

Centers for Disease Control  
Mine Safety and Health Research Advisory  
Committee (MSHRAC)  
Committee Meeting  
Wednesday, November 13, 2019

The meeting convened at 8:45 a.m., in the Atlanta Marriott Northeast/Emory Area, 2000 Century Boulevard N.E., Atlanta, Georgia, Dr. Priscilla Nelson, Chairperson, presiding.

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Present:

Priscilla Nelson, Chairperson  
Ronald Bowersox, Member  
Jefferey Burgess, Member  
Melanie Calhoun, Ex-Officio  
Thomas Harman, Member  
Robert Horn, Member \*  
Kramer Luxbacher, Member  
Michael Wright, Member  
Kyle Zimmer, Member \*  
Jeffrey Welsh, Designated Federal Official

NIOSH Staff Present:

Tim Bauerle  
Donovan Benton  
Amia Downes  
Kelley Durst  
John Howard \*  
Jessica Kogel  
Douglas Johns  
Jacob Carr  
George Luxbacher  
RJ Matetic  
Bob Randolph  
Randy Reed  
Todd Ruff  
Lisa Steiner

Also Present:

Mark Ellis, Industrial Minerals Association - NA  
Monty Cooper, Crowell & Moring LLP

\*Participating via telephone

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## Day 1 Proceedings

(8:46 a.m.)

### Introduction, Announcements, Approval of Minutes

Mr. Welsh: Good morning, I would like to get started with our fall MSHRAC meeting. For those that don't know me, I am Jeff Welsh, the DFO for MSHRAC. I would like to welcome everyone in the room and on the phone, and especially several guests in attendance, Gladys Lewellen and Chris Langub from the CDC Federal Advisory Committee Management Branch who help out with administration and operation of our committee. So I appreciate both of you coming to the meeting.

And we have some other guests, Mark Ellis from Industrial Minerals - North America, and Monty Cooper from Crowell & Moring. Also, Kelley Durst, NIOSH Deputy Director for Management is here.

Just a couple housekeeping notes: If there would be an emergency at the hotel, go out the door in the back of the room and proceed straight ahead to the exterior of the building.

For the restrooms, go out the door in the back of the room, turn right, and they are on your right.

Pauline Benjamin, who does so many things for the administration of MSHRAC is here, and is helping out with lunch for today. She will be getting your lunch order.

Next, before turning the meeting over to our chair, Priscilla Nelson, I need to confirm that we have a quorum for the meeting, which is eight members. So members, as I read your name, please confirm that you are present.

(Roll call.)

Mr. Welsh: We do have eight members in attendance, so we do have a quorum. This is an official meeting.

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The last item I want to mention and remind all committee members is that if there is a conflict of interest that comes up for you during the discussions, please declare that there is a conflict and recuse yourself from any discussion or any voting on that matter.

I will now turn the meeting over to our chair, Priscilla Nelson.

Chair Nelson: Great. Thank you very much.

We have a full agenda but I want to start off by just congratulating the mining program on the external review. I think it was very interesting to read through and you got really good input from everyone. So I'm looking forward to hearing the presentation and we be able to add our two cents and that was wonderful.

So welcome to Atlanta.

The first item on the agenda is the approval of minutes. These were circulated to everyone some time ago. I gave my direct input. I assume that you have all done so as well, if you had any.

Can I have a motion to consider these minutes for approval?

Dr. Luxbacher: So moved.

Chair Nelson: Seconded?

Mr. Bowersox: Second.

Chair Nelson: Thank you, Ronald.

So any discussion, any additional input to those minutes?

Okay, hearing no discussion, we will call the vote. All those in favor of approving the minutes say aye.

(Chorus of aye.)

Chair Nelson: Those opposed, nay.

(No audible response.)

Chair Nelson: All right, the minutes are approved. Thank you very much.

We are a little bit ahead of time but ready to -- if John Howard is on the phone. John, are you there?

Dr. Howard: Yes I am.

Chair Nelson: All right, John. Thank you for being here, and we would love to hear your opening remarks.

NIOSH Director's Opening Remarks by John Howard

Dr. Howard: Well thank you very much, Dr. Nelson. I'm sorry I can't be with you there in Atlanta. And I also wanted to give a shout out to the mining program for the success that they had with the external review. You know as we all know, there is a lot of preparation that goes into the review by the program, not only in the years of achievement in terms of getting to a certain point to be able to present findings but also just putting together the various aspects of the review that has to happen in interfacing in a presentation style with the committee. So I wanted to give a shout out to the Mining Program for doing that and also there are some terrific scores that they got.

So thanks for bringing that up, Dr. Nelson. I appreciate it.

So just on the budget, as you know, we are in a period of continuing resolution, which expires November 21st, next Thursday. So the Congress is planning to extend the CR, I think, until sometime in December, although Kelley Durst sitting there may know more than I about the exact date but that is what I have been able to hear.

The House did manage to do a Labor HHS bill, which was very favorable for us, proposing a \$10 million increase over FY2019 budget of \$336.3 million.

Specifically, they are proposing \$59.5 million for mining research, in addition to increasing monies for ERCs, the Ag Centers, the Total Worker Health Centers, and other undisclosed, unspecified \$3 million.

The Senate, in their work on the same bill, is basically the flat FY2019. We'll see what happens as we go through time here in the next CR and then what they're going to do in terms of finalizing the Labor/HHS bill.

Just in terms of new programs, I will mention the Firefighter Cancer Registry, which is the statute that the President signed last year, and we have been working hard on this new registry for Firefighters. And another FACA that we have, the Board of Scientific Counselors is forming a subcommittee that will help bring stakeholder input to that program.

I'll mention, as I mentioned previously, our effort in opioids prevention area and opioid use disorder prevention. First of all, some of you are aware that we worked on a Naloxone employer availability program which, on our website, has been well received and workplace solutions on medication-based or medication-assisted treatment.

A third area that we are probably going to put out an RFI on is this evolving concept of recovery-supported workplace. So the concept of recovery-supported workplace is a little different than the late '80s drug-free workplaces, zero tolerance kind of paradigm that we have been living through for several decades. And we are very interested in this area and, as I say, we are probably looking at an RFI to get some more information about this.

There are a number of employers that are starting to look at such programs for a couple reasons. One is the issue about ensuring that workers are well-supported in all of the activities that could involve substance use, including prescribed and un-prescribed, in terms of the labor shortages that are out there. And second and thirdly, the number of

States that have passed recreation and medical cannabis use, which has really been a problem for the methodologies that are in the drug-free workplace program that employers have relied on, which is drug testing. As we know, cannabis metabolites can exist for up to 30 days after use.

So a recovery-supported workplace concept is emerging more and more, and we want to explore that.

The other programs that I will just mention is a future work initiative that we started. You know across every program, including the Mining Program, Dr. Kogel and others have talked about, we are trying to figure out where the future of work, where the future of the workforce, where the future of the workplace is going because we want to be prepared for those changes.

Clearly, a lot of issues are impacting the workforce, including what the international labor organization called Diverse Work Arrangement and issues involving the workplace, too, but mainly what is driving a lot of it is that work is changing from a technological standpoint. And we have had a number of programs in this area, like our nanotechnology research center, now our robotics research center, we have an advanced manufacturing interest sector, and artificial intelligence intersection.

So we are putting all that together in a future work initiative that we can display both publicly, as well as providing some consolidation and coherence to all the programs across NIOSH.

So that's basically a short summary of where we're at here in terms of the program.

I wanted to end by thanking you, Dr. Nelson. I understand that this may be your last meeting. Is that correct?

Chair Nelson: Yes, it is going to be my last meeting.

Dr. Howard: Well, I wanted to personally thank you for holding us altogether and doing such a great job and to extend our appreciation to you.

Chair Nelson: Well, thank you very much, Dr. Howard.

We can open it up to questions, if anyone has any.

I would like to just bring up one thing that is somewhat related to your last point -- I think two observations. One is I have been running through SME a survey of the U.S. programs in mining engineering and the number of enrollment -- the graduation has gone from around 400 students in 2015 to around 200 students in 2019 and this is a precipitous drop. And the concern for the workforce of the future has to do with getting people who choose to move into the mining industry as a place to develop their career.

And in combination with that is the observation of diversity in the student body. Many universities right now are running what variously could be called DI&A, Diversity, Inclusion, and Access kinds of programs because I think -- I know at Colorado School of Mines, the diversity of our undergraduate enrollment is about always ten percent less than the overall school, which is fairly typical for engineering schools.

So there is a pretty significant concern that I have about exactly what can we do in these fields, such as heavy construction, mining in this industry to actually figure out who is going to be the workforce of the future under these circumstances.

I don't think we've really talked about it in the context of MSHRAC in the past, really, and the NIOSH programs are really focused towards the graduate programs in mining and developing that workforce component.

But the question about actually getting the undergraduates to come into mining and into the

heavy construction industries is a problem because this is a continuous pipeline and, if we have a break in the pipeline, we have a break.

So I don't know whether you have any comments about that but I think maybe that is something just to be thought about by MSHRAC in the future.

Do you have any comments on that, Dr. Howard?

Dr. Howard: Well you know, I probably am the least informed about how to do that, given all the expertise in the room there, so I am going to let others take that issue.

Chair Nelson: Okay. Anybody want to add anything there or raise another question for Dr. Howard?

Okay, Michael Wright.

Mr. Wright: Yes, John, I've got another comment about another part of your presentation, and this is not mining specifically but the work NIOSH is doing on emerging technologies is really superb.

We did a workshop at a conference we had back early September, in which we talked about emerging technologies and we included robotics, 3D printing, artificial intelligence, nanotech, and synthetic biology. We had about 80 participants from our local unions and the first thing that I did was ask for a show of hands for people who had those in their workplace already. And every single one, including synthetic biology, had at least one place where it was already being used. So it's really important work and this stuff is coming faster than we imagined.

Dr. Howard: Oh, I would certainly agree. In fact, I use the term the future is now because we are seeing the emerging presentation of these issues. These are very exciting technologies that industry is putting a lot of R&D into. And there are a lot of R&D workers who are involved in that side of it where we think well, gee, it hasn't actually come out in terms

of implementation, industrial processes. A lot of times some of the synthetic biology, especially, is sort of you know in an academic center or an R&D biological or pharmacological type of setting.

But you are exactly right and we are always a little behind in keeping up with all of these things from the Occupational Safety and Health perspective but, unless we start now, we are always going to be behind.

So there is a lot of interest across NIOSH. I think our young scientists are just primed for this kind of work.

You know the balance issue is always important and I appreciate your comment about that we are doing a good job in this area but you know we have these old historical-type hazards that we still have to pay attention to. So you know how much effort you put into the new versus how much effort you continue to do on the historical debt, that is always a challenge for a limited allocation in terms of a budget.

But I appreciate your comment. Thank you.

Mr. Wright: Yes, well sometimes the old traditional hazards are part of the new technologies. One of the things that we've been working on, for example, in the plants that do 3D printing is combustible dust. And you know we go in and we find that nobody's thought about that.

Dr. Howard: Exactly. And you know in advanced manufacturing you are dealing with the solvents that we've known for decades. It's just that a lot of the metals that we've known, the metal oxides, are in a nano form you know that they are charged in terms of these 3D printers.

So you're exactly right. You know it's sort of new uses of old stuff.

Chair Nelson: And in the transition from a human

workforce for productivity to partial, that transition is where a lot of the incidents are happening. So it's an issue of people and equipment being together in places they never have before.

Any other comments or points to be raised?

Mr. Horn: Yes, this is Bob Horn. The question I've got for you guys and you have much more expertise with the relationship than I do, is where the future employee will be mining specific minerals. And with different changes in carbon emissions, is it necessary or how do you keep the process going in such a way that advances the technology?

Dr. Howard: Well, I have got to refer to Dr. Kogel on all the mining issues of the future.

Chair Nelson: Well I think I just came from a meeting where many of these issues are discussed by a lot of the people in industry and, frankly, anticipate 20 years from now what the industry might look like. I think there is some thought about exactly what that would look like with renewable energy, complete transition to non-diesel, and everything else. But envisioning what is going to happen between now and then is really difficult.

There is a lot of experiments going on and I'm not sure we always understand what happens in the experiments in different minds. So any additional communication of some sort and gathering data would be interesting.

Dr. Kogel: So I think my answer to these questions, which are all really I think important things that we've been thinking a lot about will come out when I give my presentation and some of the presentations today because it is very much what this meeting is about those sorts of discussions and getting input from MSHRAC, as far as how we should be dealing with these really major issues. Because I think every meeting when we come -- when we talk about the transformation that is happening across all sectors, but particularly mining

and how do we position ourselves as NIOSH to be able to meet the challenges and stay relevant to the stakeholders and on top of what the issues are. So this kind of discussion is very important and I think over the next day and a half, we will probably touch on many of these topics. I don't think we're going to come up with concrete solutions.

These are big, ongoing, fascinating, as Mike said, issues but I think our awareness of them is you know the first thing that we have to tackle and the second is putting this together.

Mr. Horn: Yes, I didn't expect an answer but I just wanted to bring the issues to the table.

Dr. Kogel: Yes, no, I think that's wonderful and I think that's what we want to hear. We want to hear what's on MSHRAC's mind and what the issues are that we need to make sure, one, are on our radar; and then we need to go back and think about how those impact health and safety; and then what role we can play to start addressing them.

So thank you for bringing it up.

Mr. Horn: I appreciate it.

Mr. Welsh: And Robert Horn, welcome. I'm glad you were able to join us.

Mr. Horn: Thank you.

Dr. Kogel: Yes.

Mr. Horn: Thank you.

Mr. Welsh: And has Aubrey or Richard joined, too?

Chair Nelson: Okay. Well, nice to meet you, Robert.

Any other points for Dr. Howard?

All right. Well, it seems like we're ready to move on. John, thank you so much for your discussions today.

Dr. Howard: Thank you very much and thank you,

Dr. Nelson, for your contribution to MSHRAC. And we look forward to keeping in touch.

Chair Nelson: That tends to happen. Have a good day.

Dr. Howard: Thank you and have a great meeting, everybody.

Chair Nelson: Thanks. Thank you very much.

Okay, we invite Dr. Kogel to give a report from NIOSH Mining.

Report from the Associate Director for Mining by  
Jessica Kogel

Dr. Kogel: Well good morning, everybody. So it's going to be very much the same sort of format that we follow every meeting. I'm going to start by kicking off the next day and a half with some brief overviews of activities across the Mining Program and also in my office since the last MSHRAC meeting. So that's where we will begin.

But before I do that, I just wanted to mention that there have been some leadership changes and I would like to welcome Doug Johns, who is here for his first MSHRAC meeting. He is the Division Director for SMRD and he took over on October first. So, welcome.

Todd Ruff is still with us. We had the opportunity to move Todd into a position that he has a lot of passion for. Todd very ably served as SMRD director for several years. During that time he put the organization on a good path and I want to thank him for his service as Director for the past two years.

He was interested in returning to a science role. So he is now the Associate Director for Science at Spokane and is still very much part of the leadership team. I also asked him to spearhead and take on the new and emerging technologies in

automation research effort that we are embarking on. You will be hearing from him later today.

Chair Nelson: So Bob, are you able to hear Jessica okay?

Mr. Horn: Pardon me?

Chair Nelson: Can you hear Jessica okay when she speaks?

Mr. Horn: It is a little bit difficult but I --

Chair Nelson: So maybe -- is that a mike pickup?

Mr. Welsh: There is a mike up on the lectern.

Dr. Kogel: Can I move it?

Mr. Welsh: Yes, you can move that wherever you want.

Dr. Kogel: Okay. Is that better, Bob?

Mr. Horn: Yes, that's better. Thank you.

Dr. Kogel: Okay. Thanks for asking that, Priscilla.

Mr. Horn: I appreciate it.

Dr. Kogel: Okay. So with that, let me just go ahead with my presentation. I am going to cover a number of topics. I won't say much about the budget because Dr. Howard covered that pretty well. But what I would like to focus on are a couple of slides about some funding trends that have implications for the decisions we make around hiring, as well as research funding. So I just wanted to make MSHRAC aware of some of that and some of our thinking around those particular issues.

I will give you an update on where we stand with the reshaping, what the current status is. And then I also want to share with you some ideas and thoughts that we have about how we are going to manage partnerships going forward. Partnerships, as you know, are very important to the work that

we do and we have reached a critical capacity in terms of how many of them we can manage well and there are more that we want to bring online. I would like to get the committee's feedback on what we're thinking.

Then, I will give you an overview of where we're heading with research priorities for FY21 for our Intramural Research Program. And then I am just going to conclude with a brief slide that highlights some of the other major activities that you will be hearing about from other speakers during the next day and a half.

You have just heard from Dr. Howard that we are currently operating under a continuing a resolution for at least another week. And Kelley, I don't want to put you on the spot but I think Dr. Howard mentioned you may know more about the details of the CR.

Ms. Durst: Yes, I can't add much more. You know it is my understanding that it will be a short-term CR that we go into for two weeks but I haven't heard a specific date.

Dr. Kogel: Okay. So I guess we'll stay tuned. We'll find out what happens.

The other thing I wanted to mention, back in August there was a two-year nonpartisan deal signed to cap spending levels in the Government. And Congress must still pass that so that's just some other budget activity that is happening in the wings, so to speak.

Let me move on to some of the specifics around the Mining Program. I've presented a similar slide at past MSHRAC meetings and you know our funding levels have been more or less flat for a number of years in the Mining Program but we have had increasing costs particularly around wages and benefits. As wages and benefits go up, discretionary funds available for research go down. And so that is what this slide shows and we see that trend, even as the number of FTEs are decreasing over the

same time line.

Chair Nelson: Can I ask just one question?

Dr. Kogel: Sure.

Chair Nelson: Are those FTEs allocated or filled?

Dr. Kogel: These are the filled FTEs.

Chair Nelson: So you have additional spaces that can be filled?

Dr. Kogel: Yes. Yes, we have quite a few vacancies. So as people retire, we do the best that we can to fill those but we can't keep up the rate of hiring to offset the retirement. So there are vacancies as well.

All of this is important to consider, as we go into the reshaping and stand up the new organization. So really what this says to me is that we have to be very deliberate and strategic in how we do our hiring. And I think it also really underscores the importance of the reorganization because a big motivation behind the reorganization is to make sure that we are being as efficient as we can be in how we use our resources.

The next slide shows hypothetical scenarios based on three different rates of hiring. What this slide illustrates is that we have to be very careful about how quickly we hire. We would love to hire and fill as many vacancies as we can but then there's the reality of maintaining good organizational health.

So as we move into establishing the new organization, we will be keeping all of these constraints, and factors in mind as we execute our hiring plans going forward.

I am sharing this to let the MSHRAC know that these are things that we are dealing with, that we're thinking about, and we are trying to manage them and stay within parameters so that we can sustain the organization going forward and balance all of

these different competing needs.

Chair Nelson: So what is the sense of percent discretionary as an access? What is that? In your mind, what does that mean?

Dr. Kogel: So for organizational health, we will have to try to keep it at 20 percent. That is the target.

Chair Nelson: So where -- I mean I see the 227 FTE but what does percent discretionary mean?

Dr. Kogel: So that's the amount of funding that would be available to, for example, to support research. At some point, you can spend all funds on salaries and benefits and then have no funds remaining for research, which is not a situation that we want to put ourselves in. So that's how we make sure that we've got adequate funds so that we can have a healthy research program.

Chair Nelson: Okay. So just for clarification, percent discretionary means the percent of your budget which is allocated for research.

Dr. Kogel: Yes and other things as well. It is not just for research. There are other things that discretionary funds are used for but research is where we were focusing to make sure that we have adequate research funds.

Chair Nelson: Thank you.

Dr. Burgess: So for the percent discretionary, does that include both extramural and intramural?

Dr. Kogel: Intramural, in this case, yes.

Dr. Burgess: Thank you.

Dr. Kogel: Yes.

Again, I need to emphasize that this is hypothetical and I made some assumptions to illustrate a point. These are not real numbers. This is a projection into the future.

All right, so let me move on to reshaping. Since the last MSHRAC meeting, we have continued down the path of reshaping. And as we've gone down that path, we've really focused on two concurrent activities, which are shown on this time line.

So the top one is basically the aspects of the reshaping that are centered around the nuts and bolts of the restructuring. We've made a lot of progress in this area. We have submitted a reorganization package and that package consists of a number of different documents. It includes, basically, a letter that describes the intent of the reorganization and a justification for it. There are mission statements for the new divisions. There's also a document that describes the old organization, the new organization, and then a crosswalk between the two.

This has required a lot of effort and time and I would like to thank George Luxbacher because he took the lead on preparing the package. We did several pre-consults with various offices within CDC, the NIOSH OD is also very much involved in this.

And we took feedback from the various pre-consult meetings, incorporated those into the package, went through a number of different iterations and then submitted it, officially, the third of October.

So now it has been submitted into the process and it's making its way through the process. We have cleared three initial steps in that process, which are listed here on the slide. I don't know if I have a pointer. Hang on. Oh, I don't know. Fingers work really well. I don't think you could hear me if I went up there.

Anyway, so we completed these three steps. Those actually went through fairly quickly and include reviews and clearance through a number of different CDC offices. The package is now sitting with CDC HR for review. We don't know how long this will take but that is where it is currently. Once it clears HR, it will then go to senior level review within CDC

for a final sign-off. And then after that, it leaves CDC and it goes to the Department of Health and Human Services. That will be probably a one to two-month process. Again, we don't really know.

I just wanted to give you some idea of what that time line could look like but we don't really know exactly what the time line will be. So that's why there are some question marks up there as far as when the actual approval will be taking place.

Once it is approved, then we can start implementing the new organization.

I mentioned there were two concurrent activities. The other set of activities are related to employee engagement and looking at ways to improve organizational effectiveness and really making the employees an integral part of this process. We've done a number of different things that are ongoing to meet this goal. I am going to talk a little bit about some workshops that we held this summer but we've also established communities of practice, which you will hear more about during the next day and a half, and we conducted 360 Reviews.

All of these activities are focused around communication and employee engagement. I have listed some of the various activities that I've already mentioned and some additional ones that we've been engaged in to promote both of these lines of interaction and really it is about building a culture of collaboration. I think that's something that we talked about at the last MSHRAC meeting and the importance of doing this because we are trying to do as much as we can with the resources that we have. So that means becoming as efficient as we can be, really optimizing what we're doing and we think the way to do that is through collaboration within the organization as well as outside of the organization as well.

So what I'd like to do is just talk a little bit about the workshops that I just alluded to.

We hired a third-party organization that came in and worked with employees and with leadership to put on workshops that were focused on generating solutions for solving problems that were considered crosscutting problems, crosscutting across both divisions. We wanted employee input on actionable solutions to address these issues.

We had excellent participation through both divisions and I think they were really quite successful. We're still in the process of taking the work that was done at the workshops and determining next steps. So this is an ongoing activity.

And there were four topics that were addressed by employees including communication collaboration, employee retention, and information flow. So that's on going.

Now I'd like to turn to partnerships. Currently we have five partnerships shown on the left side of the slide. And for those of you who have been on MSHRAC for a while now, you've heard a lot about our partnerships. Many of you have been involved in our partnership meetings as partners. They've been around for a number of decades and partnerships, I think, are really critical to the work that we do. They are a very, very effective way for us to share information across all of our many diverse stakeholders. And so this is something that we really believe on, we focus on, and we prioritize as an activity.

But we, you know I talk about limited resources and wanting to make sure that what we do we are doing very well and we can continue supporting it into the future. Well, we want to create more partnerships and we are at capacity with five. And so when we realized that there are two more that we want to create, we thought we had better take a step back and really think about how we should manage those going forward.

And so we started looking at the various options,

asked ourselves the question of do we want to retire some partnerships that may have reached their useful life and their intended intended goals. Are the partnerships that can be combined? Are there partnerships that need to be broadened?

So we asked all of those questions and came up with a plan and then, once we came up with our plan, we shared it with various key stakeholders. Some of you who are sitting on MSHRAC have already seen this because you are those stakeholders. After we gathered input from stakeholders, we developed a revised plan.

What I am presenting to you today is that revised plan and I would like to get MSHRAC's input. So this is what we propose to do for partnerships.

Currently we have the proximity detection partnership. That partnership is a very focused partnership in that it focuses on proximity and in underground coal mines. The proposal made by one of our key stakeholders was that we could take that partnership and expand it to include collision avoidance in surface mining operations. And so that's what we propose to do.

And then the next step is we propose to bring it in under the automation and new technology partnership, which we are in the process of forming. And so it would be a topic area or an activity under that broader umbrella partnership.

The rock dust partnership is probably nearing the end of the work that it was formed to do but the partnership will continue into the foreseeable future because there is still important work to be completed. And that partnership would be folded under the respirable mine dust partnership. And you may recall from the last MSHRAC meeting when we talked about how we were responding to the National Academy's report on respirable coal mine dust, that we were proposing to start a respirable mine dust partnership. That one also is in the process of being put together, in terms of a charter,

and partners. We hope to have that one launched sometime in the first quarter of 2020.

So that's the proposal --

Mr. Horn: Can I ask a question? And this is not a political question, it is more just how do you rate the partnership or age of ideas?

Dr. Kogel: I'm sorry, what?

Chair Nelson: How do you rate partnership?

Dr. Kogel: How do you arrange them?

Mr. Horn: No, no, no. Let me ask the question more specifically.

In the scheme of things of how you are planning for 2020, we have a presidential election, do you look at alternatives, depending on who is elected in relation to how it affects the mining industry or are we just assuming that the process in place now continues through 2020 and whatever happens there happens after the outcome of the election becomes a path?

Dr. Kogel: So the way the partnerships have historically formed is they've often been formed to address the regulatory agenda and you'll see that, actually, when you look at the topics.

Mr. Horn: That's right.

Dr. Kogel: So if MSHA, for instance, is going into rulemaking on a particular topic, oftentimes, that will generate a partnership. And that's how most of the currently active partnership topics were selected.

Now for the future, the automation and new technology, that is a topic that is just a very important topic. It's not related to rulemaking. The respirable mine dust, as I mentioned, is in response to the National Academy's Consensus report and the recommendations made from that committee.

Mr. Horn: Okay.

Dr. Kogel: So that's typically what happens.

Mr. Horn: Okay. I just didn't know. That's why I asked.

Dr. Kogel: Yes, thanks for the question.

Okay, so the next one is the refuge alternatives and that partnership, I think all the partners agreed that is one that is probably ready for sunset. So the next steps to sunset it are to go back to the partners in the partnership and have that conversation with the partners to make sure that the partners agree with that, and then to develop a plan with the partners as to a time line and how we will sunset it, and if there is additional work that the partnership needs to do before we end the partnership.

We are not going to close it down and walk away from it. This and all partnership will follow a planned sunset process that partners will be involved by providing their input and an understanding of their interest in this process going forward.

Chair Nelson: So the title standard, which is blue, is that implying that it is working towards something that is standard?

Dr. Kogel: I'll get to that in a minute and I will explain what that color coding means. No but that's a good question.

And then the bottom two, the breathing air supply and the diesel health effects partnerships will continue as they are. So you can see from the list of future partnerships on the right side of the slide that those just continue.

So Priscilla anticipated what I was going to talk about next. You see that there are two different text colors. One is referred to as standard in blue and the other is broad topical.

To give you a little bit of background. At NIOSH we have had lots of conversations about partnerships. We have partnerships across the institute. Many of these partnerships involve multiple divisions and offices within the Institute. So it's really important that we have a clear way of communicating about partnerships across NIOSH, itself.

And so we started defining what we mean by partnerships and determined that there are two sorts of partnerships at NIOSH. There are what I am calling standard partnerships -- that's my terminology -- and those are partnerships that are narrowly focused that typically only of interest to one program or DLO within NIOSH, for instance, within the Mining Program.

Then, on the flipside, there are partnerships that we call broad topical. These are broader partnerships in terms of interest across DLOs within NIOSH and the diesel health effects is an excellent example of that. That partnership includes multiple NIOSH divisions. And so that one is colored orange as is the respirable mine dust because that's going to include NIOSH Mining, the Respiratory Health Division, the Health Effects Laboratory Division and others across NIOSH.

When we get into these broad topical partnerships, we treat them a little bit differently. For all partnerships we develop a charter and for the broad topical partnerships, we also have the option of signing MOUs with partners. So they go through a slightly different process. I wanted to make everybody aware of the fact that we are refining and formalizing the way that we manage partnerships within NIOSH as a whole as well.

Chair Nelson: So regarding automation and new technology, and you said that's where collision avoidance and the proximity detection is, there is a lot of products out there. I just came from a meeting at Hexagon out in Tucson and they are marketing all sorts of proximity and collision

equipment. So this is already in the marketplace.

Dr. Kogel: Right.

Chair Nelson: So the issue becomes what is MSHRAC -- what is NIOSH doing --

Dr. Kogel: Right.

Chair Nelson: -- in this regard, when it's already --

Dr. Kogel: We're not developing technology. And you probably saw that was one of the recommendations that came out in the panel review. What we are focusing on are the research questions that NIOSH needs to be prepared to answer related to the implementation of automation and new technology in mines.

So basically we want to understand what are the health and safety implications of automating a work environment or having a mixed work environment where some the equipment is automated, some of it is not.

You know Kray might get a little bit into this when she gives her report this afternoon. That's why we had the workshop, to start helping us carve out what is the space where NIOSH needs to be active in this area.

So we're not developing technologies. We are simply focusing on the health and safety implications, what are the research opportunities, and what do we need to be doing to make sure that workers are safe and work environments are healthy as these new technologies are adopted?

And I think we talked a little bit about this when Dr. Howard and Mike were having their conversation about the 3D printing where it's some of the same old issues but in a new environment.

Chair Nelson: And that sort of begs -- maybe that is something that should be thought about for our capital because there is overruns. There is possible

(telephonic interference).

Dr. Kogel: That is possible, yes. Yes.

Chair Nelson: Is the silicate the particular work that came out that shapes the particle of silicates in the respirable mine dust?

Dr. Kogel: Yes.

Chair Nelson: It's not just standard coal. It's broader.

Dr. Kogel: It's everything. That's why it's not called coal dust. That's why it's respirable mine dust.

So I'm glad you brought that up because I want to make that point. Crystalline silica will fall under the Respirable Mine Dust partnership. So will elongate mineral particles and asbestos. It includes coal dust, DPM, whatever else we want to put in that category.

I like your comment about automation and new technology and making that a broad topical partnership because NIOSH has the Robotics Center and we have nano technology work that we are doing at NIOSH. So I think that is something we need to think about maybe changing that to a broad topical.

Chair Nelson: And it gets over into civil. They have a lot of the same issues in heavy construction.

Dr. Kogel: Yes, right. So I think that's a great point.

So anyway, now that I have presented this, I would like to just stop since I would like the committee's feedback on where we're going with this. Are there any other comments or feedback that you would like to give us on this?

Dr. Burgess: Jessica, when will you introduce the one or two new areas that you would like to include?

Dr. Kogel: They are the top two. So those are the

two -- so I guess I didn't finish saying what I wanted to say.

So we have five current partnerships and by making the changes that are shown in the middle gray shapes there, we will then, in the end, have four partnerships in the future and that include broader scope and some new topic areas; one being the automation and new technology and then the other being the respirable mine dust.

Dr. Burgess: Where would a potential health partnership fit?

Dr. Kogel: So that would be a third one and that's not on this slide right now. So that could be a third one.

So if you're recommending that one through your committee, we would add that to this slide.

Dr. Burgess: Thank you.

Dr. Kogel: You're welcome.

Chair Nelson: We won't have any discussion about that in terms of whether it's something that MSHRAC wants to make a recommendation on?

Dr. Burgess: It might be more appropriate to discuss that after the work group presentation.

Dr. Kogel: Okay, so I think that's what we'll do then, Jeff, and we can update that slide to include that one. And it would be -- if your question is where would that fit here, I think it would be separate is my current thinking but that could change after our discussion this afternoon but I don't see it as a natural fit within any of the other existing or proposed partnerships.

I think one of the things, and I don't want to take too much time because I want to hear what other committee members have to say, but one of the issues is as we start folding partnerships into other partnerships we create very broad partnerships in

terms of the topic areas covered by the partnership. There are some practical things that we need to think about in how we constitute and run a very broad partnership. We've got to hit the right balance.

So Mike, what did you want to add?

