can apply an accepted  
15 method -- again, the Wheeler Relationship, which I  
16 didn't reiterate there, apply this method of  
17 assessing the effect on flow rates so that we can,

18 if we choose, to look at multiple flow rates as  
19 opposed to single flow rates in repetitions of the  
20 as-received test.

21 And, of course, we can do cyclohexane in  
22 place of carbon tetrachloride. In fact, if you are 91

1 looking at capacity, I think we are proposing about  
2 a 4 or 5 percent lower capacity to reflect that  
3 difference in the behavior of cyclohexane.

4 And with that, again, these findings are  
5 nowhere near formal. They are for your  
6 consideration.

7 Any questions?

8 MR. SELL: Bob Sell with Draeger Safety.

9 You identified four times IDLH for  
10 unlisted gases for a cartridge. What about for  
11 canisters?

12 MR. KING: No. The canister would remain  
13 at the -- or at least as we have -- the 5 point --  
14 or 6.9 liters. That would be the maximum capacity.

15 Now, the efficiency would require the REL.  
16 And I apologize. I didn't include that. We did do  
17 that in a draft, and I don't recall what it is  
18 offhand.

19 The capacity is fixed by the half percent,  
20 12-minute consistency there.

21 MR. SELL: Okay. So it is going to be  
22 considered?

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1 MR. KING: Yeah.

2 MS. DeMEDERAS: Edna DeMederas, North  
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3 Safety Products.

4 I don't have a problem with the different  
5 recommendations that you have made as far as  
6 cyclohexane, carbon tet, and all of those different  
7 things.

8 BY cutting the service time, getting rid  
9 of it, cutting it in half, I think the end users  
10 would be affected by that because people are used to  
11 using canisters and cartridges for a certain amount  
12 of time.

13 And if -- especially if you have high flow  
14 rates, they are not going to have as much time. So  
15 at this point, please take that into consideration.

16 MR. KING: Okay. Thank you.

17 MS. SWANSON: Hi. Meghan Swanson from  
18 MSA.

19 I didn't really have a question. I just  
20 wanted to comment that you mentioned we were using  
21 this wheeler method for the ISO gas test. I just  
22 wanted to clarify that, for ISO, we were considering  
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1 using this for test houses for manufacturers who did  
2 not have the resources to test at the high flow  
3 rates.

4 So certainly, you know, it is very  
5 interesting and it's good to run the test out and  
6 see what the breakthrough times are instead of just,  
7 you know, cutting things off a couple of minutes  
8 past the required service time. Maybe it's a good  
9 reality check to make sure that your service lives  
10 at the high flow rates are going to lie on that

11 line.

12 But I just wanted to say the manufacturer,  
13 you know, we would be happy to see NIOSH just  
14 running at the actual high flow rates instead of  
15 using this method to extrapolate the service life.

16 MR. SAVARIN: Mike Savarin, SPERIAN.

17 In looking at the examples of canister  
18 test capacities and breakthrough concentrations, I  
19 see we have four gases there.

20 How does this relate to all of the other  
21 gases, the list of gases? Are you seeing any -- are  
22 you seeing any variances arise from using cartridges

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1 that rely heavily on chem absorption versus  
2 straightforward absorption, you know, organic versus  
3 acid gas?

4 what happens when you use very basic  
5 and -- low boilers for example? what are you seeing  
6 when you are using the other agents?

7 MR. KING: well, to clarify, that these  
8 are minimum test capacities based on the current  
9 test requirements for NIOSH approval. So that's  
10 where those values in that table come from. So they  
11 don't really have a basis in experimental results.  
12 Okay.

13 Now, one thing that we do see is, as you  
14 say, for the cyclohexane, a slight difference  
15 associated with that.

16 we really haven't assessed the effect of  
17 low boilers, so that's pretty well understood for  
18 issues of -- I think there is a minimum vapor

19 pressure or a minimum boiling point that you should  
20 not consider organic vapor cartridges for, for that  
21 reason, which has nothing to do with our capacities  
22 here.

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1           These are for the standard tests that have  
2 already been laid out by NIOSH.

3           MR. SAVARIN: Okay. Which are you seeing  
4 for sulfur dioxide or formaldehyde?

5           MR. KING: Well, if -- I don't know them  
6 offhand.

7           what I did was -- and I didn't talk about  
8 here. It's on my poster. I did do -- take three  
9 current PAPR multitype cartridges, you know, acid  
10 gas, organic vapor, and some of ammonia, and tested  
11 them according to the conditions as were proposed in  
12 this -- the table here. And I have the service  
13 lives out there just to see.

14           One thing you do see, of course, is  
15 that -- in the case of -- I believe it is organic  
16 vapor -- no. I think it's SO-2, but under dry  
17 conditions, some of the cartridges may have  
18 difficulty in meeting what we are proposing, that is  
19 cutting -- not cutting in half for a multigas  
20 approval that minimum service life.

21           So some of that data is in there if you  
22 look at it. But I haven't made a specific study of

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1 looking at all of those aspects with regard to how  
2 they would be considered, but they certainly are

3 considerations. I agree.

4 One thing I would share with you, as we  
5 talked in our discussion, is that we would probably  
6 not apply this flow rate relationship to every  
7 approval for one cartridge or canister. We want to  
8 assess the efficiency of that bed.

9 Again, considerations of kinetics and the  
10 like, taking that into account, there is some you  
11 would test. There is some you certainly wouldn't  
12 because of service life and things like that, it  
13 would be impractical to do that.

14 MR. SAVARIN: So you could see a situation  
15 where this proposal could be adopted for just the  
16 few of the gas/vapor --

17 MR. KING: (Speaking simultaneously) Yes,  
18 I agree.

19 And in fact, I think they have done that a  
20 little because they have only seen that it really --  
21 they know that it works well for organic vapors and  
22 A, B, and K and the like.

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1 So I think this same thing we are thinking  
2 about here does not necessarily apply in that  
3 relationship because it doesn't make sense to  
4 reiterate that every time once we have established  
5 it for one set.

6 If you have multiple approvals, again.

7 MR. SAVARIN: I just wasn't sure everybody  
8 understand that here. Thanks.

9 MR. KING: Yeah. I'm certainly glad you  
10 asked the question.



11 MR. SAVARIN: That's fine. Thank you.

12 MR. BLANK: George Blank with Draeger  
13 Safety.

14 Maybe I'm not seeing something, but my  
15 original understanding was that a CBRN was going to  
16 be a subset of the PAPR standard, but I don't see  
17 any mention specifically of CBRN in anything we have  
18 talked about here.

19 MR. KING: That is true.

20 MR. SZALAJDA: I guess I will try to  
21 address that.

22 The thought process with going forward

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1 with CBRN and the approach that we took with the,  
2 you know, with the implementation of the standard in  
3 2006 were that the requirements were set in a way  
4 such that when the new PAPR standard evolved, the  
5 CBRN requirements weren't going to change. So that  
6 the requirements that you would have to meet now for  
7 CBRN will be the same if you submit something now  
8 versus five years from now.

9 Does that answer your question?

10 MR. BLANK: I'm not sure. I'm still a  
11 little confused as to -- because --

12 MR. SZALAJDA: Well, I guess things --  
13 what we have defined -- what we have currently  
14 defined for CBRN for the chemical warfare agent  
15 testing, the LRPL, the gas and vapor testing, and  
16 also the environmental conditioning, that's part of  
17 your application. Those tests are not going to  
18 change.

19 MR. BLANK: So they would be written into  
20 the standard and also be part of it?

21 MR. SZALAJDA: Yes. But it won't be a  
22 requirement. It will be if you want to get that

99

1 specific protection, but it will part of the  
2 standard. We just weren't going to talk about it  
3 because the requirements aren't going to change.

4 MR. PERROTTE: There's a LiveMeeting  
5 question.

6 MR. SZALAJDA: I guess we will take, I  
7 guess, one more, the LiveMeeting question, and then  
8 we will move on since we are a little bit behind  
9 schedule.

10 MR. PERROTTE: This question is from Simon  
11 Smith. It says: Thanks for a great presentation.

12 Is there any consideration for low boiling  
13 organic vapor cartridge as a standard item, not as a  
14 special requirement in parallel with European AX or  
15 ISO's direct standards?

16 MR. KING: No. We haven't considered it  
17 at that point. Certainly, if -- I haven't really  
18 weighed that issue, so I'm a little flat-footed  
19 there.

20 I will certainly look into it.

21 MR. SZALAJDA: All right. We are going to  
22 move ahead to the last -- the next-to-last subject

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1 we are going to discuss is Gary Walbert, who has  
2 been with us about a year now in terms of being a  
3 NIOSH employee.

4           And with regard to the work he has done  
5 over the past several years with looking at the  
6 particulate testing associated with high flows. And  
7 he spent a lot of time and effort in looking at the  
8 development of the technologies necessary to be able  
9 to evaluate the filters in these types of settings.

10           So once Gary is set up, we will be good to  
11 go.

12           MR. WALBERT: Okay. Just to reiterate, I  
13 have come to discuss recent work performed at NPPTL  
14 to evaluate high flow filter efficiency testers for  
15 PAPR applications.

16           The planned activities for this project  
17 include evaluating two filter testers, an ATI Model  
18 TDA-500P and a TSI Model 3120 High-Flow Filter  
19 Efficiency Testers for use in PAPR95 and PAPR100  
20 particulate filter efficiency level determination  
21 testing.

22           Through these efforts, we hope to identify  
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1 the high flow filter testers acceptable for the  
2 required testing, and then formulate standard test  
3 procedure for particulate filter efficiency level  
4 determination testing for PAPR and operating  
5 procedures for the acceptable high flow filter  
6 efficiency testers.

7           Next slide, please, John.

8           Okay. The specific testing that will be  
9 performed on each filter tester includes verifying  
10 that high-flow filter efficiency testers conform to  
11 advertised specifications and the PAPR standard.

12           Also determining DOP aerosol loadings as a  
13 function of time at flow rates ranging from 100 to  
14 500 liters per minute, determining the time required  
15 to load 1000 milligrams of DOP aerosol.

16           Determining the DOP aerosol particle size,  
17 distribution at flow rates ranging from 100 to 500  
18 liters per minute. And also identifying lab  
19 technician issues.

20           Next slide, please, John.

21           Okay. The operating requirements for the  
22 ATI and TSI high-flow filter testers were different 102

1           than the standard filter tester that is being used  
2 right now for low flow testing.

3           we require additional compressed air due  
4 to the higher flow rates. And for the ATI unit,  
5 that is 18 scfm at 80 psig. And for the TSI unit,  
6 we require 25 scfm at 100 psig.

7           In addition, larger vacuum pumps are  
8 required to overcome the higher pressure drop across  
9 the filter test bed and the DOP discharge filter due  
10 to the higher flow rates.

11           These were taken from the vacuum pump  
12 curves for both units. For the ATI unit, 22.5 acfm  
13 at 19 inches of mercury are required. And for the  
14 TSI unit, 25 acfm at 7 and a half inches of mercury  
15 are required.

16           Next slide, please, John.

17           Higher exhausting capabilities are also  
18 required due to higher flow rates. For the ATI  
19 unit, we require 48 scfm. And for the TSI unit, 25

20 scfm.

21           And the higher flow rates -- the higher  
22 exhausting requirements for the ATI unit are due to  
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1 a special DOP aerosol carryover venting system that  
2 they have incorporated into their system.

3           This next slide shows a photograph of the  
4 ATI TDA-500P High-Flow filter tester.

5           On the bottom enclosure, you can see the  
6 vacuum pump that is close-coupled to the unit. In  
7 the center of the picture is the filter checks. Let  
8 me go back one slide, John, please.

9           This shows the filter check area where we  
10 set our filters -- canisters for testing.

11           The next slide shows the TSI 3120  
12 high-flow filter tester. And beside that, located  
13 on the floor, is the vacuum pump close-coupled to  
14 the unit.

15           Next slide, please, John.

16           Okay. Determination of DOP aerosol  
17 loadings required an enlargement of the filter test  
18 bed to approximately eight-and-a-half inches in  
19 diameter. And this was done to reduce the pressure  
20 drop at the higher flow rates and also to collect  
21 sufficient DOP aerosol to obtain accurate change in  
22 weight measurements in measuring the loading  
104

1 generated by these two units.

2           we are also using a glass -- Type A/E  
3 glass fiber filters for the one micron four size,

4 265 millimeters in diameter, to collect of the  
5 aerosol for the loading tests.

6 And also a support grid with a one-half  
7 inch by one-half inch openings and a one-quarter  
8 inch thick lattice is being used to support the  
9 filter to prevent filter blowout at the higher flow  
10 rates.

11 Next slide, please, John.

12 This photograph shows the  
13 eight-and-a-half-inch diameter filter test bed with  
14 the support grid that we use for the loading tests.

15 Next slide, please, John.

16 There is a flow rate effect on the DOP  
17 aerosol loading, as we observed with our initial  
18 testing. Initial testing indicates that DOP aerosol  
19 loading is dependent on the flow rate.

20 We have done some recent testing  
21 employing, using a hand valve to control the flow  
22 rate through the test bed, and this has resulted in 105

1 an improvement in repeatability and consistency of  
2 the DOP aerosol loading measurements from run to  
3 run.

4 Also, we would recommend using mass flow  
5 controllers in place of the existing mass flow  
6 meters to improve the aerosol loading stability to  
7 take the human element of controlling the flow  
8 rates.

9 This next slide shows a -- this is for the  
10 ATI high-flow filter tester at 300 lpm. This was  
11 done back on July 29.

12 And as you can see here, there was no flow  
13 control employed. The flow rate drops off very  
14 slightly from about 300 lpm down to about 296 lpm.  
15 And during that time, the loading increases from 140  
16 up to almost 190 milligrams per meter cubed.

17 Next slide, please, John.

18 The next slide shows testing done just  
19 recently where we were controlling the flow rate  
20 with a hand flow control valve that's on a make-up  
21 airline that goes into the vacuum pump.

22 And, as you can see, the flow rate is 106

1 maintained very steadily between 300 and 302 lpm.  
2 And the aerosol loading during that time -- this is,  
3 again, a seven-hour test -- varied from 145 to about  
4 155 milligrams per meter cubed.

5 The units we have on site, they are sized  
6 up to 500 lpm because that would mean a larger  
7 vacuum pump.

8 The vacuum pumps are close-coupled to the  
9 high-flow filter testers. Therefore, the noise  
10 level in test lab is high.

11 The vacuum pumps for any commercial models  
12 that are this large in size should be located  
13 remotely to mitigate the noise.

14 Also, vacuum pump noise may be mitigated  
15 by sizing the vacuum pump to the final PAPR standard  
16 gas flow rate requirements and also for the  
17 particular PAPR test application.

18 Waste gas venting is an issue. The higher  
19 flow rates result in higher waste gas flow rates

20 that have to be exhausted from the test area through  
21 a controlled ventilation system, such as a  
22 ventilated hood.

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1 The ATI high-flow filter efficiency tester  
2 requires a secondary exhaust system to balance  
3 excess DOP aerosol generation from an aerosol  
4 generator vent, resulting in higher waste gas  
5 venting requirements.

6 whereas, a TSI high-flow filter tester  
7 vents directly from the aerosol generator.

8 And that should be it. I will take any  
9 questions at this point.

10 Thank you.

11 MR. SZALAJDA: All right. I guess, John,  
12 did we have any LiveMeeting questions?

13 MR. PERROTTE: No.

14 MR. SZALAJDA: We will move on to the last  
15 PAPR presentation, which is going to address the  
16 work done by Jay Snyder of the Technology Research  
17 Branch with the end-of-service-life indicator.

18 Jay had a couple of posters next door. I  
19 hope you had the opportunity to look at them. The  
20 posters -- just in general, the posters will be up,  
21 you know, throughout the course of the day. And, of  
22 course, you are welcome to peruse them. And also,

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1 if you see the associated researcher, to ask them  
2 questions as time permits.

3 So with that, if Jay -- well, he was just  
4 back there. If Jay can come forward, and we will



5 get him miked up, and he can give his presentation.

6 MR. SNYDER: Well, good morning. I want  
7 to talk to you about something near and dear to me,  
8 end-of-service-life programs at NPPTL.

9 And specifically, I would like to talk  
10 about our current work on cartridge sensor  
11 integrations and the testing and evaluation we have  
12 done, and this has to do with the electronic system.

13 I also want to talk about the future work  
14 in the area of the electronic system as well as  
15 describe to you some of the efforts that are going  
16 into an optical system. So we have two approaches  
17 to developing an end-of-service-life system  
18 currently going on.

19 Slide, John. And, again, John.

20 Hit it again.

21 Yeah. This is an animated slide to give  
22 you an idea of what we have in mind here. This is 109

1 our ultimate system where we can produce a sensor  
2 that is sufficiently inexpensive that we can have  
3 multiples of in it a carbon bed.

4 We also incorporate some electronics in  
5 with the sensor and an antenna so that we have a  
6 wireless device. I'm playing with the laser.  
7 Technical issue.

8 So we have multiple sensors in the bed  
9 that are powered by RF transmission. We have RF  
10 coming in. It powers the device. It takes some  
11 readings. That information then is transmitted back  
12 to some central processing unit, which then provides

13 the user with an indication of the condition of the  
14 respirator cartridge.

15 That's our ultimate goal. We are not  
16 there yet.

17 Next slide, please.

18 I would like to extend a big thank you to  
19 these companies who have volunteered to work with us  
20 on integrating sensors. We have just gone through a  
21 first round. Just this month, we will be completing  
22 the testing.

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1 I would like to do some evaluations on the  
2 results of that. And one of the things in  
3 particular I'm doing is a post-mortem evaluation of  
4 the sensors after they have been run through a  
5 cartridge test.

6 And then in the first quarter of next  
7 year, getting together with the participants and  
8 reviewing the information that we have accumulated.

9 Now, we did several things in this test.  
10 We tried to design this round-robin system so that  
11 we could maximize our information.

12 Next slide, John.

13 Here are some examples of some of the  
14 cartridges, APR cartridges that had sensors  
15 integrated into them. You can see we had multiple  
16 arrangements, had them where the sensor was located  
17 in the side wall as well as in the very center of  
18 the carbon bed.

19 We also had a variation in sizes of  
20 cartridge. They went anywhere from a 50-gram bed to

21 a 300-gram bed. So we have been finishing up on  
22 that work, and, as I said, doing some post-mortem 111

1 work on the sensors to see how well they survived.

2 One of the things we did in that work was  
3 to send both a fully completed sensor to the  
4 manufacturer as well as just a cap which they  
5 integrated both types. They came back to NIOSH, and  
6 then the one -- the cartridges that had just caps,  
7 we inserted a sensor. So that gave us some  
8 information of how well the sensor would survive the  
9 manufacturing transportation process, and it's  
10 proven to be quite interesting.

11 Just to give you a brief background of  
12 where this system has come from and where we are at,  
13 we have had multiple generations of the device. We  
14 started out with this one up here on top first.

15 It was a chip, a silicon chip with gold  
16 electrodes imprinted on it. And in this case, they  
17 were interdigitated electrodes, which we then placed  
18 on a conductive film. And that conductive film  
19 interacted with environmental contaminants, water  
20 vapor as well as organic vapors.

21 Following that, we went to a parallel  
22 plate system where we just had two parallel plates 112

1 with a three-micron gap. Again, filling that gap  
2 was a conductive material. That's this device.

3 Then we moved on. And by the way, these  
4 two had 24 sensors on the silicon chip.

5           Then we moved on to a spiral electrode  
6 arrangement, which gave us much greater service  
7 area. And that's the electrode arrangement we are  
8 currently using, but we have made several  
9 modifications.

10           We reduced the 24 system down to six, and  
11 ultimately we have paired the six sensors in three  
12 groups of two, covering three of the sensors, or one  
13 of each of those pairs so that we use that as a  
14 reference.

15           What we find to be the challenge in this  
16 system is keeping that reference device hermetically  
17 sealed. It is very difficult to do that without  
18 affecting the performance of the sensor itself. It  
19 is under this cover plate you see in these two  
20 models.

21           So this round-robin we have just  
22 completed, we used a Generation 5 device. From some  
113

1 of the information we have gleaned from that, we  
2 have begun to develop a Gen 6 device, which has gone  
3 through the development process. It has gone out to  
4 the foundry. They have produced the mask.

5           It is back. And so in this next quarter,  
6 we will be producing sensors and evaluating them in  
7 considerably different format. It will only have a  
8 single sensor in this new format, but it will be --  
9 have a pre-concentrator up front, which will  
10 significantly affect its performance in terms of  
11 sensitivity and we think eliminating some of the  
12 background problems with humidity.

13 Next slide, John.

14 This is a further breakdown of the  
15 Generation 5 device that we have used in the  
16 round-robin system.

17 You can see the silicon wafer here in the  
18 center. It is approximately two millimeters on the  
19 side. And on that, there are six sensors and bond  
20 pads to attach wire bonds that brings the  
21 information out to the outside world.

22 This all incorporated onto the top of a 114

1 TO-5 package, a very common electronics package  
2 found in the electronics industry.

3 And covering that, then we have placed a  
4 metal cap which has a hole, which is covered with a  
5 Teflon filter to permit vapors to permeate through  
6 into the sensor, but prevent contaminants from  
7 entering, such as carbon dust.

8 Next slide, John.

9 We are applying nanotechnology to this  
10 application, and I wanted to talk a little bit about  
11 it.

12 By nanotechnology, in our case, we are  
13 using materials from the two-nanometer range down to  
14 a fraction of a nanometer, or several angstroms.  
15 The interesting thing about nanotechnology and  
16 materials that are used and formed in the nano  
17 region is that their characteristics change  
18 significantly from what you would normally expect  
19 them to do.

20 Even the color. For example, I have shown

21 here a gold nugget, and we all know the color of  
22 gold. As you transition down to the smaller and

115

1 smaller sizes, the color you see in reflectance  
2 actually changes.

3           So the material we are using for this  
4 round-robin was a monolayer protected gold  
5 nanoparticle. And it's pictured here. What it  
6 consists of is an approximately two-nanometer gold  
7 core onto which a chemically bonded organic film is  
8 applied. And that's about seven-tenths of a  
9 nanometer in thickness.

10           And what that does is if you had pure gold  
11 touching pure gold modules or nuggets, particles,  
12 touching, it would be a perfect conductor, very good  
13 conductor. When we add the film to it, it becomes a  
14 semiconductor. And this semi-conductance  
15 characteristic changes as it interacts with its  
16 environment, such as when there are organic vapors  
17 present.

18           Okay, John.

19           Here is a summary slide of some of the  
20 work we went through before we went into the  
21 round-robin.

22           You see here is what we call our C8

116

1 nanoparticle. The reason we call it a C8  
2 nanoparticle is because that's the film we have  
3 surrounding the two-nanometer gold particle. It's a  
4 C8 material.

5           And some of the early testing we did, we

6 have a cartridge simulator in the laboratory. We  
7 can fill it with 50 grams of carbon, place a sensor  
8 inside the carbon bed as well as a gas  
9 chromatographic probe. We can monitor what the  
10 sensor sees.

11 And here you see a plot. In this case, we  
12 ran a thousand parts per million of toluene into a  
13 carbon bed of 50 grams at 32 liters a minute and  
14 relative humidity of approximately 25 percent.

15 So at the bottom, you see the response of  
16 the sensor, and this is time.

17 And -- I'm sorry. At the bottom you see,  
18 this is the response of the GC, the yellow. This is  
19 the sensor response, and you can see both are nearly  
20 the same in terms of when they see the contaminant,  
21 the difference being the actual location.

22 It's difficult to locate the GC probe and 117

1 the sensor at precisely the same location in the  
2 cartridge. But we did get decent correlation.

3 Some of the things that we like about  
4 these nanoparticles is they are easy to handle,  
5 quite stable in air, soluble in organics, so it  
6 permits us to dissolve them and apply them to our  
7 sensors quite easily. And so we can do that in a  
8 number of ways, by inkjetting, just plain old  
9 dropping, drop casting, spinning, spraying.

10 And sometimes the way in which you apply  
11 these materials affects the performance of the  
12 material because you can get different morphologies.

13 Some of the other things that we like

14 about them is we can easily modify them in terms of  
15 shape and size. And the functional group that -- in  
16 this case, the C8, we can modify either the C8 or  
17 put a totally different functional group on as a  
18 film. And it gives you different performance  
19 characteristic.