Mr. Wright: Well, the diesel partnership, which we're actually part of, I thought was not confined to health effects but was also potentially at least looking at technologies.

Dr. Kogel: Yes.

Mr. Wright: Okay. If I had say one research question which would have the most impact on minor exposures, it would be about the feasibility of different controls. That's the really not a health issue -- public health effects.

Dr. Kogel: So it got the name health effects because that's the name that stakeholders proposed. It is very technology-focused.

Mr. Wright: We know it's called the diesel partnerships.

Dr. Kogel: Yes. There was one called the diesel partnership. This is one that was formed about two years ago and stakeholders came to NIOSH, actually wrote a letter to John Howard and asked us to stand up this partnership and asked that it be co-chaired with MSHA. That's the history behind the name and the reason that it is co-chaired with MSHA. And actually, I should mention that some of these future partnerships could potentially be co-chaired with MSHA.

Before we stand up new partnerships, I meet with MSHA and we discuss if the partnership is best served by NIOSH and MSHA leading as co-chairs. The respirable mine dust partnership will be one of those that NIOSH and MSHA will co-chair.

Mr. Bowersox: So when do you expect those to start?

Dr. Kogel: I think in the first half of 2020. Both of them are fairly far down the path, in terms of getting the charters written, gathering together the list of potential partners, and those are the first steps.

So my hope would be that by the second quarter, if not the first quarter of 2020.

Mr. Horn: So when you're talking about partnerships, specifically, at some point are these partnerships that define the roles of MSHA and NIOSH in relation to product or how are they going to be informed?

Dr. Kogel: I'm not sure I got the very last part. So I heard about defining MSHA and NIOSH and then I didn't catch the last part.

Mr. Horn: I mean how are the jurisdictional issues going to be formed --

Dr. Kogel: Jurisdictional in terms of --

Mr. Horn: -- between NIOSH and MSHA?

Dr. Kogel: Are you talking about --

Mr. Horn: In relation to the partnership.

Dr. Kogel: Right. So how we actually govern work together to govern the partnership?

Mr. Horn: Correct.

Dr. Kogel: Yes. So we've been doing it with the Diesel Effects Partnership for the last two years and we are co-chairs. We work together to organize the partnerships. But the partners, themselves, really have the ownership. We just facilitate. And so the partners determine the agendas. The partners will invite the speakers. Actually, Mark Ellis is sitting here. He was involved in putting together the last

Diesel Health Effects Partnership meeting, which was last January and he can tell you more. We supported it administratively and assisted with logistics but he and his co-chair, Tim French, both partners representing different organizations within the partnership organized and ran the workshop. It's really up to the partners to develop these -- the agendas and the technical program. So that's how it happens.

NIOSH and MSHA put it on our websites. We provide support. And this how the roles are divided. And when I say we, that's MSHA and NIOSH so we have, on the MSHA and the NIOSH website, we have information about the partnerships including the charters. You can look at presentations that are published from partnership meetings and that sort of thing.

Does that answer your question?

Mr. Horn: Yes, that answers the question. My fundamental basis of the question was how does the outside world input -- I mean you've defined that now, too.

Dr. Kogel: Okay.

Chair Nelson: So any other comments?

Mr. Bowersox: Yes, I just want to go back to the proximity. I really do believe that these, on the surface, is going to be added accordingly because the haul trucks are much bigger, they're much faster.

Like Priscilla said, the market is already out there. So how -- it is unclear if I needed the operators to handle the equipment. I mean what part -- explain to me better.

Dr. Kogel: Our focus is on looking at the health and safety implications of the technology and bringing partners together, which could include the manufacturers, and the operators, and anybody that

has an interest. They're all invited to participate in these partnerships.

We bring everybody into a room. We talk about what the issues are. From that, NIOSH then will oftentimes develop specific research questions around health and safety issues identified by the partnership. We then do the research and bring the results back to the partnership. And through that process, oftentimes operators and/or manufacturers will adopt technologies or best practices, or whatever it is that NIOSH develops as a result of our research.

So it is a somewhat organic participatory process and you know the hope is that everybody can come to the table and adopt some of the things that we put out there. Now if there is a regulation that is coming, breathing down everybody's neck, then that's a different story.

Chair Nelson: So is big data, that aspect --

Dr. Kogel: Absolutely in there.

Chair Nelson: Because I can see automation and new technology just growing huge. And so come the case of if the partners are self-defining --

Dr. Kogel: Yes.

Chair Nelson: -- what the charter is or as it organically involves.

Dr. Kogel: So the charter probably won't change but the topics can, absolutely.

Chair Nelson: Yes, it can just go crazy.

Dr. Kogel: Yes, and big data is part of that. Yes.

So I'm looking at the time so let me just quickly finish up here because I'm just a minute over time right now. I want to end as close to on time as I can.

So this is the time of year we start thinking about the future and what our research priorities are for the next funding cycle. And every year, we put out a call for concepts internally. This is within our intramural program, where we invite concepts for research projects from our researchers. And when we put the call out, what we like to do, and we don't do this every year, we have particular areas that we consider high priority that we would like to see proposals on.

And so just quickly, I think everybody's aware of how we set our research priorities within the program by considering input from a number of different sources, including consideration of burden, and impact. We do this institute-wide. The policy and rulemaking agenda has a big role in determining what is going to be high priority. I think crystalline silica is a great example of that. MSHA put out an RFI about crystalline silica. Crystalline silica is a very high priority topic area for all stakeholders. I can make the comment that when I go to Washington to meet with stakeholders and I ask the question what's on your mind, what's your highest priority, for the first time since I've been in this role, I had the same answer from every stakeholder and that was crystalline silica. So that then means it's a high priority for NIOSH and it's one that we've got to be really engaged in.

We have a number of different avenues for collecting and gathering stakeholder input. I have listed those on the slide. This group is one of them. Individual stakeholder meetings are another. NORA Mining Sector Council, National Academy's Consensus Study reports, which I've already referred to are an additional source. Partnerships, which we just talked about are a big part of this as well.

And then also we just had our ten-year program review. There are recommendations that come out of it.

So there are multiple sources of input. The good news is that we don't, at the end of the year, have a hundred different really disparate stakeholder interests and priorities. They all tend to focus on very similar things, fortunately.

Chair Nelson: The NORA Mining Sector Council, how often does that meet and are you happy with those who meet, that group of people, the leadership change?

Dr. Kogel: Yes, so it meets every year at the SME annual meeting and we're working on ways to try to engage it more. Because we have MSHRAC and the NORA Mining Sector Council our situation is different than the rest of the Institute because their NORA Sector Councils function more like MSHRAC does for us. They don't have advisory committees that are dedicated to their sector program. And so we've got to be careful about not having our NORA Sector Council step on the feet of MSHRAC and vice-versa. So it is a little bit of a balancing act there.

It meets at SME and then there are activities that happen throughout the year and the number of those, the frequencies of those changes year to year.

But yes, we could improve things and we would like to see some improvements and we're working on that.

Okay, so this is just what went out in our call for concepts and I just wanted to highlight the emphasis. So the top two are general, just submit whatever you think is an area where you can have some impact. We want to hear about that. We want to make sure that whatever is submitted reflects the strategic plan. And you're going to hear more about our strategic plan later in this meeting.

But there were four areas that we were particularly interested in receiving proposal on. One I've already talked about, that's respirable crystalline silica. You understand why that's high priority.

Another one is something we're calling mine safety systems. This really reflects the new organization because we're looking at how to address health and safety problems in a very holistic approach instead of just looking at a small piece of the mine system, such as just ventilation on its own, or ground control on its own, can we start thinking about looking at these things in a broader systems approach. We're interested in any ideas that researchers within the program might have to start promoting thinking in that more holistic way.

The other, the third one we've already talked about and that's the implementation of emerging technologies and health and safety impacts.

And then the last one, of course, is miner health. We're going to hear a lot more about miner health this afternoon when Jeff gives his report on the workshop.

Last, I won't go through every one of these but these are other major activities that I didn't talk about that you will hear more about during the next day and a half and so I've just listed them. And there will be a few that we aren't going to talk about but I wanted you to know what we're up to and how we spend our time. And pretty much everything I've captured here is something that has required a significant effort of the program.

So with that, I am over time. So I don't know if you want me to take questions or not, Priscilla.

Chair Nelson: Are there burning questions that anyone wants to address right now?

Mr. Wright: I've got one.

Chair Nelson: Okay.

Mr. Wright: I'll try to be quick.

In the mine safety systems work, I don't remember if there was any MSHA involvement -- I'm sorry --

NIOSH involvement, especially for the Mining Program in the SEC-10, Safety National System Development or the ISO, I think it's 14,000 series. What is there and have you considered sort of looking at those two voluntary standards and seeing if they can be adapted to mine use.

Dr. Kogel: I can't answer if we were involved in either one of those. Maybe somebody else in the room might know the answer to that question but I don't know. But yes, we try to get involved in ISO and standard setting in general. We see a role for NIOSH to be involved in those sorts of things so we try to serve on the ISO and the ANSI Committees and make sure that we're in the room hearing what's happening and also giving input when we can.

Mr. Wright: It might be useful just to have someone sort of look at whether those could be made specific to mining.

Dr. Kogel: Okay, great. Thank you for that input. Anything else?

Chair Nelson: Okay, that's great. Thank you, Jessica.

So now we invite Doug Johns and welcome him to MSHRAC.

Mining Research Program Update - SMRD by Doug  
Johns

Dr. Johns: It's great to be here. I'm Doug Johns, and I'm the new Director of the Spokane Mining Research Division. I'm not only new to the Spokane Mining Research Division, but new to the Mining Program more broadly. However, I'm not new to the federal government and have spent about half of my federal career with NIOSH. My background is in environmental health, and I started out working with the U.S. EPA developing science assessments in support of the National Ambient Air Quality Standards. So, when you were talking about diesel,

this is something right in my wheelhouse.

I come to SMRD from the Respiratory Health Division working with David Weissman and, as many of you know, that is the division where the Coal Workers Health Surveillance Program is run out of. So, I do have some familiarity with mining but much of what I know about the industry I have learned over the past month since I've been in Spokane.

I do want to say that I'm really excited to be here and to be leading SMRD. I've spent a lot of time in my first month meeting one-on-one with all our staff who have a lot of expertise, folks that have been there for a long time and new staff who are excited to get more involved in the work to protect the health and safety of miners.

And one little anecdote I thought I'd share; I come from the west but have been in the east for the past 15 years. In my first few weeks in SMRD, we were at a mine in Washington state and talking to one of the Kinross geologists and found out she was from my hometown and had been taught by my dad in junior high. So it made me feel at home.

Briefly, going through the organization, we have four major program areas, the top two: underground metal mining ground control and mining-induced seismicity and mine stability, have historically formed the back-bone of our division and still continue to be very important to us and we have developed many close partnerships with western mines. We need to continue to strengthen these programs going forward. We also have two new program areas: emerging technologies and automation, and miner health and chronic disease and these are programs that have been going on for a few years now but we need to build up our staffing in these areas and develop partnerships. And we will hear more about that throughout the meeting.

This is just a snapshot of our division. So, at the

top, this is my office providing leadership and administrative support for the division. We're organized in four teams that align with the program areas described in the previous slide: the Mining-induced Seismicity and Stability Team; the Metal Ground Control Team; Automation and Technology Team; and Health Exposure Assessment and Monitoring Team.

We currently have about 40 FTE, along with some contractors. One of my biggest concerns is recruiting and retaining our staff and this is something related to Dr. Nelson mentioned about the number of students in mining engineering programs going down. It is a concern of ours so we're looking to get creative on how we recruit and hire.

Jessica talked about good organizational health and so I've been working with leadership in SMRD and with my staff on making sure that we maintain our good organizational health, 20 percent discretionary funds, and making sure we can accomplish it while we grow. We are looking to grow this year; I'm a realist but I am also optimistic and we're hoping to bring on nine new external hires this year. We also have some spillover from FY19, so that number may be a bit higher. We do have a plan to grow over the next several years and hope that that starts this year.

I wanted to go through some of the activities and impacts of our research from FY19. Starting out with a snapshot of the outputs and publications divided into translational and scientific products. So translational, these are products and presentations designed to share our research directly with the mining industry and students. And then scientific outputs, this is the science that underlies our translational products, and so research that we present in journal articles and at conferences. You see we have had 76 of these outputs this year, which is really a banner year for SMRD and a lot of that has to do with the number of presentations

that were given as part of symposia that were done at universities that I will talk about here in just a little bit.

We have a focus in the mining sector with our work on underground metal mining ground control but also work in coal, and a lot of this relates to our seismicity research. Stone, sand, and gravel aligns with our work on conveyor systems and dust control. And then some of our work is relevant to all mining sectors.

So I wanted to go through our teams and highlight some of our research and some of the impacts and activities from the past year.

So in the Metal Ground Control Team, we have two current projects: Durable Support for Western Underground Metal Mines and Alternative Mining Methods for Challenging Ground Conditions. Three companies: New Concept Mining, HUESKER, and Tensar have used the results from our HEHD test to modify their design of synthetic mesh and these are materials that are being considered to replace steel mesh for automated support installation machines. Synthetic mesh is lighter and more flexible and can be placed by robotic arms.

Chair Nelson: What is the synthetic?

Dr. Johns: The material, we have someone in the back that may be able to address that - Donovan?

Mr. Benton: I don't know exactly what it's made out of, basically, just some sort of polymer. Some of them are kind of guarded of how they actually make it. Yes, there's no -- I mean it removes metal.

Chair Nelson: So have you ever -- has the Spokane Program ever worked with any basalt rebar or basalt fiber? Have you ever heard of that?

Dr. Johns: I haven't come across that.

Chair Nelson: My recommendation is that you think

about finding out more about basalt fiber.

Dr. Johns: Okay, thank you for that. I will meet up with Donovan to discuss.

We have been working with Nevada Gold Mines, which is the Barrick Newmont joint venture. They are using our ground support factor of safety software in both their training and operations. We've gotten excellent feedback from them, and are using that to finalize the software and also develop a smartphone app. They are also using our recommendations for the installation sequence of shotcrete mesh and bolts along with results of our research in backfill studies to design safe undercut spans beneath cemented rockfill for permanent mine infrastructure in weak ground conditions.

We are working on developing a partnership with the Lee Smith Mine in Nevada. MSHA recommended that they get in touch with us after they had a ground failure and a fatality. So we've done work with them on determining their strength properties of their cemented rockfill and they've taken our recommendations and implemented them in their mine. And we are looking forward to additional partnering with them going forward.

The picture on top is not of the Lee Smith Mine but I'm told what we're looking at is an example of an opening under cemented rockfill. And at the bottom, these are some of our researchers discussing the best aggregate sizes for backfill.

Chair Nelson: So one thing I wanted to ask about this when I read through it was is backfill strength tested. And in fact, there is stiffness as well. If anything, it can be more important than the strength.

Dr. Johns: Yes.

Chair Nelson: So just loosely use strength.

Dr. Johns: So again, this is one of those questions I

will have to defer to Donovan but I assume we consider that in the testing we do.

Mr. Benton: Okay, yes. We had done compressive tests just on cylinders. And we have actually focused more on the seismic studies. So essentially, trying to come up with the relationship. They have their basic QA/QC the three by whatever - six-inch cylinders but that strength doesn't necessarily translate to the in-place.

So that is where the focus of our study now is, just trying to come up with the size of that relationship if you increase the size of the sinkhole.

In terms of stiffness, I'm not entirely sure -- what's the question?

Chair Nelson: I think the question is that the backfill operates because it resists the deformation and it's the stiffness that we established a sigma-3, which makes the rock mass stronger. So it's really a stiffness function. Just a comment.

Dr. Johns: Thank you.

Chair Nelson: And those size-effect lab tests, I think I really would encourage you to get out in the field and do some field stiffness evaluations. That would be really interesting to see here.

Dr. Johns: Yes, we recently finished our end-of-year review and that was discussed.

Chair Nelson: Okay.

Dr. Johns: Thank you for bringing that up.

I had mentioned earlier the presentations that we had given this year. We've done a guest lecture series at the University of Utah, Montana Tech, and the University of Arizona with over 350 students in attendance and we're planning a similar seminar series at the Colorado School of Mines this spring.

Chair Nelson: Yes, we would like to invite you so we

can be on that list.

Dr. Johns: Yes. My understanding is that this is planned.

So moving on to Mine-induced Seismicity and Stability Team, two current projects: Detecting and masking dynamic failure on near-seam features and real-time ground stability informatics systems.

Our partner, Canyon Fuel Company's Skyline Mine that won an award from the State of Utah for partnering with SMRD in installing sensors and providing analysis of seismic activity near a dam, so they won this award for both protecting public safety and miner safety.

We were asked by another mine in the State of Washington to come in and monitor increased seismic activity as the mine entered the pillar recovery phase of the operation. So they used the recommendations of SMRD for analyzing seismic events to warn of potential instability.

And then the Lucky Friday Mine in Northern Idaho, we've long-partnered with them in conducting seismicity research as they mine at depths of 7,200 feet below the surface.

I'll just bring up another thing that made me feel at home. I saw this picture from the Skyline Mine winning their award, and the person on the right there, his name is Spencer Cox, he is the Lieutenant Governor of the State of Utah and he is my brother's brother-in-law. So I've met him several times. I just thought that was kind of interesting to see when I was first shown this picture.

Another area that we're working on is looking at the correlation of bump potential with coal deposition characteristics, namely, looking at inland, wet, forest, or swamp environments which have important implications for mine design.

Heather Lawson is working on her Ph.D. at Indiana

University and for this work she received two Best Paper awards, one at the International Conference on Ground Control in Mining and one at the Society for Organic Petrology's Annual Meeting.

The Automation and Technology Team has three current projects -- well, one of those is a pilot project: Emerging technologies to improve conveyor safety; developing a field-portable DPM monitor; and the pilot project is identification of key factors affecting machine safety injuries.

We've partnered with CRH Oldcastle Materials in developing monitoring systems for conveyors and lock-out tag-out using internet of things-based technology. They use this system on a daily basis and have won a corporate award for integrating our system into their operation and they are working on now expanding this monitoring, as well as making use of electronic health and safety forms.

And one of the areas of emphasis now is working to transfer the concept to a technology company through a cooperative agreement to make it a commercially-available product.

Another area that I think Todd Ruff may be talking about later is this issue that we talked about this morning of proximity detection and making use of intelligent video.

Two areas that we've made a lot of progress on is advancing real-time portable DPM monitoring using FTIR and also development of a new filtration system for conveyor transfer points. And these are two areas we have cooperative agreements with two different companies to make these into commercially-available products.

And then again, we will be talking more about emerging technologies and automation especially focusing on automated mining equipment. This is something that Todd will give an update on later today.

So finally, the Miner Health Team. We have nine research staff and three projects: predicting heat strain on underground metal/non-metal miners; building an evidence-based framework for improving miner health; and mining applications of novel interventions for fatigue.

So we've been working a lot on the development of our strategic plan for the Miner Health Program, getting a lot of input from stakeholders. A public meeting was held in Seattle that I was able to attend in early September which was an MSHRAC meeting. I thought a lot of good information came out of it and Jeff Burgess will be talking about that later.

We have a draft strategic plan for the Miner Health Program and Dr. Jerry Poplin is leading that team and will be finalizing that strategic plan this year.

One of the main projects under the Miner Health Program is looking at data sources for miner health information, and not just health but also exposure, trying to figure out what the burden of disease is in miners, as well as potential exposures.

So we're looking at all different sources of data from National Health databases, MSHRAC data, data from States and we'll have a couple talks on that tomorrow. But one of the limitations that we have right now is just the number of people that we have to conduct those data analyses. So that's something that we're working on.

Another project we have is the prevention of heat stress and we've made a lot of progress here. We have completed pilot studies, both in our environmental chamber and in the field, and we've used that data to refine our methods in terms of remotely collecting biometric data using an app on a smart phone such that when a miner's core body temperature goes above 38 degrees, they will be alerted and then they'll be asked to take a test to measure cognitive function. So we're looking at the relationship between heat stress and cognitive

function.

Our pilot studies have really honed us in on two specific tests that we're using, the PVT test and the n-back test to look at reaction time, as well as memory and executive function. Another pilot study was done in the field and one of the interesting pieces of information that we found is just how frequently these miners experience an increase in the core body temperature of above 38 degrees and that happened, on average, five times in a shift.

So this year, we will be working on development of IRB protocols to move forward with the larger studies in both of those areas.

The last time MSHRAC convened, I think Todd mentioned that we were working on a one-pager for our fatigue work, managing fatigue. That has been released and Tim Bauerle who is here will be talking more about that.

We also participated in NIOSH's Working Hours, Sleep, and Fatigue Forum in Coeur d'Alene in September and Tim Bauerle, along with Zoe Dugdale, led a breakout session to discuss issues with fatigue specific to the mining industry.

Just going through a few awards that the staff received. This is Art Miller and he received the ASME Safety Engineering Student Innovation Challenge's first place award. This is for work that he did developing sensors to measure vibration from the arm to the hearing anatomy.

Carl Sunderman won the NIOSH Director's Intramural Award for Scientific Support. This is kind of like a lifetime achievement award, although you usually get those at the end of your career, and Carl has told me that he has no plans to retire. But this is for work that he's done to develop sensors, conduct data collection, and a number of other things that he does for us.

And then we had a paper that was the NIOSH

nominee for the CDC Shepard Science Award. This was authored by Bo-Hyun Kim, Mark Larson, and Heather Lawson and was entitled Applying Robust Design to Study the Effects of Stratigraphic Characteristics on Brittle Failure and Bump Potential in a Coal Mine.

So as I mentioned, we just finished our end year reviews and it was great to learn about the work we do. We have a lot of very dedicated, talented staff. We are using that information in helping us to plan for the future, making sure that we're supporting all four of our program areas but really trying to prioritize the research efforts to meet the needs of division and our stakeholders.

I put this up here just to show a snapshot of our hiring needs for this year. We need a computer scientist, mining engineer, electronics technicians, computer engineer, research epidemiologist, industrial hygienist, health communications specialist, management program analyst, and then two supervisors, a health scientist and an engineer. And in our discussions, we've talked more about the need to have a biostatistician to support the entire division, as well as someone to assist with management of data.

While we do have a lot of very talented staff, there is only so much we can do with what we have and so we do need to grow.

Some of our projects that we would like to move into are really being held up because of lack of staff and lack of expertise. One example I will give that Todd may talk about a little bit more is developing a ground stability informatics system. Essentially, we collect a lot of data, but how do we integrate that data to tell the bigger story and how do we present that data visually? So more to come on that from Todd.

But with that --

Chair Nelson: One last question.

Dr. Johns: Yes.

Chair Nelson: There is a lot of work going on in industry and elsewhere on this.

Dr. Johns: Yes, so --

Chair Nelson: And so really defining exactly what is --

Dr. Johns: That's a great point. And one of the reasons to have -- well, there are a number of reasons to have these meetings -- but to meet with our stakeholders is to figure out what else is going on because we don't want to go down a path that somebody is already well along, so we need to find out where we have a comparative advantage and where we fit in.

Chair Nelson: Yes, it would be really interesting on this particular topic to actually invite people to come in and maybe have not a long-term health initiative but something like a short-term. Where are we? Who is doing what?

Dr. Johns: Sure.

Chair Nelson: What is the niche that NIOSH can bring?

Dr. Johns: Yes, agreed.

Chair Nelson: Very rapidly moving.

Dr. Johns: Yes.

Chair Nelson: The other thing I wanted to ask here is you put out the blasting program, computational simulation of blasting and it was reported on before. What I am wondering is: Is industry using it?

Dr. Johns: I'd have to ask Jessica.

Dr. Kogel: I'm not sure I can -- I'm not sure exactly what you're talking about. Is it the one that is --

Mr. Benton: The Drift software.

Chair Nelson: Yes, I guess what I'm wondering is the transition from output to somebody actually using it that we saw in the External Visiting Committee. I found myself who is using that because there are so many software packages out there and so much outsourcing that mining companies do for this --

Dr. Johns: Right.

Chair Nelson: -- that I wondered who uses it.

Dr. Johns: So this I one of the things that as I've been meeting with people I've been asking about our products. When we develop open source code and software we can tell how frequently it is downloaded? That's great but we don't really have a sense for how it's being used, who is using it.

And so one of the things that we've been talking about setting up up-front in the Mining Health Program is how do we evaluate the program. And I think that's something that we need to do across the board to make sure that we have a sense for what the impact is.

Dr. Kogel: And I'll talk a little bit about that later when I do my presentation about the external reviews, this particular issue and how we don't always have specific information that would allow us to answer those sorts of questions.

Chair Nelson: So any other questions before we move on?

R.J., are you ready?

Go ahead, Jeff.

Dr. Burgess: So, Doug, thank you for the good presentation.

Two questions. The first has to do with the heat stress monitoring. Do you know if your group has reached out to the folks in DHS, Department of Homeland Security? Because there is a lot of work

being done there in terms of monitoring of first responders.

Dr. Johns: That's a great question. Tim, do you know if we have --

Dr. Bauerle: Not that I know of.

Dr. Johns: Okay.

Dr. Bauerle: I mean in working with the online rescue teams, you know I know a lot of them are sort of first responder roles but I don't know what DHS is doing.

Dr. Burgess: I suggest that, obviously, I would be happy to help you identify connections.

Dr. Johns: That would be great, thank you.

Dr. Burgess: Because I feel like there would be a lot of overlap, initially, and any work -- your work would apply to theirs and vice-versa.

Dr. Johns: Yes, that would be great and the timing would be great, too, as we get ready to develop those protocols.

Dr. Burgess: And then the second question I had was in regards to the real-time diesel. Are we going to hear anything more about that today or not?

Dr. Johns: I don't think that that's part of what Todd was going to be presenting. Did you have a specific question about it?

Dr. Burgess: Sure, I was wondering where you were in the process of actually being able to hand this off to a commercial company.

Dr. Johns: I think it's pretty close. I mean so we're working with a company right now. Is it AethLabs, something like that? So we have someone who is interested and I think they're -- I think it's not far off.

Dr. George Luxbacher: We're in the process of getting an RFP so that we can fund that next step commercial development. So we actually have draft partisan process of putting it together in a draft RFP and we're going to publish that. And we anticipate, if you have a CRADA, a Cooperative Research Agreement, with one company then we anticipate they'll respond to the RFP but that will give us a funding mechanism to actually move toward a commercial project.

Dr. Burgess: Do you have an initial product that could be used in a research fashion that could be made available?

Dr. Johns: George, with a CRADA in place, I don't know how that works in terms of making that available beyond SMRD.

Dr. George Luxbacher: So Art's actually started down that path and I think that yes, if someone were willing to do research. Art's been working also with Emily Sarver at Virginia Tech, who is also doing some diesel work. And I think Art can give you the answer to that.

The problem, again, is sizing units and things like that that have always been the problem but Art has concepts. So I would suggest talking to Art.

Dr. Burgess: Okay, thank you.

Mr. Wright: Yes, two questions about that industry. First, what's the surrogate? And second, is the goal to measure the mass or the particle count?

Dr. Johns: We're not doing particle count. It is mass but that is one of the things that we've talked about. And in fact during this end of year review, which just happened, I asked Art to send me the papers on this and he did. They are in my inbox so I need to look at them.

In terms of the surrogate, we are -- we're looking at organic carbon, elemental carbon. So that's mainly

what we're looking at, organic and elemental carbon.

Dr. George Luxbacher: The goal there is to, instead of doing the calculations as a part of your assumptions, Mike, is that for both organic and elemental?

Mr. Wright: Because the standard is what it's totals are, right?

Dr. George Luxbacher: Right, right, but this would give you an ability right now to make an estimate to measure elemental and you estimate organic or the other way around? But then you make an estimate. And so the idea here that Art was actually looking at is to measure both and get an accurate total carbon count.

Dr. Kogel: So basically, it's a direct measurement, which is the sum of the elemental and organic together.

Dr. Johns: I mean this is one of those areas where I think collaborating with colleagues would help. It would be great.

I mean you know diesel is -- it's a mixture, just like any particle, right? And so its toxicity is going to depend on its constituents.

Chair Nelson: Okay, thank you very much, Doug. Next we have R. J.

Mining Research Program Update - PMRD by R. J.  
Matetic

Dr. Matetic: Good morning, all. If you look real close on the left, you can see me in the picture.

Chair Nelson: I see all the women there.

Dr. Matetic: Okay. One of the things I would like to cover today since the last MSHRAC meeting is personnel and staffing. This has been a major concern for us, as far as sustainability and

succession for the program. So I'll briefly discuss where we are regarding staffing.

Also, over the past year, our researchers have received a tremendous amount of significant awards related to research outcomes. I will also provide an update related to those.. I then want to get into the research impacts the seven branches have had since our last meeting and to mention that we actually supported the tunnel circuit for the DARPA subterranean challenge. I will also talk a little bit about that experience as well.

As I mentioned, hiring is extremely important for us because within the next five years, 45 percent of our workforce is eligible to retire. So we've been really pushing hiring and recruiting.

The good news is we have hired, in this fiscal year, 20 additional people, new faces, which is really awesome for the program. This slide demonstrates the depth and the breadth of the positions we hired for. So in the whole scheme of things, this is moving forward and it's a positive for the program.

This slide shows the 16 positions we are working on right now to bring into the program and, of course, our goal is to, at the end of this fiscal year, hopefully, have 30 additional new faces in the program. My hat is off to Kelley and her staff, the managers in Pittsburgh for kind of being relentless on making this happen, that is constant pushing to get people into the program. You know the fruits of what we've been trying to do are actually occurring by the numbers that you see in the slide.

Chair Nelson: Are the fellowships federal employees?

Dr. Matetic: Yes, they are considered a federal employee. It's a Title 42 position as compared to a Title 5 position but they are classified as a federal employee.

Okay, we did something new with the employee

viewpoint survey this year as well. I think you're all familiar with the survey. The Government provides an employee viewpoint survey to all Government employees. So what we did, was generate a committee of 13 volunteers, no managers, within Pittsburgh to serve on the PMRD-EVS Committee. What they did was they reviewed and interpreted the survey results, as I would as the director. They consulted with all of their colleagues in the program regarding it and then they actually put out their own survey to the employees in the program to dig a little bit deeper into potential concerns and solutions regarding the results of the EVS.

They established priority areas for action and those are on the right side of the screen: Awards and promotions, -- leadership development -- leadership development in not only current leaders but also anyone in the program; and improvement of processes. We all know sometime processes can have a negative effect on outcomes and and potential for impact. So they were concerned about if we do anything process-wise to improve the opportunity for more impact.

They put together an action plan and provided me and leadership in Pittsburgh with it and we are all in support of it and we're moving forward with what the committee wanted to address.

I mentioned significant employee awards earlier in the presentation. So far for this calendar year, employees have received 29 awards; 13 Federal Executive Board Awards, six NIOSH Science Awards; six professional association awards; and four Presidential and Governmental awards.

These are just two of the most recent awards shown on the slide, Drs. Lauren Chubb and Emmanuel Cauda just received Best Paper Awards at the American Industrial Hygiene Conference, held in Minneapolis. They received Best Paper Awards in two categories: AerosolScience and also Control Technologies. I am very happy to see that the

research in these areas is having a significant impact.

Dr. Emily Haas, is on the right of the screen, you've seen her present at MSHRAC in the past, she was a finalist for the Sammies Award. If you recall, the Sammies Award is like the Oscar Awards for Government employees. She was a finalist this year in the category of Safety and Law Enforcement. And if you recall, last year, Dr. John Sammarco, was a finalist for a Sammie related to his research in illumination. Doug showed you a slide discussing research outputs since the last MSHRAC meeting. This slide represents PMRD outputs from a science and translational point of view; 55 percent translational, 45 percent science. I think the last time I presented to you, those kind of were switched; 55 percent science, 45 percent translational.

So these are just the type of outputs, the number of outputs, and how we actually distribute them from a science and translational perspective.

This slide displays the seven branches currently existing in the PMRD. There are also 16 teams that are associated with the seven branches. I want to discuss with you several impacts that have occurred with each branch since last MSHRAC meeting. First, the dust ventilation and toxic substances branch. I mentioned the canopy air curtain (CAC) previously to all of you previously. The good news is, the CAC is really taking off. Currently, there are 100 roof bolting machines using the canopy air curtain technology to reduce respirable dust exposures to the operators of these machines..

Due to the success of the CAC with roof bolting machines, we are now looking at a CAC for a shuttle car machine to reduce respirable dust exposures to those operators. We just recently tested this technology at the Peabody Francisco Mine and we found out there was a 60 percent reduction in respirable dust at the operator position using this

type of technology. So it's showing significant promise with other tasks and other machines. I think Mike will be happy to hear, we're actually looking at this type of technology for removal of DPM and we're actually testing a different type of air curtain in our experimental mine in Pittsburgh. It's just early but it shows a lot of promise as far as removing DPM as well.

Mr. Harman: R. J., do you know if those canopy air curtains, are those geographically disbursed or are they isolated to one certain area in the country?

Dr. Matetic: I couldn't tell you, Tom, but I would believe it is more dispersed than isolated. Mr. Harman: Yes.

Participant: Tom, Randy Reed is here. He'll present on that in his presentation.

Mr. Harman: Okay.

Chair Nelson: Can they be retrofitted on existing equipment?

Mr. Matetic: Yes.

Chair Nelson: Are they sold that way?

Dr. Matetic: Either way. You can request it from the manufacturer to have it on new machines or you can install after the fact relative to whatever type of machine. Randy will talk -- to you about the different types of designs that you can use relative to the CAC itself. Mr. Wright: R. J., do we have an idea of what depth we represent the percentage of roof bolters that use it?

Dr. Matetic: Randy, can you answer that?

I know there are so many MMUs and they are obviously decreasing.

Do you know, Tom?

Mr. Harman: I'm not sure of the number. I want to

say there's 450 each but I'm not sure -- something like that.

Dr. Matetic: We can get that information from Randy.

Okay, let's talk about the electrical and mechanical systems safety branch. Just to mention that the refuge alternative partnership is winding down also is the research associated. One of the last things that we need to do is test pressure relief valves regarding refuge alternatives, specifically, related to built in place shelters.

We are working closely with MSHA approval and certification on this, one of the things that we found out through testing relief valves was that we're not actually testing those relative to the 15 psi overpressure at two-tenths of a second duration related to the test enclosure. We worked the MSHA approval and certification and came up with a different type of enclosure. It's a smaller enclosure that actually meets the requirement. We are now moving forward with the testing on different types of relief valves, both in an open and closed state, regarding built in place shelters. The next branch is the Fires and Explosions branch. We are working with a mining manufacturer, related to battery-powered vehicles. One of the things we're working on is the unintended consequence of using lithium ion batteries for mining vehicles, especially in gassy mines.

Manufacturer representatives visited the PMRD to observe some of our testing. The lithium ion batteries were put in an enclosure and they didn't realize the amount of thermal runaway or pressure that can actually occur if something happens to the battery itself. We are now working with them to come up with a better enclosure to accommodate any thermal runaway due to overexposures. We are working with them to come up with a new enclosure design with enough volume the thermal runaway. VUMA, from South Africa, is a commercial mine

ventilation and mine refrigeration software suite. They actually are using our MFIRE 4.0, which was presented to you all at a previous meeting, and integrating the program into their software package.

Also, a brief update related to the testing in Poland. I think the results came out the way we thought relative to treated versus untreated rock dust in extremely humid conditions. Treated rock dust in humid conditions worked perfectly. Non-treated rock dust in humid conditions caked, didn't disperse most effectively, and didn't inert the flame front relative to a coal dust explosion.

Moving on to the Ground Control, Branch. We are finishing a project addressing longwall gateroad design. Numerous tests were conducted in numerous mines to come up with what we refer to now as the gateroad spreadsheet. This gateroad spreadsheet is now being used by operators and one of the big things we're doing with it right now is there is a mine in West Virginia that is going to consider a longwall expansion and they want to use this tool to develop their gateroads during their expansion. The final stage of this effort will be the development of a software package that can be distributed to the industry for better or improved longwall gateroad designs. In addition, we've updated our STOP program. STOP stands for Support Technology Optimization Program. This is the testing of all the standing supports we have conducted in our mine roof simulator at the PMRD. This is a database that gives ground reaction curves, effects of different types of standing supports, and the testing results of all of those.

Moving into the Health Communications, Surveillance and Research Support Branch. I mentioned at a previous meeting related to the interactive maps regarding MSHA injury and illness data. We have now added data that comprises the years of 1983 through 2018. There is also a mapping function that has been included to show where miners are employed and where reportable

injuries, illnesses, and other events have occurred. This is new since the last MSHRAC meeting on the updates of this interactive tool that you can use and it's on our website.

Next is the Human Factors branch. I don't know if you're all aware but thousands of compact florescent lights are actually becoming obsolete and it's creating a problem for MSHA, lighting manufacturers and machine manufacturers. For every new lamp you are expected to develop what MSHA calls a statement of test and evaluation, and which takes a significant long time to occur.

We worked with -- an ad hoc group -- consisting of MSHA, Fletcher, and several other organizations to come up with a method that you wouldn't have to go through the STE for every light that you want to replace. We came up with a method to actually be able to replace the old bulbs with new without a STE and I think it's called -- and Melanie might have to help me -- RAMP.

Ms. Calhoun: Yes.

Dr. Matetic: Yes. So, it's a RAMP. Instead of having to go through all the STEs, a RAMP approval can now be used based on the method we developed.

And last but not least, the Workplace Health Branch. ErgoMine 2.0, will be available this December. It will be available for the IOS platform as well. That has been an ask for a while from not only MSHRAC but many of our stakeholders. In addition, there will be some new things added to ErgoMine 2.0. For example, there will now be a slip/trip/fall checklist for conducting an audit in the software. We reported on the Boot Study a couple meetings ago. The good news is there are now several mine companies that have been involved with the boot study and are actually providing boot allowances more frequently to their workers because of the results of the study.

Lastly, we were selected to host the DARPA Subterranean Challenge for the tunnel circuit. There

will be three more circuits of testing including urban, cave, and the final events which is a combination of tunnel, urban and cave. We were fortunate enough to be able to host the tunnel circuit.

Chair Nelson: And we did STIX.

Dr. Matetic: Does anybody know what STIX stands for? Subterranean Integration Exercise. Why did they select us? They selected us because we have a longstanding history of doing that type of research and we are unique where we have two underground mines that we use for research that was available to them.

Chair Nelson: And they are very like tunnels.

Dr. Matetic: Right, exactly.

Chair Nelson: They have platforms.

Dr. Matetic: For this slide, What you see is an aerial view of our site. What you see at the bottom, is a video -- -- displaying our underground workings at our research mines.

On the right of the slide, displays underground maps of the Safety Research Coal Mine and the Experimental Mine. Included on the maps are all of the artifact locations that DARPA used for the teams to try to determine where the artifact is and what type of artifact it actually is. The teams had to locate the artifacts within a five-meter distance and then they had to identify what the artifact is through the different technologies they were using. There were 30 artifacts located in mine.

Chair Nelson: And no people underground.

Mr. Matetic: Yes, no people were underground.

Dr. Kogel: What was the time allowed to do it?

Dr. Matetic: Yes, it was one hour (60 minutes). It was an event that lasted approximately a week at

our site. An additional 350 people came on-site to participate in the challenge.

So yes, this was very exciting for us. It was a lot of work but there were some benefits to the Mining Program by doing it. Eleven teams representing eight countries, approximately 350 people, dozens of robots, including 64 ground robots, on wheels, legs, and tracks. They used 20 flying quadcopter drones and these were not the most effective because of the limited battery life of the drone itself. Also, there was one autonomous blimp that they actually used for the tunnel circuit.

The next thing I would like to show you is a video of the event. (Video played.)

Dr. Matetic: Okay, so how did we benefit? Well, we gained access to the latest technologies in the robotics world, as far as the potential technologies for disaster prevention, escape and rescue. In addition, we were able to identify and observe any new approaches to rapidly navigate search, these were the latest and greatest technologies available so we got to see that.

Strengthen our stakeholder networking, we work with DARPA very closely, the DoD, international organizations. I think this really truly benefited from the stakeholder standpoint as well.

And then what's happening in December is the AMEBA program. AMEBA stands for A MEchanically Based Antenna. This is actually -- will actually assist and help us on our -- one of our last things regarding our refuse alternative research, where we are using low frequencies through the earth technology to actually communicate. So they will come in December and start doing that testing as well. So major benefit for us.

These were the 40 volunteers that had to -- not had to but they volunteered for the DARPA Challenge. I can't say enough about you know long hours. They were awesome. They actually got into the team

spirit, too, because they were responsible for teams. And now they were liking competition with everyone else with their team. They were cheering their team on and the latest technologies to rapidly navigate and search, along with strengthening stakeholder interactions.

Mr. Wright: So who won?

Dr. Matetic: A team called Explorer. The team was comprised of Carnegie Mellon and Oregon State Universities. I should also mention they were a DARPA-funded team. There were a total of 11 teams. There were seven DARPA-funded teams and those teams were not allowed to win any cash or money because they are funded by DARPA. Now they would be able in the final event, if they win.

A team called CTU-CRAS came in third, a non-funded DARPA team and won \$250,000. DARPA is now on to the Urban Circuit but I have not heard if they found a location for the Urban Circuit yet.

Chair Nelson: No, they are soliciting, trying to find a place.

Okay, so let us take a break.

Mr. Bowersox: Just real quick, on that research related to longwall gateroad design in WV?

Mr. Matetic: Yes.

Mr. Wright: Could you circulate a link to the video? It's pretty good.

Mr. Matetic: Yes, there are a couple others I will circulate as well.

Chair Nelson: Yes, give him the ones from the mines, too, from STIX. They did a nice production.

Mr. Matetic: Yes, No problem.

Chair Nelson: They came in. They left WI-FI, they left fiber, they left all sorts of things in our mine,

which was very nice to have.

Mr. Harman: I've got just one quick question for R. J.

The elimination of the mines that claimed approval, is that available for all of the folks in this group or just (coughing) other manufacturers?

Dr. Matetic: I believe it's others as well, but I can find out for sure.

Ms. Calhoun: As I believe it is for different ones. In the RAMP program I just remember it was the Revised Approval Modification Program that were ANCC. So somebody -- and that goes across all different things that we approve. You can do a RAMP if there is something that you want to get a different approval on or you find you can make modification. We also do field modifications as well.

Dr. Matetic: And Ron, the longwall gateroad expansion, are you familiar with that? We can talk offline.

Mr. Bowersox: Yes, okay.

Dr. Matetic: They are going to use a procedure that we came up with to design it.

Chair Nelson: Okay, we've got -- one presentation is not going to be made at 11:45. So we are not so bad on time.

So we get -- let's take a break until 11:15. So we will recommence right at 11:15.

(Whereupon, the above entitled matter went off the record at 10:56 a.m. and resumed at 11:19 a.m.)

Chair Nelson: We are reconvened and we invite George Luxbacher to come and talk about MINER Act.

Mr. Welsh: Before we get started, can anyone on the phone respond if you can hear me?

Mr. Zimmer: Yes, this is Kyle. I can hear you fine.

Mr. Welsh: Thank you, Kyle.

Chair Nelson: Hi, Kyle.

Mining Research Program Update - Miner Act  
Extramural Research by George Luxbacher

Dr. George Luxbacher: I'm going to talk about the MINER Act Extramural Research Program within NIOSH. The picture on the first slide is an example of some of our contract work. This is the contract we have with Missouri University of Science and Technology, formerly UMR, that shows -- related to active barriers for coal explosion -- coal dust explosion propagation suppression.

What you see on the left there is a model mine, where they were doing some work with some different types of layouts to look at explosion propagation. And on the right, you see the triggering system for an active system, as opposed to a passive system, for example, water bags or rock dust bags hung in an entry.

I'm going to talk a little bit about our grants program, then about the technology contracts program, which is primarily the BAAs, but several other different aspects. I'm going to talk about the capacity-built contracts program. We just went through and awarded seven capacity-built contracts and I'll talk further about that.

I'm going to discuss a concept on a respirable dust - - mine dust research center, then I'm going to talk about interagency working groups a little bit and some of the interagency agreements we are currently funding through the NIOSH NPPTL group.

So first of all, I'm going to talk a little bit about the U60 grants. As you are, I think, aware from my past presentations, primarily our grants are these two U60 grants; one to the University of Arizona and one to Colorado School of Mines, both related to the

western mining safety and health.

We have a review meeting for these two grants scheduled for January in Golden. We did a review meeting last year in November in Arizona and now moving to Colorado. So we will be having a review meeting with NIOSH, CSM and UA staff in attendance.

Now the current grants conclude in this fiscal year so we just had a new funding announcement, FOA or a funding opportunity announcement that was just published on November 4th. I know UA is actively putting together a response to that and I assume CSM will as well. We also should have several other groups that are interested in it. It will be for funding for a three-year period.

Now this is published through NIH and that is one of the complexities. This is the first time I've dealt with one of these funding announcements. And we have a CDC template that we use and we have an NIH template we use. So we have to combine both templates and meet all the criteria for CDC, as well as the criteria for NIH. It was an interesting process to go through to see what you can change and what you can't change on these things, based on the two templates. It was very interesting. That's all I can say but it has been published and it's out there and several -- I've gotten responses from several different groups that are in the process of writing funding proposals.

This is our contract portfolio at the start of fiscal year 2020. It shows both technology contracts and capacity-built contracts. I will talk about each individually but we have eight contracts that we completed during fiscal year '19. We have 11 contracts ongoing. We issued ten additional contracts in fiscal year '19. So going into fiscal year 2020, we have 21 contracts to manage. You add that to the capacity-builds and our portfolio is about 33 significant contracts that we are managing right now.

The eight contracts that we completed during fiscal year 2019 are shown here. I'm not going to go into detail on that. You have the slides and you can look at these. If you have any questions, we can go into detail on them.

But we had one contract -- most of these contracts date from 2014, '15, '16, and '17. We have one contract with Biomarine, where they were trying some technology for a miniaturized CPDM, and their initial results were not promising, and they elected to terminate that contract. So that contract terminated early.

They did provide us with a number of assets that they had acquired for that contract that went to PMRD for use within our intramural research program.

The 11 ongoing contracts, this shows our 11 ongoing contracts. One of these, Randy Reed will talk about later in the schedule. It's an RFP. It's part of his canopy air curtain for shuttle car operators. So you will hear a little bit more about that from Randy. That's a 2015 contract that has actually reached its five-year. Under the Federal Acquisition Regulation, we can do up to five years for a contract and that's in its fifth year. So it will terminate within this fiscal year. But this shows several other contracts that are ongoing.

Chair Nelson: Is the University of Kentucky that's on those pressure relief valves, is that finished or what?

Dr. George Luxbacher: That's ongoing as well. That will finish up during this fiscal year, as I recall. So and it complements the work that is being done by the intramural program with using the MSHA facilities, approval, and certification. So it's a complementary type contract.

And, actually, that contract -- often, we get responses to the BAA solicitations that have been suggested by staff. In other words, someone from

PMRD, who was interested in using the facilities at UK, suggested that they respond to the BAA and we elected to fund that. And so that is complementary to the work we're doing that Dr. Matetic talked about.

I want to just mention here Jessica and I have a program where we visit the universities and discuss the ability to enhance graduate-level programs, in addition to our capacity-build program. And we recently were at Missouri University of Science and Technology. This contract should have finished and we actually did a six-month extension to it in evaluation of active suppressions systems. That's what was on my title slide.

I just wanted to show what they've done is they've actually moved in some in-mine testing here and I wanted to show a quick video of their first underground coal dust explosion and they plan to move the suppression system underground and try it.

So that was about 16 pounds of coal dust spread over about a ten-foot length underground as I cited right there. Very impressive results but very low pressure. That was only about 4 psi. So a little bit different and they still have to tweak their explosions underground, which just shows that, while we are going to Poland to do some of this work, there are some facilities in the U.S. that also have the capability to do some explosion research.

This opened up some discussion with Missouri about what could be done in their underground experimental mine going forward.

We awarded nine contracts under the BAA solicitation. As you may recall, this solicitation actually came out last year around this time and I was able to discuss the focus areas that we had used for this.

Unfortunately, this year's solicitation didn't get out on time so I can't really talk a lot about this year's

solicitation. But these are actually the nine contracts that we awarded under that particular solicitation. You can see the universities and private research laboratories that received these.

I wanted to point out that respirable dust was one of our focus areas and we actually have four contracts that we issued to Michigan Tech, Penn State, UNR, and Virginia Tech related to respirable coal mine dust. This is in response to the National Academy report that suggested that we do further research in this area. This is -- you can see Virginia Tech, this is an extension to some of Emily Sarver's work that has been published that actually shows that respirable coal mine dust has very little coal content to it, that it's primarily made up of carbonate material from the rock dust, as well as silica and other components.

We also funded a fifth contract that you can see there with UNR, which is the development of a personal real-time respirable coal dust and respirable silica dust monitoring instrument.

We had visited UNR and we talked to the PI on this particular project earlier. This was work that was initially funded by Alpha Foundation. And Alpha funded it through a certain point and then Alpha -- the project was completed under Alpha and we elected to pick it up and continue it under our MINER Act funding. So we are funding that particular project.

Mr. Harman: So you've got two there for a real-time monitor. You've got one from Thermo Fisher. How do those two differ?

Dr. George Luxbacher: Okay, so those are ongoing contracts. Let me go back.

So in the ongoing contracts, we have Thermo Fisher working on miniaturizing the existing CPDM. So we funded some work toward, as you are aware, the current CPDM has a lot of vacant space within that housing because it originally included the cap lamp

battery as well. So it takes that additional space out, miniaturizes the components and deals with some of the stakeholder issues that have been raised. So we are funding them on that.

We are also funding the feasibility testing of the silica monitor with Thermo Fisher and that's related to a quantum cascading laser, QCL technology. NIOSH developed some near-real time silica technology using a QCL and Thermo is trying to take that and trying to see if it can be miniaturized into a near-real-time instrument for use underground.

We also funded University of Illinois at Chicago on a unit that we tried to extend towards silica. And the University of Illinois at Chicago has a program that really emphasizes micromachining and everything to get down to really small sizes. And the silica component in that really was complicating efforts to get a device that could be potentially a future CPDM, smaller CPDM. So we took silica out of that.

Mr. Bowersox: I just have a question.

Dr. George Luxbacher: Yes.

Mr. Bowersox: On that Thermo, are they -- you have five years? Does that count for them, too, the five-year?

Dr. George Luxbacher: That actually is a -- I'm trying to recall this, Ron. I think that's a 24- or a 36-month contract. So, it's a two- or three-year contract.

So I just said the maximum length we can do is five years on these contracts.

Mr. Bowersox: Okay.

Dr. George Luxbacher: But we have contracts that we issue for a one-year duration.

So under our BAA solicitation, you respond with your concept, your budget, and the amount of time

you think you are going to take to do the work, and then we will issue a contract based on that.

And I believe both of those -- the CPDM I think is 24-month. The silica monitor for Thermo was, I think, a 36-month.

So these are the contracts we awarded. Again, the biggest focus area on this you can see was directed toward respirable coal mine dust. And you can see we also had two contracts that we cut with regard to lithium ion batteries. And R. J. already touched upon the work we are doing intramurally. So both of these projects, again, complement that intramural work.

There's a lot of manufacturers interested in lithium ion batteries and there is a lot of work that remains to be done.

Chair Nelson: I'm looking at -- I would like to know more about the University of Utah because there is a lot of operator fatigue stuff out there in the market now.

Dr. George Luxbacher: Yes, there is, and Tim Bauerle is going to talk -- I believe Tim is going to talk a little bit about some of the work we are doing intramurally on that. And this is an extramural contract.

Tim, can you also address that whenever you give your presentation?

Dr. Bauerle: Yes, absolutely.

Dr. George Luxbacher: Okay, so we'll address that then.

But again, we look for these contracts to complement our intramural work and to supplement where we don't have the capability internally.

Chair Nelson: I mean it's moving fast out in the industry, too --

Dr. George Luxbacher: Yes. Yes, agreed.

Chair Nelson: -- with people putting things on the market.

Dr. George Luxbacher: Agreed 100 percent.

So I just wanted to show you on these four contracts that I highlighted in yellow here the difference of approach that each one of these universities has come up with. Penn State brought in the Department of Biomedical Engineering and they are proposing a lung-on-a-chip model that they can actually do some work on.

Each one of these has some really unique facilities and unique ideas. Michigan Tech came to us and they want to use the facilities at the University of Utah Department of Metallurgical Engineering using some interesting equipment.

UNR actually brings in the Desert Research Institute as a subcontractor and they have tremendous capabilities with regard to air monitoring.

And Virginia Tech, this complements some further work on Emily Sarver's work that she had initially done under the Alpha Foundation.

So these four contracts are all very different but doing similar type work.

So what we're doing here with these four contracts is something unique to the Broad Agency Announcement. Typically, when you do a Broad Agency Announcement, and this comes back to what you were asking about, Ron, the contractor proposes what they want to do. And while we can ask questions of the contractor when we get a full submittal, we can't really say well, we want you to do this differently and this differently because it's your idea. You own the idea, and you brought it forth to us, and we have to fund it as proposed, if selected for funding.

So what we asked these four universities to do was agree to a joint kickoff and that joint kickoff is for them to present their scope of work to the whole group. And this is well outside of the scope of what we would typically do with BAA contract but we're not directing anything. We just ask if they were willing to do this. All four universities indicated they were. And we're not proposing to change the direction of anything on this.

What we hope to do is, after the four of them hear what each other is doing, that they will interact and cooperate organically without any direction from us. Each one of these is doing data collection, for example, and if they would share some of their data collection at different mines, we have the potential for really expanding the research. They each are using unique facilities, unique to assess the dust particles and, if they would cooperate, this really has some great potential.

So we are actually meeting next Wednesday is when we have this meeting scheduled and we have invited the NIOSH in-house researchers in these areas, as well as the four universities to participate.

We have also provided these researchers with material from the U.S. Bureau of Mines Generic Mineral Technology Center for Respirable Dust. This Center ran for 15 years and produced 18 volumes of funded research with different papers and things like that and this material wasn't available, other than in the volumes. We were lucky that Randy Reed happened to have the volumes that he had been gifted from a past Bureau of Mines researcher and we actually scanned all those 18 volumes. They are now available through OneMine.org and we also provided them on a Google Share Drive for all the four researchers because a lot of the things they are proposing to do are things that were done with older technology during the time of the Generic Center. And we think it really helps to bring all those papers together and give all the researchers access to them.

Chair Nelson: So you talk about data collection. Many federal agencies require that as a consequence of getting the federal monies. You can't require that?

Dr. George Luxbacher: Under the Broad Agency Announcement system, as it has been explained to me, it's basically their proposal. They proposed how they are going to go about data collection. So each one of them has an individual -- four different data collection paths and we hope that they will organically decide that hey, we can cooperate together and we can give samples that we can share.

Chair Nelson: So I understand that but I mean making public of the data base, the data that is created.

Dr. George Luxbacher: Oh, yes, and that -- so within the BAA scope, there is a data sharing which primarily relates to certain types of data and most of this data probably doesn't fall under that.

Chair Nelson: Really?

Dr. George Luxbacher: It's something we are looking into; let me put it that way.

Chair Nelson: Okay.

Mr. Wright: Just sort of a corollary there and I'm sorry I don't know this.

When either at some interim stage, where they have interim results or the final results, where do those end up? Does NIOSH publish those or are they exclusively or mostly in peer review journals?

Dr. George Luxbacher: They will appear in peer review journals. So we don't have a requirement, Mike, for anything to be published out of this, other than a final report. The final reports are all available from NIOSH.

Mr. Wright: Okay.

Dr. George Luxbacher: We used to post these on the website so they could be downloaded freely. We got into a 508-compliant issue a number of years ago and --

Mr. Wright: Sure.

Dr. George Luxbacher: -- access, ADA access, et cetera, et cetera.

So there is a certain format and, Bob, you can probably explain it better than I can.

Mr. Randolph: I think the issue is really more that they have not -- they are not NIOSH-cleared publications. They are products of the contractor. So they may -- they are not cleared through our scientific process.

Chair Nelson: Yes, but it's not your data. You just paid for it. So the idea of making it available does not imply that NIOSH --

Dr. George Luxbacher: And that's why -- well, so the decision was not to post these but we do make them available. So any researcher --

Mr. Wright: In what way?

Dr. George Luxbacher: -- all you have to do is send us an email requesting a particular -- as a matter of fact, if you go to the website under contracts, you can see all 150 contracts we have funded and any of those contracts that you wish a final report on, you just send it -- there is a link there. You just send an email and then we will send you a copy of the contract.

Mr. Wright: You don't have to FOIA it, you can just request it?

Dr. George Luxbacher: You don't have to FOIA it, right.

Mr. Wright: And is there any link to the actual peer review papers that get published?

Dr. George Luxbacher: No.

Mr. Wright: So you have to figure out where it is.

Dr. George Luxbacher: In the past, typically, the peer review papers come after the termination of the contract and we have no ability to reach out to the contractor once the contract is done. So we often aren't aware of the peer review papers.

This past summer, we retained a researcher who had worked with OEP, the Office of Extramural Programs, and we had her go back through and try to identify peer review papers that were associated with a lot of our contracts just to see what we had done in terms of impact factor and things like that. I have a report on that. If you would like, I could probably address that in the next MSHRAC presentation, give you a little bit of information on that.

Mr. Wright: Would it be possible to put as part of the contract that they have to at least let you know and then have you put on the web page what the link is to a peer review paper or the citation?

Dr. George Luxbacher: I don't think we can do that.

Mr. Wright: Because you can pay for it. I mean it seems to me like they ought to at least tell you where it's at.

Chair Nelson: You know NSF can do this. NSF requires linkages and requires access to all data produced by an NSF grant.

Dr. George Luxbacher: Right. They are grants. These are contracts, not grants.

Mr. Wright: Well, the contract is -- I mean --

Dr. George Luxbacher: It's something -- we'll take a look at that.

Mr. Wright: It's an agreement.

Dr. George Luxbacher: I can't answer that question right now. Everything I've been told is we can't do that but I will go back and I will ask some more questions. It's a reasonable question.

Mr. Wright: Yes, but we got a -- well, in our case it was grant but when we got a grant from the Alpha Foundation, that was one of the requirements. We had to tell them where it was published.

Dr. George Luxbacher: And Alpha grants are very different from our contracts.

Mr. Wright: No, I know. I know.

Dr. George Luxbacher: It's very different.

Mr. Wright: I'm just saying that it's good practice.

Dr. George Luxbacher: I will talk about that again on capacity-builds when we come across capacity builds here in a moment.

Okay, we have another contract that we issued, which was a major contract. It is a BPA or a part of a Blanket Purchase Agreement with the RAND Corporation and we're trying to look at the reason why some of the technologies that we fund never make it to commercial acceptance. We have our own preconceived notions of this but we are actually funding RAND Corporation to reach out and talk to a hundred different contacts -- we provided them with over a hundred contacts and we are going to do stakeholder interviews.

We had RAND Corporation give a presentation to PCMIA and I think that was very beneficial. They actually came out of that with about a half of dozen manufacturers who said, hey, we want to talk to about the issues we had with technology and some of the issues with the everybody always talks about the approval and certification hurdle but they also want to talk about the differences between different countries and things like that.

So I think this will be a very interesting report. It will put into -- it will put in black and white some of the issues that I think we talk about but we really don't have anything to support.

We also, I just wanted to mention, we have a Simplified Acquisition Procedure contract. This follows with what R. J. was talking about the work with DARPA on Project AMEBA. We actually started out with one of the people from OMSHR who was an evaluator on concept papers submitted for Project AMEBA and we have actually gotten very involved with DARPA on this now. We are interested in this because we think through-the-earth communications, at the end of the day, still is a viable -- should be considered as a viable technique in mine emergencies but there are technical issues associated with it and Project AMEBA has a direct correlation with what we're trying to do.

So while we aren't actively funding extramurally anything on through-the-earth at this point in time, we think that this has the potential for helping that in the future.

Now, we had funded Vital Alert to go make some measurements. And if you remember, I talked about this contract a few MSHRAC meetings ago, we actually funded Vital Alert to work with DARPA on this endeavor at Pittsburgh and they are going to be doing some through-the-earth communications measurements.

We have another small contract with SARCOS. We were in the process of turning over the mine snake robot system that we funded earlier to the MSHA Mine Emergency Operation Group, MEO, and we would like to get this robot in working order before we do. And there were a number of updates that needed done to it and repairs, and we currently have this with SARCOS right now, and SARCOS is working on this. This robot is designed to be dropped down a mine bore hole into the mine and then move around the bore hole to take pictures.

Our solicitation for the BAA will be coming out -- will be coming out here shortly. I think the pre-solicitation should be on FedBizOpps later this month or in early December. That's really all I can say about the 2020 BAA solicitations.

Chair Nelson: Can I ask you on the BAA you opened it up a bit last time.

Dr. George Luxbacher: Yes.

Chair Nelson: Did you get some things that were --

Dr. George Luxbacher: You're talking about the capacity-build now, rather than the technology BAA.

Chair Nelson: No, I'm talking about the BAA.

Dr. George Luxbacher: Oh, the technology BAA, we emphasized last time that we were soliciting proposals that were not necessarily related to the focus areas.

Chair Nelson: Right.

Dr. George Luxbacher: And I think you will be pleased to see that trend continues this time.

Chair Nelson: Good.

Dr. George Luxbacher: And that's all I can say at this point.

Chair Nelson: Yes.

Dr. George Luxbacher: The capacity-build contracts, I'm just going to touch base on these very quickly. So we had seven contracts completed from the mine ventilation cycle and we actually issued seven more contracts on what we consider the mine design cycle now.

So we actually -- the recipients of those seven contracts, we had 24 solicitations. We gave two of those contracts to CSM, one to New Mexico Tech, one to Penn State, one to South Dakota, one to

UNR, and one to VPI. And in your book you can read the names of these and you can see what they were related to.

The only thing I wanted to mention is this shows you the PIs. Our intent was to try to get these so that there was interaction between mining departments and other departments within a university and other universities. And the bulk of these either had significant internal collaboration or collaboration between universities. So we were very pleased with where we got to on this. It was very difficult to go through the 24 and pick out the ones that we felt had the best potential.

It's interesting. Some of these guys really go all out. Penn State got one of these and it seemed like it is on Facebook, its on LinkedIn. Everywhere I turned, there was another blurb about Penn State getting one of these grants.

Chair Nelson: They're good at PR.

Dr. George Luxbacher: They are good at PR. I will give them credit for it. It just blew me away because I saw it on Facebook first, and then I'm on LinkedIn and here it is on LinkedIn, and then it was on Aggregates Manager. It was everywhere.

Participant: USA Today.

(Laughter.)

Dr. George Luxbacher: So I wanted to point out that three of these -- again, continuing on our focus on respirable mine dust, at least three of these are related to mine dust. The one at CSM on smart bits had a part of it related to dust. New Mexico Tech is solely related to mine dust -- respirable mine dust. And then Virginia Tech, once again, we funded -- since this is a capacity-build, which lets them plan students over a longer period of time, we funded one of those in respirable mine dust again.

So we really are -- based on that National Academy

Study that we had, we are putting a heavy focus extramurally on respirable mine dust.

These are just the ongoing ground control contracts that we have. I just wanted to point out the impact. So after -- now that we've finished up the ventilation cycle, this is where it looks like right now. From the master's level, we have 83 master's completed, 103 in total and the doctoral, we have 52 completed and 81 in total.

Chair Nelson: Have you tried the capacity-building contract talk together at all and look at their methodology in actually building capacity?

Dr. George Luxbacher: What do you mean by talk together? We assemble --

Chair Nelson: Work together. Like I applaud you're pulling together all of the four universities that were doing that earlier.

Dr. George Luxbacher: Right.

Chair Nelson: But what is the best practice right now in capacity building?

Dr. George Luxbacher: We do these as well. We pull -- so all these universities. So for the ground control, we meet at the International Conference on Ground and Mining. It used to be held in Morgantown.

Chair Nelson: Right.

Dr. George Luxbacher: Now, it will be held in Pittsburgh.

Chair Nelson: But what I mean is you know if you are focusing on the capacity building, then all of these can get together and talk about exactly what they do with students and how they are successful in building capacity.

Dr. George Luxbacher: So that's an interesting concept. Perhaps that is something that could be

done at the Department Chair meeting at SME, although Jessica promises to attend it. I went once and I'm not going back again.

Dr. Kogel: He won't go back.