20 And we also like the fact that it's  
21 reusable. And that is we were able to expose them  
22 numerous times to solvent vapors and get some more  
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1 performance out of them.

2 This is our setup in the laboratory. And  
3 I have summarized the types of tests we did the  
4 round-robin experiments with.

5 You see at the top here, we used toluene  
6 at 500 parts per million and 200 parts per million.  
7 We also used a DuPont enamel reducer at 500 parts  
8 per million. And the reason I like that is because  
9 it is a mixture, a blend of numerous compounds. It  
10 has got over 19 different groups of organic  
11 compounds, several hundred compounds total.

12 We had aldehydes, ketones, aliphatics,  
13 aromatics, substituted aromatics, and branched  
14 aliphatics. So quite of variety of different types  
15 of compounds, numbering in the hundreds.

16 We also did trichloroethylene at 500 parts  
17 per million, and we varied these at 25 percent and  
18 80 percent relative humidity.

19 This is our laboratory test setup done in  
20 a hood. This is the actual chamber, which we have a  
21 cartridge. And this is a little larger. You can



22 see the sensor connection here on the side.

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1 Here is a summary of just some of the  
2 results. In this case, 500 parts per million  
3 toluene.

4 Now, one of the things we learned as we  
5 were building these sensors for this round-robin is  
6 that there was a significant difference in  
7 performance depending upon the film thickness of  
8 that conductive layer over the electrodes.

9 And the conclusion we came to was that,  
10 after evaluating a number of them and seeing the  
11 responses, came to the conclusion that we were able  
12 to produce a more uniform device with a thicker  
13 film. These are all thicker films to the left of  
14 this area, and these are the thinner films.

15 Now, with the thinner films, we did get  
16 some performance similar to the maximum performance  
17 we saw with the thick film, but they just weren't as  
18 consistent. And these were in terms of microvolts  
19 per part per million.

20 John.

21 Here's a summary of the results we got  
22 from one brand's integration. And I wanted to show

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1 you the results of all of the tests. Here we have  
2 toluene at 500 parts per million, 25 percent  
3 relative humidity. 500 parts per million at 80  
4 percent humidity. 200 parts per million toluene, 25  
5 humidity. The Dupont solvent at 500 parts per

6 million, 25 humidity. Trichloroethylene at 500 and  
7 25 and 80 percent relative humidity.

8 And you can see, we got decent responses,  
9 in the order of 60 to a hundred microvolts per part  
10 per million, which was really quite good.

11 So some of the preliminary conclusions  
12 that we have arrived at based on we have seen in  
13 this round-robin of tests is the uniform film  
14 thicknesses were more sensitive than the thinner  
15 film devices. That is something I just talked to  
16 you about at length.

17 The detection of the contaminates at high  
18 humidity I would term as unacceptable, and that is  
19 something we will be concentrating on this Gen 6  
20 device, to improve upon that effort.

21 Here is an interesting one. The location  
22 is centered. It didn't seem to make much difference  
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1 in performance whether the sensor was located in the  
2 side wall of the cartridge or out in the center of  
3 the bed.

4 I have marked no failures due to handling  
5 and transportation, and that was an early  
6 conclusion. Now that we are doing the post-mortem  
7 work, I'm not entirely sure that's the case. I may  
8 have more to say about that later.

9 And we have been using these devices for  
10 about year, and we haven't seen any aging effects  
11 yet. But we do have some longevity tests ongoing to  
12 further evaluate that.

13 So here are some of the tasks that we have

14 got upcoming for '09. In the materials area, we  
15 want to develop some nanomaterials, nanoparticles,  
16 particularly the gold nanocrystals and clusters.

17 And we want to also look at incorporating  
18 other devices. I have been talking to you today  
19 solely about a chemiresistive device. This silicon  
20 wafer MEMS device is capable of other types -- of  
21 incorporating other types of systems. And one which  
22 considerable work has been done is a gravimetric

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1 device. So we would like to incorporate that into a  
2 single MEMS unit.

3 These are all really important. Just some  
4 are more so than others. Next one, John.

5 In the areas of system integration, we are  
6 really excited to start testing the  
7 pre-concentrator. The design has been completed and  
8 implemented. And, as I have said, we will expect to  
9 begin testing in the first quarter.

10 We also want to look at that integration  
11 of multiple types of sensors as well as testing  
12 various analytes in a passive system.

13 And of course, the humidity effort will be  
14 ongoing through the year to improve performance and  
15 be able to better discriminate between analyte and  
16 humidity.

17 And finally, I have identified the  
18 wireless task. This year we will begin looking at  
19 the feasibility of making it all wireless, and that  
20 is taking electronics, integrating it into the chip  
21 via CMOS, the sensor chip, and adding an antenna and

22 making it wireless.

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1 Okay, John.

2 And this is a concept slide of what we  
3 think we need to do in the area of wireless work.  
4 Start out with something rather large, a flexboard  
5 approximately an inch across, which we have got the  
6 Chemsensor system in the center.

7 Later, we think we can shrink that down  
8 further and incorporate the Chemsensor and power and  
9 communications to the point where we reach this very  
10 small device. Hopefully it will be in the order of  
11 two-tenths of an inch, which will have the antenna,  
12 the sensor, as well as the electronics to operate  
13 the sensor.

14 And I have included a block diagram of our  
15 Generation 6 device, a couple of important features  
16 of it that we will bring in the sample into a  
17 pre-concentrator which will then flash that sample  
18 periodically onto various types of sensors, the  
19 chemiresistive device as well as the gravimetric  
20 device. And that data then can be collected and  
21 analyzed.

22 we also will be putting a humidity sensor

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1 on this new chip. We think that having that  
2 information available, we can better decipher  
3 responses between the humidity and organic  
4 contaminants.

5 One of the other things I wanted to talk  
6 to you about was this core silicon work, or our

7 optical system.

8           Could you back up just one slide, John?

9           It is, again, applying nanotechnology to  
10 an optical sensing system. Some of the advantages  
11 are very low power, can be produced in mass  
12 quantities at low cost. Tuneable optics. And  
13 really quite high sensitivity for the amount of  
14 surface area. So we can put a very, very small  
15 device in a carbon bed that would be totally  
16 unobtrusive in the performance of the bed.

17           Okay. Next one.

18           Again, we are working down here in the  
19 couple-of-nanometer range, and I'll describe the way  
20 in which this works with our next slide.

21           Yeah. We take a silicon wafer and etch  
22 nanometer channels into it. And these channels, of

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1 course, can be very well controlled in terms of size  
2 and length.

3           And we attach this wafer, this etched  
4 wafer, onto a piece of optical fiber and transmit  
5 some light into it so that it impinges the surface  
6 and is transferred through the wafer.

7           As it passes through these channels, the  
8 walls cause a reflection to occur. And the  
9 reflection can be monitored. And if we then  
10 continue the monitoring and expose the wafer to an  
11 organic vapor, these vapor molecules accumulate in  
12 those channels, and they cause a change in the  
13 reflectance. So we get a band shift.

14           And if we do some calibrations, we can

15 equilibrate that band shift to a concentration.

16           Next one.

17           This is a further breakdown. Here we have  
18 the film, the filament, optical fiber filament,  
19 which we have attached a photonic crystal to it.

20 This is a multitude of filaments down here, but we  
21 can take just one of those, or we could take several  
22 of them and place them at different locations inside

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1 of that and monitor them for the performance of the  
2 bed and determine the condition of the bed.

3           Next slide.

4           So just to describe this a little further,  
5 if we have a bed. We insert a carbon -- or an  
6 optical fiber with a photonic crystal on the end.  
7 We provide a broad spectrum of light. It then  
8 penetrates the photonic crystal.

9           We get some reflection back. We monitor  
10 that reflection with a spectrophotometer, and we can  
11 see this differentiation in a band. And we can then  
12 equilibrate or relate that shift to some contaminant  
13 and concentration.

14           Next slide, John.

15           Here's a simplified version. The problem  
16 with the other version I just showed you, we have  
17 got you pretty large supporting devices, like the  
18 light source and spectrophotometer. So we wanted to  
19 reduce that down. We could do that by simply using  
20 an LED.

21           The difference here is now we have a  
22 single band of light will be transmitting. And so

1 we can't look for that shift any longer, but what we  
2 can do is look for a reduction or change in  
3 absorption. And this thing can be equated to  
4 concentration.

5           Next one, John.

6           I would like to acknowledge some of the  
7 folks that I have worked with on this program.  
8 Quite a number at Carnegie-Mellon University,  
9 specifically, Lee Weiss and Gary Fedder, who have  
10 been the principal investigators at CMU.

11           Next one.

12           Other, Tony Rozzi, EG&G, is working at  
13 NIOSH. Michael Sailor, Anne Ruminski, and Brian  
14 King from the University of California at San Diego.  
15 They have been the principal investigators on the  
16 optical system.

17           And finally, you know, we have been  
18 funding the work. We have been taking advantage of  
19 a number of funding sources.

20           Of course, CDC/NIOSH has put money into  
21 this effort. Another agency is the U.S. Air Force  
22 Office of Scientific Research. They put in an equal

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1 amount of money in under their Multidisciplinary  
2 University Research Initiative Program.

3           CMU, Carnegie-Mellon, received an earmark  
4 from the Defense Department for a program called  
5 sensors for a Safer America, which had a lot of the  
6 same interests and goals incorporated into it as did

7 our program. So we have been able to leverage that  
8 work, and that was really quite significant funding.

9 And then the University of California, who  
10 has been providing the research funding so far for  
11 the optical system.

12 Questions or comments?

13 MR. BARD: Brent Bard from Supplied Air  
14 Monitoring Systems.

15 With the managing the humidity is one of  
16 your larger problems with the sensors, do you  
17 perceive it beneficial to increase the humidity  
18 level that you are going to the testing at given the  
19 fact that a lot of the end users, for example, Gulf  
20 Coast, are going to require it be exposed to a  
21 higher than 80 percent relative humidity on a daily  
22 basis?

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1 MR. SNYDER: I will be real happy if we  
2 can get the 80 percent.

3 I think once we get to that, no reason why  
4 we can't look at higher concentration, recognizing  
5 the situation you just identified.

6 MR. BARD: Thank you.

7 MR. SNYDER: Just to comment one thing  
8 further, one of the issues you begin to get into is  
9 just total condensation, and then discrimination  
10 really becomes quite difficult.

11 A couple of the things that we are doing  
12 in that area that I didn't mention was that in the  
13 optical system, we have been looking at treatments  
14 of a surface that tend to affect its performance in



15 the presence of water vapor really quite  
16 significantly, and we think that offers some real  
17 potential.

18 As well as the concentration system that I  
19 mentioned on the chemiresistive device. We are  
20 using a single sensor and actually pulsing the  
21 contaminant in along with having the separate  
22 humidity sensor.

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1 We think both of those will be of  
2 significant advantage for future work.

3 MR. SZALAJDA: Do we have anything from  
4 the LiveMeeting?

5 MR. PERROTTE: No.

6 MR. SNYDER: Thank you.

7 MR. SZALAJDA: Thank you.

8 At this point, we do not have any requests  
9 to make specific PAPR presentations, so for the next  
10 few minutes, I would like to open up the floor for  
11 any general questions and also any comments  
12 regarding the standards development program for  
13 PAPR.

14 MR. COLTON: Craig Colton, 3M.

15 I have a -- sort of going back to some of  
16 the earlier things that were said, and you have got  
17 this classification of a breathing assist and the  
18 positive-pressure PAPR.

19 Has NIOSH given consideration as to then  
20 how these devices will be approved, let's say, and  
21 then labeled or identified? Or are they all going  
22 to be different, or are they going to be approved

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1 just as NIOSH PAPRs?

2 Today, you have got loose-fitting and  
3 tight-fitting, but they are all powered  
4 air-purifying respirators.

5 MR. SZALAJDA: That's a good question.

6 Sort of what I envisioned, you know, with  
7 the classification is that this next generation of  
8 PAPR will have their own specific -- I don't want to  
9 say 14G, but I will call it like PP1, PP2, whatever  
10 that, for each, to tie it in with the performance  
11 characteristics that each -- if you get it approved  
12 at, say, 25 liters per minute, that will be a PP2  
13 classification. If you get it approved at a higher  
14 flow rate, it's a PP3 or a PP4.

15 That's something we still need to flesh  
16 through, but I think part of what we want to do is  
17 show a separation between -- yeah, not to ignore the  
18 systems that are out there, but show that they are  
19 different.

20 You know, and if you have any ideas as far  
21 as how to do that, we would love to hear them. But  
22 I think there's a need -- there's a definite need to

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1 show that there is a difference between where the  
2 approval came from, whether it was from, you know,  
3 Part 84 circa 1995 or, you know, Part 84, 19 -- or  
4 2010, but if there is a difference between that in  
5 the systems.

6 MR. COLTON: Yeah. Because I think that  
7 has implications then for the users, especially when

1 impression that you can use that baseball cap with a  
2 blower if you are working in a high workload,  
3 intensive, you know, type of environment.

4           So depending -- I mean, it all gets into  
5 the respiratory -- gets into the selection of your  
6 respiratory device.

7           I think that's where, you know, I see a  
8 need, you know, in going forward here over the  
9 next -- you know, with the generation of the rule,  
10 of being in a position to be able to talk about this  
11 with the users and increase the user knowledge, at  
12 least as far as what does this new PAPR standard  
13 mean to them, you know, and how they can use the  
14 standard and use the information coming, you know,  
15 out of the certification program and in our guidance  
16 to help them select the appropriate respiratory  
17 device where they need the protection.

18           MR. COLTON: Well, then the last comment I  
19 would have is that I would urge NIOSH to listen to  
20 the comment that was made earlier by Mr. Janssen.  
21 Because when you started talking about the inward  
22 leakage, that's never been really correlated to the  
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1 flow, as he indicated.

2           In fact, we have shown it to be even more  
3 related to the type of respiratory inlet covering  
4 since we have currently got PAPRs, for example, that  
5 are approved with the same air flow rate. But in  
6 field tests in the workplace, we know that they give  
7 different performance based on the type of

8 loose-fitting respiratory inlet coverings.

9 MR. SZALAJDA: Yeah, that is a good point.

10 I appreciate you clarifying that because I didn't  
11 want to misstate, you know, at least as far as the  
12 development of the inward leakage requirement  
13 because there a lot of -- as well as the other  
14 factors that need to be considered in going into  
15 development of a standard.

16 But, again, it's part of the whole suite  
17 of requirements that need to be considered.

18 MR. MCKEE: Tony McKee, ILC Dover. I  
19 wrote a little speech here, Jon, a little commentary  
20 relative to PAPR technology. A lot of Rich's work  
21 on establishing flow rates.

22 It appears that flow rates are established  
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1 for basic specific work rates or based on  
2 conventional existing loose- and tight-fitting PAPR  
3 technologies.

4 It seems like -- it seems to me that this  
5 may limit -- tend to limit innovation from the  
6 aspect that in future products, since the ultimate  
7 goal should be to maintain positive pressure in the  
8 breathing zone regardless of the flow rates provided  
9 by the system.

10 Excessively high flow rates encumber the  
11 user by requiring large batteries, multiple  
12 canisters, have a negative impact on canister  
13 service life.

14 My question would be, is it possible to  
15 consider an addition to the standard that provides a

16 placeholder for lower flow technologies while still  
17 providing those high levels of protection at  
18 moderate and high work rates?

19 MR. VOJTKO: The flow rates are not for  
20 approval of the PAPR itself, but for canisters,  
21 cartridges, and filters.

22 If you have a more efficient PAPR in terms  
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1 of the amount of air it requires to maintain a  
2 positive pressure, then maybe we have a little bit  
3 of a heavier filter. But I don't think we are in  
4 any way blocking development of something that will  
5 maintain positive pressure because that's the  
6 standalone test as far as for the positive pressure  
7 unit.

8 what we were looking at is just a basic  
9 capacity for the filters and such so that we don't  
10 have immediate breakthrough.

11 And in some cases, some of these devices  
12 that have lower overall flow rates may have higher  
13 peaks to compensate.

14 so we want to be able to accommodate that,  
15 and we are looking at a safe value for the sizing.

16 If you find that you are putting less air  
17 through a canister, I think it's a marketing tool  
18 for a longer life because you have a capacity there  
19 kind of based on some of Bill's statements, and  
20 you're not using it up as quickly.

21 MR. COLTON: I notice -- because I notice  
22 most of your testing was based on, you know,

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1 conventional tight-fitting and loose-fitting PAPRs.

2 MR. VOJTKO: well, we thought that would  
3 be the worst case in terms of developing these  
4 cartridge/canister capacities.

5 We feel anything else would probably be  
6 better and would stand it in good stead to -- so  
7 that a user would feel safe in using it and possibly  
8 have a longer life from that equipment.

9 MR. COLTON: Great. Thanks, Rich.

10 MR. PERROTTE: The LiveMeeting question is  
11 from David Spelce. I believe I pronounced that  
12 right.

13 It says: Since there is an STP in place  
14 to perform LRPL testing of neck sealing hooded CBRN  
15 PAPRs, are these hooded CBRN PAPRs covered in all  
16 draft PAPER standards, and can they receive NIOSH  
17 tight-fitting CBRN PAPER approval?

18 MR. SZALAJDA: Okay. I think I'm going  
19 to -- and maybe Dave can clarify this.

20 I think I'm going to assume that this is  
21 looking forward, you know, from the standard.  
22 Because right now, I mean, you would -- you know,

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1 for submission you would have to meet Part 84 as it  
2 exists plus the CBRN criteria. And I think in going  
3 forward, you know, it looks at -- for CBRN, as long  
4 as you met the performance requirement, we are not  
5 necessarily going to be looking at the -- whether  
6 it's tight or loose fitting, but rather that you  
7 meet the performance requirements that are  
8 identified.

9                   So I don't know if that answers Dave's  
10 question or not.

11                   MR. SPELCE: Well, I don't think it does,  
12 but --

13                   MR. SZALAJDA: Dave, I guess if you have  
14 voice capability, if you can restate the question.

15                   MR. SPELCE: Well, I was just wondering --  
16 boy, I'm getting a lot of feedback in my headset.

17                   Are -- a tight sealing PAPR is going to be  
18 able to receive tight-fitting CBRN approval.

19                   MR. SZALAJDA: Well, right now, you would  
20 have to meet the criteria as far as being -- if you  
21 had a hooded system, you would have to meet the  
22 tight-fitting criteria where it needs to seal to the  
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1 neck.

2                   MR. SPELCE: Right.

3                   MR. SZALAJDA: So if you had a hooded  
4 system now, as long as you had a neck dam or some  
5 sort of means to seal the neck, you could get a CBRN  
6 approval as a tight-fitting device.

7                   MR. SPELCE: Thanks.

8                   MR. SZALAJDA: Okay.

9                   All right. Since we are at 12:13, we will  
10 take one more question from Edna.

11                   MS. DEMEDERAS: Edna DeMederas, North  
12 safety.

13                   Do you still have a requirement for low  
14 flow/low battery?

15                   MR. SZALAJDA: The question, I guess, for  
16 LiveMeeting, do we still have the requirement for

17 low flow and low battery, and that is yes.

18 MS. DeMEDERAS: For everything? For  
19 breath-assisted and --

20 MR. VOJTKO: We will have a low battery  
21 requirement, and we are not measuring flow. So we  
22 are going to have a positive pressure requirement in  
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1 the positive pressure.

2 And for the breath-assisted, we really  
3 haven't developed anything yet, so we are open to  
4 suggestion on that. And we may just be looking at  
5 the inward leakage on that, or maybe flow.

6 But we haven't established that yet.

7 MS. DeMEDERAS: Okay. Thanks.

8 MR. SZALAJDA: Okay. I think with that,  
9 what we will do is we will take an hour break for  
10 lunch.

11 If we could reconvene at 1:15, and we will  
12 resume with the program.

13 (A luncheon recess was taken.)

14 MR. SZALAJDA: We are going to go ahead  
15 and get started with the afternoon portion of the  
16 program.

17 And we are about I think 15 minutes behind  
18 schedule, and we will just try to at least operate  
19 within the timeline, even if -- or the timeline with  
20 regard to the amount of time for each topic, even if  
21 we end up going a little bit later than planned.

22 But the next item on the agenda is the --  
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1 is Maryann D'Alessandro is going to be discussing  
2 the PPT planning efforts in response to the National  
3 Academy of Sciences' review of the Personal  
4 Protective Technology program.

5 MS. D'ALESSANDRO: Can you hear me?

6 Is that better? Good afternoon. I'm  
7 going to provide a brief overview of the PPT program  
8 action planning. First, I'll talk a little bit  
9 about how we got to where we are today, and then  
10 I'll give you an overview of the National Academies'  
11 recommendations. And then I'll talk a little bit  
12 about how you can help.

13 Stay on this slide, John, please.

14 First of all, in this era of program  
15 evaluations and when the government is being held  
16 accountable for what it is doing, NIOSH decided to  
17 conduct a series of evaluations through the National  
18 Academies.

19 They believed that the National Academies  
20 would provide the most scientifically rigorous  
21 review of NIOSH programs. So they identified eight  
22 programs that would be reviewed over a three-year

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1 period that started in 2005, and there were three  
2 NIOSH sectors reviewed and five NIOSH cross-sectors  
3 reviewed. We have talked about those in the past in  
4 our program, public meetings, so we won't get into  
5 those today.

6 The PPT program was one of those  
7 evaluations that was reviewed.

8 Now, all eight of these reviews now are

9 being addressed through each particular program.  
10 Now, the PPT program is managed by NPPTL, and NPPTL  
11 is the primary component of the PPT program, and  
12 that's why we are reporting on this to you today.

13 So the next slide, please, John.

14 So who reviewed the PPT program?

15 The National Academies identified a  
16 committee of esteemed scientists, medical  
17 researchers, and doctors, and subject matter experts  
18 to reviewed the committee. Now, these handouts are  
19 in your notebook that you were provided. It is hard  
20 to read here. But you will be to identify some of  
21 these names.

22 Now, the chair of the committee, John

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1 Gallagher, is an emergency medical doctor, and he  
2 did not have any knowledge of PPT.

3 Although he knew people in health care  
4 used PPT, he had never really used it himself. So  
5 this was a very enlightening experience for him, but  
6 he really was an excellent chair of this committee  
7 and really managed it very well.

8 You will also notice that there are some  
9 esteemed scientists there who are involved in  
10 protective clothing. There is Roger Barker. There  
11 is Jimmy Perkins. Also some stakeholders,  
12 scientists, Howard Cohen and Janice Comer-Bradley.

13 There will be some names that you cannot  
14 identify there who are not familiar with PPT that  
15 are esteemed scientists and researchers, perhaps in  
16 program evaluation and other areas who are on the

17 National Academies.

18 Next slide, please.

19 So what did the committee review? The PPT  
20 program had to put together what we called an  
21 evidence package. And that evidence package  
22 encompassed everything that the PPT program, not

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1 just NPPTL, but what the PPT program had done since  
2 NPPTL's creation is when we started.

3 And we had 12 goals and objectives that  
4 were identified. And they were based on our  
5 strategic goals, which were to reduce exposure to  
6 inhalation hazards, dermal hazards, and injury  
7 hazards.

8 So of those 12 objectives that were  
9 reviewed, they were categorized into three what the  
10 Committee called was PPT domains, which are  
11 essentially the NPPTL branches of research, policy  
12 and standards, and respirator certification. So  
13 that's the way they had broken down everything to  
14 evaluate our activities.

15 So then how it was reviewed is by looking  
16 at relevance, impact, emerging issues, and  
17 recommendations.

18 The Academies had to review the program  
19 based on relevance based on a scale of 1 to 5, and  
20 the details regarding what each of those means can  
21 be looked at -- you can download that on the  
22 website. And impact, a scale of 1 to 5 as well,

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1 with five being the highest.

2           And then they also had to look at what  
3 emerging issues we should be addressing in the  
4 activities that we are conducting today and moving  
5 into the future. And then they had to provide  
6 recommendations based on what we have been doing  
7 over the past year since 2001 and where we are  
8 headed for the future.

9           And this resulted in 144 different cells,  
10 if you -- cells that they had to categorize.

11           Next slide, John.

12           So the relevance score that we received  
13 and the impact scores were both 4. And you can see  
14 what those scores of 4 actually mean. Five being  
15 the highest, we could not -- they said that we are  
16 working in priority areas and engaged in  
17 transferring research, but there is room for  
18 improvement.

19           Now, those two scores of four do not  
20 really do the evaluation report justice because you  
21 really have to dig into the details of the report to  
22 see what was recommended. And what was recommended

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1 was really that we continue with what we are doing,  
2 but that we expand in a number of areas in all of  
3 our domain activities and in our outreach and  
4 transfer as well.

5           Next slide, please.

6           So what was recommended? The Committee  
7 had five recommendations that they provided to the  
8 PPT program. After reviewing the evidence, it was  
9 clear to the program that our focus was in

10 respiratory protection, and that we were moving into  
11 protective garments.

12 But they wanted to really see that NPPTL  
13 was actually living up to what it was charged to do,  
14 which was to have a comprehensive PPT program  
15 addressing not only respiratory and dermal hazards,  
16 as we are addressing now, but moving into all PPE  
17 areas.

18 And also, most of our activities have been  
19 focused in areas where there are stakeholder  
20 interests, such as mining and in emergency response.  
21 And we are now moving into healthcare with the  
22 PPE -- with the pandemic influenza threat.

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1 So they wanted to see that we are  
2 addressing all of the industry sectors that NIOSH  
3 has, not just those specific areas. And that we  
4 also are focused more in all PPE areas, not just in  
5 respiratory protection.

6 And then in the second recommendation,  
7 they recommend that Centers of Excellence be  
8 established.

9 Now, this is -- I'm sure many of you or  
10 all of you have heard of -- the Center of Excellence  
11 concept has been around. There many ways that  
12 people perceive what that should be, and we were  
13 trying to see what exactly they wanted to see from  
14 that, but they left that wide open.

15 And they said to us that, what they see is  
16 there are a number of -- especially in academia, a  
17 number of test facilities that exist and academia

18 researchers who are out there who have a capability  
19 that we don't have in house, but that we could  
20 actually provide them directed research. So we  
21 don't necessarily have to build up that capability  
22 in house, but we could manage all of those

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1 activities.

2           So that's the way they saw it. And so  
3 that is what Recommendation 2 is, and I will talk  
4 about how we are trying to address that.

5           Third, the committees have a lot of  
6 opportunity for enhancing the respirator  
7 certification program. So they left that as a  
8 separate recommendation. And that stood out, that  
9 being the foundation of NPPTL.

10           They wanted that to be addressed and  
11 figured that there are a number of ways that our  
12 activities could be enhanced in that program.

13           Fourth, they wanted to see research on use  
14 and usability of PPE.

15           While we have a good respiratory research  
16 program and an evolving program in garments, they  
17 wanted to see more research on how do we know that  
18 the PPE that is out there in the field is  
19 actually -- actually working as it is designed to  
20 work.

21           So the use and usability of that PPE that  
22 is out there, and how do we address the barriers to

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1 using that PPE. So more workplace studies, they

2 wanted to see. And also they had a specific focus  
3 on the comfort issue as well, and on the integration  
4 and interoperability.

5 So those were the three key areas in this  
6 recommendation.

7 And finally, assessing the PPT use and  
8 effectiveness using a lifecycle approach. And this  
9 boils down to having effective surveillance in the  
10 program and ensuring that all of the work that we  
11 conduct is not just based on the squeaky wheel and  
12 those stakeholders' interests, but on surveillance  
13 data that demonstrate that this is what we need to  
14 be doing. So we should have surveillance as a key  
15 input into evidence into everything that we are  
16 doing.

17 So how are we addressing the  
18 recommendations? We prepared the evidence package  
19 in August and submitted it to the Academies, and we  
20 received their evaluation in June of this year.

21 And then what we did is the PPT program  
22 leadership developed a strategy for moving forward 152

1 with this approach. And what we decided to do is to  
2 have a team approach in addressing these  
3 recommendations.

4 So we solicited both NPPTL and all of  
5 NIOSH for participants in teams to assist us in  
6 identifying strategies for moving forward with these  
7 recommendations.

8 So the three individuals that you see up  
9 here volunteered to lead those teams. Actually,

10 Colleen led Recommendations 4 and 5. Tom was the  
11 assistant lead to Lynn Rethi, who couldn't be here  
12 today due to a family emergency. And 14.3, the  
13 respirator certification, he and Ed Fries on the end  
14 led Recommendations 1 and 2.

15 And they were assisted by five to ten  
16 people in NIOSH in developing the recommendations  
17 and really providing a lot of detail. You will not  
18 see that detail today.

19 The briefing that they gave was three and  
20 a half hours, just on their recommendations, and  
21 that was not the detail that provided all of the  
22 resources. So it is a very detailed plan, and you

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1 are just going to see the surface today.

2 And also, could I just see a show of hands  
3 of other people who participated? Ziqing Zhuang was  
4 also an assistant lead. And if you participated on  
5 our team, could you just raise your hand so they  
6 realize that this was a team approach? Thank you.

7 Okay. This happened over -- this is a  
8 very intense process. It happened over a six-week  
9 time frame, in August and September. And then the  
10 teams provided us their reports in September, and we  
11 then presented it to our National Academies  
12 Committee on PPE in October.

13 And now, the leadership is in the process  
14 of synthesizing these recommendations with what we  
15 are doing now and how we move forward.

16 The next slide.

17 So the way the action plan is put



18 together -- and you will see this on the website  
19 when it is posted this month -- is that we have the  
20 National Academies' recommendations.

21 And then these recommendations are broken  
22 down into issues that are associated with each of

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1 these recommendations and desired outcomes.

2 And then each of those has associated  
3 activity output goals, which is a NIOSH term in  
4 identifying typically what project level goals are.

5 So our project activity is the activities  
6 you heard about today. These would be activity  
7 output goals that we intend to do. And then what  
8 action steps need to be achieved to achieve those  
9 goals.

10 The thing that is missing in this  
11 hierarchy is the intermediate goal step, which I  
12 will talk to you about at the end of the  
13 presentation.

14 And this is what others do with the  
15 information with our outputs. And that's where the  
16 we need your assistance in what intermediate output  
17 protocols should we incorporate in the plan.

18 Next slide.

19 Okay. Now I'll briefly go over all five  
20 of the recommendations. And then if you have any  
21 questions, you could ask the team leaders while I'll  
22 answer the questions that I can.

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1 So the first recommendation was to  
2 implement and sustain the comprehensive National

3 Personal Protective Technology program. And this  
4 was broken down into four issues. And the Academy  
5 was pretty clear with what they wanted to have  
6 addressed in these -- under this recommendation.

7           And those essentially fall into our three  
8 branch activities, which are the research area,  
9 policy and standards, and the certification  
10 activities. And then they added a fourth one, which  
11 is the integration and interoperability of PPT  
12 components and ensembles.

13           Next slide.

14           So the first one is to manage and conduct  
15 research across all types of PPT and across all  
16 occupations and workplaces. And the desired outcome  
17 that we would like to achieve with this  
18 recommendation is that we have a comprehensive PPT  
19 research program that addresses PPT needs in all  
20 industry sectors.

21           As I mentioned, we have been focused in  
22 particular sector areas based on those stakeholders

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1 that are most vocal, and also the national  
2 interests. And also we have been focused in  
3 respiratory protection and evolving into dermal.

4           Now, there are other NIOSH divisions who  
5 are focused in other areas of PPE and PPT, such as  
6 hearing protection, and also in fall protection  
7 harnesses.

8           But what the PPT program wants to do is  
9 provide oversight of all of these activities and  
10 identify where the gaps are and what activities need

11 to be conducted and researched and where could we  
12 add some areas in the Centers of Excellence and  
13 extramurally as well.

14 So be more active in identifying those  
15 gaps across all PPT and all industry sectors.

16 The second issue is to participate in  
17 policy development and standards setting across all  
18 types of PPT. And the desired outcome is that PPT  
19 policy and standards development effort is in place  
20 and gaps identified and addressed.

21 And you have heard a lot about the policy  
22 and standards efforts today, which are headed in the  
157

1 near term and that the -- we want to have notices of  
2 proposed rulemaking, two every year to address 42  
3 CFR Part 84.

4 But what we also want to do is ensure that  
5 we are effectively involved in all those consensus  
6 standards that are applicable to PPE and PPT where  
7 we should be involved, and also that we are using  
8 those consensus standards most effectively in 42  
9 CFR.

10 So how can we actually leverage existing  
11 standards to update 42 CFR? And also in addition  
12 to -- can you please go back to the next slide?

13 In addition to the respirator  
14 certification, respirator policy and standards  
15 activity, also, what other activities should we be  
16 involved with in policy and standards?

17 So not just moving from respiratory  
18 protection to include other areas. We are in the  
Page 117

19 garment area as well, but we need to identify what  
20 other areas in the PPT.

21 Next slide.

22 And then in the certification area, the 158

1 desired outcome is a comprehensive certification  
2 program is in place. And with regard to this, the  
3 Committee was very vocal that other PPE and PPT,  
4 apart from respirators, is not certified. And the  
5 committee thought that that's something that we  
6 should be doing.

7 Now, NIOSH doesn't necessarily want to  
8 take that on. So what we need to do is conduct a  
9 feasibility assessment regarding, Does it make sense  
10 for us to go beyond respirator certification? Does  
11 it make sense for us to manage the overall  
12 certification of all PPE and PPT? So we have some  
13 way to go in actually developing this concept and  
14 addressing this issue.

15 Next slide.

16 And then finally, promoting the  
17 development, standards, and certification of  
18 integrated PPT components and ensembles.

19 And with this desired outcome, we want to  
20 ensure we have a strategy in place to ensure that  
21 users have the confidence that their PPT works  
22 together as it is certified to work. So the 159

1 respirator, when it is used in conjunction with  
2 goggles or hearing protection or an ensemble is

3 actually working as it is certified to work.

4 So how can we get more involved in that  
5 type of testing and in whole body and whole ensemble  
6 testing? And that's what this recommendation  
7 addresses.

8 So then onto Recommendation No. 2.

9 The second recommendation addresses  
10 establishing PPT research Centers of Excellence and  
11 increasing the extramural PPT research.

12 And two issues were identified in this  
13 recommendation: Establishing and managing Research  
14 Centers of Excellence, and coordinating with the  
15 NIOSH Office of Extramural Programs.

16 Next slide, please.

17 So the first issue, establishing and  
18 managing the Research Centers of Excellence, the  
19 outcome under this issue would be that we have  
20 centers of the excellence identified that are  
21 targeted in addressing those areas that are not  
22 addressed with our intramural program, and also

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1 synchronized with our activities that are going on  
2 intramurally.

3 And we produce a stronger and  
4 ever-improving research base. And also we see some  
5 area of involvement in certification and standards  
6 in this Center of Excellence concept as well.

7 Right now, the thought is that we will  
8 have a -- the next committee on PPE meeting that  
9 will be held in March, the day after our stakeholder  
10 meeting. We will be focused on addressing this

11 issue and how we better establish the Centers of  
12 Excellence concept.

13           So the National Academies, through our  
14 committee on PPE, will be bringing in experts in  
15 Centers of Excellence and other experts to help us  
16 refine this concept better and look at how we can  
17 move forward with addressing this issue.

18           Right now, what we are looking at is that  
19 we would have two components of Centers of  
20 Excellence. One would be an area to address  
21 research, technology translation, technology  
22 research activities, research and development

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1 activities. And the second concept or components of  
2 the Center of Excellence, to address technology  
3 translation issues.

4           So once the research is conducted, the  
5 standards are out there, how do we ensure that  
6 effective training and interventions are taking  
7 place?

8           And that's the division that we have at  
9 this time, but that will be evolved more in the  
10 March time frame.

11           Next slide.

12           And the next component of this  
13 recommendation is effectively working with the  
14 Office of Extramural Programs.

15           The Office of Extramural Programs leads  
16 the NIOSH grant activities and leads the education  
17 and research centers, which some of you are familiar  
18 with, and also the agriculture centers.

19 Now, they all operate independently to our  
20 intramural PPT program, and the objective is to have  
21 these Centers of Excellence that have one extramural  
22 component, the Office of Extramural Programs and our  
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1 intramural program all working in harmony.

2 So the next slide, please.

3 And this is a visual that would show what  
4 that might look like in the future.

5 So we would have intramural activities  
6 that may be independent of the other two areas,  
7 Center of Excellence, directed research activities,  
8 OEP grant, ERC activities, and then some areas of  
9 overlap among all three of them.

10 Next slide, please.

11 The next recommendation focused on  
12 enhancing the respirator certification program. And  
13 under this recommendation, the National Academies  
14 came up with four issues that were clearly  
15 identified in the report, and they are -- we had  
16 broken those out into six, and you can see the red  
17 outline in the two that we have broken out.

18 The first, expediting the respirator  
19 certification regulations and updating  
20 certifications fees, we split into two because we  
21 believe they are separate issues.

22 And then registering the purchase of NIOSH  
163

1 certified respirators, the third. And the audit  
2 program we broke into the product audit and the site  
3 audit. And then finally, the sixth recommendation

4 was that respirator certification test results be  
5 disseminated.

6           So under the first recommendation,  
7 expediting revision of respirator certification  
8 regulations, you heard Jon talk about that today and  
9 his efforts to move forward with that and address  
10 this recommendation.

11           We were already headed down that path  
12 prior to this recommendation, but we believe that  
13 the approach the Policy and Standards Branch has and  
14 the activities that we have outlined in the plan  
15 will help us most effectively address this  
16 recommendation.

17           And under enhancing -- updating the  
18 certification fees, and with the exception of CBRN  
19 respirators, all of you know that the respirator  
20 certification fees have not been updated since 1972.  
21 The committee was very adamant that we recover a  
22 hundred percent of those fees and that all of the

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1 excess be put into research activities.

2           They don't realize that it doesn't quite  
3 work that way, that there are a lot of other  
4 components and external factors that are associated  
5 with how we recover fees and what is done with that  
6 money once those fees are recovered.

7           So our approach now is that we attempt to  
8 recover 60 percent of the fees. That is what we are  
9 leaning towards now. So we have to conduct an  
10 assessment of exactly how much is being spent now  
11 and then move toward that 60 percent fee recovery.



12                   And then our vision is that those fees  
13 would then go into improving the respirator  
14 certification activities by upgrading the  
15 certification test equipment and the facilities to  
16 ensure that when your products are certified, that  
17 they are using state-of-the-art equipment to certify  
18 those activities.

19                   So everything would be -- go into that  
20 program and the fee recovery. They would not be  
21 able to be put out into a research program.

22                   But what we would envision then is that

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1 then would free up other resources that are now  
2 taken out of our base budget to actually do the  
3 respirator certification activities.

4                   So we hope that in a way, it will address  
5 what they were trying to address with its  
6 recommendation, but also we think that it will also  
7 improve activities for manufacturers as well as the  
8 stakeholders in the end and internally for us as  
9 well.

10                   Next slide, please.

11                   So the third recommendation was that we  
12 register the purchase of NIOSH-certified  
13 respirators. And with the exception of SCSRs, there  
14 is no respirator certification program, no  
15 respirator registration program in place at this  
16 time.

17                   And what we need to do is -- our desired  
18 outcome is that we have registration across multiple  
19 classes of respirators to enable a better

20 understanding of respirator deployment, distribution  
21 of other data and knowledge leading to reduced  
22 injuries and fatalities.

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1           What we need to do is identify which  
2 respirators make the most sense to register and  
3 which approaches make the most sense.

4           For filtering facepiece respirators, for  
5 example, it does not make sense to have each user  
6 register those respirators with the numbers that are  
7 out there and because of they are disposable, et  
8 cetera.

9           But there may be another venue that may be  
10 more appropriate, such as having something on the  
11 web when different -- when product audits occur and  
12 different findings occur. Updating the web more  
13 regularly may be something more appropriate in that  
14 area.

15           So right now, we need to conduct a  
16 feasibility assessment for all respirators and also  
17 get a good handle on the products that are actually  
18 out there on the market. Because now, although the  
19 numbers that we have certified are great, right now  
20 we don't have a good handle on which of those are  
21 actually being fielded at this time.

22           So we are going through a process now to

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1 identify which respirators are actually out there in  
2 the field, and then moving forward with trying to  
3 determine the best way to look at registering the

4 respirators.

5 Next slide.

6 The next recommendation was expanding the  
7 product audit program. We separated this from the  
8 site audit because the two programs are conducted in  
9 separate manners.

10 Currently, because of our resource  
11 constraints, the product audit focus is mostly on  
12 the filtering facepiece respirators.

13 And in order to have an effective and  
14 statistically valid program, as they would like to  
15 see, we really need to increase our resources.

16 So this recommendation we are addressing,  
17 and it's really based on resources both from a  
18 manpower standpoint and a financial standpoint in  
19 the purchasing of the respirators to conduct those  
20 audits.

21 Next slide.

22 Then expanding the site audit program.

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1 The desired outcome is that a site audit program  
2 that uses valid methodology is properly managed,  
3 monitored, and the program is recognized as  
4 statistically valid.

5 This recommendation we believe came from  
6 the National Academies because they didn't quite  
7 understand the way our product audit program was  
8 conducted.

9 We do audit sites every two years and  
10 believe that that is definitely a statistically  
11 valid program and believe that they just didn't have

12 the information to really understand that they were  
13 merging the product and the site audit programs.

14 So we think we just need to get the  
15 information out there regarding how we conduct the  
16 site audits, how sites are selected. And once that  
17 information is out there, we don't believe that this  
18 will have to be addressed in the way they wanted to.

19 We did, however, believe that there were  
20 some ways that we could enhance the site audit  
21 program. And that is by more effectively  
22 integrating the site and the product audit program.

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1 So when findings are -- and the CPIP, the Certified  
2 Product Investigation Program.

3 So when there are findings that come out  
4 of the CPIPs or the product audits, then using a lot  
5 of those findings to feed that into those who are  
6 conducting the site audits.

7 So while that information is available to  
8 them, it would be a more deliberate approach to  
9 addressing those issues.

10 Next recommendation.

11 And the final recommendation under this --  
12 the final issue under this recommendation is  
13 disseminating the respirator certification test  
14 results.

15 The Committee was adamant about getting  
16 more than just a pass/fail information out there  
17 regarding respirator certifications, and they would  
18 like to see all of the data that manufacturers  
19 provide.

20 Now, we disagree with this recommendation,  
21 but we have identified other approaches where we  
22 believe we can address how this information could 170

1 get out, but not through the respirator  
2 certification program, but through something like  
3 the -- a research program or a Center of Excellence  
4 could actually conduct some comparative analysis.  
5 But we did not believe that this should be part of  
6 the respirator certification program.

7 So if you read about this in the action  
8 plan, you will see how we intend to approach it, and  
9 there are three activities that we have identified  
10 as potential ways to address this.

11 Next slide.

12 And the fourth recommendation, Increasing  
13 the research on the use and usability of PPT. There  
14 were four issues that were identified in this  
15 recommendation, and they boiled down to those that I  
16 mentioned earlier, the defining the barriers to and  
17 facilitators of PPT use.

18 The comfort and fit issue, which we are  
19 currently addressing through our anthropometrics  
20 action plan, which our technology and research  
21 branch has placed on the web over, I believe, about  
22 two years ago now it was put out there.

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1 And that's the basis for that 4.2 at this  
2 point. And also that branch also has just conducted  
3 a no-fit workshop, and the output from that workshop  
4 will go into better defining how we address the

5 issues under this recommendation.

6           So we think we are on a good path for  
7 addressing 4.2. We believe we do have a lot of work  
8 to do in addressing 4.1 and the barriers to use and  
9 having an effective workplace studies out there that  
10 are identifying what those barriers are and how we  
11 can address interventions to get at those barriers.

12           And then finally, in this area also  
13 developing the systems integration strategies for  
14 PPT and their components.

15           Now, this overlaps with the recommendation  
16 under Issue 1.4, and this, primarily Recommendation  
17 4 addresses that research on use and usability of  
18 PPT component of the integration and  
19 interoperability issue.

20           In 1.4, it addresses more how do we manage  
21 those activities in all of -- through all of PPT.

22           Next slide.

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1           And then finally under Recommendation 5,  
2 assessing PPT use and effectiveness in the workplace  
3 using a life-cycle approach. This recommendation  
4 boils down to having an effective surveillance  
5 program in place and conducting random periodic  
6 field testing of PPE.

7           Right now, we do have a surveillance  
8 strategy that we have developed, and that is a  
9 component of this overall plan.

10           And we have been moving forward with that  
11 with the best that we can with our resources that we  
12 do have available. But it primarily focuses on

13 using what secondary data sources are out there and  
14 what other surveillance activities are being  
15 conducted throughout the institute and nationally  
16 and trying to collaborate with the state-based  
17 surveillance programs, which are part of the Office  
18 of Extramural Programs.

19 Next slide.

20 So this slide is something that the  
21 committee on PPE put together to show what -- and we  
22 like the way that they presented what our future

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1 visions should be. So of course, we would have to  
2 have our enablers of our resources, our human and  
3 financial resources, and then our organizational  
4 structure.

5 Right now, if we were to have this  
6 foundation set up as it is today, I think it would  
7 probably be about one-fourth the size that you see  
8 it there.

9 So I think we would see this expanding,  
10 not just intramurally at NPPTL, but also more  
11 involvement from all NIOSH divisions and also the  
12 Centers of Excellence as part of that overall  
13 infrastructure.

14 And then, we have our science and  
15 engineering of PPE, the standards and the testing.  
16 But how else do we need to -- what other roles do we  
17 need to take on to address the recommendations to  
18 complete this building and have the foundation set  
19 up so we can have this group of these Center of  
20 Excellences in PPT in all that we do?

21 Next slide.

22 So what do we need to do? We need to

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1 take -- that left-hand cover is the cover from our  
2 evidence package, which is all of the information  
3 regarding the activities we were doing up until  
4 August 2007.

5 And we need to take all of those, what we  
6 are doing now in FY '08 and '09 activities, what the  
7 recommendations were from the National Academies,  
8 and the recommendations -- the ways to address those  
9 put together by the teams, and also the COPPE  
10 assessment and other inputs, such as inputs from you  
11 and other stakeholders and the inputs, once we post  
12 this on the web, that we receive to develop what the  
13 future PPT program should be.

14 Next slide.

15 So how can you help?

16 One is by helping us -- providing  
17 recommendations for intermediate -- and actually  
18 that should say goals, intermediate goals. And I  
19 have the definition of intermediate goals there.

20 And as I mentioned, the intermediate goals  
21 are those activities that other organizations  
22 conduct by using the outputs that we produced. And

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1 I have an example there.

2 So filter capacity as identified in NIOSH  
3 standards are incorporated in manufacturer design  
4 specifications as evidenced by NIOSH-approved



5 respirators.

6           So that's an example of what we actually  
7 have to put in our action plan are, what are the  
8 things you are going to do to use what we create?  
9 That's something that -- the way NIOSH has  
10 structured the way we need to define our goals now.

11           So what are -- we need to define what you  
12 are going to do. So it would be helpful if you  
13 could help us define what you are going to do rather  
14 than us doing it for you.

15           The next slide.

16           So the way, again, you can help is by  
17 providing the feedback on the action plan. We have  
18 the current activities are at that URL identified.

19           The program evaluation can also be  
20 downloaded from the web. And then the action plan  
21 will be available later this month, and you can  
22 respond to that through Docket 146, and it will be

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1 posted before Christmas-time.

2           So the steps to finalizing the plan are  
3 now that we will post it in December, and then we  
4 will address all of the comment, public comments in  
5 the January time frame. And then we have to submit  
6 it to the NIOSH higher headquarters in the March  
7 time frame and present it to the NIOSH Board of  
8 Scientific Counselors in April time frame.

9           Now, regardless of what comes out of all  
10 of those activities, the feedback that we get and  
11 the action plan as it stands today with comments  
12 incorporated from the feedback will be incorporated

13 in our strategic planning.

14 So this is the way we are defining how we  
15 are moving forward from what we are doing today.

16 So are there any questions? Questions of  
17 me or any of the team leads who put together the  
18 detail that you haven't seen yet, but ...

19 Dr. Schwerha, Joe, could you raise your  
20 hand? He was one of the members of the committee on  
21 PPE. You weren't on our evaluation team, though,  
22 were you?

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1 MR. SCHWERHA: I was on both of them.

2 MS. D'ALESSANDRO: You were on both of  
3 them? Okay.

4 So he was on the evaluation team and the  
5 committee on PPE. Now he is no longer on the  
6 committee on PPE, but he is here today as well. So  
7 he -- if you have any questions on what the  
8 committee was looking for, if I haven't effectively  
9 relayed it, he could help you as well.