Dr. George Luxbacher: I'll leave it at that.

(Simultaneous speaking.)

Dr. George Luxbacher: That's why it's better if Jessica goes.

Dr. Kogel: I don't remember volunteering.

(Laughter.)

Dr. George Luxbacher: I wanted to point out -- this is just a -- so Hugh Miller, who is the current president of SME, has a traveling road show where he goes and talks about different issues within the industry and part of that is talking about the challenges of finding faculty. Since SME is funding, they have several different programs that the SME Foundation is funding.

I just wanted to point out, here is the Department Head that responded to their question. They put out a request for mining faculty and rock mechanics. They had 28 candidates. More than half had degrees in other than mining. Very few had actual rock mechanics background. Only -- not one was a U.S. citizen. Not one had a green card. Two were in the U.S. All the rest of them were overseas. So that's 26 out of 28 were overseas and only two were qualified and they were already working at other schools and they would have had to take them from faculty at the other schools.

So this just shows the continuing problem both in rock mechanics and mine ventilation going forward. So this relates to the question that we continually get: Are we going to continue to capacity-builds and ground control? And the answer I give is: We don't know yet. We are assessing that as to whether we

are going to continue in ground control or whether we are going to morph that into something else like we did with ventilation. We'll see.

But I thought this --

Chair Nelson: I will say one thing, that in fact I believe right now when we do a search, we get ventilation and ground control people. That's what we get. We don't get mine planners. We don't get anybody else. Try to find somebody outside of those two areas; you can't find them.

Dr. George Luxbacher: Now, this quote comes from one of your faculty, so --

Chair Nelson: This was not --

Dr. George Luxbacher: -- which is simple -- I understand.

Chair Nelson: This was not a school --

Dr. George Luxbacher: And I'm not sure which school this was that was doing this but I thought it was interesting. But it just shows the problem on finding adequately trained faculty.

So I just wanted to point out since the last time around, we did pick up one more person internally from the capacity-build program. That was Eric Watkins from Virginia Tech and he joined PMRD.

I want to talk just briefly for a minute. This is under consideration. We are discussing do we want to create a Respirable Mine Dust Research Center. This could be under a U1, a U19, a U54, or a U60, which is different grant types as defined by NIH. And we're talking about this -- actually, we're holding off on this a little bit while we see what happens with trying to get the four universities to work together under a contract mechanism. If we can get significant interaction in a contract mechanism, that may be a better way to move forward than to do a grant but we are giving some discussion to this.

And you can see the Generic Center that existed really over its 15 years produced a tremendous volume of material and it's a shame that that didn't continue forward because I think we'd be far better prepared today to address the issues we're having with Black Lung and silica, had it continued.

And I just wanted to mention that the EU funds what they call a consortium called Reducing Risk from Occupational Exposure to Coal Dust and they have a website that outlines all their funding and what research they are doing. It's an interesting website. So you may want to take a look at that.

I also wanted to mention we're looking at interagency working group possibilities here. We've been working with DARPA. Actually, our discussion with DARPA related to Project AMEBA were what brought us into the SubT Challenge because while we were there meeting with them, that's the first time they mentioned it and we said hey, we'd like to talk to you about this. And that's what actually led to all that.

We're working with SRI right now on drones. We're working with JPL. JPL is one of 42 federally-funded research and development centers that the U.S. Government sponsors. JPL was actually at PMRD for the SubT Challenge and we opened up some discussions with them on the basis of that. We're currently talking to them about robotics. They've done some interesting work on potentially intrinsically safe robots, which is always one of the issues that you have to deal with. The Mine Emergency Operations robot is extremely heavy because it is explosion-proof and JPL has some interesting ways to lighten that type.

So we are working with MEO on some things right now that define a needs document that we can talk to JPL about rescue robotics. We are talking to them about quasi-static sensors, which have potential for use on location in an underground mining section to actually define exactly where each person is and

possible use in proximity detection. Since it uses both magnetic and electronic wave, you have a better positioning that possibly isn't impacted by other materials.

And we're also talking to them about additive manufacturing. I just wanted to point out here that we're going to have JPL talk with the PI at Colorado School of Mines on the smart bit because JPL is doing some things with additive manufacturing that are absolutely unbelievable that probably should be considered under the research contract that we're funding at CSM.

Mr. Wright: George, what is JPL?

Dr. George Luxbacher: Jet Propulsion Laboratories.

Mr. Wright: Oh, it is. Okay. I had no idea they were doing that kind of stuff. I thought it was just a space technology.

Dr. George Luxbacher: They are funded by NASA but so anything that deals with hostile environments, they are interested in.

It's actually been fascinating to have some discussions with them.

Mr. Wright: Yes.

Dr. George Luxbacher: I also just wanted to mention that we also have some interagency agreements we fund through NPPTL and this is all related to the closed-circuit respirator. So we're doing some things there with NASA, as well as the Naval Surface Warfare Center and finding some different types of things.

We are also doing some work right now with -- we're funding some work on a liquid oxygen storage module. Picture this as a sponge that holds liquid oxygen. It has the potential to have an SCSR that is the size of a ten-minute unit right now but actually is good for up to two hours that a miner would wear

on his belt. Come out at the end of the day --

Chair Nelson: O-Rated?

Dr. George Luxbacher: -- O-Rated -- and plug it into a charging module.

And so we're doing some work on this. This is really in the early stages but it really looks attractive. So we're enthused about that.

Dr. Burgess: George?

Dr. George Luxbacher: Yes.

Dr. Burgess: I would suggest that you talk with the IAFF and NPPTL about this because they were using some liquid oxygen technology but really hit a brick wall. There were never any issues in terms of the actual application that they be specific to firefighting or may not.

Dr. George Luxbacher: Okay, we'll take a look at that. We've been doing a lot of work -- as a matter of fact, a lot of this work has been discussed in past MSHRAC meetings, if you recall, for refuge chamber applications. So we have done a bunch of work with liquid oxygen there and this is -- we're continuing to do some work related more to firefighters because that is a much bigger market. In mine rescue, it's a much smaller market and really can't support a whole lot. So NPPDL is doing some work along those lines that are more directed toward firefighters. So I believe they are already tied into that but I will follow-up on that, Jeff.

Dr. Burgess: Thanks.

Dr. George Luxbacher: Okay and I think that's my last slide. And I had to show a picture of one of our past subjects. That's Randy. Sorry, Randy, but that happens to be his name. He's at Missouri University of Science and Technology and we used him -- or he was used under a contract that we gave them on engineered solutions, dump truck vibration, and

impact on operator safety and high-impact shovel loading operations. And that project ended a couple of years ago in 2015 and, unfortunately, Randy is now just sitting in the corner waiting for his next task.

Chair Nelson: Well, he could come up to mines and join the one we have in Edgar and they could -- who knows?

Dr. George Luxbacher: Talk to each other.

(Laughter.)

Dr. George Luxbacher: So with that, I will entertain any questions.

Dr. Kramer Luxbacher: I have more of a comment, based on what Priscilla said about how can we say these are the best practices in capacity building.

I think that, obviously, mining has a severe problem in terms of attracting and building capacity but really engineering in the United States has a problem and that might be a really interesting peer review publication that you could put out if you wanted to in like an engineering education journal.

And it might be that you could just pull all the different PIs on these and say what were some of your best practices for recruiting students. What were some of your best practices for building infrastructure? What specifically did you do that really changed your ability to educate engineers?

That would be a great publication for NIOSH and a great thing I think to contribute to engineering education.

Chair Nelson: So thank you for that. And on top of that, my comment towards the undergraduate's pipeline is dangerously broken.

Dr. Kramer Luxbacher: Yes.

Chair Nelson: So even though NIOSH has not done

this, the idea of actually integrating the undergraduates into the graduates, so you actually have a total pipeline set up --

Dr. Kramer Luxbacher: Like a research experience that NSS has done in the past.

Chair Nelson: Exactly.

Dr. George Luxbacher: Some of the capacity-builds have actually done that. And although they talk about it in their final reports, undergraduates are not reflected in our statistics but we have actually funded through the capacity-build a number of undergraduate student researchers that work in the laboratory and whatnot. And so that has helped, I think, to bring that path.

Chair Nelson: And you know what NSF does, which I think is very effective, is offer supplements to the grants so that there is a tremendous -- if students or faculty have a good project they planned that they didn't have on day one and they could get the students involved in it, there's you know like a \$5,000 supplement per student. I mean you just make the connection. It's cheap to do and it's very effective.

Dr. Kramer Luxbacher: Can I say one more thing along this line? I wanted to comment on R. J.'s presentation earlier with the DARPA stuff.

I applaud NIOSH for putting all those resources forward because, again, we have a real pipeline problem and I think that gives great exposure to mining and it shows other cutting edge engineers -- I bet a lot of those teams were mechanical engineers and electrical engineers -- that mining really is a very high tech discipline and it isn't what the public perception of mining is because that's why we're having a hard time recruiting undergraduates into our field.

Chair Nelson: So Melanie and I were talking about this out in the hall on break, that if you take a look

at who Spokane or Pittsburgh is interested in hiring, that concept of who do they want to hire, it's not we're looking for 14 mining engineers. We're looking for all sorts of people and that sort of portrays the environment that you'd be walking into if you decided you wanted to join the mining industry and that story is not told.

Dr. Kramer Luxbacher: Right. And I think that the DARPA competition is great exposure for NIOSH mining but also for mining in general. I think it's a great service.

Chair Nelson: Good. Any other comments? Yes, Mike.

Mr. Wright: Yes, I was interested in one of your earlier slides, the two U60 projects on safety training for western miners.

Dr. George Luxbacher: Right.

Mr. Wright: At some point, I would like to find out more about those because we've look at, at least the way our people get the MSHA Part 46 and Part 48 training and it's mostly dreadful. And frankly, I'm a little skeptical that universities will do -- know enough about -- well, let me not step on toes here.

But universities are really good at training people who identify as students but their knowledge of adult education is often kind of lacking.

Chair Nelson: Oh, Michael, please come and visit us at Colorado School of Mining. That is -- no professor is at fault in this.

Mr. Wright: Okay, good.

Chair Nelson: We have good people who know what they are doing the mining training.

Mr. Wright: Good.

Chair Nelson: So they just happened to be located at Arizona and Colorado School of Mines.

Dr. George Luxbacher: So the idea behind the use of --

Mr. Wright: Well, let's see some of that because we're really looking at how we can improve the Part 46 and Part 48 training.

Dr. George Luxbacher: So we'll do that as a topic for the next -- we'll do that as a topic but the U60 training is supposed to be a cooperative grant and, historically, we have taken a little bit of a hands off approach.

We're trying to get more involved in this but it is interesting, both of the grantees have taken a lot of the NIOSH stuff and really developed the NIOSH stuff a lot further and developed some great material out of it. So I think there's a lot to be said for what we've done with this. It has actually been a very effective tool but you still have too many miners trained the old fashioned way, if it doesn't --

Mr. Wright: Yes, well these days, the refresher training is typically --

Dr. George Luxbacher: Yes. Yes.

Mr. Wright: The lowest ranking supervisor who doesn't want to be there walks in with a stack of videos and starts putting them on and leaving the room for a bunch of miners who don't want to be there either.

Dr. George Luxbacher: Yes.

Mr. Wright: And it's --

Dr. George Luxbacher: It's unfortunate.

Mr. Wright: Yes.

Chair Nelson: So any time.

Mr. Wright: Thanks.

Chair Nelson: All right, we prolonged that

discussion, as we always want to do but I really want to get more in before lunch. Next, we will hear about the Lake Lynn 2.

Update on Acquiring a Replacement Mine for the  
Lake Lynn Experimental Mine by Jeffrey Welsh

Mr. Welsh: This morning I want to briefly talk about the progress toward a facility to replace Lake Lynn Experimental Mine.

Just to refresh everyone, the proposed site is near Mace, West Virginia. It is a 461-acre site and the proposed development would include an underground safety research facility, supporting surface facilities, and parking.

Shown is a map of the proposed site. In yellow, the Lake Lynn Experimental Mine underground entry configuration is overlaid on the site as proposed for the new facility.

The site is between Randolph County and Pocahontas County in West Virginia.

Chair Nelson: Can you just remind me what is the geology in which you expect to develop it?

Mr. Welsh: Yes, as you know, it's not an existing mine, but it is a limestone formation.

Chair Nelson: So you expect all of it to be in limestone.

Mr. Welsh: Yes, exactly. And core samples have been taken to make sure the limestone formation meets the required characteristics and specifications.

As far as the activities to date, a draft environmental impact statement (EIS) has been completed that looks at and analyzes potential impacts on the vegetation, threatened and endangered species, water resources, noise and vibration, and utilities, of both the construction process and our operations once we would take over

the facility.

Two public meetings were held at a library near the Mace, West Virginia site. At both meetings, many community residents attended. A couple of concerns expressed were water supply and vibration. There is no public water there, water mainly comes from springs and wells. Also, concern over vibration and movement from the construction and operation of the facility on their foundations and their buildings was expressed.

GSA has responsibility for the process to purchase any property for the federal government. They have awarded a third-party contractor to appraise the property, and that has been completed.

The landowners have provided their selling price for the property, and GSA has determined their appraisal. Negotiations to acquire the site are in process. At this point I can't discuss either of those numbers.

The GSA EIS contractor is completing the information collection for the final environmental impact statement, and they hope to have that done in December. They hope to hold another informational-only public meeting in the January/February time frame. And they plan to post the final EIS in March/April 2020.

As long as negotiations are successful, GSA hopes that the actual property purchase would happen fairly quickly.

And once property purchase is complete, activities would include securing the funds for the construction, preparing and posting the facility construction RFP, awarding a construction contract, and constructing the new facilities. That process could take four or more years.

Chair Nelson: Do you think -- it's so far away that I haven't really raised this question. But the design of the facility, in terms of not just spatial arrangement

but instrumentation, both underground and at the surface, really making it into a field facility in fullness -- is that done? It doesn't necessarily have to be done for the EIS process, when do you have to worry about the buildings and other things.

Mr. Welsh: Yes, we have begun to think about those type of things.

Chair Nelson: But anything else conceptually to generate the excitement about it coming, it would be really interesting to do that.

Mr. Welsh: Yes, I agree.

Chair Nelson: -- and maybe even to suggest or have not a competition but an RFI to universities and contractors, potentially, about what would you wish to do at that site, what kinds of things, so that it's not just coming from internal. Actually think about how to make this a facility that many different kinds of things can happen.

Chair Nelson: You have time to do that.

Mr. Welsh: Yes.

Chair Nelson: Good.

Any questions or comments?

Mr. Wright: Is there any significant public opposition at this point or is it --

Mr. Welsh: Not that I am aware of. Some congressional staffers have attended the public meetings and we have had phone calls, and they appear to be in support.

And as I mentioned, at the public meetings, concerns expressed were the water supply and vibration. And I think the EIS addresses both of those.

Mr. Bowersox: Jeff, I understand the meeting in January/February will just be for information only.

They can't make any comments for that meeting?

Mr. Welsh: Yes, it will just be informational. At that point the public comment period is over.

Mr. Bowersox: It would be four years from once they start. Is that what you're saying, once they start the ground breaking?

Mr. Welsh: Hopefully, once purchased, then advertising the construction specifications RFP, and awarding that, maybe a year, and then three to four years after that of actual construction.

Chair Nelson: But you have a photo op for putting your shovel in the ground maybe in 2020, once the purchase is done.

Dr. Kogel: I just want to add one more thing to that time line. Once we purchase the property, then we also have to have funds to actually do the construction. There is going to have to be some time built into the time line where we're going to have to acquire the additional funds that are going to be needed to construct the site.

Mr. Welsh: Yes.

Dr. Kogel: And we don't know what that's going to take.

Chair Nelson: You know there are some underground mines, like over in Hagerbach -- have you ever been over to Switzerland -- where people, contractors, equipment manufacturers want access, and space is made available for them, and actually leased.

Mr. Welsh: I have not.

Chair Nelson: I don't know whether something like that can happen, but there may be some possibility of innovation/entrepreneurship coming in on the design to make space available for people interested in particularly new technologies, becoming a part of it.

Mr. Welsh: Thank you for suggesting that.

Chair Nelson: Any other questions or comments?

Kyle or anybody else who is on the phone, does anybody have any questions before we break for lunch?

Mr. Zimmer: No, I'm good. Very interesting.

Chair Nelson: We are going to break for lunch, and we are going to reconvene at about 1:15. (Whereupon, the above entitled matter went off the record at 12:13 p.m. and resumed at 1:16 p.m.)

Chair Nelson: Okay, are we reassembled, and we have a quorum. Is anybody back on the phone?

Mr. Zimmer: Yes.

Chair Nelson: Good. So the floor is yours, Dr. Kogel.

External Review of the NIOSH Mining Program:  
Outcome and Recommendations by Jessica Kogel

Dr. Kogel: Okay. So let me just do a quick check. I guess that was you, Kyle. Can you hear me?

Mr. Zimmer: Yes, that's fine, Jessica. Sounds good.

Dr. Kogel: Okay, excellent.

Okay, so I wanted to just give an update and an overview of the Mining Program review, which we have had several presentations about at past MSHRAC meetings.

So as a reminder, the approach that we used was a contribution analysis approach and Amia Downes, who has actually just joined us for this presentation today, talked about that at the last MSHRAC meeting and provided a lot of details. I'm not going to go into all of that again but you probably remember from her presentation that the process was to develop logic models and we use the logic models to establish a theory for how our program

outputs then translate into impacts and contribute to a given outcome.

One of the things that she stressed and I think is a very important part of this process is it is evidence-based, based on credible measurable metrics that focus on evaluating and measuring program relevance and impact.

We had a five-member independent review panel. The review panel represented all of our major stakeholder groups, labor, industry, academia, and government. And the panel was comprised of four subject matter experts. We had one translation expert and then also an evaluation expert on that panel.

You will probably recall from previous presentations that this review is a little bit different than previous reviews. It didn't review the program in its entirety but, instead, we selected three areas for the review. And these three areas are listed on the slide but they really represent the bulk of the program. These were areas that we felt had measurable impacts that we could present as part of our evidence package to the review committee.

The review covered the period of 2008 to 2018 and the program was scored in each of these three areas based on a five-point scale; five points for relevance or five total points possible for impact for a total of ten points.

In addition to scoring relevance and impact, the panel was also asked to respond to a set of questions provided by NIOSH. So there are four NIOSH programs prior to us that went through this review process but we were the first to include specific questions posed to the panel for their consideration.

As we've gone through this process, NIOSH has learned new things along the way and we've made adjustments. And so for our particular review, one of the things that we did that was a little bit

different is that we supplied specific questions for each of the three review areas that we wanted to have feedback on from the panel. And you know this was really an effort to help sort of focus the panel around some areas that we thought would be important for us to get feedback on.

I don't expect you to read any of those. I just threw them up here just so you can see they do in fact exist. And you can refer back to the report, which was sent out to you ahead of time.

This slide shows the review process. I had the same slide earlier for another presentation. So basically, it's a nine-step process. It started in June of 2018. I think we will be completely through the process by the second quarter -- I'm looking at Amia -- so it's almost a two-year process, once all is said and done.

The blue squares are all of the steps in the process that have been completed. And so we have two steps to do going forward. We have the report in hand and we are in the process of looking at that report, extracting the recommendations that were made by the panel, and then NIOSH will come back and we will respond to those recommendations in a report, and then our response to their recommendations will be posted on the NIOSH website. The committee report, as you know, is already posted on the NIOSH website.

So I'll jump right to the scores. So the panel gave us a score of five out of five for relevance and they gave us a score of 4.5 for impact, for a total score of 9.5. So we were very, very pleased with these results.

And in addition to giving us this overall score, there were also, as I've already mentioned, a number of recommendations, as well as some comments. So I certainly would refer you to the report to read these. But there were just a couple of them that I wanted to highlight for the committee that I thought were very useful sorts of things that we can now

take forward and use them to inform some of the decisions that we're going to be making as we set out our research program.

One comment that I want to share it about our program making substantial, unique, and vital contributions to the field. Another comment is that the majority of our intermediate outcomes were rated at the highest levels for impact and relevance. And they commented on the sustained and effective research-to-practice efforts which was something that was clearly highlighted in the evidence package and reflects our focus on research-to-practice.

So this next comment, I won't read it, but basically it's about how we've provided the foundation for the mining industry's evidence-based selection of equipment and programs to improve mine worker health and safety and also for the regulatory setting.

And then a final one, the panel felt that we did a good job interacting with stakeholders and this is something we have already talked a lot about today, this participatory approach with our stakeholders for identifying research gaps. So that was something that they commented on as well.

So that was some of their general comments and there are others in the package.

In addition to these comments that highlight where we are doing things in a way that is commendable, there were also recommendations. And I think recommendations are very, very useful. It's always nice to hear about what we do well. But I think equally important, and personally for me, of even more importance is hearing about how we can do things better, or in different ways, or how we can maybe shift the focus.

So what I've done is I've just put together three slides, one for each of the three areas that were part of the review. And I extracted three examples of the kinds of comments and recommendations

that were provided by the panel.

So these three are related to the chapter in the evidence package on disaster prevention and response. One of the recommendations made is that the panel felt that ongoing research needs to continue to be focused more on human factors aspect of self-escape.

The next one also addresses this idea of human factors research and says that NIOSH may need to focus more on social science behavioral research. And you know this is an area that, with the establishment of our Human Factors Branch, we have been working in for ten plus years. We continue to build capacity in this area. We continue to hire social scientists so that we can do this kind of work. And I think the feedback the panel is giving us is very consistent with feedback that we've gotten through other interactions with stakeholders, where a lot of the problems that we're trying to solve are not just technical problems but they are problems that also have a big social component and that's where the challenges are. And for many of our stakeholders, particularly mine operators, this is the kind of research that they are really interested in because I think this is where they are having the biggest challenge and it is where NIOSH has expertise.

So it was interesting to see that reflected back from the panel after they did our review.

They also made a suggestion that it might be worth us going out -- I think this actually already came up today -- and looking at some of the self-escape research that has been done for firefighters. That's not what our original comment was referring to earlier today but you know this comment of let's look at what other sectors are doing. What can we learn and how can we apply that to our work?

So they are suggesting that we look at self-escape research from firefighters as well as the military. What can we learn? How can we bring that into our

research?

So again, those are just -- I'm not going to say completely recommendations that I thought were worth sharing and highlighting for this meeting today.

Similarly for ground control, the panel suggests that we continue doing the work that we're doing with the interaction between frack well sites and coal mines because they really feel that, especially in the Northern Appalachian Coal Field, there is going to be more and more potential for the interaction between frack well drilling and mining and that there are some real health and safety consequences that we have to continue to do research around in this area.

You know they suggest that we continue doing our cemented backfill work, especially in western underground coal mines. So that is helpful to hear because oftentimes we have research that is -- ongoing research that we feel is important but we need to have the independent judgment of these panels to come in and just confirm that for us.

And then another one around ground control addresses adding case histories, especially for the dipping limestone beds and also multilevel underground mines that have deeper overburden. So these are some of the ground control recommendations and, again, there are many others that are also in the report that we will be considering and providing responses to.

When it comes to respirable hazards, the top one comes back to opportunities for looking at more optimal dust suppression methods that specifically target the removal of respirable crystalline silica from coal mine dust and that's an area that we're actually looking at and have some active in -- did I do that? Maybe I did. I don't know.

So another suggestion that they make is that we should consider exploring interactions between

crystalline silica and diesel particulates to look at the question of mixed dust exposures, which is something that we talk a lot about. I think we know that this is an issue that requires more research and this recommendation helps raise that issue to a higher priority level.

And then the last one is something that actually came up as a recommendation from the National Academy's Report and the Consensus Study that was done two years ago and that is basically a recommendation to do research aimed at understanding the fundamental characteristics of coal mine dust in terms of particle size, particle shape, particle size, and shape distribution, and the types of particles that are found in coal mine dust and how that then leads to disease, to lung disease.

So that is an area that is also on our radar. George talked about some of the work that is being done in that are through the extramural program.

So that's just to kind of give you an idea, if you haven't had a chance to look at the report yet, the kinds of things that are in the report.

The two next steps are for NIOSH to provide a written response to the recommendations and post them on the NIOSH website. That is my last slide.

So any questions on this discussion?

Mr. Horn: Yes, Bob -- yes, I have a question. Bob Horn.

The question is not a criticism, it's an observation and I would like your reaction.

I'm probably the oldest in this conversation, having dealt with the silica question for the longest period of time, especially in relationship to black lung. And the question I've got is that technology has changed dramatically in the sense of miners having the opportunity to use protective helmets, and air masks, and whatever else you want to designate

them to be, and has reduced, at least in my understanding, the incidence of black lung.

So the question really is: In the research that you guys are doing, are you talking about new very much stricter silica regulations or research ultimately ending up in MSHA regulations or have we accomplished the goal already, in terms of reducing the amount of silicosis that exists?

Dr. Kogel: So thanks for the question, Bob. I think it's both. I mean I think to address this issue, we've got to look at the regulatory piece of it and MSHA is doing that now. And they published an RFI on crystalline silica, so I know that they are looking at the standard. And NIOSH is participating in that by providing comments to the MSHA RFI.

And also at the same time, as you mentioned, there has been a lot of changes in technology, both in terms of technology that can be used to reduce exposures and technologies that can be used to monitor exposures. And so there have been technological advances but we need to continue working in those areas as well, to be able to effectively address this issue. So I think it's all of the above.

Mr. Horn: But I mean from what I am understanding, correct me if I'm wrong, is that we're looking at the potential for further regulation. And I ask, fundamentally, whether that's necessary.

Dr. Kogel: So that's an MSHA question. What I can tell you is that MSHA is looking at the standard and that was the RFI. That's where they are in the process.

Mr. Horn: Yes, correct.

Dr. Kogel: And you know I'm not sure -- from NIOSH's perspective, I think we work with MSHA and I'm speaking just kind of more generically than just respirable crystalline silica --

Mr. Horn: Yes.

Dr. Kogel: -- but what we try to do is to make sure that the research that we do is research that can be used to inform the regulations and I think MSHA also shares that interest as well.

In an ideal situation, regulations and science work on a time frame where one can inform the other so that we have good science-based regulations. That's the ultimate goal and that's what we try to accomplish.

Mr. Horn: I guess the fundamental question I'm asking, and maybe I'm not articulating well, is I understand the difference between MSHA and NIOSH, and what their roles are, and what NIOSH's role in terms of research is. So from a research perspective, from where I am sitting, and correct me if I am wrong, the hazard has changed but the way of addressing the hazard and reducing the amount of risk have changed dramatically. And so the question becomes, in your recommendation of how to proceed: How do you join in responding to MSHA's initiative in relation to how you address the hazards from a scientific point of view?

Dr. Kogel: So I'm not sure you elucidated your question exactly. I guess your first comment about the hazard hasn't changed, I think that is an open question still --

Mr. Horn: Okay.

Dr. Kogel: -- I think because that is how you couched the question the first thing we could debate or talk about is whether or not the hazard has changed over time.

Chair Nelson: Or the understanding of the hazard has changed and is still changing.

Dr. Kogel: Or the understanding of the hazard.

Mr. Horn: Yes.

Dr. Kogel: You know there are different hazards. And I talked a little bit about mixed exposures. And so to play this out, miners now today -- and this is hypothetical

Mr. Horn: Sure.

Dr. Kogel: -- may be exposed to more things, DPM, crystalline silica, coal mine dust, you know radon -- I don't know, I'm just throwing a lot of things in there, and we've never really looked at the health effects of complex mixed exposures that are probably occurring in the mine environment.

Mr. Horn: Yes.

Dr. Kogel: What I am trying to say is that the profile of hazards or exposures maybe has changed.

Crystalline silica may change over time, depending on where you are mining, the geology of the particular deposit, or the mining methods being used may change the characteristics of that exposure.

So I'm just giving you very hypothetical examples of how the actual exposure could change and we never -- well, I shouldn't say we never -- we have not recently done that kind of work to determine variability of exposure over time or spatially. And that gets back to one of the recommendations made by the panel and that's looking at the fundamental characteristics of these dusts because I don't know that we have information as to whether or not these dusts have changed in terms of particle size and shape, for example, over time. And that could all have a consequence on the prevalence of disease. So let's say you have more finer crystalline silica that miners are being exposed to than in the past.

Mr. Horn: Yes, but the amount -- from my understanding, the amount of exposure in the sense of the incidence of the disease has diminished substantially over time.

Dr. Kogel: As measured by the MSHA data, I think is what you are referring to, if you go back and look at the data.

Mr. Horn: Yes.

Dr. Kogel: Yes.

Chair Nelson: Well and not that we completely understand all aspects of the exposure. I mean maybe aggregate dust exposure has decreased but it may be the active components of the dust may not have been.

Dr. Kogel: Right, exactly.

Chair Nelson: So I think you know just fundamental understanding of this.

Dr. Kogel: Of that, right.

So Mike, I know you have a comment.

Mr. Wright: Yes, two things. One is there is a lot -- there is -- we think there is less silicosis in -- well we know there is less silicosis among metal and nonmetal miners than there was say 20-30 years ago.

But the other disease silica causes, and this is a relatively new understanding, is lung cancer and we have no idea about that.

We also believe, at least in our minds, that on some of the new technologies coming online, like the use of these continuous miners on steroids that can actually handle hard rock, may create more dust than in the past and we need to sort of take that into account.

The other thing that I wanted to comment on was what you said earlier about the use of these. It seemed to me you were talking about powder and purifying respirators, helmet-type, and we are very skeptical about those as a means of control.

Some of that is based on personal experience. I was once testing one that had a filter for sulfur dioxide and went into bronchospasm from the sulfur dioxide. And it turned out I had over-breathed the respirator because I was working hard. It only supplied 4 CFM to the helmet and I was apparently breathing harder than that.

But I have also done a couple of inspections. One in particular in a plant in Northern Canada which recycled essentially arsenic tailings from an arsenical ore body in a gold mine. And everybody had an enormously high urinary arsenic levels, even though it was kind of new high tech plant. And it turned out they were wearing this kind of respirator. They have a pretty high assigned protection factor but I don't think it's any better than two or three.

So I know there is a lot of interest in terms of using these as I guess a higher up control on the hierarchy of controls but we would really caution against that.

So I think there's plenty of evidence that MSHA needs to at least take a look at its current silica standard. My union and the mine workers joined the petition for a new silica standard that had at least the same PEL as the current OSHA standard and the one that's recommended by really every major organization that recommends health standards.

Chair Nelson: Well I also wonder about there is a lot of talk about moving towards selective mining. And when you try to come in with the selective mining, the dust concentrations are going to be changing dramatically. And you may have had dilution from mass mining that now is concentrated because of selective mining.

So anticipating that that's going to be a driver. I mean I hate to have it where it just goes down along the road and then somebody says oh, we have a problem, when we can anticipate that there will be a change and then have to evaluate whether it's going to impact or not.

Mr. Bowersox: I was just going to add on to what you said. The cord was bigger. It cuts faster. They are cutting more rock now than they did in the past. So that's got a lot to do with it.

Chair Nelson: Yes but what I wanted to ask about this is when I read the report from the committee -- from the panel, they were recommending things like surface mine and quarry high-wall stability studies. And they got into tailings, and dams, and impoundments, frack wells, and casing-associated damage with substance. These are quite a number of things that I don't think of NIOSH as having done a whole lot of this stuff.

Dr. Kogel: Yes.

Chair Nelson: What are your initial thoughts about some of these recommendations?

Dr. Kogel: We will go through each of the recommendations and one of the things that we will evaluate is whether or not NIOSH has a role in a particular research area that they are recommending to us.

And so we are going to look at each recommendation and determine if we have the capacity and expertise to address the recommendation.

It's perfectly acceptable for us to come back to the panel and say that something is out of our wheelhouse. It may be a topic or problem that falls outside of the scope of the work that we do or we may determine that it's an area that we have the resources to do effective research in.

So there may be some recommendations where that would be our response.

Chair Nelson: But the kind of things -- these kinds of things are certainly subject to research --

Dr. Kogel: Correct.

Chair Nelson: -- that people are doing in academe.

Dr. Kogel: Yes.

Chair Nelson: So the basic sense of maybe being clear once you post this and have all it up that some of these areas that NIOSH may choose to not go in intramurally might be something that extramural people could respond to. And if that is welcomed and could be made clear that it is welcomed, that would be helpful I think.