10 MR. BARD: Brent Bard from Supplied Air  
11 Monitoring Systems.

12 I would like to start by applauding the  
13 efforts of the Academy. I think that this is a good  
14 first initial step into really understanding how and  
15 why all of the components have to fit together.

16 I do believe, though, that one of the  
17 areas that you are missing is to consider a type of  
18 standardization that will analyze really what PPT  
19 is, and that's -- there's a lack of engineering  
20 controls that results in the use of it, and then I

21 think that you have to have some sort of methodology  
22 of evaluation of the environment in which the

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1 apparatuses will be combined and used to really  
2 determine the interoperability of them.

3 I think that is kind of paramount because  
4 you are going to have to look at, you know, doing  
5 some air analysis. You are going to have to look at  
6 doing some abrasion requirements. There's just a  
7 whole bunch of other things that you have to look at  
8 for the end use.

9 And I think that your field testing audit  
10 that you have there kind of addresses that. But to  
11 really fully understand whether or not it is going  
12 to work together properly as intended would be to  
13 come up with some sort of standardized assessment  
14 program that the end users can turn to to help  
15 figure that out on their behalf.

16 MS. D'ALESSANDRO: I'm glad you said that.  
17 Good recommendation.

18 Anything else? Thank you.

19 MR. SZALAJDA: (Speaking without the  
20 microphone on.)

21 Is that better? It helps to turn the on  
22 switch on.

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1 I guess to start, I'm going to use my  
2 prerogative as a moderator to kind of structure this  
3 portion of the meeting a little bit differently.

4 And I think what -- for the purposes of  
5 time, I think it is kind of important to at least

6 get through the three topics as a block to sort of  
7 give everyone a perspective on what the NIOSH  
8 approach to developing standards for air-fed  
9 ensembles is.

10 And along with that, we wanted to have the  
11 opportunity to have another organization discuss  
12 their approach in identifying performance criteria  
13 for one of their particular applications. We are  
14 very fortunate to have some representation from NASA  
15 today to be able to discuss how they addressed the  
16 development of performance requirements for the  
17 propellant handlers ensemble.

18 So at least at this point in the meeting,  
19 what I would like to do is we will go ahead and  
20 cover the NIOSH portion, take questions at the time  
21 when we are done with the three NIOSH presentations,  
22 and I will introduce my NASA colleagues, and they 180

1 will be able to go through their presentation. And  
2 then we will have an open comment period following  
3 that presentation.

4 When you look at the -- let's go to the  
5 next slide, please, John.

6 The development of air-fed ensemble  
7 standard, there are some things that have become  
8 apparent to us as an organization. And seeing that  
9 there was a gap in identifying performance criteria  
10 for this type of system on a national basis.

11 You know, the fact that different agencies  
12 had taken different approaches to trying to identify  
13 performance criteria for these type of systems as

14 well as, you know, internationally and other  
15 standards organizations trying to address the  
16 development of performance criteria for air-fed  
17 ensembles.

18           And to that end, what we have done  
19 internally is try to take a look at the problem,  
20 both on a respiratory performance need as well as a  
21 dermal performance need. And what you are going to  
22 hear in the following presentations by Angie

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1 Shepherd and Colleen Miller are the approach that's  
2 been undertaken to actually do that. The ASTM  
3 method is identifying and addressing performance  
4 criteria for providing protection against dermal  
5 hazards. And what we are looking to do with the  
6 NIOSH portion is to address performance criteria for  
7 respiratory protection.

8           Now, having said that, I think in looking  
9 at this type of product, with the -- from a  
10 standpoint of the fact that NIOSH will issue a  
11 certification for these types of the devices as  
12 respiratory protection devices, you know, how are we  
13 going to do that?

14           And I think the first point to make is the  
15 fact that if we were to get an application today,  
16 you know, we would look at it from two different  
17 perspectives.

18           One is the standpoint of the system being  
19 a respirator alone, you know, as far as when you  
20 look at the second bullet, looking at it from the  
21 aspect of with and without the ensemble, the dermal

22 protection evaluation.

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1           You know, we get the application. we look  
2 at it. We evaluate it in accordance with the  
3 requirements that are already in 42 CFR Part 84, as  
4 well as being able to use the policy provisions that  
5 are given to us in the respirator standard.

6           Along with that, though, is an  
7 acknowledgement of looking at the system of the  
8 other performance aspects of the ensemble. And that  
9 is where we would look to other standards available  
10 in the industry to, you know, supplement what we do  
11 as part of the Part 84 evaluation, you know, against  
12 the performance criteria that's already set up.

13           And we would look to other standards, such  
14 as ASTM or EN or Department of Energy or other  
15 organizations that may have standards to address the  
16 dermal protection performance criteria for this type  
17 of system and where it would be used.

18           So looking at least initially, the  
19 interest that we have seen from stakeholders are for  
20 ensembles, which we think would fall and be  
21 evaluated under Subpart J, which is for supplied-air  
22 respirators.

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1           And that is Subpart J as it currently  
2 exists today. From the August 20th public meeting,  
3 we had discussed the evolution of that standards --  
4 of that portion of the regulation in making the  
5 standard a little more robust and a little more

6 all-encompassing. But at this point, in doing the  
7 evaluation, we would be focused solely on the  
8 requirements as they currently exist today.

9           And then, the other thing to keep in mind  
10 is that with having said that, you know, we don't  
11 want to limit, you know, the thoughts of interested  
12 applicants.

13           At this point that we are solely looking  
14 at supplied air. But if, depending on the  
15 technology, that were to be considered, we would  
16 look at other supplied air as well as air-purifying  
17 types of technologies, depending on the  
18 configuration of the ensemble.

19           Next slide, please, John.

20           And so I think the picture that we wanted  
21 to leave with you with going into the discussions  
22 that you are going to hear about the addressing the  
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1 dermal performance characteristics as well is the  
2 respiratory protection characteristics are a  
3 strategy, at least as far as how we would address  
4 the problem -- or not the problem, but address the  
5 opportunity right now if we were to be given an  
6 application for evaluation.

7           And I think when you -- the one thing that  
8 we wanted to see, or at least to share is to  
9 maintain a consistency with conformance to Part 84  
10 requirements. And I think when you think about this  
11 in concert of how we have done other systems. I  
12 think you will see there's a continuity there with  
13 how we have looked at other problems.

14                   And I think the CBRN PAPR I think is a  
15 good example of that, that, you know, this morning,  
16 I had mentioned, when the question had arisen, we  
17 hadn't talked about CBRN.

18                   And then the standpoint is that the  
19 foundation -- the Part 84 foundation is already  
20 there, that when you get the certification, the Part  
21 84 requirements, it's certified for that whether  
22 it's the Part 84 of today or the Part 84 of 2010.

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1     There will be a consistent thread for the systems.

2                   So regardless of how that evolves, that  
3 common certification thread will remain.

4                   And I think in terms of evolving the  
5 concept, this is where we would be looking at our  
6 using the policy provisions of the standard to be  
7 able to identify additional tests that might be  
8 required to show the performance characteristics of  
9 the ensemble.

10                  And the carbon dioxide testing and inward  
11 leakage I think are examples of the additional tests  
12 that we would expect at this point in time as part  
13 of doing an evaluation for certifying an air-fed  
14 ensemble at this point in time.

15                  You know, and other testing, types of  
16 tests may be needed depending on the design of the  
17 ensemble that's been submitted for evaluation.

18                  And I think in general, when you consider  
19 things and consider the requirements of Part 84, you  
20 know, for example, if you think about carbon  
21 dioxide, you know, one of the things that we would



22 be looking to see is how you control CO2 buildup in  
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1 the ensemble as part of the respirator design.

2 You know, and similarly, we would be  
3 looking for the same types of considerations for  
4 total inward leakage types of evaluation.

5 And, again, I think for those that are  
6 familiar with the work that we have done in the  
7 past, that how we addressed carbon dioxide in the  
8 CBRN escape respirators with the air purifying  
9 escape respirator I think is a good similarity.

10 There are some similarities there to how  
11 we would approach the looking at the air-fed  
12 ensembles, or at least as far as looking -- being  
13 able to measure carbon dioxide and the extremes,  
14 whether it is a low flow rate, you know, low type of  
15 operation versus a high, you know, the other end  
16 being like the high demand on the flow in the  
17 ensemble.

18 And, again, you know, in looking forward,  
19 what we hope to capture with the air-fed ensemble  
20 module is that all-encompassing subpart which will  
21 enable us to address these types of devices  
22 specifically in the future.

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1 But, you know, knowing the fact that we  
2 are going to have other modules in place for  
3 supplied-air and for powered air-purifying  
4 respirators, the technologies that we know are being  
5 applied to these types of the systems, as well as  
6 looking at self-contained breathing type of devices,

7 whether they are open-circuit or closed-circuit, and  
8 using the subparts that are either in the process of  
9 being developed or will be developed to help us  
10 evaluate these systems in the future.

11 And, again, you know, the other part of  
12 the equation being looking at other standards like  
13 ASTM, which you are going to be hearing about in the  
14 next couple of minutes, or other standard  
15 development organizations that may have specific  
16 criteria that need to meet a specific performance  
17 level.

18 So with that, like I said, I would like to  
19 go ahead and go through the NIOSH presentations to  
20 kind of give everyone an overview of how we are --  
21 the perspective on how we are addressing this  
22 portion of the -- this perspective development,

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1 whether it's our involvement with ASTM or, you know,  
2 our development of a new subpart.

3 So with that, I will let Shepherd come up  
4 from our technology research branch, and she has  
5 played an active role, you know, with regard to the  
6 development of the ASTM requirements.

7 And one of the handouts that we had  
8 available -- I'm not sure if everyone picked it up.  
9 There is the current draft of the standard. If you  
10 didn't get a copy of it, you know, on the way in,  
11 there are some available at the registration table.

12 MS. SHEPHERD: Can you hear me okay? I  
13 absolutely hate microphones, and they don't make  
14 women's suits with pockets so you can put these

15 things in.

16           You're ahead of me. Jon mentioned there  
17 is a draft standard, and we are not encroaching on  
18 any copyright laws. Since it's not an official ASTM  
19 standard yet, we can supply the draft. And this is  
20 the one we recently submitted in November, and it is  
21 available out in the front on the front table. See  
22 Judy or Tess for that.

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1           So what is an air-fed protective ensemble?  
2 It's an ensemble with respiratory protective  
3 equipment that provides a source of air directly  
4 into ensemble without the use of a normal  
5 tight-fitting facepiece.

6           You can see the image on the left that  
7 would be what you would consider an air-fed  
8 ensemble. And then the one on the right is a normal  
9 tight-fitting facepiece.

10           There is also an air-fed ensemble -- thank  
11 you to SPERIAN for letting us borrow it -- in the  
12 next room, but unfortunately the mannequin and I had  
13 a wrestling match earlier, and he won. It's not in  
14 this room. It's in that room.

15           So for the ASTM, as you heard Jon say,  
16 there are actually parallel paths here, and I'll be  
17 discussing the ASTM effort. For the ASTM standard,  
18 we are looking at two different ensemble designs,  
19 one, either using an airline directly to the suit,  
20 or the having a powered air-purifying respirator.  
21 There is also a provision for having both of those  
22 sources of air feeds.

1           And then both of those designs also can  
2 have a means for distributing air inside the  
3 ensembles. So that's how it is actually defined  
4 within this draft of the standard.

5           These were developed -- this suits were  
6 developed in the 1960s, primarily to protect nuclear  
7 workers from respiratory and skin hazards, such as  
8 plutonium and tritium.

9           These replaced airline -- suits that had  
10 airline respirators inside of the suits. The new  
11 design actually provided much more comfort and  
12 mobility and still provided the really, really high  
13 protection factors that were needed.

14           Years ago, NIOSH was requested to provide  
15 a standard in testing on these suits, but at that  
16 time, NIOSH actually declined. And so the Atomic  
17 Energy Commission set up a lab out at Los Alamos in  
18 1973 to test these suits.

19           So who uses these suits now? There are  
20 government and industry uses. A couple of the  
21 government uses are the Department of Energy. They  
22 have 11 nuclear facilities -- some of them are

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1 listed up there -- that use these suits.

2           The Department of Defense also uses these  
3 suits at their U.S. Army Medical Research Institute  
4 of Infectious Diseases. And that is a BSL-4  
5 laboratory there. And the CDC also uses a number of  
6 these suits in their BSL-4 laboratories as well.

7           Some of the industrial uses, you will see  
8 with these suits how the nuclear industry protected  
9 against radioactive contamination. And it's funny,  
10 you think about operation and maintenance, but you  
11 don't necessarily think about decommissioning. And  
12 a number of these suits are used in decommissioning  
13 activities.

14           The pharmaceutical industry uses these  
15 suits for inhalation, dermal contact. It's not only  
16 to protect the wearer, but it's also to protect the  
17 manufacturing process from contamination from the  
18 wearer.

19           The chemical industry would use these  
20 types of ensembles for any kind of toxic chemicals,  
21 anything that can provide damage or inhalation or  
22 dermal issues to the wearer.

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1           And there's a number of laboratories. In  
2 2001, there were actually five BSL-4 laboratories in  
3 the United States that are now, if my data is  
4 correct, there are now 15 in the United States since  
5 2001.

6           So we have tripled the number of BSL-4  
7 labs, and that would be the type of lab that would  
8 use this kind of ensemble.

9           Some of the backgrounds and issues that we  
10 have fought for a long, long time with this topic,  
11 is it a respirator or is it a protective clothing  
12 item? well, the answer is both, and that really  
13 creates some heartburn and some difficulty for a lot  
14 of people and especially as you go to write a

15 standard for this kind of item.

16 As Jon said before, there is no  
17 nationally -- U.S. nationally recognized standard  
18 for this type of ensemble. We have had requests  
19 from federal agencies such as DOE, CDC, and DOD as  
20 well as a number of manufacturers and users for  
21 standards for these suits.

22 So it's not just one group pushing for the  
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1 set of standards. It's almost across the board that  
2 we are being asked for this.

3 Currently, another issue is manufacturers  
4 can make any claim they wish. There is no  
5 third-party certification. There is no real  
6 oversight for these suits. And so we have  
7 manufacturers -- that is a concern of a lot of  
8 manufacturers and users.

9 As we go to think about how to write a  
10 standard for this, one of the problems is these  
11 things are used -- as you can tell from the previous  
12 slides, they are used in a wide range of  
13 applications. So it's not like you just have -- you  
14 have to write a standard for an ensemble that goes  
15 into one place. You have to think about all of the  
16 other uses it could see.

17 You also need to look at selecting the  
18 test methods and, not only selecting the ones that  
19 are out there. Some of those may need to be  
20 modified, and we may have to create other new test  
21 methods that don't exist yet.

22 Once we have those test methods created,  
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1 we have to look at determining what the design and  
2 performance pass/fail criteria are -- pass/fail  
3 criteria are. So it's not just that you test it to  
4 a certain amount, but you have to figure out, you  
5 know, where that ensemble has to be.

6 And then, of course as I mentioned before,  
7 the certification manufacturer quality assurance.  
8 We have to address that in the standard.

9 We have reviewed the existing standards  
10 out there, and Colleen will go through some other  
11 standard that is we looked at, more of a respiratory  
12 basis. But these are some of the things that have a  
13 real dermal kind of focus.

14 There is also -- well, the first one  
15 doesn't. But Title 42 CFR Part 84, which you are  
16 all very familiar with, we looked at that. And it  
17 really doesn't contain, as Jon mentioned, specific  
18 approval for air-fed ensembles, but we do feel that  
19 there may be a possibility -- Colleen will talk  
20 about that in more detail -- of where we can make it  
21 work for now.

22 There is also a DOE standard, 1167, but

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1 this is really just aimed at nuclear workers.  
2 EN1073 also focuses on the nuclear industry, but  
3 doesn't contain any certification requirements or  
4 quality assurance. NFPA 1991, this one is actually  
5 a fairly close standard for what kind of durability  
6 issues that these suits would need. But there's no  
7 provision for an airline, and these suits are

8 intended for emergency response only, not for like  
9 an industrial going-in-every-day kind of use.

10 So the objectives. The first one, pretty  
11 obvious, fairly simple. To develop standards for  
12 these air-fed ensembles will result in appropriate  
13 respiratory and dermal protection for wearers for a  
14 variety -- excuse me. I'm trying to fight a sore  
15 throat up here -- during a wide variety of uses.

16 The second one is the harder part, and  
17 something that Jon went over earlier.

18 We have to figure out where to draw the  
19 line, where do the NIOSH requirements cover, and  
20 where does the third-party outside standard cover?  
21 So where do we draw the line between those two?

22 So this is probably -- thank you. Excuse 196

1 me. That's what I get for playing with my nephew  
2 over the holiday, my sick nephew.

3 So this is probably one of the most  
4 important slides that you will see today.

5 We are taking a parallel approach. We are  
6 working within the NIOSH standards, but we are also  
7 partnering with an outside standards development  
8 organization. And I see a lot of the F23 members  
9 here today, and some of you may be members of other  
10 ASTM communities that I'm not aware of.

11 But we are working with ASTM. They have a  
12 huge background on protective clothing, so we will  
13 actually be doing the NIOSH part with the CFR, and  
14 then the ASTM part with the dermal. So those are  
15 our two paths that we are heading down.



16                   And it works well to have a NIOSH liaison  
17 head up this effort because we can work with ASTM  
18 and with the CFR efforts to make sure we don't have  
19 overlapping requirements.

20                   Some of the other issues. We don't just  
21 have to look at performance requirements. We also  
22 have to look at things like design, certification, 197

1 classification, labeling, other documentation for  
2 the users, which there is really not a whole lot of  
3 right now.

4                   We have a couple of different criteria  
5 built into the standard right now. We have limited  
6 use and multiple use criteria as well as tests for  
7 suits that have an airline design or a PAPR or both.

8                   We also had to look at selecting an inward  
9 leakage test. The two that we considered were the  
10 man-in-simulant test, which uses olive wintergreen,  
11 methyl salicylate, or sulfur hexafluoride. Most  
12 people know it as SF6.

13                   We also have to work directly with, in the  
14 CFR effort to make sure we don't duplicate any  
15 requirements. And we also don't have any that are  
16 mutually exclusive, which could be -- that would  
17 present a major problem for us.

18                   And with these suits being used in so many  
19 different applications, we also had to create some  
20 kind of provision for permeation performance. Some  
21 suits in their use may not need it. Others may need  
22 to be protected against a wide range of chemicals. 198

1           So we had to provide that option in the  
2 standard as well.

3           So we started this effort. We created  
4 Work Item No. 14247, which is the standard  
5 specification for air-fed protective ensembles at  
6 the January 2007 ASTM meeting.

7           Usually -- for those of you that are  
8 familiar with the ASTM process, usually you start  
9 within a single subcommittee and get the standard  
10 vetted out to where it's almost -- where you think  
11 it's in fairly good shape, a couple of ballot  
12 cycles.

13           But we wanted really as many people to  
14 review this as possible, so we worked within three  
15 different committees, the committees on biological,  
16 chemical, and radiological hazards. And we got a  
17 lot of good feedback from those three committees.

18           We have submitted a draft for four ballot  
19 cycles to date, and we were looking for input from a  
20 wide range of people. So we actually put blips in  
21 the ASTM standardization news that gave information  
22 and asked for input on the standard.

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1           We conducted meetings and conference calls  
2 for interested parties, anyone that we could get to  
3 participate. And we also conducted a presentation  
4 to AIHce in 2008.

5           The first draft was primarily based on  
6 NFPA 1991 because it did have much of the physical  
7 durability requirements that we were looking for,

8 but we did bring in parts from the DOE and EN  
9 standards as well.

10 In your books, these came out a little bit  
11 funny, so i apologize for that. But somehow when  
12 they printed them, the colors came out a little  
13 strange.

14 But there are several levels of testing in  
15 the standard, and I'm not going to go through these  
16 in detail. You have them in your packets.

17 But for the ensembles, we were looking at  
18 things like positive pressure, ergonomic impact, air  
19 flow, excuse me, liquid inward leakage. And the  
20 bottom one you can see is sulfur hexaflouride.

21 We had a lot of discussions within the  
22 ASTM community, and we did decide to move forward

200

1 with the SF6 test instead of the MIST test. There  
2 was a lot of discussion on that. we are moving  
3 forward with the SF6 test.

4 So that was the ensemble.

5 That was everything. That was your  
6 gloves, your boots, your suit, everything it takes  
7 to actually be able to wear this ensemble. Now, for  
8 the suit, just the suit part of the ensemble, we are  
9 looking at more things like physical requirements.

10 And you can tell we test materials. We  
11 test seams. We test closures. And also in the  
12 yellow column, there are criteria for limited use.  
13 In the green column, there are criteria for multiple  
14 use.

15 And you can tell all of the criteria for

16 multiple use are more difficult to. The test is  
17 actually performed after five industrial  
18 launderings. So that was, yeah, we are trying to  
19 build in the durability for those multiple-use  
20 suits.

21 We even test hardware. We actually test  
22 everything on there. You can see there are hardware  
201

1 tests, mounting strength and fold-out strength.  
2 Things like the airline connection, that will  
3 actually be covered in the NIOSH standards, so we  
4 refrained from adding that into the ASTM standard  
5 because that is crucial to your breathing air, so we  
6 felt like that should fall into the NIOSH standard.

7 The visor criteria, this is very, very  
8 similar to the suit criteria except you don't get --  
9 we don't do abrasion on visor criteria. Hopefully  
10 you are not going to be abrading your face like you  
11 would it at the bottom of your feet or your arms.

12 Glove criteria. So you can see in these  
13 requirements, they are once again criteria for  
14 limited use and multiple use. And we do test on  
15 whole gloves, seams, materials, just on the  
16 materials. And you can see in there there are  
17 liquid leakage tests and a hand function test. So  
18 there's actually a dexterity test built in.

19 So not only do we want you to be safe in  
20 the suit, we actually want you to be able to use to  
21 suit and use your hands to do the work that you need  
22 to do.

202

1           The footwear criteria. Footwear criteria  
2 for this is actually very difficult because you have  
3 the barrier layer, which could be inside or outside  
4 of your primary foot protection. So we had to  
5 really think as we write these requirements.

6           So some of the requirements are going to  
7 be on whole footwear. Some of them on your upper  
8 material, some of them on your sole material. So  
9 you really have to -- and there's specific  
10 requirements built in as if you have an overboot or  
11 if you are actually wearing like a workboot  
12 underneath your suit.

13           Next, please.

14           Labeling requirements. This is a big deal  
15 when it comes to third-party certification. And  
16 right now, we have labeling requirements including  
17 the certification organization's mark, such as an  
18 SEI or a Classified UL mark.

19           It has to have whether it's an airline or  
20 PAPR as the primary respiratory supply.

21           It has to have a limited use or multiple  
22 use statement. And then a lot of information on the  
203

1 manufacturer's detail -- manufacturer's details.

2           And this comes back to where if an  
3 accident happens or if you have a recall, there is  
4 traceability built into the garment.

5           I can't tell you how many used garments I  
6 have looked at -- and probably you guys have, too --  
7 where the information is either gone from the label,  
8 or it was never there in the first place.

9                   There is also cleaning and decontamination  
10 that is required to be on the label as well as  
11 required ensemble elements. Which that means, you  
12 know, what gloves you have to wear with the suit,  
13 what boots do you have to wear with the suit. So  
14 all of that has to be on the label, and that  
15 information is there for the user.

16                   Also a requirement in the standard is user  
17 information guide. And this would be something that  
18 would be on a hang tag attached to the garment that  
19 the user would have to remove for the first use of  
20 the garment.

21                   It would include any kind of warnings that  
22 the manufacturer wants to include, donning and

204

1                   doffing, that kind of thing. Decontamination  
2 information.

3                   Another part that is required in the  
4 standard is technical information. And all of this  
5 information has to be required -- or has to be  
6 supplied from the manufacturer upon request.

7                   It has to include any kind of test data  
8 that's required in the standard as well as anything  
9 else that you are saying your suit does. You  
10 actually have to have test data, and that has to be  
11 available to the users upon request.

12                   Next.

13                   The certification program. This is a  
14 little bit of a departure for an ASTM standard.  
15 Typically, they don't require third-party  
16 certification. But since no one else is really

17 covering this area, we decided that was a thing we  
18 were actually going to move forward with.

19 The big thing here is we require, as a  
20 prerequisite to the ASTM standard, NIOSH  
21 certification to 42 CFR 84, whatever applicable  
22 subpart, depending on your design.

205

1 It has mandatory third-party certification  
2 and requires ISO 9001 for any manufacturing  
3 locations. It not only has initial testing  
4 inspection, but it also has quarterly visits and  
5 annual retesting is required.

6 Some of the retesting is reduced from the  
7 initial testing, but it is something that -- I don't  
8 know if any of you are familiar with the NFPA. It's  
9 something that's very common with NFPA, and we  
10 decided to use that as our basis here.

11 There is also a complaint investigation  
12 program requirement. So if you get a complaint as a  
13 manufacturer, you have to have a complaint  
14 investigation program as well as a safety alert and  
15 product recall system.

16 The timeline for this, the fourth ballot  
17 cycle will be complete in January 2009. Like I  
18 said, we have submitted this draft. It is available  
19 to you today. I'm hoping that those of you that are  
20 ASTM members, the ballot -- I'm hoping it will be on  
21 next week. And then we will be able to deal with  
22 the ballots, the negatives and affirmatives that

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1 come out in January, in our meeting in January.

2 And if we don't get any negatives, which  
3 I'm actually really hoping for, we could publish as  
4 early as 2009. So this could actually be a standard  
5 as early as 2009. So we have been working on it for  
6 about two years now.

7 And submission of products for  
8 certification could begin as soon as the ASTM  
9 standard is published as long as you are working  
10 with NIOSH to get your certification within the CFR.

11 Next. So this is a good example. You  
12 heard Maryann talk earlier about us kind of  
13 spreading our wings a little bit and moving into  
14 other things other than just respiratory protection.

15 This is still respiratory protection, but  
16 we are also adding in a clothing component as well  
17 as, you know, we are broadening the amount of users  
18 we are getting to.

19 So I think this actual effort fits in  
20 very, very well with some the National Academies'  
21 recommendations.

22 Through this effort, we will actually have <sup>207</sup>

1 standards and certifications for manufacturers. So  
2 everybody is competing on a level playing field,  
3 which I think is a very good thing.

4 And we will be able to have, for users,  
5 these ensembles that have actually been tested and  
6 verified through a third-party certification. So  
7 that we are providing better protection for the  
8 wearers. And overall reduction in all of the



9 exposures for any kind of area where you would wear  
10 these type of suits.

11 And special acknowledgments. We have an  
12 excellent photographer down at the CDC, which is  
13 kind of our parents, and his name the Jim Gathany.  
14 He provided a lot of the photographs to me today,  
15 and I wanted to thank him especially.

16 And also to Delta protection and SPERIAN.  
17 They have kind of worked along with us and provided  
18 quite a few images in my presentation today as well  
19 as the suit in the next room.

20 Thank you.

21 MR. SZALAJDA: We will take questions, I  
22 guess, after the next presentation which will be by  
208

1 Colleen Miller, and she is going to discuss the  
2 portions of the effort they are looking at  
3 developing the new subpart. And Colleen is the  
4 newest member of the policy branch and she has been  
5 with us a little less than a year.

6 MS. MILLER: Okay. Moving right along.  
7 Obviously, we are concerned about certifying the  
8 air-fed ensembles at NIOSH, and we are specifically  
9 addressing the ensemble acting as a respirator.

10 As Angie just described, ASTM defines an  
11 air-fed protective ensemble. The other standards  
12 out there, DOE specifically calls it an supplied-air  
13 suit.

14 The European standard actually defines  
15 four categories of suits, three of them that they  
16 suggest are gas-tight, and one that is non-gas

17 tight.

18           The ISO standard goes beyond that and has  
19 five types of chemical protective suits, the  
20 gas-tight, the non-gas tight. And then they go into  
21 liquid-tight, spray-tight, and a protection against  
22 airborne solids.

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1           The last three obviously don't really  
2 account for respiratory protection so much as dermal  
3 protection.

4           ANSI goes one step further and has a sixth  
5 category. Their first five categories are very  
6 similar to ISO, and the sixth category may include  
7 aprons or sleeves and other PPT protection that  
8 people wear to protect their skin.

9           NIOSH reviewed all of these standards and  
10 the -- we had at that time the draft NASA standard  
11 for the certification criteria and their test  
12 results for their propellant handler ensembles,  
13 which are specific to those workers.

14           When we began to think about how NIOSH was  
15 going to approach the certification of an air-fed  
16 ensemble, there were a couple of questions that came  
17 up. Should the NIOSH development plan require the  
18 air-fed ensemble to be certified according to  
19 respirator type used, whether it was a supplied-air  
20 respirator or an air-purifying respirator.

21           Some air-fed ensembles are made using  
22 powered air-purifying respirators, which are not

210

1 certified for use in environments immediately

2 dangerous to life and health. We thought that maybe  
3 that should be a concern for us in certifying the  
4 ensembles.

5 In other cases, workers use the ensembles  
6 in work environments that have very good engineering  
7 controls in place.

8 But if those engineering controls could  
9 potentially fail, then the work environment may be  
10 immediately dangerous to life and health.

11 And perhaps, if the ensemble was certified  
12 as a supplied-air respirator, in our upcoming  
13 revisions of that module, for example, we would  
14 require an escape canister. So these are some of  
15 the concerns and things that we discussed in how we  
16 are going to approach the certification process.

17 The current subparts for air-purifying  
18 respirators and supplied-air respirators and whether  
19 they would be able to meet the future technological  
20 advances in the work place and the needs of the  
21 workers was a concern for us.

22 And also, having just gone through the

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1 National Academies' review and their report and  
2 actually focusing on the action planning process and  
3 how we are responding to it as an organization  
4 affected how we wanted to approach this  
5 certification.

6 And we feel that we want to be able to  
7 impact more workers and advances in the technology  
8 of the air-fed ensembles.

9 So therefore, next, thank you, the NIOSH  
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10 development plan, as you-all are very aware of at  
11 this point, would include creating a subpart to 42  
12 CFR Part 84 that would specifically address the  
13 air-fed ensembles to give us an ability to certify  
14 ensembles that would address a broader range of  
15 potential uses of the ensembles as respirators that  
16 may not be addressed in the existing subparts.

17           So in order do that, we began by  
18 reviewing, as I said, the European, the ISO, the  
19 DOE, the ANSI, and, of course, the NASA standard.  
20 And we began to categorize the tests as to those  
21 that pertain to respiratory protection and those  
22 that pertain to dermal protection. And of course, 212

1 we focused for the NIOSH development plan on the  
2 respiratory protection, and Angie has already gone  
3 through the work that the ASTM committee has done on  
4 addressing the dermal protection.

5           Thank you.

6           All five of the standards reviewed have  
7 these tests in common, the inward leakage test, the  
8 CO2 content, and the inhalation air requirement was  
9 included in all five standards, although it was a  
10 little bit different.

11           The ANSI and the NASA standards tended to  
12 follow 42 CFR very closely. The ISO and the CEN  
13 followed a European standard. And the DOE was just  
14 more concerned with a, if the airline was shut off,  
15 how quickly could you doff the suit and get out of  
16 it safely.

17           There were also noise requirements and  
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18 tests that optimized performance of the couplings,  
19 the air flow rate, the air supply source, and the  
20 external breathing hose.

21 In addition to that, there were 15 other  
22 test requirements that four of the five standards 213

1 tended to include in their draft standards, or their  
2 standard. And I have listed those.

3 We can go on to the next slide, John.

4 Thank you.

5 The air supply source and the supply tube,  
6 the breathing resistance and the breathing tube.

7 Conditioning either was included as by  
8 conditioning by wearing or conditioning by  
9 temperature. Both of those things I think are  
10 important.

11 The connections for dismantling and  
12 cleaning or the strength of the connections, the  
13 continuous flow valve, internal breathing hose  
14 specifically its mechanical properties, pressure in  
15 the suit.

16 Resistance to ignition and flame,  
17 actually, is the exception, that it wasn't included  
18 in our four out of five. It may have only been  
19 included in two of the five. But it is so important  
20 to those standards that included it that I have  
21 included it here.

22 And then of course vision and warning and 214

1 measuring means. ANSI, ISO, and the European

2 standard all want a warning device for minimum  
3 design flow rate if it is not achieved.

4 NIOSH, based on its work with the revision  
5 of other subparts, we consider these test  
6 requirements also important. The air supply harness  
7 and the system pressure, especially if it's an SAR  
8 or SCBA-type respiratory protection.

9 The escape test is especially important to  
10 the DOE people. Remaining-service-life indicators,  
11 which we heard quite bit about earlier today. Test  
12 temperature, I'm going to speak about in a moment.

13 Unmanned CO2 in respired gas is very  
14 important to us. We have our human subject review  
15 board that is going to want us to be able to say  
16 before we put the ensembles on people that we  
17 cannot -- that it's safe.

18 And a weight requirement is also  
19 important.

20 To give you an idea of some of the  
21 thoughts we had about test temperature and  
22 preconditioning, it seems like a very simple

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1 parameter, but it can be very important to specific  
2 users, like DOE and NASA.

3 And the preconditioning requirement test  
4 temperature may be significant together to consider  
5 because components in the suit may be made from  
6 different materials with widely varying thermal  
7 properties.

8 Polypropylene, polyvinyl chloride and  
9 silicone rubber, for example, which are all common

10 materials in our business all have significantly  
11 different temperature requirements.

12 If the ensemble were made of PVC, but the  
13 tubing or the exhaust valves were made of  
14 unprotected polypropylene or polyethylene, the  
15 temperature conditions at which those materials  
16 function well mechanically are very different  
17 sometimes.

18 In addition to meeting some of the  
19 requirements that we have just stated, we would also  
20 require the ensembles to meet subparts A, B, D, E,  
21 and G. I have listed those for you.

22 Go ahead, John.

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1 And some potential optional requirements  
2 that came out of the review of the five standards  
3 were service time and temperature. Again, the  
4 temperature might not be a consideration if you are  
5 only using the suit for a limited period of time.

6 Environmental control unit, the NASA  
7 people will be speaking to you about that, I'm sure,  
8 in just a little bit. Hand-operated valves,  
9 self-donning, and contaminated suit removal is very  
10 important to the nuclear industry. Again, as I  
11 said, flame and electrostatic charge resistance is  
12 important to specific workers as well.

13 And how about UV exposure and  
14 sterilization effects on the performance of the  
15 suit?

16 So we have a projected timeline for the  
17 continued development of the certification plan.

18 In May 2009, we will have -- we will post  
19 the concept requirements on our website. I'll be  
20 very busy apparently until May of 2009. And then in  
21 August, we will have another public meeting to  
22 discuss that concept. And mid 2010, we would like 217

1 to initiate the rulemaking process. And a year  
2 later, in mid 2012, we would like to complete the  
3 rulemaking process.

4 We truly welcome your comments about our  
5 development plan for air-fed ensembles. We would  
6 like information about the suits that are currently  
7 produced, how they are used by workers now and how  
8 you think they may be used by more workers in the  
9 future and what methods are you using to evaluate  
10 their performance currently. And any ideas you may  
11 have for future evaluations as well.

12 And I'll remind you to submit your  
13 comments by referencing NIOSH Docket 148. And I  
14 believe John, if you go to the next slide, there is  
15 the complete information.

16 And I think, Jon, at this point, wanted --  
17 there he is -- to have us take our questions.

18 MR. SZALAJDA: Yeah. At this point, I  
19 appreciate you bearing with us.

20 We would like to take any questions or  
21 comments that you may have on the material that has  
22 been presented so far. 218

1 MR. BARD: Brent Bard, Supplied Air  
2 Monitoring Systems.



3           The first question that I have,  
4     considering that you are going to look at it  
5     qualifying as a breathing apparatus, although you  
6     have visual acuity for the lens/visor portion of the  
7     suit, are you going to require or include anything  
8     on impact resistance?

9           And the reason why I ask is because I  
10    think it is something you have to consider and look  
11    at. I also think that you need to consider adding,  
12    as a NIOSH requirement, your testing of the suit,  
13    pre- and post-usage.

14           I think that you have to clearly define  
15    what that criteria would be that you would expect so  
16    that a manufacturer can assemble and build a test  
17    kit that will meet that requirement.

18           I also think that it would be worthwhile  
19    to consider you had laid out two things, industrial  
20    washing and decon. I think you need to clearly  
21    identify a cutoff point of when is it no longer  
22    industrial washing, and when does it become decon.

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1     And that you would have to have that addressed.

2           And with reference to the  
3     end-of-service-life indicator, when it is used, I  
4     think that's great. But I also think you have to  
5     include in the standard what would be the maximum  
6     storage cycle for the product, whether it is used or  
7     not used. Right.

8           MR. SZALAJDA: Thank you for the comments  
9     on that.

10           I guess just, you know, you mentioned I  
            Page 163

11 guess just the one, on impact resistance. I think  
12 that's -- you know, obviously, I think as we had  
13 mentioned, there is a short term, and there is like  
14 the future.

15 And I think, you know, again it would  
16 probably be part of an evaluation of an application,  
17 whether that would be, you know, one of the tests  
18 that we would consider as part of the respirator.

19 MR. SAVARIN: Mike Savarin, SPERIAN.

20 Yeah, taking the last point, we currently  
21 have SARs approved. I don't believe there is an  
22 impact resistance requirement for that. So I'm not  
220

1 quite sure why that we would need to incorporate one  
2 here either.

3 MR. BARD: (Speaking, inaudible to the  
4 court reporter.)

5 MR. SAVARIN: Understood. There is always  
6 the possibility of adding an option, agreed.

7 The temperature conditioning thing as well  
8 was something that -- you know, I'm looking at the  
9 possibility of integrating any such device under the  
10 current regulations and subparts that focus heavily  
11 on the supplied-air respirator part. So any  
12 comments I make are really in line with that.

13 I think, first of all, I want to say that  
14 selling these kind of products in the industries  
15 they are being sold in an unregulated fashion, and  
16 us having the ability to create a new subpart in the  
17 new standard I think should be applauded.

18 This has gone on for years, and I don't  
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19 know about any illness/fertility statistics that may  
20 exist out there. But if there isn't anything, it is  
21 certainly just a case waiting to happen.

22 At the same time as applauding that, I 221

1 also believe that, you know, waiting six years or  
2 eight years or ten years to promulgate a standard on  
3 this is almost just as bad because it is just so  
4 long.

5 So if we could find a way to -- fast track  
6 isn't an appropriate term used in government  
7 circles, but if we could find a way to make good,  
8 you know, expedient integration of these products  
9 into something like the Subpart J, that would be  
10 really good.

11 I think one of the things that needs to be  
12 answered in doing that is that Subpart J doesn't  
13 deal with environments that are IDLH. And we would  
14 have to decide how the standard would have to  
15 address those requirements, if those requirements  
16 are something that is a standard and a regular thing  
17 that the industries that support these products are  
18 going to want to have.

19 Right now, they are using them. And if  
20 they are in an IDLH environment, there is nothing  
21 backing them up.

22 So, you know, I think it would be a really 222

1 good thing for us to not to get completely bogged  
2 down in that because we know we won't have a

3 standard, is first to try to find mechanisms to  
4 either address it or add things to it as extra tests  
5 that we could do. Then that would be really  
6 positive.

7 Temperature conditioning environment, we  
8 currently don't really have under the SARs either.

9 Again, it is the environments we use them  
10 under are quite benign in that respect. And I don't  
11 know about most of the people in this room, but my  
12 personal experience of utilizing the Delta  
13 protection type suits isn't very high. So I'm not  
14 clear on the details of the environments that they  
15 would use.

16 But if we are going to support this kind  
17 of standard, we need to understand those things to  
18 enable us to make decisions as to which part would  
19 you choose.

20 Finally, there is a lot of work -- which  
21 is unusual. There is a lot of work already been  
22 done by people in this in standards groups that we

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1 could comfortably extract from and integrate and use  
2 as placeholders in any potential standard.

3 So in the same way that NFPA does, they  
4 come up to something, and they will say, must -- as  
5 a prerequisite, must meet this element, must meet  
6 ASTM, this element, without us necessarily having to  
7 specify that.

8 I was thinking of all of those conditions  
9 that relate to the clothing, the burst strength, the  
10 tensile strength, a whole list of things that are

11 currently being considered in all of the joint  
12 standards.

13           You know, NIOSH has been focusing  
14 primarily on the respirator element, and we can  
15 still do that and have those things added as  
16 additional requirements based on the environments  
17 they are going to be used under, or the  
18 classifications that they might create for those  
19 dermal protection and other aspects.

20           That's all I want to say on that, thanks.

21           MR. HASKELL: Jon, can I make a comment?

22           MR. SZALAJDA: Go ahead, Bill.

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1           MR. HASKELL: Well, your point about  
2 leverage other standards is an excellent one. And  
3 many of the people that are on the F23 committee for  
4 ASTM are also working in the other NFPA standards  
5 and some of the other committees. So the vast  
6 majority of the physical performance requirements we  
7 have been able to leverage from those existing  
8 standards.

9           And there's a wealth of information on  
10 limited use and multiuse. And so a lot of that has  
11 been pulled from it. Maybe it's not exactly what is  
12 needed for all of the different environments used  
13 here, but it's an excellent starting point.

14           MS. SHEPHERD: Also mentioned in your  
15 handouts, you can see the reference to the standards  
16 that were in my presentation.

17           Many of them reference back to either ISO  
18 or ASTM methods because I really don't want to

19 recreate the wheel. The other thing, it was  
20 interesting you talk about IDLH. Because by basing  
21 it on NFPA 1911, those type of suits are made for  
22 IDLH atmospheres. And so by using that as our basis

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1 for my durability and dermal side, we have kind of  
2 taken that into account. Now we are just going to  
3 have to figure out the NIOSH side of that as well.  
4 That was a good comment.

5 MR. SZALAJDA: Yes. I'll chime in, too.

6 I appreciate your comments, Mike, and I  
7 think the one point I just wanted to make sure that  
8 was clear, you know, and when it is -- I guess to be  
9 lost with the discussion on where we are going with  
10 the new subpart, is that if there is interest now,  
11 we will look and certify, you know, this type of  
12 system, you know, using what we currently have.

13 I think the thought is in trying to go  
14 through the process with the -- developing, you  
15 know, coming up with a plan for how we are going to  
16 develop the requirements and then going through the  
17 concept paper is, you know, that information  
18 gathering type of stage to, you know, find out what  
19 is important and what is not and then be able to  
20 make decisions on how to set that performance  
21 criteria.

22 And what I would do is for you and any

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1 other stakeholder that really thinks this is  
2 important that we develop this quickly, to please  
3 make those types of comments to the docket, you

4 know, in terms of that helps us.

5           As Les had mentioned this morning, when  
6 you look at these types of efforts, it helps us with  
7 our strategic planning and resource allocation, at  
8 least as far as being able to bring things to  
9 fruition quicker than may have otherwise taken  
10 place.

11           MR. GIANFORCARO: Good morning. My name  
12 is George Gianforcaro. I'm with Indutex USA. And I  
13 would like to thank you all for taking on this  
14 challenge. We have been making these suits and  
15 selling them in Europe for over ten years.

16           And I have been dying for the day that  
17 when it comes to the U.S. and the standard has been  
18 written, and I applaud you for that. Thank you.

19           At the very beginning of today, both Jon  
20 and Les said that you folks are here to listen and  
21 learn. Has your organization or has your group  
22 conducted any end user surveys regarding this new

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1 standard?

2           And if yes, how many and which industries?  
3 And I would like to follow up with another question.

4           MR. SZALAJDA: Well, I will take a shot at  
5 that.

6           At least from the respiratory standpoint,  
7 this is the first foray into trying to develop that  
8 type of information.

9           You know, we have not done any formal type  
10 of survey, at least with regard to the respiratory  
11 standpoint.





20 does not include the glove.

21           The reason why the end users don't want  
22 this is they might have a work environment, and the  
229

1 employees are wearing four or five different pairs  
2 of gloves. The direction that this standard is  
3 going, we would have to then certify every single  
4 suit with each one of those gloves.

5           And should another glove company come in  
6 and convince the buyer to change the gloves, now, as  
7 a manufacturer, we would have to take those gloves  
8 and now resubmit it for new certifications.

9           There's an end user I was talking to at  
10 one of the breakouts, and in their facility, they  
11 have 12 different pairs of gloves for one  
12 application where the suit might be used.

13           So that means as a manufacturer, they  
14 would need to submit it 12 different times, each  
15 time with a different glove. That's not what the  
16 end users are looking for.

17           Now, my request or recommendation is, if  
18 the committee does want to move forward with this  
19 because they like an ensemble or they think it is  
20 better, more protection, perhaps we can split it  
21 into two and have a suit standard like the Europeans  
22 where it stops at the cuff, and then have an  
230

1 ensemble standard where the glove is incorporated or  
2 the glove is included.

3           And this way we would then -- we would

4 give the end users exactly what they want, the ones  
5 that really require protection and want the glove  
6 incorporated, we have the ensemble standard. And  
7 the other folks that are saying, Don't tell me which  
8 gloves to wear. I just want a suit with positive  
9 pressure, defaulting to the European standard, then  
10 we can give them a suit certification.

11 So thank you.

12 MR. HASKELL: I see this observation,  
13 which is a great one, really being aimed more  
14 towards the ASTM part of this process. I think  
15 NIOSH as far as the respiratory part of this,  
16 whether it ends here or includes an attached glove,  
17 maybe is not the issue.

18 So I'm wondering, are you going to bring  
19 these forward to the F23 committee in February so we  
20 can discuss it within the ASTM?

21 MR. GIANFORCARO: I have been bringing it  
22 forward, and it has been falling on deaf ears at

231

1 ASTM, and that's why I'm bringing it here to NIOSH.

2 MS. SHEPHERD: Actually, let me add some  
3 information.

4 That comment was posed on the negative  
5 ballot during the last ballot cycle, and the  
6 committee as a whole chose to vote it negative,  
7 nonpersuasive.

8 So the whole entire ASTM committee, F23  
9 committee has dealt with this issue and has had a  
10 formal vote, and it is in their records if anybody  
11 is interested in looking it up.

12 MR. GIANFORCARO: Thank you.

13 MR. SZALAJDA: George, I would encourage  
14 you, and anyone that has information from the, you  
15 know, from the standpoint on any part of the topics,  
16 please submit things to the docket, you know, at  
17 least the more information that we can generate and  
18 that we have helps us with the development of the  
19 requirements.

20 MR. SAVARIN: I would like to follow up on  
21 George's question, not question, on his observations  
22 on his feedback from the end user.

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1 As a respirator user, something struck me  
2 very unusual that I wasn't thinking about the need  
3 to, when you are doing the ensemble, that you would  
4 have to approve it with each glove.

5 I was thinking about actually using the  
6 respirator system. If you are using the respirator  
7 system and you have a suit on, and you are doing  
8 more than one function in that job, you are going to  
9 need to switch out gloves. But you may keep the  
10 same suit on.

11 Under the scenario that I just heard,  
12 there would be this horrendous situation where  
13 actually you would have to change suits.

14 So this can't be -- this cannot be the way  
15 forward. I think it logically has to end at the  
16 wrist. I just think we should, as a group, you  
17 know, try to enforce that wherever we can, George.

18 MR. HASKELL: I agree with you. One  
19 challenge we may have is the ASTM allows additional

20 provisions for permeation protection in other  
21 chemical environments, so maybe we need to look at  
22 case by case and see what the industry needs and see  
233

1 what is appropriate. Because there is a case to be  
2 made in certain high level chemical environments,  
3 that you do want some sort of integrated glove  
4 protection.

5 But in other lower cases, what you are  
6 saying makes sense. So obviously the situation  
7 needs to be discussed.

8 MR. SAVARIN: It is very interesting that  
9 ASTM, with the body of knowledge they have on this,  
10 chose not to vote -- they chose to vote negative.

11 Is that right, Angie? Is that what you  
12 were saying?

13 MS. SHEPHERD: We are not requiring the  
14 glove be permanently attached. You could have a  
15 glove ring system or some other type of attached.  
16 But we could change out the gloves, and there is  
17 actually a requirement where the gloves have to  
18 be -- you can take them on and off in a certain time  
19 period.

20 But the option is they can either be  
21 permanently attached, or they can be removable. So  
22 it's not necessary that you have to redo all of the  
234

1 testing. It is just that, you know, we feel like it  
2 is important to provide full body protection in any  
3 kind of atmosphere that you could be in.