Dr. Kogel: Yes, so like I said, we will evaluate each against some criteria. And Amia is going to be working with us -- we have already started this process.

Chair Nelson: Yes.

Dr. Kogel: Is there anything you want to add to that, Amia?

Chair Nelson: I wanted to ask one other thing. There was a lot of discussion about outputs, and intermediate outcomes, and then ended -- end outcomes. And a lot of the metrics that you are doing are output metrics, right, because it seems like you're -- so maybe I don't understand this but the idea of how many papers get published is an output metric.

Dr. Kogel: Correct, that's not an impact metric.

Chair Nelson: Right. So the intermediate outcomes are when -- has to do with adoption --

Dr. Kogel: Right.

Chair Nelson: -- responding to the research. And then the end outcome is a measurable reduction.

So you can set the stage for these but I'm wondering if, in the canopy air or the helmet cam, their comments that they made there, the idea of saying are you prepared to get the measurable reduction that will tell you it's an end outcome that

can be rewarded. Even with the canopy air situation, do you have the metrics? Do you have the observations in place that you can make to actually demonstrate the end outcome.

Dr. Kogel: So I'm going to make one comment and I might ask Amia, also, because this is something that she's thought a lot about and we've had a lot of discussions about end versus intermediate outcomes.

But one of the things that did come back from the panel, and you saw that for impact we had a four and a half.

Chair Nelson: Yes.

Dr. Kogel: And this kind of is maybe a little tangential to what you're talking about but it gets back to this idea of we have to have credible evidence. one of the things that came out in the report is that the panel feels that we weren't really able to demonstrate impact in certain areas because we didn't really have good credible evidence.

Chair Nelson: Right.

Dr. Kogel: And that all has to do with our initial project planning and making sure that when we write a project proposal we have this some idea in mind of we are going to measure impact. For example, this is the information that we are going to collect and this is how we are going to collect it.

Chair Nelson: Right.

Dr. Kogel: And we don't have a systematic way to do that and it kind of gets back into what you were saying because there are times when it is easy to measure outputs, right?

Chair Nelson: Uh-huh.

Dr. Kogel: You can count how many downloads but the point is that downloads don't have anything to do with impact because you don't know if somebody

adopted what they downloaded and then put it into practice in the mine to help improve health and safety.

Chair Nelson: Right. So the canopy air is perhaps because we heard about this today --

Dr. Kogel: Yes, and Randy is going to talk about it.

Chair Nelson: -- units have done it sort of like okay, now how are you set up to make actually make this -- make the end outcome observations.

Dr. Kogel: Right. So I'm going to let Amia talk a little bit about the end outcome, if you would like, if you are prepared to do that.

Dr. Downes: Yes.

Dr. Kogel: Do you mind?

Dr. Downes: Can I just give you five likes? It was so great.

But I was so excited to hear you just catch on to the definitions of those things. It takes us forever, like over and over to get people to understand what these are. So you got them quick.

So with the intermediate outcomes, the whole thing behind contribution analysis is that cause and effect relationship trying to measure that end outcome in research, especially at program level when you have all these different things coming out, it is almost impossible, if not impossible, to make that cause and effect connection. So we are trying to measure our impact through the establishment or looking at intermediate outcomes, which is the adoption. That's really our first step.

And so mining and every program that went through review, this is their primary struggle is identifying where it happened and then documenting that it happened. And so contribution analysis works well for us.

And OMB, and CDC, and HHS seem to have accepted contribution analysis.

Chair Nelson: It gets a lot of anecdotal --

Dr. Downes: Yes.

Chair Nelson: -- that's the thing that --

Dr. Downes: But then the end outcome comes when, at the national level, that cause and effect relationship, we don't have a great way of demonstrating it but what we have been able to do is, in certain cases, where if we went out to a company either on State level or local level to be able to show that there is a reduction and then we can also show cases where it has been adopted, we have a strong case to say this has been proven an effective intervention. Here it is on a case basis and a case study where it has been shown effective.

And in theory, and that's why we pull these independent experts together and ask them: In your opinion, do you think NIOSH is contributing to X reduction and to show you these results. If we can show that it has been adopted more widely, we can say here's what we think the reduction would be.

Chair Nelson: Right but if tagged along with the getting it adopted embedded in there or some kind of observations about reduction or improvement, rather than just adopting it, I mean it seems like we could think about it ahead of time. It might be possible to get some of that stuff.

Dr. Downes: We need to do more intervention and effectiveness and that will give us some of those case studies where we can actually do that cause and effect relationship.

And NIOSH, historically for our engineering controls, our technologies, I mean we really do that stuff because you have to show that the control or the technology is effective.

Chair Nelson: Yes.

Dr. Downes: But when it comes to training and health communication documents, and stuff like that, we haven't historically done that.

Chair Nelson: So I didn't read the evidence package because it was too big but in there is the -- it discussed about the explosibility meter and that it has been used by many. And it was like okay, to what end? Are they still using it? Did they try it once? Do they believe it? Do they trust it? I don't know.

So yes, things to do. Okay.

Any other comments?

Kyle, do you have any questions or comments?

Mr. Zimmer: No, I'm good, Priscilla, thank you.

Chair Nelson: Thank you.

Any other comments?

Well, thank you very much. It's an interesting process and I know that everybody will be interested in what is finally posted.

All right, we are ready for the strategic plan update from Lisa.

Dr. Steiner: Hi, everyone. I'm glad to be back after -- I think the last time I talked to you guys we had just started the strategic plan. You guys gave us input for that plan and then we took those thoughts into account and came up with a plan that came out that was interactive.

So I don't know how many of you use this, while in the beginning it seemed like we were maybe using it as a way to walk through our web. It's just another tool to use. But I wanted to give you an update that what we've done in the last 18 months or so about with the plan.

So do I have a -- I don't have a mouse, do I? So this just goes -- okay. So down here is this -- Bob, at some point, could you -- I'm going to come back to this at the end, the link.

Mr. Randolph: Do you want to click on it?

NIOSH Mining Strategic Plan Update by Lisa Steiner

Dr. Steiner: Not right now but I will in a little bit.

Okay, so one of the things that we took a look at whenever we were going back to update the plan were some of the IGs and I've circled two here because we were taking a look at whether or not the intermediate goal was broad enough to allow us to study more things. And two of these stood out. I think there is probably two more that can stand out. I also think there might be a couple things to be combined but it wasn't real necessary at this point because we didn't have more projects that were going to be basically in violation of this, and I say that loosely.

But for our intermediate goal 1.3, that was about heat stress. And instead, we've decided to increase this to environmental factors because we've learned that there is a lot more than just heat stress out there. For instance, I think SMRD has been asked now to do cold stress. So we think that improving that to being more broad in terms of what our goals are, remember this is a snapshot of what's going on in our program and what our path is forward, so we have decided to improve on that goal.

And the same with 2.5. We had something in there called fit for duty. That can sometimes be considered a program, something that kind of has a phrase attached with it. We changed that to readiness for work. One of the reasons why is we also introduced a new project this year for inexperienced, the highly inexperienced worker, the attributes of that contribute to health and safety issues.

So this let us broaden that and we are going to keep looking at our goals in that way. Everything else you see here is what it was before. I don't know if people find this useful to go out there and look at this. One thing I was thinking about -- we want your feedback. So one thing I was thinking about is underneath each one of these IGs could be a little icon you could hit that would tell you everything that we're doing for that goal and how that -- how all of these things that we are doing project-wise, or research focused area-wise contributes to the successful completion of that goal.

So these will stay the same for the most part. We've done a pretty good job, I think. It held up over two years, so it's pretty good.

So what have we done? So we have added and hyperlinked all of our new projects. So since you have seen this before, there have been 15 new projects added and they were in 2018 and '19, just the timing when you saw it the last time, those projects weren't approved. So now they are in there from 2018 and then the new projects that just started last month are there as well. So we made sure that those research-focused areas are there.

We've also updated, necessarily, the activity goals. So you have new activity goals that come along with the new projects. In some cases, the new projects are kind of carry-on. So we had a float dust project before. We have another float dust project to do the actual intervention and engineering controls. So of course, we will link those things together so that you can see the basic research that we did and then the intervention research that we did.

So we have updated those and verified the activity goals. And that might seem odd to you but it is research and sometimes things change a little bit. And so we think we have an activity at the beginning of the project and it might just change a

little bit as we learn. So that's why that is like that.

We updated all the data and statistics to bring them up. I don't know if you remember we did a five-year running average for our reporting of the new MSHA data. It came out twice since then, so that's been updated. And then anywhere else that we can, if somebody has some new demographic data, that's all updated in there.

So I know one of our projects for surveillance had some new metal/non-metal come back. That's updated in there. So we will continuously do those updates as it goes along.

We also removed projects that ended in 2017 and '18 but we retained the links to them. I don't know if you remember the tables, and I will show you one in a little bit here, but I will show you how this one works in a minute here. I won't go into it.

And then we have a partnership list. We're talking about having two more partnerships that are going to come in the near future, so we mentioned them in there, but we also have links to those partnership pages so it will be easier for you, when you are looking at it, to find those links.

So this is -- did I go one too many? No.

So this is an example just to show you here. I don't know, is this a pointer here? Oh, look at that. Okay.

So in this particular IG, and we just picked this one out of there and I think that this one might have some of the gas well -- I think it might have the gas well. But what we did was took a look over here. This one ended in 2019, so it just ended, but it's still here on the list. Now, the 2018s were taken off but there are still ways to link to those. And if we have something in here that's saying this, that means next year, unless something else comes up that fits into this particular IG for that health and safety concern, which I will probably say that something would be in there, this would fall off but

you could still get them on the project pages.

Chair Nelson: Why did you take them off?

Dr. Steiner: We take them off, the two years prior.

Chair Nelson: Why?

Dr. Steiner: Well because the table will get really long.

Chair Nelson: But if you put the newer ones up top and then the older ones down to the bottom --

Dr. Steiner: Is that something you would like to see? Because I'll put that down --

Chair Nelson: To me, I'd like to see how it's building, how the entire flow of research in that area builds to the crescendo of where we are.

Dr. Steiner: Sure.

Dr. Burgess: How about an alternative being a link for older projects at the bottom? At least that way -  
-

Dr. Steiner: I think that's better.

Chair Nelson: Something, yes.

Dr. Burgess: -- you could go to it if you want to but it doesn't clutter up your table, otherwise.

Dr. Steiner: So and in that case, this is how we have done it, is for instance, this mine fires. When you go to this link to the mine fires, it will take you to the pages that have to do with mine fires and you'll find all that information. So we don't lose the information. We still have the link and have the related research project or, if something in health and safety concerns comes up and it is related to that project, you will find that link when you go to that one.

So and it's an effort to keep the tables down but it doesn't mean we can't give that some thought

about how we are going to do that but that's how we were doing it.

Okay, so down here when you look at the equipment fires, now this was a new project added in 2019, so it's in red. That means that you're seeing this and it's new for you. So in order for you to go there quickly, you would just find the red things and you'd say oh, I haven't seen this yet; let me see what's going on here. And the same with lithium ion batteries, that came onboard in 2019, too. So that makes sense. But again, this feedback is really good.

Okay, so you know a reminder that we are trying to do a good job at this and I would really like to know if you're using it, if it is something that you go to. Do you pull it off of the website? Is it apparent enough, things like that? If anybody has any feedback on that because we have things that we need to do better.

We'll keep improving those tables but if there is something that anybody would like to comment on regarding how we could do this better, how you could use it better.

Chair Nelson: Well, I think it's really good that you did this and organized the work that you're doing, which is very good and self-explanatory in many ways.

And I like the way -- you know I refer people to this when I hear civil engineers in heavy construction say we have a question about the fire. And I say did you ever look at this and see what NIOSH is doing because they didn't know. They didn't find it. They didn't know what. Now they can actually find it and that's good.

Dr. Steiner: That's good. I appreciate that.

Bob, can we go back to that one? I guess I could do it. Never mind -- or if you could press the button.

Mr. Randolph: Okay. Do you want to bring it up?

Dr. Steiner: Yes, just bring it up once real quick.

I mean it's pretty prominent on our site. You know is that good enough, the way that we're updating it, where the red is the new stuff coming in and the -- I mean does that draw your attention to it enough? Oh, no, we didn't do that in statistics.

Chair Nelson: Well, I just as soon have like a start date somewhere on that so that -- I mean for a project, so that you can see when the project started and you know --

Dr. Steiner: You mean like that in the table? Because as soon as you have a link, it gives you all of that and it gives you all of the outputs that are associated with it.

Chair Nelson: I think for me, I would like that.

Dr. Steiner: Start mandates on it.

And sometimes I guess we could do that and then if it was something that was a continuation like float dust, it would just expand the time frame that was being studied. We'll have to talk about that.

So here you can get the overview of the strategic -- of that table that we showed, which can take you automatically to whatever you need to see but we also have each of the pages there. If you just want to see things in mine disasters and survivability, you just hit StratGoal 3. I don't know if there is a way that you would envision that happening.

You know we update -- just to give you an idea that we update this. So the MSHA data comes in about July and then we have to go through that data and make sure that it is okay and usable. And once we get through that, it is usually about August to the beginning of September and then we use that data to regenerate the statistics that you see here. So this will come out in about November of every year.

The other thing that we do is update the project pages so that it's not just on the researchers' minds to update it. We have a person, Joe Shaw (phonetic), who updates those pages and then has the researchers check them. So now you have a current list of all the outputs that came out of that.

So these are the project pages and that's another thing that we did this year. We had a meeting with all of the PIs and we said hey, here's three different types of or ways that researchers put their project pages in, because you'll see that some are a lot more detailed than others. And then when they see how their work is getting captured, and some of the ones that put the more detail in or the more links, they see that and now they're starting to go towards that model. So really, there is a lesser, more, and most model here.

Chair Nelson: I see a search up at the top. What is that search? I'm wondering if you're interested in all of the mining research and you wanted to find out who is doing what on one thing, you know --

Dr. Steiner: Yes, so slips, trips, and falls.

Chair Nelson: Is the entire database searchable?

Mr. Randolph: That search is restricted to just the NIOSH Mining Program website. It is unlike the rest of CDC's where you would search one term. It might bring up some of your relevant things.

We have programmed this search. You can undo it but by default it goes just to the Mining Program. So I can show you. See right there, it defaults to Mining. And you can search all of NIOSH and all of CDC, if you wish.

Chair Nelson: Okay, so that -- if that could be explained, if it is not explained, what people are doing when they just click on the search. If you don't what you're looking for but you have got a key word, try search and it will pull up projects.

Dr. Steiner: We could have a box that comes out and says that, I guess. You know I'll say things and Bob will tell me I'm crazy.

Mr. Randolph: Yes, it's a balancing act between cluttering up the interface and providing guidance.

Chair Nelson: I mean some search engines go out and they are just a Google search and they just they go everywhere. And you don't want to go everywhere and so you stop using it.

Dr. Steiner: Any comments? Any thoughts, questions?

Chair Nelson: Great.

Mr. Randolph: We have tagged all of our website with a thesaurus of terms specific for mining. So we have gone through a lot of the work to help you find the latest.

Chair Nelson: Good.

Mr. Randolph: So this will bring it up.

Chair Nelson: So this is all internal, intramural.

Mr. Randolph: Yes.

Chair Nelson: So the next thing is to include the extramural stuff in it.

Dr. Steiner: We were just talking about that. Weren't we, George?

Chair Nelson: There you go. That's just the next thing.

Dr. Steiner: We're talking about including some of the BAA work in the strategic plan for the future years because we also see the connection between the intramural and then for everybody else on the outside, they like to see that.

Chair Nelson: Yes.

Dr. Kogel: So Lisa, kind of on where this is, there is a plan NIOSH-wide to provide a platform where people NIOSH or people outside of NIOSH can come to a website and look at what research is being done, both intramurally and extramurally, to try to kind of bring those together. So that is something that is in discussion and there is talk about doing a pilot project and then, eventually, depending on how that goes, it may lead to some sort of platform that will be available in the future.

Chair Nelson: Good. Okay, thank you, Lisa.

All right, Kray is up next.

Metal Mining Automation and Advanced  
Technologies Work Group Report and Discussion by  
Kray Luxbacher

Dr. Kramer Luxbacher: So the Mine Automation Work Group Report, I distributed the second page of the report as a hard copy. So those of you that are opening the electronic report, we are looking at page 2. It says Executive Summary at the top.

I don't think I had quite enough hard copies. There are some in the back, if anybody wants to grab one.

Let me say a couple of things about the report and then I'll talk about the recommendations that we made.

First, the report is quite -- it is lengthier than one page, of course, but really what comes after this executive summary recommendation are support and justifications for the recommendations. So I think that will be helpful to NIOSH, but it's not something we need to discuss here now.

The other thing that is in the report that is important is there is a link to the raw materials project workshop. And that includes any PowerPoint presentations that speakers agreed to be released and it includes notes that Kyle Zimmer and Jeff Burgess help me put together to sort of capture the

discussions that we had in workshop. So I would say those are great materials for mining for NIOSH in terms of what you want to do, some ideas.

One other thing is that I think our role as an advisory board, when appropriate, should be to advocate for the work that you do at NIOSH. And I made a point in the conclusions to say that in automation things are developing very rapidly and they are developing on an international scale. And I think that it can be difficult for a lot of federal organizations to send their researchers on international travel and it is pretty critical here that you have the freedom and the money to do that because things are developing real quickly.

And there are very unique things going on in Europe, and Australia, and South America that I think it would be very useful for you to see.

And the other point is that NIOSH has a great reputation and long history for building good partnerships. And again, there need to be international partnerships in those areas of automation.

So I just wanted to make that point and sort of I put it in there as an advocacy type of piece.

So why don't I go through the recommendations that I made? And my goal was to give you something you could pick right up and run with, if you chose to, but not make the recommendations so narrow that you didn't have some freedom because, certainly, as we pose research questions, I think the great thing is you usually come up with three or four better research questions if you start on the first.

So the first is fairly broad: track the degree of automation in various sectors in the industry best practices and determine measurable impacts on health and safety. That could be an umbrella over all of the bullets that I have here and gives you some freedom.

The second is assess and define appropriate limits for human operators interfacing with machines, particularly in remote control. And this was a bit harder to define but I wanted to give an example of what I was getting at.

Joel Haight, who was very engaged with this workshop, gave an example of remote operators who are watching patient vitals in hospitals and how much data they can actually deal with at a time; how many alarms a single human can manage at a time, that sort of time.

So this is a new area where we don't necessarily understand the impacts of all these alarms and data on a single human operator. And that's going to be back to behavioral science and that kind of expertise.

The third is identify and study the gaps in sensing and situational awareness, developing solutions that complement existing technology. So this could include designs for providing situational awareness to operators; new sensing devices, such as wearable sensors, which you are already working on; and continue to expand and build upon the work in proximity detection; sensing of alertness; and controls for maintaining alertness and engagement.

And feel free to interrupt me if you have something to say.

The next is research the use of unmanned vehicles for collection of environmental data that can lead to improved health outcomes; collection of environmental data to provide group safety. So I sort of set those apart because one might be that you are collecting data about particulate matter in the air; whereas, the other may be doing something like going into a particular hazardous area, rather than sending a human in for inspection purposes. And then collection of data, of course, during emergencies and catastrophic events.

Identify measures of success for autonomous

systems in terms of health and safety, and disseminate standards and tools for such measures. This came a lot in the workshop in that we've got all of this going on but everyone is not on the same page. We don't know exactly how to measure success yet.

And for instance, what is a near miss in an autonomous system? Things like that I think is a place that NIOSH could really contribute. And how does efficacy of such distort metrics?

And then conduct a complete review of other industries undergoing similar conformitive change. This is pretty obvious. I don't think I need to tell NIOSH that's a good recommendation. I suspect you are already doing this with regard to autonomous systems. And identify partner offices in NIOSH, as well as partner agencies around the world for transfer of knowledge and best use of resources.

The next: Identify partner operations for holistic research that characterizes the best approach for mine site design or retrofit with regard to autonomy. Develop plans for long-term projects. And there is certainly an operation I have in mind here, and that would be the Resolution Copper Mine. We talked about that a lot at the workshop and I think now is the time to really build relationships with them and talk about things that you want to track and study as they design really a greenfield site for automation. There won't be many opportunities to study and operation that size and that complex from the ground up.

Design risk management approaches that are less linear than current approaches for use with complex autonomous systems. And this came out of some of the recommendations Robin Burgess-Limerick made. A lot of these risk management approaches have really been developed and utilized in Australia but they are fairly linear. They really aren't taking into account these new more complex systems.

And finally, study how the behavior of workers in mines changes as they interact with autonomous systems. And one area I have had in mind there is situational awareness is shifting. So we are going to sense and tell a person about the situation, rather than let them sense and understand the situation. So how does their behavior then change?

And what I'm thinking about, for instance, is if you have proximity detection on everything and you are counting on your equipment to tell you are too close to another human, you are too close to another piece of equipment, are you thinking about where you are? Are you thinking about your proximity, things like the red zone around the continuous miner? I don't think new operators think about the red zone as much. I think they count on their prox detection.

So those were sort of the bulleted list and I would like to know if anybody sees any glaring omissions or areas that are just too narrow and that I should broaden.

Chair Nelson: Well, thank you. It's great to see the report. Sorry I didn't have time to digest it.

Dr. Kramer Luxbacher: Oh, it was my fault. I apologize for not getting it out.

Chair Nelson: No, it's fine. But you know the points that were brought up about -- I mean it's a very high level thing to say how do we get to the truly transformative beyond disruptive implementation of some of this technology, either in new mine design or in retrofit of existing? To me that was the most important thing was to say how do we do that because, otherwise, we are making incremental changes, which very often are without efficacy by the time you do it.

Dr. Kramer Luxbacher: Right.

Chair Nelson: The one thing that occurred to me, I think there is an opportunity in here to put in there

you talk about institutional awareness but the --

Dr. Kramer Luxbacher: Institutional awareness?

Chair Nelson: I'm sorry -- situational awareness. Yes, yes, yes. Right in front of me.

And I think that you know if you combined VR in there, that you get to the point where you are actually supporting a decision making, which I think is an integral part of this as well.

Dr. Kramer Luxbacher: Well, NIOSH has more strengths in virtual and augmented reality and I should point -- you know specifically point to that.

Chair Nelson: Yes, I think that would -- and that takes you sort of beyond this, rather than the incremental thing. We're going beyond that --

Dr. Kramer Luxbacher: I like that.

Chair Nelson: -- so the people outside and inside the mine can actually consult and understand about what to do.

Okay, any other inputs? Jeffrey, you have anything to add?

Member Burgess: She did an excellent job. And Kray has summarized it really nicely.

Member Luxbacher: Thank you.

Chair Nelson: So, any questions, Kyle or Rob? Bob.

Member Horn: I just want to echo Jeff's comments. Kray did a great job on it and really summarized it great. Thank you.

Chair Nelson: So, what's the --

Member Zimmer: Agreed. Thank you very much.

Chair Nelson: Good. So, what's the strategy with this report? It would be finalized? But it's actually a report that this Working Group submits to MSHRAC.

Member Luxbacher: So, I will -- next week I'll just send out the final. Oh, I'll add the augmented and virtual reality, and I'll send out the final version.

Chair Nelson: Okay. So then it comes to me. And I send it to NIOSH, and say, "Here. Here's our recommendation. Tell us what" --

Member Luxbacher: What we're going to do.

Chair Nelson: -- "what you're going to do. And tell us about it at the next meeting."

Member Luxbacher: At the next meeting, yes.

Chair Nelson: Okay. That will be the path forward. Okay? Great. Thank you very much.

All right. We are to Mr. Todd Ruff. And we're going to hear about many promised things. And we thank you for actually taking on Spokane during that period of transition. You did a super job.

Mr. Ruff: Well, it's my honor and my pleasure.

Chair Nelson: Thank you very much.

NIOSH Mine Automation H&S Research:  
Recommendations and Implementation Plan by  
Todd Ruff

Mr. Ruff: Thank you. All right. So as you know, we've been talking about automation for the last couple of years. And thank you very much, Kray, and to the rest of the MSHRAC work group on automation. I'm looking forward to integrating your recommendations.

We were able to work in a bit from the results that we saw from the workshop that we had in 2018. So, you'll see a little bit of that.

But I just want to thank you for that effort. And there's more to come. This is very much a working plan. And it will evolve. And so I'll show you what we're thinking over the short term and get your

feedback.

So, as we've talked about, over the last two years we've seen a lot of momentum building, especially in metal mining, as far as integrating or implementing automated equipment.

That equipment has been recently focused on automated haul trucks and surface mining. We've seen a lot of discussion around that. And one mine in the U.S. actually has a pilot project, which I'll talk about.

We're also seeing it in automated drills, remote controlled dozers, even underground haulage equipment. For a number of years people have been talking about automated haul trucks underground. They're even implemented in some other countries. And then also semi-automated or supervised autonomous LHDs or scooptrams.

So, we're hearing a lot more about it. In fact, we've been contacted by some companies that are starting to implement this equipment, and had some questions about doing it safely. This included Barrick. A couple of years ago they were starting to plan for a pilot at Gold Strike, in a new area of the pit there called Arturo. They invited us, and involved MSHA, too, in their planning efforts, getting ready for this pilot project with autonomous trucks. And they came to us and had some questions. And we were able to make a couple of visits there. And we've been involved with them to learn about the implementation and how things are going.

HECLA, also, as they considered an semi-autonomous narrow vein mining machine at Lucky Friday. They came to us and had some questions around situational awareness. And then also we've been in discussions with Rio Tinto and the Resolution effort.

And then we also heard from MSHRAC. A couple of years ago I remember Bruce Watzman bringing this up. And he said this is a critical area that we need

to be looking at with the emerging technologies and what we see in the movement towards automation.

And also during those MSHRAC meetings, and from our outside contacts, trade and labor organizations also have concerns about where things are going in this area.

So, we've been working on this, both internally and through some contracts, and through MSHRAC, over the last couple of years to help define the areas that we need to look at as far as research at NIOSH.

We had some internal efforts early on. In 2016 we formed the Mine of the Future Work Group, internal to NIOSH, in the Mining Program. More recently, Jennica Bellanca at PMRD had a pilot project in haul truck safety research and she had some recommendations in her draft road map around automation.

We also had a couple of contracts. Joel Haight. And then, more recently, Jonathan Keyes, formerly from Barrick, has finished a contract report with recommendations around haul truck automation safety.

I've got the order a little bit backwards here, because the Metal Mine Automation and Advanced Technology Work Group came before our RFI. But the MSHRAC Work Group, of course we based some of the results from that early on. We worked that into our plans. And then we followed that workshop up with a mining automation RFI. And we didn't get a huge response. We had six. Five of those came during the official comment period, and one came a little late.

And there were some interesting perspectives there. We were hoping for a little bit better response. But there was some help -- or some useful comments came out of that.

And then I think really the main driver though is the discussions and the visits we've had with our

industry stakeholders in mining. I mentioned Barrick and their pilot project -- they have five automated haul trucks operating in the Arturo section of Gold Strike mine. They have been very accommodating and very interested in having us help them with this project. They've had those trucks operating for about a year, and they plan to expand.

Also, I mentioned HECLA. And we continue to work with them as they are getting ready to bring in that narrow vein continuous miner onto their site.

Chair Nelson: So, on the HECLA, what about the union, then? Who gets to run these automated vehicles? Is this --

Mr. Ruff: Yeah, that's an item of discussion, for sure. That's been, you know, one of the hot topics for them. And so the introduction of the continuous miner has been delayed, but they still do plan on bringing it onsite.

The main concerns where I think we could be involved there is around situational awareness. And I brought this up before, you have less eyes and ears in the stope. As they bring in automated equipment, they're pulling people out. And they want to know, what are the best ways to get that critical information for ground control without having people in there? So, that's what we're planning on helping.

Chair Nelson: Are they taking dust samples to actually figure out if there's a difference in the dust --

Mr. Ruff: I don't know their plans on that front, but I can imagine that would be an interesting study.

So, based on those sources that I listed -- with the addition of Kray's report -- we are formulating our future research. We've noticed some recurring themes. I've only listed a few here. There are many more subjects and topics that we could look at. But these are the things in our early work that have

come up over and over again.

What we've heard from our stakeholders is the need for a forum, some type of partnership where we can get around the table and discuss the concerns around automation, the benefits that we see in automation, individual experiences in implementing technology, and then also around the safety and the regulatory questions. So, mining companies that we've talked to would really like to have some type of forum to begin this discussion.

Another thing that has been requested is information on what's been going on globally. And this aligns with one of your recommendations, Kray. A lot of work has gone on in Australia. There are mines in the oil sands in Canada now that have automated equipment. There are other countries, underground mining in Europe, that have automated equipment. What lessons have been learned? And there's really a need to disseminate that information so we're not reinventing the wheel as we do this in the U.S.

There are questions around guidelines for human-machine interaction, around functional safety. And one of the questions is, "hey, we've gone through this over and over, you know, what is the acceptable level of risk? And when is it safe enough?"

For example, they worked really hard, at mines with automated equipment, in their testing and their simulation and their proof of concept to address these questions. But there's always that nagging question, you know, have we done enough? And so I think that's something that we could look at in functional safety requirements.

Chair Nelson: That's also for machine-machine interaction.

Mr. Ruff: It could be. Yeah, absolutely. We're more concerned, I think, about the people and health and safety. But, yeah, you're right.

Then there's questions that keep coming up around human-centered design. One priority area is human-machine interfaces, again, this plays to a recommendation from Kray's report we heard today. Are we overloading operators? Because in many of the situations where we've seen automated equipment implemented, you still have to have an operator supervising multiple machines.

So, you'll have a person in a remote operating station on- or offsite. Sometimes as far as hundreds of miles away, in the case of some of the operations in Australia. But you have one operator supervising multiple machines.

We also saw that at the pilot project at Barrick, where they had one operator supervising five haul trucks.

There's a lot of question about, what information is critical to the operator? We want to make sure we're not overloading them. How do you display that information? How do you display alarms and how do people react to those alarms?

That's something that's still not fully understood. Although, there's a lot of research in other industries. And we want to pull that in. Aviation is a big one.

So, again, cognitive considerations need to be studied.

There are also some questions around change management. That came up a lot.

Chair Nelson: Did you see anything -- I mean, with all this automation, an issue that is out there is cybersecurity.

Mr. Ruff: Yeah.

Chair Nelson: And when you make the commitment to the human-machine interaction, you believe your data and you're making decisions based on

dataflows. Now the issue of cybersecurity becomes huge.

Mr. Ruff: Yes.

Chair Nelson: It seems -- it's not necessarily what your responsibility is. But a lot of these systems may be safe as long as there's data there. And when the data's not there, then they're not safe.

Mr. Ruff: We heard that come up. And, so, this is just a partial list. Some of the technology questions that came up as we visited mines is around that, cybersecurity, network reliability, radio systems, and performance issues. It's all --

Chair Nelson: You need the systems to be really redundant and fail gracefully and be resilient. I mean --

Mr. Ruff: Right.

Chair Nelson: It's just like any complex system.

Mr. Ruff: Yes, exactly. So, this is just a partial list. And this, you'll see on my timeline in our approach, which is somewhat based on the expertise that we have currently, too. This is a short term plan that I'm presenting here. We will expand this. And we will be looking at areas in our staffing that we need to expand in order to meet some of the other considerations. Also, we'll be looking at extramural programs to fund the gaps that we can't address internally.

So, as I mentioned, this is our short-term plan. We're not done yet defining this program. We're still collecting information to further define the needs. And we'll be integrating the Work Group's report.

We need to be working with others that have global experience. We'll probably initially do that through a contract. Maybe even through the BAA.

And this kind of addresses that question where it's really expensive and difficult for NIOSH researchers

to travel, and especially international travel. This is what needs to happen - we need to go talk with the companies that are doing this, especially in Australia. They've learned a ton. And we can take that and pass that on. One way around, though, the difficulties in travel, for us, is to go through a contractor. So, that's in the plan.

Also, we will need to be participating in the standards and guideline development.

We're going to establish a stakeholder partnership to address that need for a forum to get people around the table to talk about mining automation safety in the U.S.

And then we've identified the human-centered design of interfaces as a high potential area, in the short-term, a research area that we could address.