4 And for that, you need a glove.  
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5 MR. SAVARIN: And what's ASTM's position  
6 precisely on that?

7 Do they say it's one way or the other, or  
8 do they make it so that you can do all of those in  
9 the one standard?

10 MS. SHEPHERD: No. You can have it  
11 permanently, like maybe a welded, or you can have  
12 one that's detachable.

13 And you could use 12 different gloves or  
14 20 different gloves.

15 MR. SAVARIN: Thank you.

16 MS. SHEPHERD: And there is also a  
17 provision where you can actually test a glove  
18 independently from a suit, and the glove can carry  
19 its own label, so you could interchange them.

20 MR. SAVARIN: Right.

21 MR. HASKELL: Yes. But every time a  
22 different glove is used, the entire ensemble has to

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1 be tested and certified.

2 So if one person is wearing nitrile glove,  
3 and the other -- he or she decides to take it off  
4 and wear a different glove, they are not in  
5 compliance with the certified ensemble unless that  
6 secondary glove was also submitted for testing, went  
7 through the MIST or SF6 test or something, and  
8 tested as a separate unit.

9 MS. SHEPHERD: That is correct.

10 MR. SZALAJDA: We will take one more  
11 internal question, and then we will see if we have  
12 anything on the LiveMeeting.

13 MR. BARD: This is directed more as a  
14 comment.

15 One of the things that you need to  
16 consider is, if you use an interchangeable glove  
17 with a cuff ring system, you now have to address the  
18 changing of the gloves, because that's going to be  
19 part of your seal.

20 How do you test that prior to going to  
21 use? In other words, it would have to be assembled,  
22 tested, and then put on prior to going to work.

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1 MR. SZALAJDA: John, do we have anything  
2 from LiveMeeting? No.

3 All right. With that, I would like to --  
4 hold on a second.

5 I guess the last presentation we have in  
6 this topic is from our colleagues at NASA. And this  
7 past summer, I had the opportunity to go to the NASA  
8 Occupational Safety and Health annual meeting that  
9 they had in Baltimore, and I happened to meet Mike  
10 Cardinale, and we struck up a conversation following  
11 my presentation on PPT, at least with regard to some  
12 of the perspectives that NASA has had in approaches  
13 towards personal protective technology.

14 And we felt it was appropriate, at least  
15 at this time, to get their perspective on how they  
16 have addressed the development of the particular  
17 requirements for their propellant handlers ensemble.  
18 And so with that, I was going to let Mike introduce  
19 the NASA staff that's here, and then Dennis  
20 Dudzinski is going to give a presentation on their

21 experiences.

22 MR. CARDINALE: Once, again. Thanks for 237

1 letting us be here and participate in this.

2 My name is Mike Cardinale. I'm the  
3 industrial hygiene officer for NASA Kennedy Space  
4 Center, and my role in this is initiating our own  
5 certification criteria for propellant handlers  
6 ensemble, which we have been using for quite some  
7 time for the space operations program.

8 I brought with me some of our coworkers to  
9 be available to answer some of the questions that  
10 you might have.

11 We have Chrissy Du Quesne. She is an  
12 engineer over at NASA life support engineering  
13 office. She has prepared the criteria test report,  
14 and she can answer questions about the test methods  
15 that we have used.

16 Don Doerr, biomedical engineering branch  
17 chief. He did all of our human factors testing in  
18 his laboratory. And Kenneth Ahmie. Kenneth is with  
19 EG&G, life support engineering. He is responsible  
20 for sustaining engineering for our propellant  
21 handlers ensemble. He is also part of our  
22 improvement team lead.

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1 And finally, Dennis Dudzinski. Dennis is  
2 the manager of our EG&G life support operations.  
3 His operation provides support for all of these  
4 hazard procedures that occur at the Kennedy Space

5 Center involving use of rocket propellants. They do  
6 deeper level maintenance of all of our ensembles and  
7 repair the ensembles.

8 And Dennis, he is going to go ahead and do  
9 his presentation now. So thanks.

10 MR. DUDZINSKI: Hear me okay?

11 I'm going to just -- my presentation is  
12 going to be kind of at a high level. NASA has used  
13 this type of equipment for over 40 years at the  
14 space center.

15 As a result of that, there is volumes and  
16 volumes of data and information that we have as  
17 directly users of the equipment as well as designers  
18 and participation and continuous improvement of the  
19 program.

20 The SCAPE, Self-Contained Atmospheric  
21 Protector Ensemble, that is used at the space  
22 center, SCAPE is a generic term used for all the

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1 protective equipment or protective clothing that is  
2 used or protective suits for propellant handling.  
3 Actual SCAPE predates shuttle operations. And, in  
4 fact, the Air Force was the first user using a  
5 rocket fuel handlers coverall in the late 1950s.

6 When NASA started supporting propellant  
7 operations in the early '60s, they developed their  
8 own standard, which was done in 1964. And it ended  
9 up being a -- they ended up using the modified  
10 rocket fuel handlers coverall as a result of that  
11 spec.

12 The next year, the Navy explosive ordnance



13 disposal team up at Maryland developed their own  
14 specification as well, and that was based on the  
15 NASA standard.

16 Go back, please.

17 The equipment has evolved throughout that  
18 40-year time span dependant on the different launch  
19 programs. Each program seems to bring its own  
20 requirements for protective commodity, the type of  
21 access that users have, and other specific  
22 requirements that have been met throughout the 40

240

1 years with each ensemble.

2 The current SCAPE that we are using right  
3 now, the propellant handlers ensemble, it has been  
4 in use for over 20 years. And all the SCAPE that we  
5 have had are used in IDLH environments.

6 The classification of SCAPE, NASA has  
7 determined in categories. The Category 1 is a  
8 self-contained suit that uses an environmental  
9 control unit which gives total mobility to the user.

10 The ECU is also a cryogenic-supplied unit  
11 that works for two hours time span.

12 Category 4 is an airline-supplied suit,  
13 the same suit, but using an airline adapter. And it  
14 also uses a portable air supply for ingress and  
15 egress from the operational unit.

16 The Category 2 and 3 were used as  
17 modifications throughout the program, and they are  
18 no longer in use at the space center.

19 Features of the SCAPE, or the PHE, it's  
20 got detachable various size boots and gloves. We

21 have either a bubble visor to accommodate people  
22 with glasses, and that seems to have been more of 241

1 the standard right now, as well as a flat visor, a  
2 polycarbonate visor.

3 It also has an internal air distribution  
4 system that distributes air in specific quantities,  
5 and I'll go through that a little bit later  
6 throughout the suit.

7 On the left-hand side, you see the early  
8 1960s version of SCAPE. On the right-hand side is  
9 the current propellant handlers ensemble, and this  
10 is a Category 1 mode. You notice on the left, you  
11 have got a protrusion in the backpack pouch, and  
12 that's to accommodate the environment control unit.  
13 It is worn with the suit.

14 Next slide, please.

15 On the Propellant Handlers Ensemble, you  
16 can notice the same protrusion, a little bit larger.  
17 The suits are made on average a little bit larger  
18 than the initial suits primarily because the user  
19 population has changed in size themselves.

20 Next slide, please.

21 The Environmental Control Unit again uses  
22 locally manufactured liquid air that we make at the 242

1 space center in a 20 to 30 percent oxygen content.  
2 Again, the unit is authorized for use for two hours.

3 It will run much longer than that, and  
4 everything that we use at the space center has a  
5 type of redundancy built in. So there -- are on top

6 of the operational criteria and performance  
7 specification we have for the unit, there is an  
8 additional safety factor built into almost every  
9 facet of the operation.

10 Next slide, please.

11 The Category 4 is an airline-fed suit. On  
12 the left-hand side, again, you will see the 1960s  
13 version of the SCAPE that was used at the space  
14 center. It uses an vortex cooling unit.

15 That has also been in use right now for  
16 the propellant handlers ensemble, which is on the  
17 right-hand side.

18 You note that the propellant handlers  
19 ensemble also has the capability of snapping the  
20 backpack closed to provide a lower profile for areas  
21 where we need access in some small areas to provide  
22 protection and also prevent damage to the suit

243

1 material.

2 Next slide, please.

3 And again, this is a Category 4 with the  
4 egress bottle that we use, or ingress and egress  
5 bottle, going to and from the operation.

6 Next slide.

7 In the early 19 -- or late 1960s, early  
8 1970s, there were a couple of factors where NASA  
9 needed to update their 1964 specification.

10 What drove that was that NIOSH was  
11 changing the allowable exposure limits for the  
12 propellants that were used out at the space center.

13 Another factor in that is that the Air

14 Force rocket fuel handlers coverall was involved in  
15 an incident, and it wasn't just personal injury.  
16 There were fatalities as well.

17 And because of the similarity between the  
18 NASA suit and the Air Force RFHCO suit, NASA and Air  
19 Force partnered in an effort to develop a new  
20 specification for a new suit.

21 The things that they found most important  
22 were single point failure mode. And what I mean by 244

1 that is because you have got a totally encapsulated  
2 suit without wearing a full-face respirator, any  
3 puncture in the suit is considered potential single  
4 point failure.

5 Again, glove and boot disconnects and  
6 seals. The two first items there were the ones that  
7 were directly involved in the Titan incident.  
8 Single Point Failure Mode, the operator ripped his  
9 suit in the presence of severe oxidizer, and the  
10 glove and boot disconnects and seals were also  
11 involved because there was liquid impingement past  
12 what seals and attachments there were to the gloves.

13 Further down, the visor -- go back,  
14 please.

15 Visor improvements, and the rest are  
16 pretty much improvements that were to be made as  
17 long as they were doing -- developing a  
18 specification. They wanted to make improvements all  
19 the way around and come up with a totally new suit.

20 So the visor was under consideration to  
21 prevent better properties in the presences of

22 hypervalves, vent valves, suit fabric. The gloves 245

1 themselves, torso closure assembly. Communication,  
2 and emergency air supply. And I will go through  
3 each one of those individually.

4           The way they developed the execution for  
5 the program to develop the spec was they first did a  
6 survey of all users' protective suits and  
7 propellants operations, and those propellants were  
8 the ones that were used by NASA at the time.

9           They then developed a test program to  
10 evaluate propellant resistance and other  
11 characteristics, physical properties of the suit,  
12 materials and components for an improved suit, as  
13 well as the physiological testing and  
14 maintainability analysis afterwards.

15           Then there was a specification prepared to  
16 define and describe an improved ensemble.

17           Next slide.

18           Single Point Failure Mode was one of the  
19 first things that NASA considered. What they wanted  
20 to do was prevent or minimize the circulation of  
21 toxic vapors in the head area or breathing zone in  
22 the event of a puncture or tear in the suit

246

1 material.

2           Some of the things they looked at were  
3 manual mode change to head air only. They evaluated  
4 using a neck ring with air to the head first, and  
5 that was just a mechanical connection.

6                   They also looked at automatic mode change  
7 to head air only, as well as an internal face mask.  
8                   What they ended up was a manual mode  
9 change to head air only, and the -- that went  
10 through qualification testing, but it was removed  
11 because it wasn't determined really feasible for the  
12 operational scenario.

13                   So what they settled on was an air  
14 distribution system that directed 60 percent of the  
15 incoming air to the head area at all times.

16                   Glove and boot disconnects and seals,  
17 primary they were trying to prevent liquid  
18 impingement, which was a contributing factor in the  
19 fatality in the Titan silo.

20                   They also wanted visual and mechanical  
21 indicators to ensure to reliable connections. And  
22 that is our answer to part of the testing and

247

1 design. Because we can duplicate the connection  
2 every time, we don't do pre-use inspections of the  
3 suit. They are all post-use and then staged. But,  
4 again, that's by design because of the repeatable  
5 connection and a proven connection.

6                   What we ended up with was aluminum quick  
7 disconnects with O-Ring seals and visual indicators  
8 of locking.

9                   Gloves, they tried to improve on the  
10 gloves that were used on the initial SCAPE. And the  
11 glove thickness, because it was 50 mils thick,  
12 limited dexterity. And the material became sticky  
13 when exposed to high levels of oxidizer, which they

14 used all the time.

15           What they found out was the oxidizer  
16 actually degraded the crushed butyl rough coating on  
17 the outside of the glove, but it did not actually  
18 penetrate the glove proper itself. And what they  
19 ended up again is they reviewed different glove  
20 configurations and different glove materials, but  
21 they ended up with the same glove that they had  
22 before as far as material goes.

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1           The suit fabric, NASA worked with one  
2 of -- the fabric manufacturers to develop a more  
3 robust fabric that than they had before. Their  
4 goals were to improve flammability resistance, also  
5 to help improve maintenance.

6           And what they ended up with was a thicker  
7 fabric that incorporated a wear indicator to assist  
8 in the maintenance process.

9           They validated the protection through  
10 permeation testing and other physical properties  
11 testing. And it also ended up having reasonable  
12 flame resistance.

13           Flammability is always a big deal. The  
14 suits are not meant to be used in a fire, but we do  
15 our best to try and protect against enabling an  
16 operator who might be in a fire to egress to a safe  
17 area.

18           Next slide.

19           The visor improvements were, the goals  
20 were to minimize and prevent scratches on the  
21 visors. And because the operators have to work in

22 close proximity to a lot of flight hardware,

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1 facility systems, and things like that, sometimes  
2 they need to get close to see what they are trying  
3 to get at. And also the facilities were not built  
4 with protective clothing in mind. So access, as you  
5 would expect, would be kind of a problem.

6 So this was also an attempt to try and  
7 design around those kind of problems and trying to  
8 get in advance to at least have some kind of  
9 prevention so that the equipment could be reused.

10 Also, for improved chemical resistance, to  
11 prevent -- an N2O4, a tap or hit a PVC visor would  
12 fog up in the presence of water when you are trying  
13 to decontaminate. So they were trying to improve  
14 the characteristics of that so that operators would  
15 always have good visibility throughout.

16 what they ended up with was a  
17 polycarbonate material with a chemical resistant  
18 hard coating, which was also a scratch resistant  
19 hard coating.

20 Vent valves have always been a problem, I  
21 think, for any protective equipment.

22 The goal is to prevent vapor migration

250

1 under steady state venting and negative pressure  
2 scenarios. Every suit that we have looked at, you  
3 can have a momentary migration depending on what  
4 levels, if you squat down quickly stand up again  
5 real quick.

6 It may not be open all the time, but there



7 is just a momentary flutter, if you will, before it  
8 actually closes. We deal with that operationally,  
9 as do a lot of other organizations.

10 The testing was performed in the NASA lab  
11 to try and understand the flow characteristics of  
12 the vent valves, and they use helium to try and do  
13 that because of the small molecular size.

14 The design preference was they implemented  
15 a diaphragm tight exhaust valve, basically the same  
16 thing you would have as an exhalation valve in a  
17 respirator, to direct air flow and provide  
18 impingement protection.

19 And in addition to that, they had a relief  
20 valve cover, and they tested it in at optimum  
21 lengths that would also help to divert the flow in  
22 the event that you had some kind of migration.

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1 The torso closure assembly, the previous  
2 design worked against the positive pressure in the  
3 suit. And what I mean by that is that the zipper  
4 lips themselves were formed on the outside. So that  
5 if you had -- when we had positive pressure in the  
6 suit, it would tend to put stresses on the zipper  
7 lips and would try to force them open.

8 What NASA selected at the time was a  
9 ziplock style that, with positive pressure, it would  
10 end up actually trying to make them lock tighter  
11 together.

12 Communications. Because the suits were  
13 used at various locations, Air Force and NASA, and  
14 each had a different communication system, they

15 wanted to go ahead and try and incorporate a  
16 universal system that could be adaptable to other  
17 facilities. So what they ended up with was a  
18 headset that you connect with a cable inside the  
19 suit and a bulkhead connector on the outside that  
20 you could adapt to whatever kind of cord you wanted  
21 to.

22 Emergency air supply was attempted at 252

1 first with the initial suit. It ended up being  
2 something that also wasn't feasible. It was a  
3 bottle worn on the back with a SCUBA-type mouthpiece  
4 on Velcro mounted in front of the hood.

5 Users didn't like it. It got in the way.  
6 It added weight to the suit. And it was removed  
7 based on lessons learned from operators actually  
8 trying to use it.

9 And what we opted was with the bottle that  
10 you saw originally, was an ingress and egress bottle  
11 that they actually carry in and out of the areas.

12 The suits have been through a lot of  
13 testing, and this is where you can find volumes and  
14 volumes of the information. Don Doer, Ken Ahmie,  
15 have been greatly involved in all kinds of testing  
16 from day one on the suit.

17 Most recently, the suit was sent up to  
18 Aberdeen Proving Grounds, and we did protection  
19 factor testing.

20 The suits in the Category 1 and Category 4  
21 modes exceeded 50,000 protection factor as far as  
22 test results go, but were assigned a 20,000

1 protection factor.

2 That factor includes what we did also is  
3 because we wanted to double check the penetration of  
4 vapors inside the suit under maybe operational  
5 conditions as we initiated penetrations in the suit,  
6 punctured holes in the suit with known leakage rates  
7 to test and see if that had any affect as well, and  
8 they still passed with a 20,000 protection factor.

9 So we kind of had a chance to play, and we  
10 like doing that because there are so many different  
11 things that operators will do to be creative to get  
12 their job done.

13 And that's been the challenge all along,  
14 to try and make sure that the people are protected.  
15 And NASA does a really, really good job because of  
16 the redundancy they built into the system and  
17 because we what everything to death -- what-if  
18 everything to death, to try and figure out ways  
19 where people might try and compromise the safety of  
20 the suit, and then take action to try and design  
21 that out.

22 The physiological testing that was done

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1 incorporates a lot of things to check for dermal  
2 stresses, CO2 testing, testing oxygen levels under  
3 different workloads, suit pressurization, as well as  
4 interior suit temperatures.

5 Some of the additional testing that was  
6 done was done by Lawrence Livermore labs back in

7 1988. And they also found high protection factors  
8 with this suit.

9           And later on, some of the people from  
10 Kennedy went to DOE because DOE was looking for  
11 suits also to compare their three suits with. And  
12 they evaluated the NASA suit, and maybe -- I don't  
13 think they end up incorporating anything from that,  
14 but they were impressed with the fact -- the air  
15 distribution systems and some other things. But for  
16 various reasons, they couldn't implement them.

17           In addition to those manned and unmanned  
18 carbon dioxide testing, the ECU testing and vertical  
19 and nonvertical attitudes, the ECU was built with a  
20 swivel pickup in it so that within the first half of  
21 its level, it could be used in a horizontal position  
22 or near horizontal.

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1           Air flow decreases. Operators are taught  
2 that they need to pay attention to that. And if it  
3 decreases too much, they just stand back up. Air  
4 flow restores, and then they can go about their  
5 business.

6           Other testing that was done, we did liquid  
7 impingement testing from all attitudes. Again, that  
8 reverts back to the incident in the Titan silo. We  
9 wanted to make sure that in the event that we had a  
10 high pressure leak -- and what we did for that was  
11 throughout the space center, all of the operations  
12 units reported on what their credible leak would be  
13 for all of the hypervalve systems. And we used the  
14 top end of that as the measure of what type of

15 impingement testing we give.

16           The ensemble was also -- went through  
17 exposure testing in addition to component level  
18 testing for permeation and those kind of things, the  
19 physical properties.

20           we also did a prolonged ensemble testing.  
21 And one of them was to instrument the inside of the  
22 suit and then douse it with chemical with the

256

1 positive pressure that we see during normal  
2 operations to see what, if any, effect that had on  
3 this suit. And the suit passed with no penetration  
4 whatsoever.

5           we went a little bit further beyond that,  
6 too, as well as the flammability testing of the  
7 different components. We actually took a suit,  
8 doused it with chemical, and then lit it on fire.  
9 And we are very pleased to see that the suit  
10 sustained very little damage. As a matter of fact,  
11 the only damage it sustained was where the  
12 thermocouples entered into suit where we could take  
13 our instrumentation.

14           So, again, you know, there are certain  
15 things -- maybe we have gone a little bit extreme on  
16 how we try to do our testing, but it has given NASA  
17 and the users a level of comfort and confidence in  
18 the equipment because we have gone above and beyond.

19           Once we have done all of the testing and  
20 the design work is done, we need to, and do, go back  
21 and validate that it still performs the way it is  
22 supposed to.

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1           And we do probably more maintenance on the  
2 suit than maybe anyone else in the industry that I  
3 have seen.

4           What we do is we go through -- first of  
5 all, the suit is deconned on site. Once it comes to  
6 the shop, it goes through a soap and water shower  
7 with biodegradable detergent. And all of this  
8 maintenance is done every time the suit is worn,  
9 directly after it is worn.

10           We also have what we call light inspection  
11 where we look for small pinholes that you can't pick  
12 out with your naked eye as far as visual inspection  
13 goes. We also check for any material degradation,  
14 and that includes the boots and gloves as well.

15           We also do an ensemble leak test to make  
16 sure that there's no leaks in the suit and that all  
17 of the components are secured properly.

18           The airline that is attached to the suit,  
19 we do an airline flow test as well to make sure that  
20 the airline is still clean and that it performs the  
21 way it is supposed to.

22           We do a leak test, reverse flow test on

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1 all of the relief valves as well to make sure that  
2 there is a proper seal.

3           We also do a flow test to make sure  
4 that -- and the suit, because it's at a positive  
5 pressure, you have to make sure you don't get too  
6 much pressure in the suit.

7           So it is designed to have a certain amount

8 of -- less than two inches of water pressure inside  
9 the suit. So we check to make sure that the -- with  
10 the flow that we get during airline or ECU  
11 operations, that the suit still is not  
12 overpressurized and is still below two inches of  
13 water.

14 But on the other hand, too, we also check  
15 and make sure that the relief valves don't leak if  
16 you have a pressure from the outside -- a greater  
17 than ambient.

18 After that is all done, we make our  
19 repairs, and we go through a quality inspection and  
20 verification. And they use the same criteria that  
21 we use when we do our inspection and repairs. And  
22 then all of the boots and gloves are tested

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1 individually.

2 In addition to the maintenance, we also  
3 have a comprehensive -- and I didn't put this in the  
4 slide -- but there is a comprehensive training  
5 program as well that very much mirrors what NIOSH  
6 requires for respirator tech where we have got a  
7 stringent physical.

8 We have operators actually wearing,  
9 donning. They have to demonstrate that they can  
10 take themselves out of the suit in the event of an  
11 emergency and all of the other normal things, that  
12 the fact that have -- because of their stature, they  
13 either can or can't wear an environmental control  
14 unit because it might change their center of  
15 gravity. And it's all centered around safe

16 performance of the suit during the jobs.

17 And any questions?

18 MR. SAVARIN: Mike Savarin, SPERIAN.

19 Thank you, Dennis, for that presentation,  
20 answering many questions that we have been asking  
21 this afternoon. If we had waited five to ten  
22 minutes, we would have got what we needed to know.

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1 I think the environment that your people  
2 work in is an extreme environment, and so,  
3 therefore, you know, these mitigations are all in  
4 line with that, and actually it is really comforting  
5 to know, we can certainly learn some stuff from the  
6 approaches taken. That's for sure. For me, I have  
7 one question, and it relates to the protection  
8 factors.

9 In the earlier presentation, I believe  
10 that Colleen or Angie, someone mentioned that they  
11 are going to use sulfur hexafluoride, SF6, for the  
12 protective factor testing, and obviously RDECOM uses  
13 mineral oil aerosol.

14 Do you have an understanding what the  
15 correlation might be between those two?

16 MR. DUDZINSKI: No. The protective factor  
17 testing that was done up at Aberdeen was done with  
18 corn oil.

19 MR. SAVARIN: Right. I'm familiar with  
20 that.

21 I just wanted to know if we could  
22 correlate that to anything that was done on the

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1 proposal for sulfur hexafluoride?

2 MR. SZALAJDA: Mike, I'll see if I can  
3 clarify that a little bit.

4 I'm not aware of any correlation work  
5 between the -- at least from the perspective for the  
6 respiratory protection standpoint, we are using corn  
7 oil just from the standpoint of the database and  
8 understanding what you are seeing in the breathing  
9 zone.

10 My thoughts in looking at the other  
11 testing with methodology was that is geared more  
12 towards the resistance of the suit, or the ensemble,  
13 at least with regard to resisting penetration or  
14 permeation. With corn oil, we are just solely  
15 concerned about what your individual is seeing in  
16 the breathing zone.

17 MR. SAVARIN: I mean, there is a distinct  
18 demarcation between the test paradigm used in Europe  
19 and the testing here, and that's where the sulfur  
20 hexafluoride came from in the first place. And they  
21 are both trying to give an understanding of the  
22 level of protection that the suit provides.

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1 I'm thinking if we are going forward with  
2 this, would we have any problems not adopting the  
3 sulfur hexafluoride and just carrying on with our  
4 knowledge base that exists with corn oil?

5 MR. SZALAJDA: Yeah. I think the other  
6 issue with sulfur hexafluoride is I think  
7 nationally, it's not -- you know, for the United

8 States, it's not considered an acceptable, you know,  
9 product to be used.

10 So from that standpoint -- internationally  
11 we know it is being used in Europe, but  
12 domestically, I don't see how we would be able to adopt  
13 that under the current guidelines.

14 MR. SAVARIN: Thank you.

15 MR. SZALAJDA: Any other questions for  
16 Dennis?

17 Well, I think I would like to give him a  
18 round of applause.

19 At this point, I think what we would like  
20 to do before we move into the next session is take  
21 about a ten-minute break.

22 Verizon says it is 3:26. Maybe we can

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1 reconvene at 3:36 Verizon time, and we will move  
2 into the next topic.

3 If Barney Lambert is present, if you could  
4 stop up and see me in the next couple of minutes, I  
5 would appreciate it.

6 (A recess was taken.)

7 MR. SZALAJDA: The final topic that we are  
8 going to address is an initiative to look at the  
9 requirement for an end-of-service-life indicator for  
10 the self-contained apparatus.

11 And we have two presentations on that  
12 topic, which will be provided. One will be  
13 delivered by Roland Berry Ann, who is the deputy  
14 director of NPPTL and has been involved with this  
15 topic for several years.

16                   And also we are going to have a  
17 presentation by Dave Bernzweig, who had raised the  
18 topic originally, and will be able to provide us  
19 some of the historical perspective on why the  
20 stakeholders feel that there is a need for making a  
21 change to the federal regulation.

22                   We had also received a request to provide  
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1                   some additional information. I don't know if that  
2 individual is here today or not. I haven't been  
3 able to track him down, but the input that he had  
4 submitted, we will consider as part of the -- and  
5 make it part of the docket submittal and make it  
6 available through the docket.

7                   So with that, I'll introduce Roland Berry  
8 Ann.

9                   MR. BERRY ANN: Thanks, Jon.

10                   I'm going into work. I'll try and speak  
11 faster. For those of you who know me know that  
12 that's not possible. Now, everybody is laughing at  
13 that.

14                   Okay. The background on this requirement,  
15 or request for change in requirement, looking at the  
16 current requirements, Section 84.83, paragraph (f)  
17 requires that warning device or remaining service  
18 indicator be provided that gives an alarm or an  
19 indication within a range of 20 to 25 percent of the  
20 rated service time of the device or the apparatus  
21 remaining, as in warning for -- under the NFPA, it's  
22 called an end-of-service-life indicator for

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1 withdrawal, exit from the scene.

2           There is no provision stated in the  
3 regulation as to when that would initiate. But our  
4 traditional enforcement policy has been that it  
5 cannot initiate before the 25 percent level, and it  
6 has to initiate by the 20 percent level.

7           There is also no specification on the  
8 duration. So it can remain on for the entire time  
9 that there's air remaining in the cylinder, or it  
10 can just be for a short duration and then cut off  
11 before it runs out of air.

12           Okay. But the significant thing, it's  
13 based upon 20 to 25 percent range of the remaining  
14 service time.

15           Okay, John.

16           The current status in this rulemaking  
17 activity is that we receive the petition for  
18 rulemaking from, as Jon said, Dave Bernzweig, who is  
19 here today and is going to give some background as  
20 to what his intent and thoughts were.

21           But he has requested through his petition  
22 that we eliminate the range concept and just have a <sup>266</sup>

1 minimum platform of 20 percent for the alarm to  
2 sound and allow the setting to initiate at any  
3 predetermined adequate level by the user. Okay.

4           And the user in this case we would expect  
5 to be the program manager of the respiratory  
6 protection program of the jurisdiction that's using  
7 the device.

8           Okay. There was an article which Dave put  
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9 in the fire engineering journal on June 2004 talking  
10 about the time to exit. I won't go into that  
11 because I'm sure he is going to cover his desires  
12 and thoughts in that area.

13 We have received more than 30 docket  
14 submissions. Most of those were form-letter type  
15 submissions, which there's not a problem with that  
16 except we don't get much detailed information from  
17 those. It's just a basic statement that says, I  
18 support the concept, and we have not received  
19 anything in opposition to the change. The IAFF has  
20 endorsed the change.

21 But all of the information we have  
22 received has been from the firefighter community,

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1 and those specific uses.

2 John.

3 Okay. The proposed changes to accommodate  
4 this request for rulemaking would be to remain at  
5 the 20 percent service time for, if you will, for  
6 the alarm to be given and allow settings at higher  
7 settings for the alarm to come on. And like I said,  
8 it would be the respiratory protection program  
9 manager's determination as to what would be  
10 appropriate based upon their actions and their mode  
11 of operation within the fire department.

12 Okay. We would continue to evaluate the  
13 operation of the alarm or the indicator to make sure  
14 that it operated at the appropriate setting. Okay.  
15 So basically verification of operation.

16 Okay, John, the next.

17           Okay. So what we are looking for is input  
18 from stakeholders. And this is an attempt to try  
19 and get some additional input. And we have listed  
20 out here the issues that we have raised that we  
21 would like to get some input on and some thoughts  
22 and considerations.

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1           Basically, when you are going from a range  
2 to a single setting, do you have -- you know, how do  
3 we determine where that setting may be in the field  
4 to make sure that the setting will be accurate and  
5 repeatable from time to time to ensure that the user  
6 is going to get the proper notification, whether  
7 it's at 40 percent, 50 percent, or 20 percent level.

8           Are there other ways to achieve the  
9 additional time to exit that Dave is proposing?

10           Is there a way, since everything we have  
11 gotten has been from the firefighter community, is  
12 there a rationale and a method that we would -- that  
13 we should look into to differentiate the firefighter  
14 apparatus from the traditional industrial apparatus?

15           Now, one avenue that we can take, which  
16 makes this important, is since we have gotten no  
17 objections to the proposal, we have the capability  
18 to go to what is called the direct final rule, which  
19 would be the publication or the change to the  
20 regulation.

21           And I think it's 30 days that's allowed  
22 for anybody who has an objection to pose an

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1 objection. And if we don't get any objections, then  
2 it automatically becomes a final rule. So, again,  
3 that's called the direct final rule.

4 So we are going through this effort to try  
5 and make sure that we have covered everybody's  
6 opportunity to speak their minds for this issue.

7 And the information -- if you will turn to  
8 the next slide, John, there is the information for  
9 submittal to the docket.

10 And that's all I have. Any questions?  
11 Comments? Suggestions?

12 MR. BARD: Brent Bard, supplied-air  
13 Monitoring Systems.

14 My initial thought on it is, seeing that  
15 it is being brought forward by the IAFF, what I  
16 would recommend would be that you look at the  
17 implementation involving NFPA compliance SCBAs and  
18 leave the industrial units completely alone.

19 But I think the danger of doing it for the  
20 NFPA and leaving it up to an individual respiratory  
21 protection manager is now you are going to have a  
22 scale that's going to be all over the place.

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1 And I think that's going to cause greater  
2 confusion. I think it is going to cause greater  
3 issues upon servicing, who is servicing their pack  
4 and what information they have as to what the  
5 desired limit is that they want.

6 I would suggest that I would go back to  
7 the IAFF and ask them to come up with a standardized  
8 level of change -- I believe the one that had been

9 mentioned was 30 percent -- and get them to come to  
10 a consensus on their own and come back to you with  
11 that.

12 But I think it is important to keep the  
13 NFPA community satisfied, but keep it separate from  
14 the other end users who don't have the same  
15 stringent requirements that they do.

16 Thank you.

17 MR. BERRY ANN: Could I ask for a  
18 clarification?

19 Are you suggesting moving this -- the  
20 setting to the NFPA standard, or getting input from  
21 the NFPA as an official body?

22 MR. BARD: Getting the input from the NFPA  
271

1 to you after the IAFF goes to the NFPA.

2 And because I'm pretty sure the NFPA would  
3 ask them to give a unified, what do you want that  
4 alarm set point to be?

5 I don't think that they would accept one  
6 that could be set by an individual department  
7 respiratory protection manager.

8 Thank you.

9 MR. HODSON: David Hodson, Draeger safety.

10 One of the things I think that just caused  
11 confusion with regard to using percentage of the  
12 volume that's already left in the cylinder is it's  
13 different for every size of cylinder.

14 You have got a 1,200 liter, 1,800 liter,  
15 2,400 liter cylinder. Therefore, the time that you  
16 have is different in each case.



17 I think perhaps a different approach would  
18 be to identify what is the required amount of air to  
19 accommodate all of the users, firefighters or  
20 whatever the users are, and to ensure that they have  
21 sufficient air to get out in 95 percent, 99 percent  
22 of all of their escape cases. And then work from 272

1 that where the setting should be.

2 As an example, you would perhaps set it at  
3 say 500 liters remaining in the cylinder, 400  
4 liters, whatever is an appropriate amount remaining  
5 the cylinder.

6 I think that would then potentially say to  
7 all the end users, it doesn't matter what size  
8 cylinder they have. They know how much air remains  
9 in the cylinder. And, depending on their work rate,  
10 they know how much time they have to get out.

11 One little aside to all of that, and of  
12 course the training of the firefighters is always  
13 one of the difficult areas. And the question really  
14 is what is the firefighter supposed to do before he  
15 gets to his end-of-service-time indicator.

16 And there is some controversy over that,  
17 and I think there always will be. 4b04 in the Alex  
18 (phonetic) indicates that you should be out of IDLH  
19 atmospheres before the end-of-service-time indicator  
20 goes off.

21 I don't think there's many firefighters or  
22 perhaps industrial users that actually pay attention 273

1 to that. Therefore, I think it is better to  
Page 203

2 actually look at how much air do you need to cover  
3 most escape cases and give the guy that amount of  
4 air.

5 Thank you.

6 MR. BLANK: George Blank with Draeger  
7 Safety. I think if you have to be very careful if  
8 you allow the program manager to determine the  
9 amount of escape time that a person needs.

10 SCBAs these days have mechanical alarms  
11 that are driven by air, and they have electronic  
12 alarms that can be set differently and they can be  
13 very confusing.

14 I think a very productive point, just  
15 another sidebar here, is to some manufacturers,  
16 allow their electronic alarms to go down to zero air  
17 and other manufacturers have their breathing rates  
18 go down to a time of warning.

19 I think that would be better to create a  
20 standard wearer as all manufacturers will be  
21 required to have their electronic breathing rates go  
22 down to the alarm rather than down to empty.

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1 Just a comment.

2 MR. BERRY ANN: Could I ask a  
3 clarification on your concern about the program  
4 manager having the authority to determine the  
5 proper --

6 MR. BLANK: Well, that was in the -- that  
7 was what your --

8 MR. BERRY ANN: Right.

9 MR. BLANK: But I mean to make sure that  
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10 if they adjust them, if they are allowed to adjust  
11 them in field, you are talking about a couple of  
12 different alarms which are really set at the  
13 manufacturer. So now somebody would take that and  
14 set it out in the field.

15           Provided the correct software, it is very  
16 easy to -- it could be very easy to set the  
17 electronic alarm, but be very difficult to set the  
18 mechanical alarm at the correct pressure. And any  
19 kind of discrepancy could be very confusing to the  
20 user.

21           That was my point.

22           MR. BERRY ANN: And did you have an

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1 alternative to the user making a determination?

2           MR. BLANK: I would rather not have the  
3 user make that determination. I would rather have  
4 the manufacturer set it, and really set it what it  
5 is right now, 20 and 25 percent of the cylinder  
6 capacity.

7           Or come up with something like Mr. Hausman  
8 came up with a specific pressure -- or a specific  
9 escape time for all cylinders.

10           MR. BERRY ANN: Okay. Thank you.  
11 Appreciate the clarification.

12           MR. WELLS: Jesse Wells, NOVA Chemicals.

13           But for purposes of my comments and  
14 questions, let me just say that I spent 26 years in  
15 a professional fire department. So just so the  
16 background is understood.

17           Couple of things I have heard up here

18 really strike a true tone. Most firefighters don't  
19 watch the amount of time they have been in the  
20 building.

21 On a hazardous material response or in a  
22 technical rest due response, we time how long people  
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1 have been in. We don't typically do that in a tire  
2 service.

3 Big red truck pulls up. People run in the  
4 building. We do a personal accountability report  
5 every 20 minutes, but we don't mark the on-air time  
6 typically.

7 If there's departments out there that  
8 going that far, I applaud them, but I haven't seen  
9 it.

10 So if the fire service is asking for an  
11 earlier warning, then I think maybe there is a  
12 better methodology than having people just set their  
13 alarm whatever the way they want. And here's my  
14 concern.

15 If you going to allow people -- each  
16 individual manager to set his alarm, there needs to  
17 be some very strict training requirements and  
18 controls on that so that we don't have mistakes  
19 being made that cost people their lives in there  
20 because somebody didn't do something right in  
21 resetting an alarm.

22 MR. BERRY ANN: Thank you.

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1 MR. SZALAJDA: And with that, the next

2 presenter is Dave Bernzweig, who is with the  
3 Columbus fire department and originally raised the  
4 issue that has precipitated this discussion.

5 MR. BERNZWEIG: How about that? Okay.

6 I guess I probably should have gone first,  
7 actually, Roland.

8 Let me just state for the record, I am in  
9 no way advocating -- this is very loud -- that the  
10 program manager should have the ability to adjust  
11 this. It should not be field adjustable.

12 What we would like in the fire service is  
13 that we can specify -- like we can specify turnout  
14 gear. We can specify fire trucks. We can specify  
15 our hose. We want to be able to specify where our  
16 end-of-service-time indicator would alarm.

17 It would not be field adjustable. It  
18 would be whatever local economy dictates in the  
19 absence of a consensus standard. And from there, we  
20 would basically be able to avoid all of the problems  
21 that just got raised.

22 Because it would be a serious problem if

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1 we just opened up the door and said, Field adjust it  
2 or program manager adjust it. Who has got what on  
3 and when does it go off? Everybody has got  
4 something different. So get that out of the way.

5 A little background about me. My name is  
6 Dave Bernzweig. I'm a Columbus firefighter. I'm  
7 also a principal member of the NFPA Respiratory  
8 Protective Equipment Technical Committee. I also  
9 serve on a federal USAR team in Ohio, Ohio Task

10 Force 1.

11 And how we got started on this was  
12 actually back in 2003, in Columbus, Ohio, we were  
13 getting ready to go out for bid for a new SCBA. And  
14 based on some research that we had done and some  
15 recent line-of-duty deaths, our own experiences  
16 going back a few years farther back, but some  
17 deaths around the country as well as some  
18 statistics, reports that had been put out by the  
19 U.S. Fire Administration, NFPA, we realized that  
20 really we probably weren't carrying enough air on  
21 our backs for an emergency if we got into trouble.

22 And so we decided we would like to go from  
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1 a 30-minute rated cylinder to a 45-minute rated  
2 cylinder, a 1,200 liter to an 1,800 liter cylinder,  
3 with the intent that we could increase the work  
4 period.

5 As on the slide up here, the objective was  
6 to have an appropriate work volume, an appropriate  
7 exit volume, appropriate reserve air, and the EOSTI  
8 set in the appropriate place.

9 And as you see, I have used the word  
10 appropriate a lot, and I have kind of put it in a  
11 parentheses because I'm not trying to tell you where  
12 it needs to be. We don't think that -- you know,  
13 that's not what we are looking to change within the  
14 regulation. We believe it is better left up to  
15 consensus standards or even local economy do  
16 determine what are those appropriate numbers and  
17 where they need to be.

18 But there is significant research out  
19 there which does say that, you know, there are  
20 reasonable work periods, and there are unreasonable  
21 work periods. We also know as far as reserve air,  
22 how long after you get into trouble, how long it 280

1 takes for us to get you, the reflex time to get out  
2 to a firefighter.

3 We know these from empirical studies, and  
4 we know them from experiences on the fire ground.

5 Next slide, please.

6 Okay. Just a quick review. This is 8483  
7 Subpart F there or Part F. And as I have gone  
8 around speaking about this the last five years, I  
9 have always asked people what is the flaw in the  
10 law.

11 And, really, there is two things here, one  
12 of which I was kind of ignorant to. The other is  
13 that the 20 to 25 percent is a range. And really  
14 was it intended to be a range, and what is the  
15 purpose of having an upper limit and a lower limit?

16 Most standards specify a lower limit, and  
17 that's their minimum standards. But here we have a  
18 minimum and a maximum. And the effect of it is that  
19 it prevents us from being able to add a margin of  
20 safety if we want to for when that EOSTI goes off.

21 Next slide, please.

22 So why the upper limit? I'm going to take 281

1 these in reverse order because it's probably a  
2 little more appropriate there.

3           As I did some of this research and talked  
4 to people who had been around a lot longer than I  
5 have, the explanation was that, actually, the  
6 percentage, the range was really probably intended  
7 more as a testing tolerance. And that -- the  
8 language -- not necessarily the language, but the  
9 regulation or the requirement, the 20 to 25 percent,  
10 dates back to the Regulation 1995 and actually goes  
11 back to when this was a regulation or a standard  
12 under the Bureau of Mines before 1960, so that's how  
13 it was.

14           So the rationale back then was that it was  
15 a testing tolerance, a range of success for when the  
16 EOSTI sounded.

17           The rationale back then and what's really  
18 been relayed to me is that there are several things  
19 that really didn't make it much of an issue because  
20 25 percent was really -- was probably the best thing  
21 they were going to do that was appropriate. One was  
22 SCBA technology.

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1           When firefighters first started wearing  
2 these, there were 1,800 PSI cylinders. They were  
3 much heavier, carried less volume. Our protective  
4 clothing, we didn't have the level of protection  
5 that we have today. We couldn't go in as deep.  
6 Smaller structures than today. We weren't going as  
7 deep for that.

8           Strategies and tactics, firefighters were  
9 able to -- were putting fires out from either the  
10 outside a lot of times, but also just not going as  
Page 210



11 deep into structures. And the fuel packages  
12 changed, where we have fuels which burn much hotter,  
13 more quickly.

14 So all of these things kind of really  
15 didn't force the issue of firefighters becoming  
16 lost, trapped, and disoriented, which is what killed  
17 a lot of firefighters inside of structures.

18 Next slide, please.

19 So what has changed? Well, if we look at  
20 some of the statistics over the years and some  
21 recent studies by the NFPA, we find that in the  
22 years from '77 to 2002 and really up until today, we  
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1 have had more than a 50 percent decline in the  
2 number of structure fires in the U.S.

3 At the same time, though, if we look at  
4 the traumatic firefighter deaths inside of  
5 structures -- these are noncardiac deaths that occur  
6 inside structures -- we have actually had an  
7 increase, almost a twofold increase in the number of  
8 firefighters who get killed.

9 And this was at the -- not just the  
10 number, because the number hasn't gone down as the  
11 structure fires have declined, but the rate of  
12 firefighters, 1.8 per hundred thousand  
13 firefighters -- or hundred thousand fires in the  
14 late '70s to the late '90s, at 3 per hundred  
15 thousand structure fires.

16 So as you can see, it is actually more  
17 fire -- despite the decline in structure fires, more  
18 firefighters are getting killed inside of

19 structures.

20 63 percent, the cause of death is listed  
21 as smoke inhalation.

22 I'm not showing any of this to try to make  
284

1 you believe that everybody is dying from smoke  
2 inhalation there, is running out of air and dying.  
3 There are other contributing factors that lead up to  
4 it.

5 But many of the firefighters who are dying  
6 are becoming caught, lost, or disoriented. And they  
7 do run out of air before they die. There is other  
8 precipitating events, but they run out of air. And  
9 they end of having a high carboxyhemoglobin levels.

10 Some other things we look at is the rate  
11 of firefighter death by occupancy. And as you see,  
12 we are quite a bit more likely to die in  
13 nonresidential structures. Some of the reasons for  
14 this are probably related to the size of the  
15 structure.

16 You know, before I go on to that, there's  
17 some work that has been done. Really, since I have  
18 started this, there was a U.S. firefighter  
19 disorientation study trying to identify what is  
20 causing firefighters to die, and it's noticing a  
21 sequence of events that occur.

22 But the gist of all of this is that  
285

1 firefighters are getting too keep in the structures;  
2 they are running out of air; and they are dying.

3 And that we do have a problem with how our reserve  
4 air is met, and maybe even how we are using the air  
5 that we have.

6 Next slide.

7 In order to maybe better understand why we  
8 are dying inside of structure fires, I want to take  
9 you through how we use our air, how we interpret it,  
10 and how we pay attention to what is in our cylinder.

11 Next slide.

12 Historically, air allocation was made up  
13 of -- you have a cylinder on your back; you have a  
14 work volume; and you have basically an exit volume  
15 in there. And if you hit the button one more time,  
16 we put our alarm right in there.

17 After you are done working, that was the  
18 interpretation. When your bell goes off, that's  
19 when it is time to leave.

20 I have been with the fire service for  
21 about 20 years, and that is how it was made back  
22 then. That is how most fire departments still teach  
286

1 it today.

2 Although there have been some changes in  
3 that because there has been a reaction from the fire  
4 service -- and the fire service does realize -- I'm  
5 not the first person to come up with this and say,  
6 Hey, we are killing guys inside because they run out  
7 of air.

8 The fire service, in order to address the  
9 inadequate volume that remains when our bells go off  
10 says, Hey, leave before your bell goes off. And we

11 call it air management, and I will talk more about  
12 it a little bit later.

13 The other part of it was -- and the theory  
14 behind it, if you could go back, actually. If you  
15 go back, the other part of it, the theory behind it  
16 was that, well, 25 percent to go in. You get to  
17 work for 50 percent. You have 25 percent to go out.  
18 That was the 25/50/25 rule, which probably goes back  
19 a generation.

20 But today's reality, as I mentioned, we  
21 don't allocate enough air.

22 Next.

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1 Just a chart here that gives you some idea  
2 of what it looks like inside the cylinder and how  
3 that's broken up with a 25 percent alarm.

4 I have done it through the various rated  
5 service life and volumes. And the top was a  
6 30-minute rated cylinder, which is the most  
7 prevalent cylinder in the industry.

8 The one underneath it, which is shaded a  
9 little bit is also a 30-minute. That is kind of an  
10 anomaly. That's the 3,000 PSI. It is a 1,700 liter  
11 cylinder.

12 It is out there in the fire service, but  
13 it's a 30-minute rated cylinder, and it has  
14 virtually the same volume as a 45-minute rated  
15 cylinder. So it's -- whenever we are talking about  
16 SCBAs, I want to make sure that we are comparing  
17 apples and oranges, know what we are talking about.

18 But in any event, I broke it down. I

19 based it on 100-liter-a-minute work rates. In a  
20 couple of slides, I will talk more about why that is  
21 important because it is what is probably a more  
22 realistic work rate for the fire service.

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1 But in any event, if you look at the exit  
2 time, as you can see, the 30-minute rated cylinder,  
3 which most people are wearing, when your bell goes  
4 off, you have about three minutes.

5 Something else that was found in the  
6 disorientation study -- and really all of the work  
7 when you look at firefighters who become lost,  
8 trapped, and disoriented -- is that the vast  
9 majority of the time, when firefighters become lost,  
10 trapped, and disoriented, they do it at the end of a  
11 work cycle.

12 when we walk into a building, when we go  
13 into a building that's on fire, we are disoriented.  
14 We just don't call it that. We are just going to  
15 work. We are going in the door. We are doing what  
16 we have to do.

17 The bell goes off. Now it's time to go  
18 out. So either we realize, well, maybe I don't know  
19 where I am, or, on the way out, a lot of times we  
20 become separated.

21 Hose line or tag line separation is  
22 usually one of the things that occurs inside a fire.

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1 If we are on our way out, we become  
2 separated from our hose or tag line, or we didn't  
3 bring one in, and the smoke hasn't cleared. Now we

4 call it disorientation, and that's when we start to  
5 get into trouble.