So, just a quick overview of the timeline I'm proposing. So, on top there is program planning and overseeing the partnerships. So, that's a task that we'll undertake this year. We'd like to have our first partnership meeting in the spring. So, we'll continue to develop that. And I'll keep everybody posted. But this planning and partnership would oversee the NIOSH collaborators, research collaborators from both universities and other organizations, and then also oversee that stakeholder partnership.

I'm also starting, this year, it's the plan to have some type of contract, possibly a two-year contract, with somebody to address the dissemination of the global experience in this area.

And then we're in our proposal phase right now for new projects. And we will have at least one, maybe two, efforts proposed for intramural research. And you see, you know, one of the areas that we're looking at is human-centered design. There may be others. We're waiting to hear back from the researchers on the projects.

Chair Nelson: So, is this -- I'm trying to -- is this

the automation and new technology partnership? Okay. Does it have a new name?

Dr. Kogel: We're probably not consistent. Do you have a name for it up there?

Mr. Ruff: Automation and emerging technology. So, swap that around.

Dr. Kogel: Yes. So, we haven't settled. That's --

(Laughter)

(Simultaneous speaking.)

Chair Nelson: I just wanted to make sure --

Mr. Ruff: Yeah, I'm just trying to keep you on your toes.

So, that's the short-term plan. Like I had mentioned, we plan to expand and develop our internal capabilities and look for outside help at the same time.

So, that's what I have. My questions, if you have any feedback, if you could think about suggestions for expanding our partnerships. And then, also, in your dealings with mining industry, have you heard of any other concerns or priorities that need to be addressed in the short-term? Thank you.

Chair Nelson: Okay. Any questions or comments on this? Kyle or Bob?

Member Zimmer: No.

Member Horn: No.

Chair Nelson: Oh, you do?

Mr. Welsh: I do, yes. Yes.

Chair Nelson: Oh, please do.

(Simultaneous speaking)

Mr. Welsh: As far as Kray's Work Group report, what do you plan on doing? Send it to Priscilla --

Member Luxbacher: I will send it to Priscilla.

Mr. Welsh: Priscilla will give it to the full Committee. And if Tom from NMA, Dale from Stone Sand and Gravel, Stacy Kramer with Freeport can provide input from their respective organizations, we are interested in that feedback.

And also from labor too, Mike, Ron and Kyle. So when we talk about the report at the next meeting, we'll have that input that can be considered.

Dr. Kogel: So, can I just add one thing to that comment? I think that's a really good comment, Jeff, because we do want to make sure that we get everybody's input from all of these stakeholders.

So, the other part of this, it always comes down to what's the priority. And it's very helpful for us, also, as you provide your input, if you can also have -- if there's certain things that you think are really critical issues.

That way, if a number of different stakeholders come back and say this particular topic is a big issue for us, then we know that's something we need to really focus on. That kind of information would be helpful.

Chair Nelson: Well, there's work going on over in the EU on this. And there's quite a bit of work not funded by NIOSH going on in this area, all across from a whole bunch of agencies, and not the least of which would be DoD and DARPA. So, I mean, there's an opportunity here to maybe convene some kind of a workshop that's broader and brings people in. Because the construction industry has exactly the same questions going on. And if we could figure out actually how to -- whether -- I don't know how to put it together.

I don't think it's something that MSHRAC by itself

should be the committee that does it, but I could see where NIOSH, DARPA, some of the federal agencies that are interested in this could actually say, let's pull it together and talk about our industries.

Mr. Ruff: Well, that has been done, to a certain extent, through the NIOSH Center for Occupational Robotics Research. And we will be cooperating and establishing a closer relationship with that group.

Chair Nelson: So, what exactly have you done with that?

Mr. Ruff: So, we're in -- I attend -- I'm on their steering committee. And Jacob is on their steering committee. And we also attend their meetings. And we are in discussions right now how we can merge the charter that we have drafted for our partnership with their group.

Chair Nelson: Who else is in that group?

Mr. Ruff: So, that's run out of the Division of Safety Research. Dawn Castillo is heading that group. And they have -- I can't even list how many partners they have. But it focuses on industrial robotics. So, it's a little bit different, but they have a lot of the same partners that you just described; DARPA, you know, a lot of the military work.

Chair Nelson: Well, maybe they could think about, you know, like in a GPS-denied environment involving underground and very, very dirty things. You know, how does that change the questions and the answers?

Mr. Ruff: Well, yeah, just the fact that you have a huge haul truck running around all by itself is very different than occupational robotics. But there's some overlap. And we're going to pursue that and see where we can work together.

Chair Nelson: Well, it just moves so fast. It seems that sooner rather than later, I mean, there's an

opportunity here, I think.

Mr. Ruff: Yeah. Yeah, thank you. Okay.

Chair Nelson: Any other comments or questions? No? Okay.

Member Horn: Yeah. We talk about becoming more automated. And I'm not going to talk about the emissions from vehicles, for example. However, as you become more automated, doesn't the risk of things like silica also become less?

Mr. Ruff: Absolutely. I mean, that's the hope.

Chair Nelson: Well, during the period of transition, we hope.

Mr. Ruff: We'll have people there for quite a while still. But, ultimately, yeah, that's the plan.

Member Horn: Oh, okay. So it's the transition period that we're now concerned about less than the long-term impact?

Chair Nelson: Well, no. When I say transition it's before we go full robotics. By the time we're full robotics we don't have people breathing down underground.

Member Horn: Okay.

Chair Nelson: Okay. One more question from Michael.

Member Wright: Somebody's got to fix the robot.

Mr. Ruff: That's right, yeah.

Member Wright: You'll have to go --

Chair Nelson: The robot will anticipate the robot's problems. And the robot will take himself or herself to the robotic doctor.

(Laughter.)

Member Wright: I stand corrected.

(Laughter.)

Chair Nelson: Yeah, right. We make them smarter than us. That's the thing. Okay. So, we are having a break right now for 15 minutes. We will reconvene at 3:00 p.m. Thank you.

Chair Nelson: Thank you very much.

(Whereupon, the above entitled matter went off the record at 2:42 p.m. and resumed at 3:01 p.m.)

Chair Nelson: All right. The floor is yours.

Communities of Practice: Virtual Reality, Ground Control, and Machine Safety

Mr. Welsh: Good afternoon, everyone. The next agenda session is on Communities of Practice. Jessica has talked at previous MSHRAC meetings about things that the Mining Program is doing with Communities of Practice. And Priscilla and others said let's hear some more.

Chair Nelson: Yeah.

Mr. Welsh: So, in the NIOSH Mining Program there are three Communities of Practice: on ground control, virtual reality, and machine safety. Today we have researchers in Pittsburgh, Spokane and here in Atlanta representing those three Communities of Practice. The Plan is to give each of those areas ten minutes, it's not a formal presentation, but just tell us a little bit about what their particular CoP is doing, and maybe some benefits realized so far. And the MSHRAC Committee will have an opportunity to interact and have some discussion.

So, hopefully, the video conferencing technology works. And thanks to Bob Randolph for putting all this together. So, can Pittsburgh and Spokane hear me?

Participant: Yes.

Mr. Welsh: Okay. I suggest that we start with the ground control area.

Participant: Okay. Jeff, actually we actually are incorporated another one, too. So, really we have four COPs now that we've actually incorporated. And I'll talk about the first two and then Dave will go with over second two. But the first two practices are numerical modeling and seismic monitoring. Dave, I'll let you introduce the other two.

Participant: Okay, the other two are just general mine monitoring techniques and practices. And then --

(Off-microphone comments.)

Participant: Okay. As far as the details, numerical modeling, the program leads are Essie Esterhuizen, Bo Kim, Mark Larson, and Peter Zhang. And, Essie, do you want to go over some of the subject matter?

Mr. Esterhuizen: Okay. Thank you. I'll introduce it and give a little background and then Mark Larson will take over from there.

Basically our group started about ten years ago, in fact, when we were all working together on some projects. And, you know, we just had a need to know what each other was doing and to coordinate our efforts and methods, and so on, for numerical modeling, because there are lots of different ways of doing the same thing.

So that group kind of was quite strong in the beginning. And we had very regular meetings. It kind of died out a little bit for a while. I think we maybe kind of ran out of things to say to each other.

But then, you know, we've kind of, what you say, restarted up our Community of Practice beginning in February of this year.

We kind of meet about, you know, once a month or bimonthly. Occasionally we might skip one meeting or so. And, you know, we've got members from Pittsburgh and in Spokane. And we occasionally will also involve outside presenters, especially if they've got some -- been doing some research or something of interest to our group.

And so our meetings are on Skype, you know, just because of the geographic locations. And when we go to conferences, and so on, we will also have some discussions just informally.

That's a little bit of the background about how our group has been working. So, we've been kind of active for around ten years, actually. And Mark Larson, I think, will just finish off whatever is left of our three minutes.

Mr. Larson: (Inaudible.)

Chair Nelson: So, may I ask a quick question?

Participant: Sure.

Chair Nelson: I mean, I think you've got a group of people associated with this that really constitute a lot of historical and current knowledge about mining, which offers the best opportunity, in fact, to validate most of the codes and the predicted response, because you're so close, much closer to a failure than we are in the world of civil, for example.

But I'm aware of the WIPP project, you know, the Waste Isolation Pilot Project, in New Mexico, which is having some ground control problems, and which is trying to get some computational modeling going on as they decide to double the space there.

And it's in salt, I grant you. But they were looking for independent lookings at what they're doing. And it seems like there might even be an opportunity for this Community of Practice to contact DOE, volunteering, say, can we look at your measurements, your stuff, and actually perhaps

provide an independent review of what's being done for WIPP?

Dr. Kogel: So, we've been involved with WIPP for quite a while.

Chair Nelson: Okay.

Dr. Kogel: We're not currently involved. They did a purchase a couple of years ago. So, we aren't having any conversations with them at the moment, but we were kind of officially in this. And I'm sure many -- some of the people that are in this virtual room have been involved with the WIPP project.

Chair Nelson: So, they've actually formed a panel. Because I know that I'm on it. And John Kemeny is on it, and Navid from New Mexico Tech is on it. And Lee Petersen is on it, and Gabe Walton. And we're being asked to review some work that was done by contractors. But since you've had some of the background work, there may be a reason to recontact and, as a sister agency, more or less, to maybe make some comments on that. Because they're planning a tremendous extension in a new geometry in the salt. And this could be something that could be pretty interesting. So, just throw it out there.

Member Wright: Just a quick comment. We are the union at WIPP. And we would very much welcome some outside expertise. Enough said.

Chair Nelson: So, there you go.

Participant: Okay. The second Community of Practice, seismic monitoring. The program leads, Derek Chambers (phonetic), Mark Van Dyke (phonetic), Shawn Boltz (phonetic). Mark will start. Mark.

Participant: We've been doing our community projects for about two years now. It goes on and off, mostly based on need. We used to meet about monthly, and then it became more informally based,

depending on what the need was at the time.

We've met in person before, but we usually try to go over Skype or email or phone calls. But some of the things that have helped us, because we don't typically do seismic; Spokane experience in that. So we look to them and then try to see what's worked in the past, what hasn't worked, and try not to repeat mistakes, or anything else like that.

And that's worked really well for us, just getting their input on how we do things. Because we're looking at doing things more underground versus on the surface.

So, that's worked well. Also being able to talk to each other and look at paper writing and making sure that the science that we write about makes sense. And basically getting that expertise has been critical to us. I'm going to pass it over to Stu (phonetic) to finish the rest of it.

Participant: (Inaudible.)

Participant: Okay. Any questions?

Chair Nelson: I am curious that there -- I was speaking with some people from South Africa. And what is the big company on seismology? The ISM?

Participant: IMS.

Chair Nelson: IMS. I knew I was going to do it wrong. And so, I've been talking to the guy who's the head of that. What is his name, Aleksander? But I think this is something that really interests students. And the idea of getting some of the datasets out there, so that the students can actually work on them, would be really fantastic. So, I encourage you to think about doing that.

Participant: (Inaudible.)

Chair Nelson: Yes.

Participant: (Inaudible.)

Chair Nelson: And they're the first arrivals, the arrival time datasets. But also frequency content. So, you get to look at the waveforms?

Participant: I would say limited. I mean, because it's not a very user interface friendly --

Chair Nelson: Yes.

Participant: So, it's all, like CSV files and X files (phonetic).

Chair Nelson: Yes.

Participant: So, but yes, I mean, you can export those into Excel and things like that.

Chair Nelson: Okay.

Participant: But right now there is no interface. It's all programming. (Inaudible.)

Chair Nelson: Okay.

Participant: (Inaudible.)

Chair Nelson: Well, good.

(Off microphone comment)

Participant: (Inaudible.)

Participant: Yes. The next we were going to discuss is mine monitoring safety practice. This includes scanning, use of different instruments, appropriate venues for their use. Just general discussion of where and how to monitor.

That program's been run by Brad Seymour (phonetic), Brent Slaker (phonetic), Mark Larson, (inaudible).

Anyway, Brent, do you want to go ahead and talk about what's going on with that group?

Participant: Sure. Thank you, Dave. I'm going to lean forward here so I can be in the camera. I don't

know if that's important. Yeah, so, we're a brand new Community of Practice, just started. This is more of our focus for the future, more than what we've done as of yet.

So, I think kind of a common theme here is this mind-share. And those divisions, Spokane and Pittsburgh, have long history of monitoring with instrumentation and we really just want to share that experience that we've had thus far, rather than developing all these programs in isolation.

So, some of the examples of what we've been doing lately involve laser scanning (inaudible), I think that's what kind of jumped out first from this Community of Practice. And our experience is with both applications, we think we can apply both to things like how to set up a regional instrumentation project to monitor more broadly, or small scale (inaudible) projects, or something.

It's a combination of two, depending on what we're after. And having more minds in the room to figure out what best captures the data you're looking for is what's important to us.

And kind of piggy-backing off what was mentioned a minute ago with the large quantities of data. That's a problem with us in seismic and, you know, our laser scanner entry data, stress monitoring data. A lot of this stuff is large quantities of data. And how we manage that, how we get it out, make it real time how we get it out, without us making trips to the mines every month or two has been a challenge.

And that's something we all have our own techniques to handle. And sharing that, especially in this future where we're moving towards a new data warehouse structure, I think that's going to be incredibly important as we all have to (inaudible).

But otherwise, I think, going back to developing these instrumentation projects in isolation, that sometimes you forget what data you're looking for,

or you hone in on the one thing that satisfies a project, and you've already done the hardest part. You've gotten into the mine. You bought all the equipment. You've got people committed. But you're not gathering everything you could. And I think it really helps to have someone that's in office that maybe isn't putting the same thing as you every day to come in and say, hey, have you thought about collecting this while you're there?

And with that difficulty getting in the mines, that itself, I think, is something that this Community of Practice is going to help with. Just sharing our techniques for dealing with different companies, different individual mines. Who wants what, and that kind of thing.

How do we communicate our value to the mine itself? Because I'd say we all have different strengths and weaknesses. Communicating our value and betting back cost is probably one of the most important things we can do.

So, I think that's the kind of stuff that this is going to help with, concerning our instrumentation projects. Just because it's so varied and we have a lot of experience here.

But we are in planning so not a lot to discuss yet. I mean, some of this was in the numerical modeling Community of Practice, because it's instrumentation data feeds into numerical modeling data.

But, as of yet, we've got to split it out. And seismic, as well, because it's just an enormous problem it kind of merits its own. But that's all I've got, if anyone has any question.

Chair Nelson: Yeah, so, I'm very interested. There's a lot of people who are doing experiments these days with laser and photogrammetry, sometimes looking for geotechnical structural data, sometimes looking for just repeat measurements and getting displacements.

We're really interested in looking at it for fragmentation, before and after a shot. So, don't get it in the truck, just do it right there on the face.

So I think you're right. There's a lot of experiments going on in the mine and in the consulting world, in the academic world, in NIOSH. And we don't really have a platform to talk about all of those experiments.

So, it's good that you are getting together. But, you know, you might even sometime think about having something bigger where you invite people to a workshop that's broader. And people who are trying to make measurements in mines, what are they trying to do, and how are they using the different pieces of equipment that are generally available?

And then how do you make them available to everybody, right, so that they can also experience what your issues are? Maybe virtual reality will come and save the day.

Participant: Absolutely. I think this has exploded so far beyond what just NIOSH is doing, that getting all these other people that are dealing with laser data or including cloud data into, you know, a room together. Because, yeah, we're just a small fraction of the resources going on out there. And it would be beneficial to everyone.

Chair Nelson: Yes. So, I was even thinking Gabe Walton at Mines has the project which is really focused on LIDAR data. And the idea, I mean, if he were asked by NIOSH to try to pull something like that conversation together, I think it would be great, just to have people talk about what you can do and what you can't do, instead of having to go to a vendor and choose to believe or not.

Participant: For sure. Yeah. And there's a lot of, I won't say misinformation, but everyone is trying to sell a product, their product. And this kind of technology lends itself pretty easily to the high precisions and accuracies and applications that

having a thing like that is helpful.

Chair Nelson: Great.

Mr. Welsh: Can we move on to the other two Communities of Practice and hear a little bit about them?

Participant: Sure. I think the last one we have is just getting started. Just I guess for software development. So, there's not a whole lot that's there. (Inaudible.)

Participant: Yeah, I think the second one here is, as Priscilla said, that VR is here to save the day. But the problem is that we have the same sort of issues with data that we were just talking about.

It's, you know, really tough to share some of the large datasets and do collaborations on software development, you know, when we have some of the network connectivity issues.

And, hopefully, data warehousing solutions will solve that. But one of the big collaborations that we've done recently has been on kind of an overlap with VR and the ground control that Spokane was involved in with us in the Lucky Friday simulation, looking at photogrammetry data and some of the other geologic data and trying to pull that all into one VR utilization.

But just real quickly, just the background. I started doing VR stuff with Todd Ruff (phonetic) when I was in Spokane, in the mid '90s, right around the time that the Bureau of Mines was transitioning into NIOSH.

And, you know, he really did a lot of this kind of organic, you know, reaching out to other parts of NIOSH and Pittsburgh to try to, you know, learn as much as we could about the technology and possible applications as we were finding what our niche was going to be within NIOSH, our new role.

And as part of that, you know, we connected with the Division of Safety Research. I'm not sure what they were called in the late '90s. But they had their cave system (phonetic) up and running by I think the late 1990s.

Pittsburgh, of course, had been doing their mine emergency response interactive training simulation. So, it was kind of like back end of VR, it didn't have any real have all the graphics. But it had a really robust simulation on the back end.

And then I started working directly with Pittsburgh on collaborative projects, and then, you know, joint projects that ultimately led to the release of map reading basics, and the NEEP software (phonetic) for emergency response for self-escape and that sort of training and simulation software.

So, like I said, we continued to do development after I moved to Pittsburgh. And we opened up the lab. And so we're continuing to talk back and forth and communicate with the teams back there where they're doing development.

Pretty much everybody in the VR world that I know of is using the Unity game engine. So, that's really helped kind of solidify that as a standard platform for the Community of Practice.

So, we're still in pretty regular contact with Division of Safety Research. They've updated their lab using Unity engine.

We've been working with Spokane where we kind of tried to make sure that our hardware is compatible. So we're using the same space to develop software and, you know, we can send that over through some kind of data stream and we can get the, you know, same kind of results out of that.

And that's just, you know, some of the stuff that we've been collaborating with and continue to do across the divisions. So, in the interest of time, I'll just open it up for questions. And do you guys want

to have a discussion about that?

Chair Nelson: I've got an idea. I mean, this kind of big datasets and getting kids, students, to work on it, the idea of having some kind of a challenge for VR in the underground, say, where different datasets could be set up and you need to interpret them. Or even opening it up, I could see opening it up for teams to come in and take their own datasets and then play with them, figure out what they can do with it, and then come back. This is a way of getting some excitement at the universities about doing this. So, I think it is hard to share, because they're so big. But it's going to get easier.

Participant: Yeah. The VR software that we've been developing in Pittsburgh, that lets you generate an underground coal mine, the team is in the process of doing the final cleanup. In the next month or two, we're supposed to have it wrapped up by the end of the calendar year. And then we'll have a package that we'll be able to share, so we'll have something you can install on top of Unity that will allow you to create an underground coal mine with, you know, all of the infrastructure and equipment.

And we've talked to a few different folks in academia who are interested in getting access to that software. And then the idea is to build a Community of Practice around that VR software that we can build content and share with all of you.

Chair Nelson: And maybe if we piggyback you over into training, the safety training kind of aspects could be interesting.

Okay, anybody else?

Mr. Carr: I guess the last Community of Practice here is the machine safety. So I'll try to get through it pretty quickly here in the interest of time.

But, essentially, the community here is collaboration between the Electrical Mechanical System Safety Branch within Pittsburgh, the Human Factors Branch

in Pittsburgh, and then the Spokane Division as well.

So we've got four projects right now that we're working on between these three branches. We've got the conveyor safety project that's being led by Art Miller in Spokane; the Electromagnetic Interference Project, which is being led by Jim Zhou in Pittsburgh. Vaibhav Raj has a project on analysis of surveillance data for injuries and doing some machine learning type things -- which, I believe, Dr. Raj is on the line. And then the haul truck pilot that Jennica Bellanca is leading.

So we've talked before about some of the coordination here. Art Miller and Jennica presented at the last MSHRAC meeting in May and talked about the coordination of that machine safety work and the alignment of that with the MSHA RFI on powered haulage, both for the conveyor stuff as well as for the haul truck stuff.

But I guess -- and I'll open this up for the others on the line to pitch in here -- but some of the benefits that I've seen with having these strong collaborations, you know, is that we can really bring the expertise to bear across the branch lines and across the division lines.

You know, that's been a big push with this community practice effort is to kind of break down the silos and get that matrix management type strategy going and that across divisional and across branch collaboration going. And on all of those projects, you know, we've got some good collaboration.

Maybe one of the better examples is on the EMI project that we have. Ron Jacksha, electronics technician in Spokane, is now working the majority of his time on electromagnetic interference. He's still reporting to his supervisor in Spokane, but through the dash line reporting-type structure, working technically on EMI stuff, which is being led, as I said, out of Pittsburgh.

We've also got some good data sharing going on, you know, between the accident and injury data that has been shared to benefit both Vaibhav Raj's project as well as the haul truck project.

Some of the data that has come out of what Todd talked about with the contracts from Robin Burgess Limerick and Jonathan Keyes, as well as Joel Haight, you know, those efforts we've been able to coordinate and been able to inform the research across several of these efforts from that, and then also good collaboration with MSHA.

We've got a good relationship with the Approval and Certification Center and have done several meetings with them, joint meetings between folks from Spokane, as well as Pittsburgh, with the folks from A&CC and got some good input there. I'll open it up if Art or Tim or Ron have anything to add.

Chair Nelson: Hello.

Participant: (Inaudible.)

Participant: Yes. So I think Jacob covered it fairly well. It actually goes a little bit deeper than that. It actually stems back a long time ago with the MINER Act and communications underground.

There's a very small group of us within the Mining Program: myself, Carl Sunderman, and Todd Ruff from Spokane. More recently, Justin Srednicki and Dave Snyder, who have experience in RIF.

And while it's not an official Community of Practice, we consult with each other on a regular basis to gain knowledge and share our experience in various aspects of the challenges of implementing wireless technologies in an underground mining environment.

Dr. Raj: (Inaudible.)

Chair Nelson: We can't hear you very well.

Dr. Raj: (Inaudible.)

Mr. Welsh: Vaibhav, we're still having trouble. Wherever Ron was sitting, it was really clear.

Chair Nelson: So we can't see him, but we can hear him.

(Laughter.)

Dr. Raj: Is this better?

Participant: Perfect.

Dr. Raj: (Inaudible.)

Mr. Carr: Okay, final comments from Art Miller (phonetic). One of the things that's happening in the world of machine safety from my perspective is that we're having a collision between engineering and social scientists.

And my team, we're a bunch of engineer geeks, and what we're doing is we're trying to create a community of practice with the human factors folks, because we really need their perspective on some of the things that are happening in our air safety project, for example.

So that's one of the things we're trying to do, is pull Jennica's group and the human factors people into our work and share notes on our mutual goals.

Chair Nelson: Well, this is great, because this is the kind of collaborative environment and interactions that we are hoping for and glad to see.

Mr. Carr: It's working well.

Chair Nelson: And I think, you know, even if it's anecdotal, some examples where a synergy happened that was very important to something could be a story to tell. It becomes myth almost. We need good myths about how you do things.

And it sounds like things are starting that way, so great. Just make some more myths for people to remember this is how we're supposed to work,

right, exactly. Fantastic, thank you so much.

Any comments or questions?

Member Bowersox: I've just got a question about electrical interference. You told Mike, a remote control binder being interfered with, like, proximity.

Mr. Carr: Potentially, yes. So what inspired it or what kicked it off really is the personal dust monitor and the proximity system where we saw that when those two devices were, you know, on a miner's belt that they could interfere and effectively disable the prox system.

But we've broadened that out now, and we're trying to look at all electronic and electrical devices underground and identify where the potential is for problems that we're not aware of, you know, things that don't quite work quite right and we don't know why.

Member Harman: So have you fixed the dust monitor?

Mr. Carr: Yes. So we've got a couple strategies there. One is internally shielding the components of the PDM so putting either copper or aluminum shielding around the battery and the pump within the PDM.

And then another strategy that we've recently come up with is a capacitive filter that we can put in line with the battery. And we've been talking with Thermo on that as part of their redesign.

Member Bowersox: Good research, it's a lot of stuff.

Chair Nelson: Okay, any other questions, comments?

Well, thank you very much, people, from wherever you are. We didn't hear from Heather or Kevin. Goodbye.

(Simultaneous speaking.)

Chair Nelson: Okay, that was good.

Chair Nelson: Okay, so you're having a substitute presenter for the 3:30, is that right? Yes, for LaTasha. So we have two presentations. So the public comment period's going to be a little bit late. So I hope anyone who wants to comment can wait with us until maybe 4:15.

Mr. Welsh: Yes. What we used to do is just have one public comment at the end of the second day. But we thought instead of having to save questions we'll do one at the end of each day.

Chair Nelson: Okay.

Mr. Carr: All right, so obviously I'm not Tasha.

Chair Nelson: What is your last name, Jacob?

Mr. Carr: Carr, C-A-R-R.

Chair Nelson: Oh, I can do that.

Mr. Carr: Yes, it's an easy one.

Mr. Carr: All right. So to Art's last point there during the community practice talk, you know, we've had that strong collaboration between the engineers and the behavioral scientists. So we'll have an engineer here talk about some behavioral science stuff.

So the proximity detection project, if I can advance it with this ---

Mr. Randolph: Sorry.

Mr. Carr: All right. So we've talked about proximity before with MSHRAC, you know, but this really ties into everything that we're looking at in terms of emerging technologies. These automated systems really are going to change the way that we work and the way that we live.

And especially in terms of health and safety, the technology is moving incredibly fast now, you know.

And to Kray's point earlier, it's exciting to put that out there that mining is a dynamic industry and we are, you know, pursuing these high tech solutions.

So the question on the human factor side is how do these systems fit into the underground mining environment. And then how can we ensure safe integration of those systems? So those were the two questions that Tasha was looking at in her study within the proximity detection project.

So a proximity system, you know, is designed to prevent collisions between humans and machines. We've had research going back, well, back to really 20 years ago on the continuous mining machine stuff but more recently on the mobile machines, shuttle cars, ram cars, and scoops.

And the system is designed to provide protection. If you enter into the warning zone, the system detects you and gives warnings. If you go into the red zone, the machine will stop. And the question here is, how does that fit into the underground mining world? And that's still kind of an unclear question here.

So there are definitely benefits to proximity detection. So this is from the MSHA proposed rule on mobile equipment. So they came to the conclusion that systems could prevent 70 injuries and 15 fatalities over a ten-year period, so some pretty clear benefits.

However, there are some indications that there are issues with acceptance and use, right. So we've had fatalities where a miner has taken the wearable component of the system off, hung it up on a roof bolt, and been killed by doing that.

And then there are the problems of unintended consequences, the electromagnetic interference that we were talking about here with the PDM causing unexpected behavior where a miner could have these two devices that are designed to protect him or her from health hazards and safety hazards in the mine.

But when you have them both on together, it can cause the unexpected consequence that the prox system is essentially disabled, and you can walk right up to the machine and be injured. So it gives that false sense of security.

So the approach that Tasha took to look at this question of fit is the task technology fit framework. So this is something that was adapted from other applications.

And the assumptions here are that the system supports the workers to complete the tasks safely, right, so this is a system that is supposed to help. And the degree of how much it does help is conveyed through the assessment of the system by the actual user.

So the opinions that the miners provide of the system give a good assessment of how well the system is helping them to complete their job safely.

So with that, the key here is that positive evaluations are linked to improved performance, technology adoption, and utilization. So if the miners are rating the system highly, then they're more likely to use it. They're more likely to gain some benefit from it.

And this is really the idea behind task technology fit. So you've got three inputs, task characteristics, individual and mine characteristics, and system characteristics, leading to an output which is the user's evaluation of the task technology fit.

So as an example we look at an online bill paying system, right, so something we're familiar with. You can go online and pay your bills. The task characteristics could be that we want to be able to pay our bills quickly. We want a convenient system to pay the bills and we want it to work quickly and be convenient.

Maybe some of our individual characteristics, at least for me anyway, maybe we're a little bit

impatient, and we don't want to wait for the system. And a poor fit for that would be if we had a system that was slow, right. And that would lead to a poor evaluation.

So we can apply the same kind of thinking to the proximity systems or to any other sort of new emerging technology that we're introducing into the mines. What are the characteristics of the task that the miner is going to be doing with the system? What are the characteristics of the miners as well as of the organization and of the mine that we're working within?

And then what are the characteristics of the system or the technology that we're introducing, and look at how that correlates or how that affects the evaluation by the miners.

So Tasha did a mixed methods approach here where she conducted focus groups, 60 to 90-minute focus groups with leaders from underground coal mines that are currently using proximity detection systems on mobile equipment, so scoops, ram cars, shuttle cars.

And the participants completed a survey before the focus group to give their evaluation. So that's the numerical piece of the data. And then the qualitative piece of the data is the responses that they provided during the focus groups.

We had a pretty wide selection of representation at these meetings. So folks from safety, we had a foreman, a dust coordinator, a superintendent, I'm sorry, four superintendents, and someone whose title was specialist.

So we'll look first at the quantitative piece of the data, the user's evaluations. And we looked at nine different aspects of the evaluation. So this was adapted from the Thomas framework.

And the items that have arrows next to them are the aspects that we modified. So production

timeliness, we changed to task completion, information system relationship with users, we simplified down to just user perspective. And then we added in the last item which is safety.

Member Luxbacher: Can you explain what user perspective means?

Mr. Carr: So there are some examples in here of that. But it's really just the attitude of the users toward how well the system helps them do their job safely.

So in terms of those, we had a number of different areas where the questions were asked. And more than half of the leaders gave favorable responses for seven out of these ten. So training, quality, locatability, authorization, ease of use, and the two user perspective questions were all, on average, positive. And the four areas where the ratings were below 50 percent positive, were reliability, safety, task completion, and compatibility.

So now looking into the qualitative side of the data, so the feedback that we received during the focus groups that we can try to use to explain the quantitative ratings that we saw, we'll look first at task characteristics.

So just a couple of examples here from some of the things that the leaders at the mines said during the focus groups is that the proximity detection systems can help to improve the situational awareness and decrease risk, right. So one of the miners said it really makes you think, it makes you think about where you're standing, and stay further away, and brings down risk.

On the negative side, on the other hand, some of the leaders said that it makes things harder and less safe, you know, by pushing the miners to stand possibly in a place where they wouldn't normally stand.

Another question here was on visiting the section.

So for folks who are coming in to do inspections on the section, people who don't normally work at the face or at the section, the proximity system they said can inhibit folks coming in from the outside to the section.

On the mine characteristics aspect, we had some interesting comments on conditions. So one of the traits of the systems is that they are affected by the environment that they're operating in, right. So they're affected by humidity, they're affected by the presence of steel or any sort of metal around them.

So if you have roof mesh and rib mesh, that affects the performance. Soft floors can influence the performance as well in terms of the ability of the machines to stop. So we had both positive and negative comments there. One of the mines, they said that it did work well at their mine, because the conditions were consistent, right. Sorry?

Chair Nelson: No. It's just does random things like that --

Mr. Carr: Okay.

(Laughter.)