6 At that point, my bell is going off. I  
7 have maybe three minutes of air. That's at a  
8 hundred liters a minute.

9 when that stress goes in, one of the  
10 things that's really going to kick up that  
11 respiratory rate is stress, probably more than so  
12 than even work, and I'm probably going to have a lot  
13 less time than that.

14 As you can see, though, as you go down  
15 there, even at 45 minutes, you are not gaining much.

16 So as you increase your volume on your  
17 back, you are increasing your work period, but you  
18 are not increasing your exit period a whole lot.  
19 And I think what it points out the most is if you  
20 look at 60-minute rated cylinder, or the 2,400 liter  
21 cylinder, you really have about six and a half  
22 minutes -- or actually six and a quarter minutes of  
290

1 exit time for all of that air that you are bringing  
2 in.

3 That really points to me a real deficiency  
4 as far as where that set point is.

5 Next slide, please.

6 Okay. Just as an example -- and I'll go  
7 through some of this. But, again, looking at the  
8 predominant cylinder in the industry, the 30-minute  
9 cylinder and the 25 percent alarm.

10 The first is rated time. And this has  
11 been a point that has been hard to drive home to the  
Page 216

12 fire service, but it's -- we are doing better with  
13 it. And that's telling people that, Hey, we call it  
14 a 30-minute cylinder, but it's not really 30  
15 minutes.

16 Again, we talked about it in the other  
17 slide, the 1,200 liters at 30 minutes. 1,200 liters  
18 of air gives you about three minutes of exit. It  
19 gives you very little margin of error for what-if  
20 scenarios.

21 And we don't do this anywhere else in the  
22 fire service. We don't pack for one scenario. If I  
291

1 pull up to a structure fire in a house, I have one  
2 hose. I will probably take a smaller hand line,  
3 inch, and inch and three-quarter line.

4 I pull up to a commercial structure, and I  
5 take in a bigger hand line. My tool selection  
6 changes. Everything changes. But the bottle that's  
7 in the back of my seat, that's one that I get to  
8 choose whether I go to a high-rise, a residential, a  
9 commercial building. It doesn't matter.

10 And so really, there is a flaw in how much  
11 air we are packing for that one scenario.

12 Next slide.

13 Okay. What is the appropriate range of  
14 service time? NIOSH uses 40 liters a minute, and  
15 that's where they come up with that 30 minutes, is  
16 1,200 liters based on 40 liters a minute. It  
17 roughly comes out to about 32 minutes, and they call  
18 it a 30-minute cylinder.

19 A hundred liters per minute, you are

20 really more likely to get a little more than 12  
21 minutes of air out of it. How does this play out  
22 for the real world?

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1 Next slide, please.

2 There aren't many line-of-duty deaths  
3 where you get everything you need, when you know  
4 when people have their last transmission, where you  
5 get all of the timestamps that you need, but there's  
6 a handful of them. There is probably a few more out  
7 there that I haven't found yet.

8 But here are three that have been well  
9 documented by the NIOSH Research and Training  
10 Branch. And what we have is about basically 12 to  
11 13 minutes in most of these cases.

12 They are fire departments. They have an  
13 early on-scene time, but they have timestamps with  
14 everything. And we are looking at 12 to 13 minutes  
15 from on scene to last transmissions.

16 Now, this is life experience. There is  
17 actually empirical data. The Trial Fire Services  
18 just completed a pretty extensive research study in  
19 2007 -- it is published. It is out there on the  
20 web -- looking at firefighter work rates doing  
21 firefighter tasks, high-rise fires, subway fires.  
22 And they actually got work rates well in excess of a  
293

1 hundred liters a minute.

2 So the empirical data and the life  
3 experience does point to that a hundred liters a



4 minute is probably a more realistic work rate.

5 Next slide, please.

6 What if everything doesn't go right with  
7 their margin of error? As I mentioned, we know when  
8 firefighters get into trouble, it's toward the end  
9 of their work cycle.

10 We don't have time, whether it's a 1,200  
11 liter cylinder, 18 or 24, if we are waiting to leave  
12 when our bell is going off, then we are -- the best  
13 we are going to do is six and a half minutes or six  
14 and a quarter minutes with a 60-minute cylinder,  
15 which very few firefighters are using for structural  
16 operations.

17 We don't have time for self-rescue. We  
18 don't have time for receiving assistance from others  
19 because, as I mentioned, the reflex time. It is  
20 about eight to nine minutes.

21 Some studies that were done in Phoenix and  
22 Seattle after a fatality in Seattle in 2000. And 294

1 they did some -- again, some pretty empirical data.  
2 They used universities to help them do some  
3 evaluations on how long it took to get to  
4 firefighters.

5 It was eight to nine minutes. And that  
6 was about 200 feet into a building. So we don't  
7 really have enough of a margin of error for this.

8 What is our backup plan? Well,  
9 historically, our backup plan is rapid intervention,  
10 which is very reactionary. I would rather see us  
11 have a backup plan which says that you have more air

12 set aside for if you get into trouble.

13 Next slide.

14 Okay. How have the consensus standards  
15 dealt with it? Well, NFPA 1981 basically is -- we  
16 are kind of boxed in on that because we have to --  
17 we have to meet a NIOSH standard. And there is  
18 really no way around that.

19 I think the comment was brought up that  
20 the -- if the NIOSH changed, the consensus standard  
21 should change. We can't change unless NIOSH is  
22 going to allow us, so that's kind of why we are here

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1 today.

2 Some people point to the heads-up display  
3 that was added in 2002, that this is a possible  
4 solution because it does -- it is an  
5 end-of-service-time indicator that will alert you  
6 earlier.

7 The problem with the heads-up display is I  
8 guess really twofold. One is that it is a personal  
9 alarm, and firefighters shouldn't be operating on a  
10 personal level. We operate in crews.

11 And as a supervisor, I need know when  
12 people in my crew are getting low on air. So it  
13 puts the responsibility on the end user instead of  
14 making it something that really the crew knows, the  
15 supervisor knows, and even other crews in the area  
16 know that, Hey, somebody is at the end of their work  
17 cycle.

18 The other part about it, the other  
19 deficiency with it is that there is, at least with

20 some of the older generations of -- there is some  
21 deficiency or some -- basically it is called  
22 attention blindness, which is when you are doing

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1 heavy work and focusing on other things, you just  
2 don't notice it so much. Sometimes it's hard to  
3 see.

4 So it's a start, but it's not really the  
5 solution. What we do need is we do need an audible  
6 alarm and something which alerts everybody at the  
7 tactical level.

8 And the universal air connection was  
9 another thing that has been repeatedly pointed out.  
10 Well, that was a solution if we run out of air.  
11 That is, again, a very reactionary solution, that's  
12 to give a transfer of air to a firefighter who is  
13 down.

14 NFPA 1500, which is the health and safety,  
15 and 1404, which is the training for respiratory  
16 protection, basically point to two things. They say  
17 situational awareness and air management.

18 Next slide.

19 They say that those are the solutions that  
20 are the keys to prevention of inadequate air supply.  
21 And I will talk about those here in the next slide a  
22 little bit and really the limitations of them and

297

1 some the problems with having good situational  
2 awareness.

3 The heads-up display, as I mentioned  
4 earlier, may not be the -- really isn't the solution

5 the fire service needs. It is a great solution, and  
6 it gives personal awareness of your air level, but  
7 it doesn't give the group awareness.

8 Another comment that we have heard a lot  
9 of was that an earlier EOSTI will only result in  
10 being ignored by the user. Really, if that's the  
11 attitude of it, well, shame on that person. That's  
12 not why -- we don't not make a standard, not make  
13 the change because we think it's going to be  
14 ignored.

15 If there's an individual who is going to  
16 ignore the EOSTI, my guess is they are probably not  
17 going to have very good air management skills  
18 either, to leave before it goes off.

19 And then the other thing is people say the  
20 EOSTI shouldn't be used for an exit alarm. You  
21 should leave before that. And that's really the  
22 premise or the key behind some of the thinking

298

1 behind air management.

2 There are people who, along with that,  
3 believe that the SCBA is not a backup system. And  
4 we spent the last two years on the NFPA technical  
5 committee looking at -- looking at maybe some  
6 potential backup systems in the forms of APRs.

7 And really, in our last meeting, we  
8 decided it really was the wrong way to go. That an  
9 APR wasn't the solution. That supplied air is the  
10 solution or what is needed for the firefighter who  
11 gets into trouble. And we are trying to be able to  
12 create a solution which might push us in that

13 direction.

14 Next slide.

15 So what's the problem with air management?

16 Well, air management basically came about because we

17 recognized three things. We said your working

18 environment varies. Your air consumption varies.

19 And exit time.

20 So basically it says that, Hey, the 25

21 percent in the end-of-service life in here probably

22 isn't right, probably isn't adequate, so let's not

299

1 pay attention to it. Let that be the reserve air,

2 and let's leave before it.

3 And I think it's a -- conceptually, it's a

4 good concept, and it may work in some places. But

5 the problem is that it takes a positive control

6 factor, a mechanical alarm, which is not very error

7 prone, and it puts it in -- it replaces it with a

8 human solution, which is error prone.

9 And why I say it's error prone, I guess

10 it's because it relies heavily on good situational

11 awareness and also the lack of human error, which

12 incidentally are cited as the two number one issues

13 or two of the top issues with firefighter injuries

14 and fatalities in a recent report that was done

15 looking at firefighter injuries.

16 As well, if you read the NIOSH fatality

17 investigations, it is continually cited as poor

18 situational awareness, poor air management are

19 factors contributing to line-of-duty deaths.

20 But situational awareness is defined as

21 the degree of accuracy by which one's perception of  
22 his current environment mirrors reality.

300

1 Next slide.

2 It's affected by your view of the  
3 situation, incoming information, expectations, and  
4 biases. And it's reduced by the things over there  
5 on the right, insufficient communication, fatigue,  
6 stress, task overload or unload, degraded operating  
7 conditions.

8 Everything right there on the right,  
9 that's my work environment.

10 So everything that the firefighters are  
11 doing degrades our situational awareness, and it's  
12 no wonder that we have problems maintaining good  
13 situational awareness. But to put on top of that  
14 the responsibility to try to be able to gauge when  
15 is the right time to leave, really, it results in  
16 firefighters fatalities, as we see.

17 The reality of air management. Again, it  
18 relies on a high degree of situational awareness.  
19 It's subject to failure due to human error, unknown  
20 factors. Unknown factors might be things like  
21 building construction, modifications, or alterations  
22 to a building, catastrophic events that may occur,

301

1 structural failures or collapse.

2 It doesn't take those into account.

3 A human solution for mechanical  
4 deficiency, which is really an alarm which goes off

5 too late for us. And, again, it replaces a positive  
6 control system, the EOSTI, with an error-prone human  
7 solution.

8 Next slide.

9 So how do we add more reserve air? The  
10 current regulation basically gives us a couple of  
11 options. We can either increase the time in the  
12 hazard zone by going with the larger cylinder, but  
13 it probably doesn't give us an adequate exit time  
14 even at that.

15 Human monitoring prior to alarm, which  
16 would be air management concept. Okay?

17 In either case, if we add more air to the  
18 back of our cylinder -- or onto our backs in the  
19 cylinder, we risk getting additional work stress and  
20 other work period issues.

21 What we are requesting, basically to  
22 propose changes that we remove the ceiling from

302

1 EOSTI and allow us to determine an earlier set  
2 point.

3 Next.

4 Some of concerns that get raised when we  
5 talk about adding more air, too much weight and  
6 bulk. That's one you hear a lot of. Although it  
7 needs to be noted that the size and weight of our  
8 cylinders has gone down considerably in the last 25  
9 years.

10 And, actually, they are due to have some  
11 other big changes. There is new cylinder technology  
12 which is being worked on which will reduce the size,

13 the weight, the profile significantly more.

14 Also, too much air. Again, a concerned  
15 firefighter will ignore the alarm, go in too deep.  
16 It is very important to stress that in no way am I  
17 suggesting that we need to add more air for work  
18 period, that we actually want the air to be set  
19 aside just for the escape purposes.

20 Next slide.

21 Some of the work period issues if we were  
22 to use more air, some of the things that we would be  
303

1 concerned about if we added more air back and it was  
2 intended for work, is that the -- certainly more  
3 work stress, cardiac stress. Thermal stress on the  
4 body, which also will cause greater cardiac stress.  
5 How deep we are going into structures, and fire  
6 progression, what is happening with -- if we stay in  
7 longer.

8 structural failure. And within all of  
9 that, really, there is a fire ground rule of thumb  
10 which is touted in many books and has really been a  
11 tradition of the fire service that has been passed  
12 on, and that's that, Hey, when the bell is going  
13 off, that's the incident commander's time to really  
14 assess and see, Hey, how are we doing? Making  
15 progress. If we are not, maybe we need to think  
16 about changing our strategy.

17 And so we don't really want to expand that  
18 window because what happens if we do? What happens  
19 as far as the structure? What happens as far as the  
20 depth of entry and things like that? So our work



21 period is probably appropriate.

22 And some work stress studies that been

304

1 done within the last three or four years also  
2 indicate that really about 900 to a thousand liters  
3 of air by volume is probably an appropriate work  
4 period for a firefighter, regardless of whether it  
5 is a large individual who is physically -- or large  
6 individual who may not be physically fit, or a small  
7 individual who is physically fit, or either way  
8 around, the volume is the volume. And if we start  
9 working beyond that volume, we start seeing the  
10 cardiac markers saying that we have worked too long.

11 So what are the benefits of adding more  
12 air and keeping an earlier EOSTI, basically keeping  
13 the work period the same? We have a larger exit  
14 window. We have a larger window for self-rescue or  
15 rapid intervention, reflex time, to get to us.

16 The work stress, depth-of-entry concerns,  
17 all of those concerns are able to be kept in check,  
18 and we are able to meet our local needs for what we  
19 want to -- what we want to achieve in keeping our  
20 people safe basically.

21 Just a few points to clarify.

22 what we are trying to do here? We want

305

1 the authority of having jurisdiction to be able to  
2 specify an EOSTI greater than 25 percent.

3 And that was another point. I know that  
4 in the handout, we have mentioned 20 percent as a  
5 rule. I don't know that -- most of the fire service

6 and most SCBAs that I'm familiar with, the EOSTI  
7 goes off at 25 percent and remains alarming through  
8 the end. But 20 percent is probably pushing it, if  
9 we lowered it from there.

10 But, again, it's not the program manager.  
11 It would be that we would be able to specify it, and  
12 the manufacturer would have to meet that.

13 It allows the fire service to address --  
14 go back a second -- allows the fire service to  
15 address its escape time needs without increasing the  
16 work period and allows us to determine the  
17 appropriate set point.

18 In the absence of a consensus standard,  
19 which says that -- what is the appropriate set  
20 point, because that point was brought up, that maybe  
21 the NFPA or I think we mentioned the IFF needs to  
22 determine what is the appropriate set point.

306

1 In the absence of that, the local  
2 authority should have the ability to do it. I think  
3 it becomes problematic if we try to say that this is  
4 what it should be. That's how we got into kind of  
5 the mess we are in right now, is that there is too  
6 many variables that are out there if we try to stick  
7 with a percentage.

8 I like Dave's suggestion that we use -- we  
9 determine what is a reasonable exit period. what is  
10 a reasonable escape time as well as a reserve air,  
11 and that sort of solution may well be a good  
12 direction to go in the future.

13 Next slide.

14 Here is things that we are not trying to  
15 do, that any change really shouldn't do.

16 It shouldn't require you to change from  
17 your current EOSTI set point. We do not want to  
18 give individual firefighters, the department, the  
19 ability to adjust the EOSTI set point in the field.  
20 And we don't want to define -- I'm not trying to  
21 define the EOSTI beyond the minimum level.

22 This is just a quote taken out of the US

307

1 Firefighter disorientation study in 2001 -- or  
2 actually, it was a 2004 study.

3 Because of disorientation, firefighters  
4 frequently exceed their air supply in efforts to  
5 evacuate these extremely dangerous structures.

6 The picture there actually is the wooster  
7 cold storage building. Six firefighters died in  
8 that fire there after becoming lost.

9 So that's all I have.

10 MR. SZALAJDA: Any questions for Dave at  
11 this time?

12 MR. WELLS: Jesse Wells, NOVA Chemicals.

13 So, yeah, you should have gone first.

14 So given that we are not changing them in  
15 the field, my previous comments would have been I'm  
16 sure recorded as, you know, a don't do that, you  
17 know, a disagreement with their suggestion.

18 So at this point, with this information, I  
19 don't disagree with allowing them to order an SCBA  
20 with a higher set point.

21 what I don't want to let pass by is I

22 think Dave has presented a good enough information

308

1 that somebody, whether it's NIOSH, OSHA, somebody,  
2 needs to take a realistic look at what should that  
3 minimum set point be, whether it's an amount of time  
4 or percentage of the bottle.

5 Perhaps it is time for us to take a real  
6 critical look at that and decide what actually is  
7 the right alarm point.

8 MR. SZALAJDA: Thank you. That's a good  
9 comment.

10 And I think one of the things that kind of  
11 struck us, at least with regard to listening to the  
12 dialogue is I think one of the things that you may  
13 see with the evolution of our standards is going  
14 more away from time to capacity.

15 I think if you look at the closed-circuit  
16 technologies, where the standards are mature or  
17 maturing, that we have gotten away from the two  
18 hours, you know, 45 minutes, and gearing it more  
19 towards the capacity of the system.

20 And sitting here and listening to the  
21 discussion, it seems to me that -- I think what  
22 Dave's comment was earlier, you know, regarding

309

1 determining that volume, the volume that's  
2 necessary. And that may be, you know, capturing  
3 that information in terms of capacity may help  
4 identify the proper level.

5 MR. BERNZWEIG: Let me just add one

6 more -- when you talked about earlier the industrial  
7 versus fire service and whether a need to identify  
8 it or pull it out separately, and I really don't  
9 have much of an opinion on that.

10 If there's a different need in the  
11 industrial sector to break it up, and maybe it is as  
12 easy as the rulemaking, recognizing that for fire  
13 service SCBA instead of minimum set point.

14 But I'm really not looking to do anything  
15 other than just allow people to set it earlier if  
16 that's what they want to specify, if they can  
17 justify it and do it that way.

18 MR. BERRY ANN: And I would like to  
19 address the authority jurisdiction. What you said  
20 is consistent with what I intended to say. So if I  
21 misspoke, I apologize.

22 But the intent was it would be the local 310

1 jurisdiction to determine what setting they thought  
2 would be appropriate, not necessarily to be doing  
3 the settings, but that they would -- and the issue  
4 is still, How do you determine what that upper limit  
5 or what the, you know, that the settings at some  
6 unknown value potentially is repeatable and  
7 accurate.

8 MR. BERNZWEIG: Right.

9 MR. BERRY ANN: Even if it is done by the  
10 manufacturer.

11 MR. WELLS: Thank you.

12 MR. SZALAJDA: Thank you. Are there any  
13 other comments on this topic before we move into the

14 final presentation?

15 I think the battery is going on the remote  
16 microphone. It is probably time to quit.

17 Just a couple of things. One on the  
18 administrative notes, the survey. If you have the  
19 survey, if you still have it with you, if you could  
20 fill it out and just pass it towards the center  
21 aisles. Or, if you want, there is a box on the way  
22 out. You can put the survey in the box. And, you

311

1 know, we will collect them from that point.

2 Also, with the name tags, if you are not  
3 inclined to want to take it home for any reason, if  
4 you could put it in the recycle bin and we can reuse  
5 it for the next public meeting, we would appreciate  
6 that.

7 Just a very few brief comments. And I  
8 think just keep in mind keep and keep an eye out  
9 with the Federal Register notice here in the next  
10 several weeks with regard to the near term standards  
11 development efforts for the closed-circuit escape  
12 respirator and QA modules.

13 Items that we discussed today and that we  
14 are actively looking for comment, please go to the  
15 document for comment page on the NIOSH website. And  
16 there are links, specific links there to some of the  
17 material that was discussed today for the PAPR, for  
18 the air-fed ensembles and also for the EOSTI.

19 Near term, we will have information up  
20 regarding the personal protective technology action  
21 planning effort.

1 we are looking at a mid April -- I think it is  
2 either the 15th or 16th due date for submittal of  
3 comments. And that I would ask that you try to  
4 submit your comments by -- within that time frame,  
5 so we can take the steps with regard to either  
6 finalizing the proposed rule or developing our next  
7 iterations of concepts for developing the standard.

8 And I think, John, if we could jump -- the  
9 next few slides relate to the docket comment, or how  
10 to provide information to the document. If we could  
11 go to the save-the-date slide.

12 For those of you who are still here,  
13 somehow -- I don't know how it happened -- but I  
14 made an error when I put together the slide.

15 I think it was probably because the  
16 stakeholder meeting last year was on March 6, and I  
17 must have had in my mind. The stakeholder meeting  
18 upcoming in this venue is going to be on March 3,  
19 and I'm sure there will be additional information  
20 forthcoming over the next several weeks with regard  
21 to the content of that presentation.

22 But if you can change your handouts to 313

1 reflect the March 3 date, I would appreciate it.

2 And with that, are there any other general  
3 questions or comments with regard to the content of  
4 today's meeting?

5 MR. WELLS: Jesse Wells, NOVA Chemicals.

6 We have moved on -- we were ready to move  
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7 on with the discussion about air-fed suits, so just  
8 a couple of things.

9 I don't know if manufacturers intend to  
10 bring these forward, the way that chemical  
11 protective garments are now where they are tested  
12 against a battery of chemicals and you are either  
13 rated well against this chemical or not.

14 But if so, then the idea of having gloves  
15 that come off and you change the gloves -- and I was  
16 part of this discussion earlier, this side  
17 discussion earlier.

18 If you are going to have an air-fed suit  
19 that you are going to use against chemicals, then if  
20 you breach your glove, you breach any part of the  
21 suit, now you have depreciated your breathing  
22 apparatus. So that suit to me is the same thing as  
314

1 a Level A ensemble for a hazmat response. And my  
2 belief is that the gloves should be built in, that  
3 it should be an ensemble instead of a suit.

4 My other question is at -- the one that we  
5 saw over here, next door. Some of the discussion  
6 was about having like work boots inside the suit.

7 So my concern with that would be work  
8 boots inside of a suit against a hard surface, and  
9 now you are grinding that suit material underneath  
10 while you walk.

11 Some kind of boot cover or maybe a built  
12 in boot or some kind of hard sole so you don't have  
13 to wear a work boot under it might be more  
14 appropriate.



15                   That's it.

16                   MS. SHEPHERD: Can you hear me?

17                   This a really good comment about the boots  
18 wearing through the base. And so we have actually  
19 gone back and built in some very stringent abrasion  
20 and slip resistance requirements, especially if you  
21 are wearing your suit over your boots. And you  
22 actually have to test -- if you are using a boot and  
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1                   then an overboot, you actually have to test it in  
2 that formation.

3                   So that's a good comment.

4                   The question earlier -- if you don't mind  
5 me going back one second. The question earlier  
6 about have we vetted, have we surveyed any users, I  
7 actually should have mentioned, for those of you  
8 that are not familiar with it, ASTM F23 is made up  
9 of users, a number of the manufacturers in this  
10 room, academic institutions, government institution,  
11 other special interests.

12                   So we have vetted it through, you know, a  
13 wide number of users. We also did, as I mentioned,  
14 the presentation at AIHCE. So we have gotten a lot  
15 of user input in on the standard. So we haven't --  
16 we are not doing this blindly. We have a gotten a  
17 lot of input.

18                   MR. SZALAJDA: Thank you, Angie.

19                   I guess one other thing. I just wanted to  
20 thank everybody for being patient with us as far as  
21 trying to use the LiveMeeting capabilities. And I  
22 think overall, it is going to provide -- you know,

1 the more we do it, the better we are going to get  
2 at, you know, being able to address the use of the  
3 technology. And I think by the time we come around  
4 to our next stakeholder meeting in March and  
5 subsequent meetings in 2009, we will get more  
6 proficient at it.

7 But thank you for bearing with us today on  
8 the use of this new technology for us.

9 So with that, any more questions?

10 All right. Well, thank you very much for  
11 your attendance, and we will look forward to seeing  
12 you at the next event.

13 (Whereupon, the proceedings in the above  
14 matter were concluded at 4:47 p.m.)

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## CERTIFICATE OF REPORTER

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I, Joseph A. Inabnet, do hereby certify  
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12 employed by the parties thereto, nor financially or  
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Joseph A. Inabnet  
Court Reporter