Mr. Carr: On the negative side, some of the leaders noticed that the performance was inconsistent as they went about their day. And what they attributed it to was the humidity level.

Whether or not that is the true cause of the inconsistency in performance, we don't know, of course. But that's the assessment that they made, was that humidity level created some inconsistencies in performance and caused some issues for them.

Then lastly, looking at system characteristics, and this is the sort of thing that the user perspective would be represented in, there were also some other questions related specifically to, you know, how well it aids in their ability to do their job safely

and their ability to get their job done efficiently. But this speaks to some of it, right.

So there are issues with wearability that some of the miners identified, in that just the ergonomic overload of all the devices that these guys have to carry around between the PDM, the radio, all the things they have to hang on their belt, it gets cumbersome. So that was something that was brought up.

Chair Nelson: That was interesting down there at the bottom ---

Mr. Carr: Yes.

Chair Nelson: I had so many people in the last two years. So I guess it's just what, attrition? Like, I know I loaded close to 500. Is that a big mine? What is the turnover?

Mr. Carr: So I do know that Mine A was a fairly large mine. But I'm afraid I don't know any of the details on that one. I mean, it is a coal mine, right, so equipment does wear and tear. But yes, I'm not sure where that 500 number came from.

So some of the suggestions that Tasha and her team were able to come up with were that the systems really do need to be evaluated in the environmental conditions that they're going to be operating in, you know.

So looking at the floor conditions, looking at the presence of metal that may be around, looking at the electromagnetic environment that they're going to be operating in, and really understanding how all those different factors can affect performance really is critical to promoting acceptance by miners.

Because they need to understand what can affect the performance. Otherwise, they're going to, you know, find something to blame it on. And it may not be the actual cause of the inconsistencies.

Identifying how a proximity system can change specific job tasks, so this is looking again at things like inspections on the section where you have someone who isn't normally there coming and walking through, or you have tasks like manually loading materials onto a scoop where you may have challenges that are introduced by not being able to move that equipment while someone's standing close to it.

There's a need for training programs for workers, and especially maintenance workers, the folks who do need to work around the equipment, and work close to the equipment, and also be able to maintain these electronic systems that they may not be used to.

Assessing and securing dedicated resources for implementation really is important. So, you know, this isn't something that we can just install the systems on the machines and hope for the best. It has to be a concerted effort to make the most of that implementation.

And then the safety culture, you know, this gets back to the point of acceptance, and sabotage, and proper use of the systems. If you have miners who are taking their pads off and hanging them up, or not using the system as it's intended, or actively trying to sabotage the system, you know, obviously that's not a good thing.

And then identifying ways to manage worker frustration, you know, any time we have to adjust to something new we're going to be frustrated. That's just human nature. But finding ways to work around that and work through that is important.

And then some suggestions on the research side and on the equipment manufacturer and designer side, there really is a need to address the electromagnetic interference problems both for the active interference where you have an electronic or an electrical device emitting electromagnetic radiation that's interfering with the systems, or if

it's the passive interference where you have metal or environmental structures within the mine that can be coupled to and have interference that way.

You know, that causes a good deal of inconsistency in the performance. And that's, you know, something that can lead to frustration and can lead to those low acceptance levels.

And then resources and forums are needed for common challenges and best practices. You know, a lot of these mines are going to be facing a lot of the same challenges as they implement not only proximity detection but also other emerging technologies. Providing a forum for those discussions is a need.

If applicable, consider ways to improve wearability, you know. So this is an important thing that I think a lot of people are aware of and talk about, the fact that we're just physically overloading these guys with all these devices.

Chair Nelson: How big is it?

Mr. Carr: So there's a few different systems out there. The smallest is about the size of a smartphone, so not huge. The largest is, you know, maybe something like that and fairly thick. So there's ways of designing it that you could have a smaller device, you know, that should be considered. But I do know the one that is a larger case, if you open it up, it's a lot of empty space inside that case.

Member Harman: Do they wear it on the miner's belt, so it's worn?

Mr. Carr: Yes. Typically, they wear it on the belt. There are miners that wear it, you know, on the suspenders or on the coveralls up higher. And, you know, with the EMI issues, one of the main ways of dealing with that is separation distance. So if you've got two devices that are on your belt, they may interfere. Which if you place one on your belt, and

one up higher, you may have less of that interference.

Member Harman: And you're talking about a PDM and the PDS ---

Mr. Carr: Yes.

Member Harman: -- as far as interference?

Mr. Carr: Yes. So that's the one that we've observed the most and that we've been working on. But we've also seen interference between gas monitors, hand-held radios. There's a number of different devices that interfere, not necessarily with proximity but with various things. And there likely are other things that will interfere with the proximity system.

And then the last point there is system customization. You know, no two mines are alike. So providing that ability to make something that will be safe, but will also work with the task at hand at the mine, you know, if you have a low seam mine, if you have continuous haulage, if you have something unique at the mine, being able to adapt it and make it work for those peculiarities.

Member Bowersox: Does coal seam height interfere more or lower seam, higher seam?

Mr. Carr: Yes. So seam height can affect the propagation. If you have a consistent seam height throughout the mine, which you would, I would suppose, then it would be consistent. Where it could be problematic is if you have roof mesh.

Especially if you have roof mesh in some parts of the mine and no roof mesh in other parts of the mine, you would have what looks to the system like a metal sheet fairly close to the machine. It could cause some problems.

Member Bowersox: What about rib mesh?

Mr. Carr: Yes. So rib mesh is a bigger concern, because you can have both the generators, the

transmitters, which are mounted on the machine, could be close to the ribs. And then the miners can be close to the ribs. So yes, so rib mesh is definitely a concern.

We've got some publications on that, some ways of handling it. You know, obviously if you replace it with plastic mesh that works. If you keep the separation distance, keep the machine away from the ribs, keep the miner away from the ribs, not always practical, but that works.

Chair Nelson: Okay, thank you very much, Jacob.

Mr. Carr: Yes.

Chair Nelson: Well done.

Mr. Carr: Thank you.

Chair Nelson: Tell Latasha that we appreciated her prompting you to give this. That's wonderful. Okay, so our last speaker of the day is Donovan Benton on corrosion, one of my favorite subjects.

#### Corrosion Research by Donovan Benton

Mr. Benton: Okay. Actually, and I do have a response to that question you asked earlier about the synthetic meshes that we've tested. Tensar mesh is a polypropylene. The Huesker mesh is polyester.

And then for New Concept Mining, from working with it, it's really kind of like somebody stitched a bunch of basketball netting together with seat belts, so maybe some nylon. It would be my guess. So those are the three different types.

Anyway, I am here representing Amy Chambers. She is the task lead for our corrosion research. She's unable to travel, so I am speaking from kind of the PI level. It's a task on the project for which I am a PI. So I'm going to do my best. And if there's any questions I can't answer, then I'll just connect whoever with Amy.

So some background to the corrosion research that we have, essentially there were observations that, in a mining environment, steel can corrode to the point where it loses support capacity. And that wasn't necessarily surprising, but it was something that had kind of been overlooked in terms of the larger corrosion issue in mining.

Traditionally, it had looked at infrastructure like surface structures, processing facilities, machinery, but not ground support itself. So that's where this project kind of wanted to focus.

And even more so, there were instances, and there are some photographs of this in this presentation, where even if the ground support itself outwardly looks okay, if you're just walking by and you look at, say, a rock bolt, that's no indication that, within the rock mass itself, that that rock bolt is actually still performing well.

Chair Nelson: How fast can it be significantly compromised? Are we talking one day, one week, one month, one year?

Mr. Benton: That's part of the project, is to come up with these corrosion rates. But in some cases in Nevada it is weeks that this can start to happen. And there are some pictures of some Nevada mines, nasty looking places. So partners ---

Chair Nelson: That's where the gold is.

Mr. Benton: Our big partners at present are Hecla Mining. We've been, I think we're in our fourth year working with them at their Greens Creek Mine.

And then we are in the process of developing a cooperative agreement with Nevada Gold Mines. They have asked us to go and help them at their Goldstrike location. So it's the Cortez Hills underground location. And a couple of our engineers actually have a lot of experience working in Nevada. So that was kind of a nice in for us.

Let's see, so a lot of our research actually is focused on hollow bolts, the friction-set bolts. That's not meant to be the end of the research. But because it's one of the primary rock bolts used in these mines ---

Chair Nelson: Are you talking about split sets?

Mr. Benton: Yes. And then Jenmar produces these, and they've sent us a lot just for sample testing. So Jenmar has kind of been our existing industry partner.

And then currently we are working with New Concept Mining developing a cooperative agreement with them. They have a bunch of corrosion mitigation techniques that they want to test and actually see what the success of these are.

Chair Nelson: I was talking with Mark Board at Greens Creek. And he said that they're just using a whole lot of epoxy now and rebar because of the corrosion problems. So they're not using the split sets, and they're not using the swellex.

Mr. Benton: They may, well, they're in a transition period. Because we were just up there. And the primary installed rock bolts are still the split set.

Chair Nelson: Because those can't easily be epoxy grouted. You don't usually epoxy grout those.

Mr. Benton: No. And so they're investigating everything from just switching en masse to stainless steel, if that would be cost effective, or just, you know, whatever else.

And it's really interesting there too. Even their stockpiles, you can see just the atmospheric exposure, these things just start to rust and kind of fall apart in months time.

So here are some pictures, again. The top left, that's basically just an example of welded wire mesh that has disintegrated. The top right is a rock

bolt that actually had some sort of coating. I don't know what the coating was made out of, but it was meant to be corrosion resistant.

And this is something that we've observed during installation of these rock bolts. A lot of times, they get kind of cut up and scratched. And then that actually increases the corrosion rate, because it localizes it into these particular areas. So that's what this is kind of showing here in that top right where that hole is.

The two bottom pictures are the same bolt. Mines had the idea of "Let's get borescopes, and then we can just look inside these bolts and see if they're corroded." So they did that with this bolt on the lower left.

And it looks relatively okay. It's still largely intact. But when it was pulled out, you can see on the outside of it where it was actually in contact with the rock mass, it's undergone significant corrosion.

So a brief research overview, basically there're four main things. I'll try to summarize this pretty quickly. So we wanted to look at if we could improve our understanding of conditions that contributed to corrosion. And you can see the factors there that we looked at.

But the big kind of output that we would like to have is this "corrosion rate" [information] that could be given to mines. So it would be based on conditions in a mine, geologic, atmospheric, and the mines could actually use this as both a predictive tool for what needs to be installed where, and also to guide their rehabilitation schemes, or plans.

The bottom two are more monitoring-based. So non-destructive testing methods, again, really one of the only ways to actually test how corroded a bolt is and what its capacity is now is to pull it out, in which case you destroy that support. So mines have asked for just an easier way to do this without destroying their ground support in the process.

And in situ monitoring strategies, which basically kind of go along with these non-destructive methods, so we've developed a couple tools that can be used for that. And I will go through those.

So where we started was basically doing these corrosion coupon tests. So "coupons" in this case refers to these representative samples of, say, like a welded wire mesh that's the bottom left there. And then in this right-hand side, it's actually one of the split set bolts. It's just been cut into little pieces.

And then these are exposed to the corrosive conditions that we see in the mine. In the case of the bottom left, that's actually installed in the Greens Creek Mine. One of the coupons is in contact with the rock mass itself, and the other one's just exposed to atmosphere to see if there's any way to differentiate what the rock mass contribution is versus just atmospheric.

And then over time, we control the conditions, and then over time, say three months, six months, nine months, and so on, we take these out, and we test their physical properties. So everything from just their mass loss to their physical strength. And that is to try to develop this corrosion rate tool that can be used.

Chair Nelson: So in the previous slide, you talked about stress corrosion cracking. Do you really think that's what's driving this here, stress corrosion?

Mr. Benton: The corrosion itself, no. Are you talking about the ---

Chair Nelson: Are there any stray electric currents? Did you ever check that out to see if there're any stray currents? Because it's a very acidic environment. Perhaps you can get some ground currents.

Mr. Benton: Yes. And that's been one of the key components of our study.

Chair Nelson: It's got re-distributing measurements, yes.

Mr. Benton: So this is something that actually just got published in the Materials Performance magazine put out by NACE, and what Amy, and that's Carl Sunderman there in the picture, they worked together to come up with this rock resistivity measuring tool that could be used in mining.

And so in that picture, there's actually just four electrodes that we installed into the rock mass itself. And it's just metal screws, put in the rock mass. And then that instrument tells us how conductive that rock mass is. And the idea was, based on other industries, civil engineering, the higher the resistance of the rock mass the lower the potential for corrosion.

So on the bottom right, in that graph, you can see the soil resistivity range had already been approved. That's in kind of the yellowish orange [range]. And then the concrete range is in that purple color. And what we found, what Amy found, is that a lot of this in the mining environment links up a lot better with the concrete system. And it kind of follows the trends that you would expect.

So going back to this slide, one of the in situ monitoring strategies that we developed are these, we call them Time of Wetness sensors. These sensors are placed on the rock ribs themselves. And this is basically just a battery housing. That's the sensor itself.

And what that sensor does is it monitors the air temperature, the air humidity, and then the amount of condensation that actually develops on that sensor. And these are set up to relay this information wirelessly out of the mine.

So as long as the mine has some sort of infrastructure, in this case, this is the Montana Tech Research Mine, they had a wireless system set up.

And we were able to kind of pipeline this data to that gateway. And then it actually comes out [of the mine].

So in this case, if we had a computer here that was hooked up, we could monitor the conditions at Montana Tech's mine in real time right now, the temperature and humidity anyway.

We also have some of these installed at Greens Creek Mine. That's a different scenario trying to actually get access to that data. But it does work. If you're at the mine on surface, you can monitor this.

Going forward, our corrosion research has been identified as something that we'd really liked to pursue. There's a lot of industry need for it. We've actually started developing new tools now for future use.

So in the case of these, these are corrosion strip sensors. And they are designed to be inserted into boreholes in the rock mass. So the principle behind this, it's the same as the resistivity tester, except in this case along the length of this instrument are strips of metal. And so the resistance of that metal is being tested.

What this allows, let's say you're using six foot bolts, a mine could go in, drill a six-foot borehole, and put these instruments in, and leave them installed. And they could see if there's a particular depth at which corrosion is happening, if there's some sort of geologic feature where it's going to concentrate. And these are set up the same way as Time-of-Wetness sensors to where the data is collected and can be relayed out in real time.

Chair Nelson: Have you ever thought of, anybody thought about putting something sacrificial in? Because you've got the spring steel of the split set.

And if you actually put in a thinner section that's going to corrode faster, it could be on the edge, something like that, where you actually still

preserve the integrity of the bolt, but you can tell whether the corrosion is going very fast by having a thinner section, you know, so it goes first before the rest of the bolt goes. Actually, see what I mean?

Mr. Benton: Like attaching a coupon to the rock bolt itself?

Chair Nelson: Something like that, just a sacrificial indicator that says, "Oh, we're in heavy corrosion here." But the bolt's still there. And you make it thin enough so you observe it before the whole bolt has failed.

Mr. Benton: The next tool, it kind of does that in some ways, maybe. This was a bolt probe, and it's been tested. These have been installed at the Greens Creek Mine and are currently operational.

And then this instrument has been tested as well. And it just kind of looks like a wand, really.

Chair Nelson: Yes.

Mr. Benton: But it's inserted into these bolts, and there's this air bladder that you can just pump up manually. And it causes these electrodes to make contact with the rock bolt itself.

And then the resistance is measured between the electrodes on the rock --- or the rock bolt, understanding, or the concept being that if the bolt is corroding there will be increased resistance. And this is actually, it was designed to be able to, number one, be easy to just carry around. But it's not meant to be installed long term. So it is basically meant for campaign type monitoring.

And it can also be, it does the same thing as these [strip sensors] in the sense that it can be put in the full depth of the rock bolt, and then used, and then you can pull it back out and just get a sense along the length of that bolt.

So this is more for rock bolts that have already been

installed, a way to kind of test those. And this is more for monitoring areas over time or placing them into new areas.

So future work, again, I mentioned this with Nevada. So what this picture is representing here, most of these rock bolts, and you can see some of them, look good. But these are rock bolts that one of our engineers literally walked up to, just grabbed them, and pulled them right out of the rock mass.

Chair Nelson: Have there been rock falls where there's been out and out just collapse?

Mr. Benton: Yes. Luckily, I don't think there's been any fatalities. But there have been rock falls due to corrosion. And it's just more been a matter of luck that nobody was there.

Member Harman: Are they typically in intersections or, I mean, do you know where they're located?

Mr. Benton: That I don't know. And that's actually one of the things too that the mines are wanting help with, and where corrosion rate kind of comes in to be more important is the intended life span of certain portions of the mine as well, such as production versus development areas.

Let's see, I don't know. Some of these other [pictures], it's just really kind of disgusting. But they call this rock sap, I guess, this stuff that just, this "goo" that kind of comes out of the rock mass. And we've actually collected a lot of it and are actually currently trying to get it all tested, elemental analyses of it. So anyway, this is the sort of thing that we're walking into in Nevada, but why it's also a big issue here.

Because, again, just this picture right here kind of shows it all. The bolt looks fine, and then there's a portion of it that just falls apart.

Chair Nelson: Would you suggest to Amy that she look at least at basalt rebar and, I'm serious. And

I'm happy to talk with her more about it.

Mr. Benton: I looked it up myself over lunch. And it actually looks pretty nice.

Chair Nelson: Yes.

Mr. Benton: So and then the [basalt] mesh too. So yes, certainly, I'll take that back [to Amy].

Chair Nelson: Well, we're going to do this so that we actually, because you make this stuff by melting basalt rock and pulling fibers. And then it's made into a composite material a lot like the fiberglass, same kind of manufacturing process. But we want to melt tailings and produce rebar out of tailings that is comparable. But I think it's a no brainer.

Mr. Benton: Yes. All right.

Chair Nelson: Okay, any questions?

Member Wright: Yes.

Chair Nelson: Yes, Mike.

Member Wright: This is probably a long shot, but we had a case in a refinery where bolts, and these are obviously not rock bolts, there were, like, bolts.

Chair Nelson: Yes.

Member Wright: You know, were corroding much faster than we expected or than the company expected.

Chair Nelson: Now, that was probably stress corrosion.

Member Wright: No. What it was was a counterfeit bolt.

Chair Nelson: Oh.

Member Wright: And we have found those from time to time where, you know, these bolts that are supposed to handle really high pressure flanges and

things are pretty expensive. And companies, you know, as far as we know it was Chinese, were selling these things marked as the right kind of bolt. But when the company did an analysis of them they were a much cheaper grade of steel. And they corroded faster and they weren't really strong.

We heard later on that some of these actually got into things like commercial airliners.

Participant: Sounds nice.

Member Wright: Yes. And so there was a real push in the refineries, and I assume the commercial airliners, that was just a rumor, I don't know if it's true or not, to really do a lot more testing of these things to test batches and things like that.

Is there any chance that any of that might be happening in this industry? I mean, have people really looked at the grades of steel just sort of randomly and made sure that they were what they were supposed to be?

Mr. Benton: I don't know how, okay, I don't even know if I can actually answer that question, number one. But number two, I know that there are standards, ASTM standards, that the steel used, anyway, to produce these rock bolts have to go through.

And I think MSHA's supposed to enforce or make sure that those standards have been met or that the mine understands that. Does anybody here actually know who enforces that?

Member Wright: What was the question?

Mr. Benton: So they ---

(Simultaneous speaking.)

Member Wright: -- counterfeit bolts.

Mr. Benton: Yes. So if the mine --

Member Wright: Or cheaper grades of steel sold as if they were legitimate products.

Mr. Benton: Because I don't know if there's, I mean, I haven't personally heard of any. I haven't heard of that.

Chair Nelson: Do they proof test at all a certain number of the bolts periodically or after installation to seek capacity?

Mr. Benton: I think some do. I don't know if there's any real standardized program for that.

Member Calhoun: I know we did some testing for bolts, but I'm not sure. To your question, I don't believe so in terms of enforcement.

Member Harman: So these are supposed to be ---

Chair Nelson: Right.

(Simultaneous speaking.)

Mr. Benton: Though I will say that New Concept Mining is actually South African, so that may change things. But Jennmar, I think all of their bolts that we get come from Utah.

Member Wright: Yes. First, I know everything that the refineries found was imported.

Chair Nelson: Okay, any other questions? Bob, do you have any questions?

Mr. Horn: No.

#### Public Comment

Chair Nelson: Okay. So we have had a very productive day and heard a lot of things. So we want to open the mic for any public questions or comments. Is there anyone from the public that would like to make a question or a comment? Yes, we have someone. Please step up to the mic. Where do we want them to step?

Participant: Step up to the mic.

Chair Nelson: Step up to the mic.

Participant: And I'll sit next to Melanie.

Chair Nelson: Okay. Thank you. And tell everybody who you are.

Mr. Ellis: Yes, I'm John Q. Public.

(Laughter.)

Chair Nelson: Hi, John, very nice to see you.

Mr. Ellis: Seriously though, I'm Mark Ellis with the Industrial Minerals Association, North America. And I have a few questions for Jessica. They go back to the partnership issue you talked about earlier today. The reformulation of the partnerships, what's the timeline on that?

Dr. Kogel: So I'm thinking back to my slide. So are you talking about the ones that are going to be folded in or all of them that we talked about?

Mr. Ellis: Well, for the ones that are going to be folded in, that's a change. I know you talked about charters and things like that.

Dr. Kogel: Yes. So that can't happen until there's new partnerships, because they're being folded into new partnerships. So that wouldn't happen, of course, until after the new partnerships are formed. And right now, I'm saying sometime in the first half of this coming year.

Mr. Ellis: Okay.

Dr. Kogel: So I would say, yes, that was very helpful, I have the slide in the front of me. So that could happen sometime in 2020.

Mr. Ellis: Okay. And then I had tried to be attentive, but you mentioned two new partnerships, and I don't recall hearing what the two are.

Dr. Kogel: There's the Automation and New Technology and the Respirable Mine Dust, the two on the top. Those are the two new ones.

Mr. Ellis: Oh, so Automation and New Technology is going to be one new partnership.

Dr. Kogel: Yes.

Mr. Ellis: And the other one is going to be --

Dr. Kogel: And the Respirable Mine Dust is the second new partnership.

Mr. Ellis: Okay. So in other words, they're reformulated partnerships, but you're considering them new partnerships then.

Dr. Kogel: So really the way it works is those two are new partnerships. And there are some existing partnerships that we feel are coming to the point where they're going to be changing. And instead of keeping them as stand alone partnerships, they actually have kind of logical places where we could put them in these two new partnerships.

Mr. Ellis: Yes.

Dr. Kogel: So it's a two-step process.

Mr. Ellis: Okay. And then, let's see, the other one was from RJ, or at least one of the other ones was from RJ, mentioning the rock dust testing that you had done in Poland. When do you think that the reports are going to be available?

Mr. Matetic: The most recent set of dust, the report is in draft form now. And the next set of testing in Poland is going to be on the front rock face. And they're actually doing that currently. And once the results are in, the report will be generated. But the most recent one that I mentioned is in draft form right now.

Mr. Ellis: Okay. Well, we'd be most interested in seeing that.

Mr. Matetic: Yes.

Mr. Ellis: And then Jeff Welsh mentioned the Lake Lynn replacement. And as I understand it, NIOSH has the funds for the purchase of the property. Can you go into any detail about the funding that's required for the development of the facility? You know, you talked about a four maybe five-year timeline for construction. But what kind of costs potentially are involved in that?

Mr. Welsh: Yes, I think some early estimates were on the order of \$50 million.

Mr. Ellis: Fifty?

Member Wright: Fifty, yes.

Mr. Ellis: Okay. And that would include not only the construction itself but all of the infrastructure, the mechanisms to do all the testing and all that? Okay, great.

Well, based on that information, I've got a recommendation for the Advisory Committee. The loss of Lake Lynn has really compromised the ability of NIOSH to do a real fundamental part of their research with explosives and mine fires.

And if the funding is available for the purchase of the facility, and on the assumption that that goes through, I think it would be completely appropriate, and I would encourage the Advisory Committee to consider sending a letter the appropriators and to the substances committees of jurisdiction expressing support for funding the construction and infrastructure that's required to complete that project and to do it as expeditiously as possible.

This is likely something that is going to take time to get the funding through, but having something in the record about the support of the Advisory Committee, I think, would be very helpful. You've done stuff similar to that in the past. And I think it would be appropriate to do it.

Chair Nelson: And that would probably be a letter to John?

Dr. Kogel: That would be a letter to the Committees, right, the --

Mr. Ellis: Yes, the Committee, it would be a Committee letter, I would suggest.

Chair Nelson: Yes. And not to the tracks but go outside.

Dr. Kogel: No, because this is from the committee to support funding, so appropriated funds for the construction. So that would have to go to the ---

Mr. Horn: Would that go to the appropriator, to the Congress, or to the NIOSH itself. My thought would be to NIOSH hierarchy first. And if they agreed, then --

(Simultaneous speaking.)

Mr. Horn: -- perhaps to Congress.

Chair Nelson: Because if it's not in the budget --

Dr. Kogel: It's not.

Chair Nelson: No, I know it's not in the budget now. But, I mean, if CDC doesn't put it in the budget ---

Mr. Ellis: Well, this is the challenge, you know. Federal employees cannot lobby for expenditures. And, you know, the Advisory Committee can give advice. You can give the advice to Dr. Howard, but you could copy the people that had been involved in the public meetings ---

Chair Nelson: Okay.

Mr. Ellis: -- that had been going on and ---

Chair Nelson: So let us think about the politics involved here of what should happen. I think we do strongly support it. In what way should we express our support, we'll have to talk about that.

Mr. Ellis: Understood.

Dr. Kogel: So I think we have done it as ---

Mr. Horn: I think that's fair.

Dr. Kogel: -- we've done in the past. And so I think just going back to see how it was done in the past would be the way to chart the path forward.

Chair Nelson: Because it's possible to annoy the current administration, and I would rather not.

Mr. Ellis: Well, you know, that wouldn't stop me. But I know that we have been party to a group that has involved industry, labor, to go and make these requests to Congress and to the administration. And I fully expect that we'll do that again. You know, it was quite a successful effort that we had last time, but it's a long process and a lot of money.

Chair Nelson: Well, I think, I mean this is a formal FACA committee, and the reporting is pretty clear in terms of what we should do. As individuals, we could do it if we want to. But I think we just better figure out exactly what it is that can go. Jefferey?

Member Burgess: I'd like to add onto that. That university employees are not allowed to lobby for any legislation. It's not permitted unless I do it as an individual.

Chair Nelson: Yes.

Mr. Ellis: So I'll let you figure out how you might need to do it. But my recommendation stands.

Chair Nelson: Okay. Thank you very much.

Mr. Ellis: And I have one more comment.

Mr. Horn: Also in regard to the partnerships that are emerging, in the report on this meeting, can we get a listing of those? And when can we anticipate the new partnerships, or when we hope the new partnerships will come into the existence and be

formulated so that it also provides whomever with an outline of where NIOSH is going in relation to its research?

Chair Nelson: Yes, Jessica is saying yes.

Mr. Horn: Okay, super.

Mr. Ellis: And before I relinquish the floor to Mike, I'd like to offer in closing an appreciation to you, Madam Chairman, for what you have done with the Advisory Committee over the past several years. You've been a great chair and, as a member of the public, I want to thank you for that.

Chair Nelson: Well, thank you very much. This is a wonderful group of people, and it's been a joy to get to know them. It's been wonderful.

Mr. Ellis: Okay. I yield.

Chair Nelson: Thank you. Thank you very much. Any other members of the public want to say anything at this time?

We will have another public comment period at the end of the meeting tomorrow morning around noon, right, 1:30.

Mr. Horn: So when did we say on our time tomorrow morning?

Chair Nelson: 8:30 we start.

Mr. Horn: Okay, super.

Chair Nelson: Okay.

Chair Nelson: Okay. Any final comments anybody want to say right now? Otherwise, we are adjourned until tomorrow at 8:30. Thank you very much.

Adjourn

(Whereupon, the above-entitled matter went off the record at 4:41 p.m.)

Centers for Disease Control  
Mine Safety and Health Research Advisory  
Committee (MSHRAC)  
Committee Meeting  
Thursday, November 14, 2019

The meeting convened at 8:31 a.m., in the Atlanta Marriott Northeast/Emory Area, 2000 Century Boulevard NE, Atlanta, Georgia, Dr. Priscilla Nelson, Chairman, presiding.

## Present:

Priscilla Nelson, Chairperson  
Priscilla Nelson, Chair  
Ronald Bowersox, Member  
Jefferey Burgess, Member  
Melanie Calhoun, Ex-Officio  
Richard Fragaszy, Ex-Officio \*  
Thomas Harman, Member  
Robert Horn, Member \*  
Kramer Luxbacher, Member  
Michael Wright, Member  
Kyle Zimmer, Member \*

## NIOSH Staff Present:

Jeffrey Welsh, Designated Federal Official  
Tim Bauerle  
Donovan Benton  
Amia Downes  
John Howard \*  
Jessica Kogel  
Douglas Johns  
Jacob Carr  
George Luxbacher  
RJ Matetic  
Bob Randolph  
Randy Reed  
Tashina Robinson  
Todd Ruff  
Lisa Steiner

## Also Present:

Monty Cooper, Crowell & Moring LLP

\*Participating via telephone

## Day 2 Proceedings

(8:31 a.m.)

## Call to Order and Opening Remarks

Mr. Welsh: Good morning. We'd like to get the meeting started. We have a packed agenda again this morning. So we'll get started so we can finish up by noon. I'll do a roll call. Ron Bowersox?

Member Bowersox: Here.

Mr. Welsh: Melanie Calhoun?

Member Calhoun: Here.

Mr. Welsh: Jeff Burgess?

Member Burgess: Here.

Mr. Welsh: Mike Wright?

Member Wright: Here.

Mr. Welsh: Kray Luxbacher?

Member Luxbacher: Here.

Mr. Welsh: Tom Harman?

Member Harman: Here.

Mr. Welsh: Priscilla Nelson?

Chair Nelson: Here.

Mr. Welsh: On the phone, Robert Horn? Robert Horn?

(No audible response.)

Mr. Welsh: Kyle Zimmer? Kyle, are you on the phone?

Member Zimmer: I'm on the phone.

Mr. Welsh: Okay.

Mr. Welsh: Richard Fragaszy? Richard, are you on the phone?

(No audible response.)

Mr. Welsh: Aubrey Miller? Aubrey Miller? Richard Fragaszy? Robert Horn?

(No audible response.)

Mr. Welsh: We have a quorum, we have eight, so it's an official meeting. So we can get started.

Chair Nelson: We are official meeting. And we understand Kyle is on the phone. Is Bob on the phone?

(No audible response.)

Chair Nelson: Okay. So welcome, Kyle. Every time it makes a noise, we never know what that means. Okay.

So we are in the second day of the November meeting, and the first item on the agenda is to hear from Jefferey Burgess about his workgroup that was chartered earlier and has been active. So we invite Jefferey to bring us up to date.

#### Presentation by Dr. Jefferey Burgess

Member Burgess: Okay. I sent some slides to you yesterday, Jeff.

Mr. Welsh: Yes.

Member Burgess: Can you pull those up?

Mr. Welsh: They're coming up now.

Member Burgess: Okay, thanks.

Mr. Welsh: Jerry Poplin, are you on the phone?

Mr. Poplin: I'm on mute, yes.

Mr. Welsh: Okay. Good morning.

Mr. Poplin: Good morning.

Member Burgess: That's Jerry's 5:30 in the morning voice. All right.

Well, thank you for the opportunity to present the draft report on our workgroup. So we had this earlier in the room in September I believe, and as a formal subgroup of MSHRAC with the objectives -- actually if we can go to the next slide please -- with the objectives of answering three questions, and those are listed here.

What gaps exist in miner health research? What mechanisms can be established to improve communication and participation of occupational health research? And then how should the miner health program be evaluated? And there's a sub-bullet asking for which measurements and methods would indicate success or improvement. So can we go to the previous? Actually, go back one slide, please, to the beginning. There we go.

So I wanted to thank everyone that helped put this together. So I just have the working group leads. I need to look and see the additional folks that work with us during this time period. But these were the individuals that were all present at the meeting and helped us to go through the agenda.

And I'd particularly like to point out that Kelly Bailey was absolutely essential to the process. He brought in a number of industry partners and was absolutely fantastic through the whole process. And he's not even a regular MSHRAC member, so he was just doing this out of the goodness of his heart. All right. Next slide, please. One more, please.

Member Horn: Bob Horn. I'm on.

Mr. Welsh: Good morning, Robert. Welcome.

Member Burgess: So --

Member Horn: Thank you.

Member Zimmer: Excuse me. Are the slides in the ePackage, Jeff, or not?

Member Burgess: Oh, I'm sorry. Here, I can -- let me send you them, Kyle, right now.

Mr. Welsh: And Robert.

Member Burgess: So for both Kyle and Robert, what I'm just doing is taking the tables, each of the three tables and then the top part of the priority list for each of the questions. So that's what we're looking at right now. But we're working on getting them to you. Thanks. Thanks for bringing that up.

Member Horn: Thank you.

Member Burgess: So the first question was: what gaps exist in miner health research? And we spent the majority of time during the meeting on this particular topic. So what you're seeing in front of you now is a table that summarizes these topics by group.

And I'd like to start out by bringing up that silica is already an item that we are evaluating within -- or that NIOSH is evaluating. And we pointed out a few times that the objective of this meeting was to look beyond the existing programs.

However, that said, there was still a lot of comments from the workgroup participants that this continues to be an area that requires additional research. So that's, I think, the point that I'd like to make about silica. The others could be equalized into surveillance which had three topics, then health and well being which had a large number of topics, and we'll see some of the examples on the next slide. And then hazard -- oh, go back. Sorry. Back again. There we go.

And then for hazard exposure, monitoring, and assessment, there were nine and then health economics, there were one. So it was relatively difficult to categorize all these fairly disparate

topics. Because we wanted to get an idea of which were perhaps more important to the workgroup than the others, we went to prioritization. And if we could see the next slide, please. You can see here that the list of individual topics and the number of votes that were given to each.

So what we did was similar to the process that we did for the automation in mining workgroup that Kray had led. We took all of the different topics that had been brought up, we put them on a list, and we asked all the participants to rank their top three. And then we tabulated those and essentially added up all the votes and you can see the results here.

So the ones that have greater than two votes are all listed, are all underlined. And the first one again as I mentioned previously was an increased focus on silicosis.

The second one was really looking at surveillance. So additional -- that was gathering additional information on worker health and deaths associated with occupational exposures in the mining industry. And they also brought out specifically looking at retirees as well to understand the long-term consequences of these exposures.

Dr. Luxbacher: Hypothetically, how many -- if everybody voted for the same topic, how many votes would a topic have had? Like how many people voted?

Member Burgess: That's a great question. I did not have that tabulated, George. But by the end of the meeting when we did this, there weren't a huge number of non-NIOSH folks in there. So I would have been surprised if there were greater than 20.

Dr. Luxbacher: So that's 6 out of 20 then. So that helps put that in context.

Member Luxbacher: How many people did you have sort of when the meeting was well attended? I'm guessing people were leaving. They're traveling.

Member Burgess: We had about 45 people to start with, I think. Jerry, do you have better numbers than that?

Dr. Luxbacher: Could people vote for more than one?

Mr. Poplin: Forty.

Member Burgess: Thank you. So Jerry is saying 40, and people did. They voted for the top three. And then we just took those and added them together.

So on the third was this concept of fitness for duty, which was actually brought up earlier in the meeting or this current MSHRAC meeting yesterday I believe. And so that's something that a lot of mining companies are concerned about is: is someone able to do their tasks, and is there some way of looking at that at the beginning of a shift or over a longer time period?

And then there's some additional topics that only got two votes. And then a large number that had one vote. And if you look at the information that was sent to you prior to the meeting, you can see the full report and see the additional listed topics.

Chair Nelson: And there were a total of 45 votes. So if they each did three, there would've been 15 people involved.

Member Burgess: That would've been I think probably about right, I'm guessing. So then from my perspective what this shows is that everyone has certain topics that they're interested in. There's not necessarily an enormous consensus about which is most important when you look at the group as a whole.

So it becomes difficult perhaps to prioritize based on this a smaller number of topics, let's say three or four. All right. The next slide please.

Chair Nelson: There's -- and when I looked at this

report, go back, there's the silicosis that's down below. So I guess part of the question is: can they be lumped? Should they be lumped? So third from the bottom is another silicosis.

Member Burgess: Yeah, I think that's -- yes, I should. Thank you, Priscilla, for pointing that out. So I can look back at that and see and it could be handed out.

Mr. Poplin: The table -- the major groupings should encapsulate those two silicosis topics.

Dr. Kogel: So the slide previous, Bob, if you go back one slide. So this slide I think is the one that Jerry is referring to. So what you just suggested should be captured that way in this slide, right?

Member Burgess: Yes. But I think Priscilla's point is a good one. I would probably want to combine those together --

(Simultaneous speaking.)

Member Burgess: -- in the report.

Dr. Kogel: -- is what I think Jerry is --

Member Burgess: No, no. But I would probably revise this tabulated slide and combine the two. So I'm just going to write down to combine the two silicosis topics because I think they're similar. Next slide, please.

All right. I'm just looking here. Expanded research on silicosis including improved exposure data. And the first one was a topic on small mines and metal, non-metal mines. So looking at that again, maybe they are different enough that it would be better to leave as they are. Because they're both about silicosis, but they're different topics on silicosis. So I'm going reverse what I just said and probably leave them the way they are, unless folks believe otherwise. Next slide, please.

So the next question that we had was the

mechanisms to improve communication, participation, occupational health research. And there was a fairly limited amount of time to address this, I believe about an hour. And what we came up with in terms of the tabulations was a focus on establishing more partnerships.

So we know that NIOSH has done a really good job working with industry and labor around various issues. And they feel that this would be a good mechanism moving forward. Also continuing to share effective processes. Again, that's what NIOSH has done, NIOSH mining particularly over the years. Additional thematic areas would be case studies. So this was also discussed during the meeting that it's a good story. It is quite a good way to get people to consider changing their processes. So if we could put some appropriate case studies around help together and (inaudible), that would be helpful.

There were also -- there's also a discussion around financial aspects that the cost component should be analyzed and brought forward as an argument for improving occupational health. And then there was just a variety of other topics. So if we could look at the next slide, please.

You can see here that I had to make the text very small. And you might want to look at the full report that was sent to you. But we did not do a prioritization of these as we did with the individual health topics. And you can see that there's again quite a few. And what I've done is kind of underline the breaks between each topic. So the first one was the idea of partnerships, and then so on. Again this is in your full report. Next slide, please.

And then the third point that was brought up is how the miner health program should be evaluated. And you can see here that we're able to organize things into four different topics. One was survey, again, a fairly typical approach. The second one shows various aspects of partnership as we saw for the second question. The third topic was outcome

measures, the very explicit objective measures. And the fourth category was other. Next slide, please.

And here we had a smaller number of topics, again on this evaluation subject. And again, I don't see anything that was kind of particularly beyond what we mentioned in the previous slide. So at this point, we provided a draft report to MSHRAC committee. And I guess what I'd be looking for is some suggestion about how we create an executive summary of this report. So they had provided some information on her automation in mining which was a list of executive summary points.

And I would like to hear from you what you'd like to see to improve the current draft report that has been sent to you. So I'd like to open up to discussion at this point about how to move forward to finalize the report.

Chair Nelson: Okay. So thank you very much. You mentioned that Kray had sent you some information?

Member Burgess: So Kray had sent everyone her report. And then during the meeting yesterday, she provided the executive summary bullet points. So that's what we have a result of her workgroup.

And also, Priscilla, if I could ask Kyle and Jerry if they could provide -- if they would like to mention anything else that I neglected to mention that would help the group move forward. So if we could ask Kyle. Kyle, do you have additional points, things you think that are important for us to consider as we're deciding how to move forward?

Member Zimmer: I do have a couple of comments, but I don't know if this is the time to do it, or wait a little bit later. But as you all know, I'm very passionate about the behavioral health issues, especially suicide and behavioral health in general.

We have an opportunity here I think with this report to maybe bump up those categories a little bit and

support Dr. Howard's opening comments yesterday. And it seems that he feels that these issues should be a priority and look into them.

And then data, these issues, data is coming out very rapidly on how it's affecting the workplace. So some consideration I think should be made. And again, this is my passion. So this is my thought and my thought only. Maybe bump that up a little bit.

You know, to Priscilla's point and others, silica is already on the map. A lot of work is following around the silica standards. So it came up for construction, and you're looking at it for mining now and things along that line. That's my only question at this point.

Member Burgess: Kyle, thank you. I think I should also bring up for the benefit of individuals that were present during the planning and at the meeting that we had a lot of discussions with both labor and management around the topics to discuss during the meeting. And I believe that perhaps it would be helpful in terms of the prioritization to include that as well so that we have certain thematic areas like behavioral health. And another example would be welding that was brought up during the planning process and would help us to prioritize as well. Jerry, do you have anything to add?

Member Zimmer: Jeff, you were very broken up. I didn't hear your last statement. Could you please summarize that for me?

Member Burgess: Sure. Sorry, Kyle. What I was suggesting is that we take into account the categories of the meeting. For example, behavioral health and welding as two examples within the prioritization process. So these were the things that were requested by the individuals who were helping to plan the meeting, which included both labor and management. So I think if we put those as part of the executive summary, it would help us move forward. Would you agree with that?

Member Zimmer: Yes, I do. Thank you.

Member Burgess: So Jerry, did you have anything to add?

Mr. Poplin: Just two things. When you look at Slide 3 and just keep in mind the number of topics within each of the major groups, kind of what you and Kyle were talking about. There may be opportunities to break out a subset of topics.

So please do keep in mind that there were 36 individual research topics mentioned. And so it is worthwhile to kind of take a look at them individually. There are some, as Priscilla mentioned, that are naturally grouped together. So we can still expand or shrink this however the group think is necessary.

The second thing that you might want to mention is just the general timeline intent in terms of where you're at in the process. And I can give you a general sense from what I kind of presented MSHRAC with this subgroup notion. I think the intent right now is you've got a near complete version of the report completed by the end of the calendar year. And then NIOSH and the folks in my office will take it from there and kind of put this back into the strategic plan and update the committee hopefully with a new version of the strategic plan with some guidance on our goals and future intentions probably by the next MSHRAC meeting was the intent, unless you have something to update us on.

Member Burgess: Jerry, thank you for that. I like the way that Todd had followed up Kray's report with, if you will, a NIOSH response to the input that was generated. And I think that would be a great way of moving forward here as well.

So I would suggest that at the next MSHRAC meeting we plan to have an abbreviated version perhaps of the presentation I just gave that highlights any changes that we've made since in the

interval between now and then. And then have Jerry present on NIOSH's response in terms of any changes to their strategic plan.

Member Horn: May I ask a question?

Member Burgess: Please.

Member Horn: One of my concerns and I'm not as well versed or educated as many people are with regard to the silica threat and silicosis -- the condition of silicosis as a major disease affecting mining currently.

But I feel a little bit like the dinosaur in the room in the sense that when I chaired one of the environmental committees at EII when I was vice president of Michigan utilities, this issue was prevalent.

And the question I have is maybe the one I think I need the most help with in answering in terms of policy development is: where do we go from here? I had thought way back that the whole issue of black lung would be substantially alleviated. And some of the numbers are reduced and do indicate an improvement in the situation.

Why is the silica issue again as prevalent if there are ways to improve the situation?

Member Burgess: Bob, this has been brought up during previous MSHRAC meetings with a great focus on the increase in coal workers' pneumoconiosis, silicosis, predominately in Appalachian coal mines. It's become -- there have been fairly marked increases in the number of cases, and this has resulted in a lot of evaluation of exposures, additional surveillance.

So what we're responding to now is this return of silicosis after a decline for a number of years. So what we were trying to get to with this workgroup was to focus on other areas that weren't currently covered. So I think that NIOSH is appropriately

responding to this increase in silicosis cases. They have strong existing programs and partnerships within NIOSH to address this. And I think that we should mention that in the report but be focusing on additional areas that they haven't addressed so far which was the objective of the meeting.

Member Horn: Understood. But the question then too is one of the things we should be talking about too is: how do you train people who have access to equipment, be it air cleaners or different equipment individual miners can carry, that would have an impact going forward in terms of reducing the risk?

Member Burgess: I believe, Bob, that we've had a number of presentations on this very topic previously and spent a number of prior sessions on this. I'm not sure if you're asking for us to review it again in a future meeting or have some other idea in mind.

Member Horn: Yeah. That's exactly what I'm thinking about because the net goal is to reduce the risk of the disease.

Member Burgess: All right. I so noted that this is a topic that came up during our session and that Bob is bringing it up now again. So I would suggest that we consider how to talk about current NIOSH efforts during part of our next meeting.

Member Horn: That would be appreciated.

Chair Nelson: So can I ask a question here? I'm looking at the three parts of the charge. First part is shown here in this slide focusing on the gaps. So I want to make sure I understand that these areas that you've got on the list and that people have voted on are things that are not being done now.

Member Burgess: That was the idea.

Chair Nelson: Is that in fact? I mean I would appreciate I think feedback from NIOSH eventually that these are gaps and that maybe something is

being done that we don't necessarily know.

So the second point deals with mechanisms to improve communication. And there's a lot of mechanisms here, right? I guess what I'm thinking is the idea of something summative about an approach that could be used or that might be considered or hasn't been done. It may be a combination of some of these that you've got listed here.

I mean it's clear that you want engagement. You want to get all the stakeholders involved. You want whatever it is. But there's a -- I almost think that it's really, to me, building a responsibility in all the stakeholders to participate in the engagement instead of just sending a page. That they want to on a continuing basis because it's important for them to do it.

And then on the third, this question of evaluation. I wasn't sure what was coming out of it in terms a recommendation because I mean I think the question becomes in part: is data collection being done? Does something need to be done differently about just simply the data collection that forms the basis for the evaluation?

And then I mean one of the speakers in here talked about a process evaluation and the impact evaluation. So are we getting data on -- sufficient data about implementation of anything that comes out of NIOSH? And is it implementation as designed, or is it being used in some other way -- perhaps appropriate, perhaps not? And then the impact evaluation which is the final end outcome, right, is in terms of, is there an impact and what's going on?

So the idea of if this -- these could be sort of put together and saying the committee rather than the entire group of everybody who was there. But if the workgroup can say, okay, here's where we think after having heard all of these conversations, where we think the gaps are, where we think the communication needs to be focused, and where we

think the process of data collection and evaluation needs to go. Just as an honest statement of -- and you've heard all these discussions -- this is what the workgroup thinks.

Member Burgess: So thank you for that, Priscilla. We did put together the list. And I agree that we need to have some more summary or executive summary form from the points that were brought up during the meeting.

I also believe that we are early in the process of addressing health problems beyond those that are already being addressed such as silicosis. Therefore, we'd be looking more at the design of new programs to address these issues rather than focusing on the evaluation of the work that's being done because the work that's being done is very early in the process.

Chair Nelson: But as we talked about yesterday, the idea of knowing how you're going to evaluate it at the time that you start is a connection which I think needs to be brought in there. So that when you start a project, you actually already know how you're going to evaluate the process and what impact evaluations you're looking for or you're expecting to get.

So they're sort of wired in, and then the community will know what you're looking as well, and may say these are important things to know. I want to participate. Something that generates that sense of responsibility for participation.

Member Burgess: Thank you. We'll work on putting that in.

Member Horn: In terms of making that kind of evaluation, we've been evaluating the same criteria behind the systems of the disease that we're concerned about.

Member Burgess: Okay. Thank you, Bob. For certain conditions such as silicosis, I think that's fairly well

understood because the disease had been with us for many years. For some of the other things such as heat stress, I think those are also reasonably well known. So perhaps you could explain a little bit more about what you're looking for in this report.

Member Horn: What I'm saying again based on past experience is that if you go to different doctors, symptoms are defined in ways that use the similar language although they may not necessarily use the same disease. So the question then becomes: as we do this evaluation of the need for criteria, we're talking about targeting the same kind of symptoms and the same kind of disease?

Member Burgess: Bob, would it be reasonable to restate that as it would be helpful to provide information for treating physicians who perhaps might not be knowledgeable about some of the diseases that miners could develop?

Member Horn: Yeah, I think that's fair.

Member Burgess: Thank you. Anymore questions, comments from the group? Mike.

Member Wright: Yeah, I was trying to figure out what sort of help do you need from the rest of the group. And it looks to me like -- let me ask if this is fair. You're at the level now of formulating sort of major research topics but not at the level of formulating research questions.

So we can say from this, for example, that we needed more -- that one finding of the workshop was we needed to do more on silica. But what in particular do we need to know? We're not at that level yet. Is that fair?

So for example, we did sort of a data dump from the MSHA sampling data to see if we could do for silica what the Center for Science -- do for metal-nonmetal mines what the Center for Science in the Public Interest did for coal mines with respect to silica which is they produced a pretty good

distribution of what kind of mine and what kind of levels.

That hasn't been done as far as I know for silica. So for me, that would be a research question. And it seems to me you're not at that level yet. Is that where you want us to help you get, or --

Member Burgess: What I would like to see, Mike, would be edits or recommendations for a formulation of an executive summary for this report. I believe the report does a reasonably good job of summarizing the presentations, of listing the topic areas that were identified. But we're not at a point yet where we have an executive summary with the major points of the meeting and recommendations for NIOSH being listed.

From the perspective of silicosis, this was a bit problematic from my perspective because we specifically mention it is something that was already being covered and tried to during the meeting repeat the point that the purpose of the meeting was not to go into greater detail on things that NIOSH was already doing but to identify areas that they're not addressing. So while we clearly heard that silicosis was an issue that still needs to be addressed, there are programs within NIOSH that are already working on it.

So from what I would say right now and what I'd be building for towards the report, unless the committee feels otherwise, is to say that there remains a great concern about silicosis and it needs to continue to be a focus area for NIOSH rather than going into details for this report about silicosis because that's not something that we went into great detail to determine what additional things need to be done.

We're just saying here that, in general, our stakeholders don't want us to forget about some of the major things that are already out there like silicosis.

Member Wright: Yeah, I guess what I was confused about was the idea of sort of helping write an executive summary because that's based on the four corners of the document. You don't go outside the document to further questions. And really it's an enrichment --

Member Burgess: Yes.

Member Wright: -- issue. It's not an issue where people come up with ideas like the committee does, if that makes sense.

Member Burgess: I agree. Just what we were left with was a list of topics as mentioned here. Without perhaps the clear -- other than the presentation topics, we didn't have perhaps the agreement that I saw during the automation meeting, where certain topics just popped out and everyone coalesced around them. We ended up --

Member Luxbacher: Generally, this is just a more nebulous area I think, and it's not as far along. So we're just not getting that consensus that you get under automation.

Member Burgess: I agree with you, Kray. And that's the difference between Kray's report and our report, which ours is a bit more diffuse and therefore it's, from my perspective, a bit more difficult to make the summary statements that usually come with an executive summary.

Chair Nelson: Well, I guess there's -- to me, I mean, you've got three things that you identified in the charge. And the approach can be just simply summarizing exactly what it is out of each one of those and the executive summary.

But the alternative is to actually have you and Kyle and Aubrey and other members of the MSHRAC to actually digest this a little bit with -- and come back with -- granted, it's a small -- a subset of everybody capturing what the priorities are that you see them coming in. And that would add value, I suggest, if

you decide to do that.

Member Burgess: I agree. We will after this meeting and taking the input that we've gotten today, we'll go back. We'll have the major folks that were involved in this have a meeting. We'll develop our executive summary and bring it back.

Chair Nelson: Okay. Any other input? Thomas, you've been very quiet for quite some period of time. You have no comments?

Member Harman: Well, even still thinking about these issues, it seems to me that it's been a fairly narrow focus on what works and what doesn't work in the last year that I've really come back into the mining industry from an active standpoint. I've visited a lot of underground mines, both coal and metal-nonmetal mines. And it strikes me that the type of technology that exists to control dust is a lot better than it was 30 years ago, and that's a collective effort by everybody in this room, industry, labor, policy makers, enforcement agencies.

And I think it really needs to expand from there. Some of the pieces of equipment that I've seen, for example, the full face miner is an amazing piece of equipment. And if you don't know what that is, it's a dual piece of equipment that operates both to extract coal and to pin the top as you move forward. And the way that it's designed, you can advance your face ventilation within five feet of the face which is much more effective for dust control than 20 feet from the face in coal mines.

I haven't seen many people wear powered respirators. And I'm thinking that's an approach that we need to take a look at as far as controlling the individual dust exposures to miners. And in that regard, it's the National Personal Protection Technology Center would be what they're working on. If they're working on respirators right now, I think that could provide some clarification with what works.

Chair Nelson: And implementation adoption, are there things moving in a direction that may be difficult to implement actually effectively, or any --

Member Harman: No, I don't think so. I think it's out there. For example, 3M is discontinuing the use of the trademark, the Airstream helmet because of permissibility issues. But it's been replaced with what's called Versaflo PAPR. But it hasn't been approved as permissible for use in the U.S. yet. It's widely used in Australia is my understanding if I remember correctly.

One thing that I'll note too is that the coal dust exposures and silica exposures among coal workers, there's no dearth of information there. So far this year, there are just under 6,000 exposures the MSHA's inspector has taken for silica monitoring by the coal miners. And I don't know. Since the dust came into effect, I want to say 400,000 coal dust samples -- individual samples for them.

So there's -- I mean, we know what the exposures are, and we know the percentage of exposures that are above the permissible exposure limit so that the dearth of information about that is in the metal and nonmetal sector to your point.

Member Wright: Well, except I think even in the coal sector, and correct me if I'm wrong, but it seems to me like there are plenty of measurements, but there isn't a corresponding lot of analysis.

So we know what the exposures are, but we don't know the conditions under which each exposure measurement is taken. So we can't really evaluate the impact of different equipment, of different work schedules, of all kinds of different things that would be interesting to know.

Chair Nelson: Well, that's interesting and that provides guidance where there's a gap on process, right, of evaluation rather than -- I mean, you've got a lot of data, but it's not allowing you to evaluate the question that you have. So something

needs to be done on data collection so we can get linked more to the specifics of where did the exposure come from.

(Simultaneous speaking.)

Member Wright: B- and see what I think maybe the role of MSHRAC is at this point or the subcommittee or subgroup. We know from the workshop we want to do more on silica. It seems to me the next step is to ask: what don't we know that we need to know to better protect miners? And we're kind of not at that step yet.

That's really formulating essentially research questions with the proviso that we don't want to duplicate or we don't want to suggest that NIOSH do what it's already doing. What research isn't being done that needs to be done? What research questions haven't yet been answered with things that we need to know, either to craft a good regulation or just as good practices? What kind of research fits into that?

Chair Nelson: Yeah, what are the outstanding questions? And then what is the data --

Member Wright: Exactly.

Chair Nelson: -- needed to actually address it without getting the data?

Member Wright: Yeah.

Chair Nelson: And if not, we're going to have to modify the data acquisition.

Member Luxbacher: Can I just make a comment? So my understanding of the charge for the health group was not to deal so much in silicosis and exposure, which is what we're talking about now. But it seems obvious that this committee really wants to engage -- continue to engage in that area.

Should we wrap up the health component in Jeff's discussion and then maybe leave this for the later in

the meeting, what we want to do in the next meeting around silicosis and exposure?

Chair Nelson: We can do that. But I feel like that, in fact, the context that we're talking about here may be silica. But the condition, the issue of research and do we have the data to go after it and really thinking about the evaluation. At the same as the research question is proposed, it goes across the board for all of them.

(Simultaneous speaking.)

Member Luxbacher: It does. It makes it difficult as Jeff is expected to incorporate something into his report that he didn't address really, it sounds like, in the meeting.

Member Burgess: I support what Kray is suggesting is that we hold onto silicosis as a topic that was raised during our meeting that needs to be addressed within the larger research context that NIOSH has. And therefore we should pull it out of the discussion right now and put it as an item for discussion for a future meeting.

Member Luxbacher: I think it's clearly something the committee wants to engage in and should engage in.

Member Wright: And just to be clear, I wasn't suggesting formulating research questions as part of the report of the committee. I was saying that's the next step after -- that's what we do after this report. That's what this report feeds into.

Member Bowersox: I just kind of want to add to what Mike was saying, talking about equipment is a lot better. We have a problem with silica. It got a lot faster. People work more shifts a week. A miner works six, seven days a week, working longer hours. And the data is not being collected like it should be. So I think that should be moved right at the top.

Chair Nelson: Right. And I think that is mentioned in the report.

Member Wright: One example of that is I think they don't -- I think mine operators in coal don't have to take coal mine dust samples when they're just developing -- when they're driving a shaft, and that's when the silica exposure is going to be the highest.

Member Harman: Yeah, most of them don't go to coal production. Right?

Member Wright: Yeah, but not when you're not in coal.

Chair Nelson: Melanie, do you have any comments here?

Member Calhoun: I don't have any comments right now. I just know that we have our RFI that is going on. And if you guys have any comments, please submit some to us because we do have that. That's going on and we would love to hear from you. So in terms of silica, that is something that MSHA really is taking a hard look at. So we do ask that comments are provided to us.

Chair Nelson: Good. Thank you. So Jeff, where are you now?

Member Burgess: I have what I need to be able to move forward. Thank you, Priscilla.

Chair Nelson: Any final comments from anyone? Kyle or Bob?

Member Zimmer: No.

Member Horn: No, even though I was listening intently. Thank you.

Chair Nelson: Okay. Thank you. And thank you and your workgroup, Jeff. It was very good. Thank you. Okay. We are -- go ahead.

Mr. Fragaszy: This is Rick Fragaszy. I'm online -- I mean, I'm on the call.

Chair Nelson: And you're healthy?

Mr. Fragaszy: Mostly. I'd --

Chair Nelson: Go ahead.

Mr. Fragaszy: I'd rather not eat today. But otherwise, I'm okay.

Chair Nelson: And have you set a retirement date yet?

Mr. Fragaszy: Not specifically, but probably going to be mid-March.

Chair Nelson: Well, I do hope --

Dr. Fragaszy: Early to mid-March.

Chair Nelson: I hope I get to see you before that date but then after. Do you have any comments, Rick?

Dr. Fragaszy: No.

Chair Nelson: Okay. Well, welcome to the committee. And we're going to move on to Tashina, there she is -- talking about the miner health data sources and analysis, which is timely given what we've been talking about. The floor is yours.

#### Presentation by Tashina Robinson

Ms. Robinson: Okay. So hi, everyone. My name is Tashina Robinson. I'm an epidemiologist in Spokane with the health exposure assessment and monitoring team. I've only been here about a year, and this is my first MSHRAC meeting. So please not too many hard questions. You can direct those at Jerry though since he's on the line. And today I'm going to be talking about miner health data sources and analyses and providing an update.

So first off, I'm part of the building an evidence-

based framework for improving miners health project, which is essentially the backbone of the miners' health program that Jerry has talked to about before. There are four of us equal to about two FTEs, and we're hoping to have it for five years, but we're hoping to kind of continue as we continue with the miners' health program since it's sort of the backbone of the program.

Aaron Sussell is the principal investigator. And the main goals are to really understand the data's utility. How well do these data sources that we have describe the health status and experience of miners and who does the data represent? And to improve the use of existing data to characterize the health of miners and guide future prevention efforts.

So why this project and what don't we know about miners' health? So we know that we have good data on injuries in general, but we're really lacking in other health outcomes and health related exposures. And we've talked about this already with the previous presentation. But we're really missing health and retirement, total health and wellness, health status compared to other workers, and exposure patterns.

And we really need more data on health outcomes and health exposures to guide prioritization of effort for both research and prevention. And then the data we have interest in includes population surveys, clinical data, and private industry data, medical surveillance data, case reports, government, and industry.

So these are the current data sources that we're looking at on the EBF project. We have five right now, and we are looking to expand this. So the first is one that you're already familiar with, MSHA, a regulatory data set consisting of 20 data sets on injury, illness, and exposures.

The next is the Miners' Colfax Medical Center clinical records, and this is a self-administered medical questionnaire of New Mexico miners. And this

already resulted in a publication that found different chronic health challenges across the mining sectors. But we want to continue working with this data by adding more recent years. So the current analyses were from 2004 to 2014.

The next is the Wyoming Miners' Hospital medical claims data, and we're hoping to do a similar screening using these medical claims data. And we're collaborating with the Centers for Workers' Comp Studies over the next one to two years. And these data sets include current and retired miner health claims data.

We also have two active analyses in the behavioral risk factor surveillance system, or BRFSS, which is a population health survey conducted annually. It's a telephone interview survey. It's five years, includes an industry and occupation module covering 32 states.

And the two analyses we have currently, one is looking at health risk factors and that one is almost ready for publication. And the other is looking at depression and mental distress. And then the final one is my project, the National Health Interview Survey, also called NHIS or N-H-I-S. This is another population health survey, an annual household interview survey. I have an 11-year data set looking at all 50 states with about 2,000 participants in the mining sector. And this is going to be the remainder of the talk is me talking about my work with NHIS.

So this is just kind of a visualization of what the NHIS sample looks like. For the 11-year data set, I have about 330,000 total sample adults as they're called. And for these, over 90 percent have some sort of industry and occupation information, meaning that they're either current workers or have worked in the past.

But as one would expect and kind of the problem that we're running into is that the total number of current workers in both the mining and oil and gas sector are small. So I included mining and oil and

gas together in this, although the analyses are performed separately just because they're within the same NAICS sector. And that's only about 0.4 percent of the total NHIS sample, so it's very small.

And then looking at retired workers, which make up about 18 percent of these people with industry and occupation information, only about 0.2 percent include retired miners and oil and gas workers. So again, very small.

The numbers are large enough to work with, but it also means that for uncommon outcomes and exposures, we really don't have enough sample size. And so for point estimates, it results in large uncertainty and just large confidence intervals.

And also just a quick note. I do have -- this is unpublished preliminary data, not for distribution. We're still using it and going through the peer review process. So just a quick note.

So I mentioned why I study retired workers, and this was mentioned as a priority health outcome. And we chose to look at retired workers in NHIS really because it's a pretty unique capability of NHIS in general. Like in BRFSS, you can't look at retired workers but you can in NHIS.

And due to latency, many chronic health outcomes such as heart conditions, cancer, hearing loss are not diagnosed until later in life or until after retirement. And again, we know little about retired miners and oil and gas workers. We know that they have high rates of respiratory symptoms, lung disease, and hearing loss. But the national burden of other diseases is largely unknown.

So that comes to my analyses. I did a retired miners and oil and gas workers and manual labor occupation comparison. So I looked at those within the oil and gas and mining industry, and only manual labor occupations, meaning those that were actively working in the mine and compared them to the general population of retired workers.

The outcomes that I could look at, this was due to sample size, there are many more outcomes in NHIS. I was able to look at any type of cancer, any heart condition, high cholesterol, hypertension, hearing, self-reported health, function-limiting lung and breathing problems, any lung condition, and diabetes/pre-diabetes. And I had to group those together because the numbers were so few.

Member Wright: What was your response rate to the survey?

Ms. Robinson: To the survey? So in NHIS, it is -- oh, goodness. So it's run through NCHS, and I think it's like 30 percent. So it's a very intensive survey. So the response rates are kind of low. I think about --

Member Wright: The 330,000 is the size of the initial sample or the size of the respondents?

Ms. Robinson: So it's the size of the respondents.

Member Wright: Oh, okay.

Ms. Robinson: And that's over an 11-year period. So like 25,000, 30,000 a year.

Member Wright: Were you able to separate -- if somebody responded this year and then -- or let's say two years ago and this year, were they counted twice? Or did you know who you would survey previously so you could --

Ms. Robinson: As far as I know, they already know who they surveyed previously. So they don't gather more information on the same people. So here are just some demographic information that I just think is kind of interesting to look at. I looked at many more demographics than this, but these were just sort of the ones that jumped out at me.

And these are weighted percentages. So that means with nationally representative surveys, each person who answers a survey is assigned a weight based on how representative they are of that population.

So these percentages are representative of the population, and then their range in parenthesis is the 95 percent confidence interval containing the true value.

As one would expect, miners and oil and gas workers are overwhelmingly male compared to all other retirees about nearly over double as much. Also mostly white and non-Hispanic. Although compared to all other retirees, oil and gas workers have a high percentage of Hispanic ethnicity. Most respondents were located in the South, also what we would expect compared to all the retirees, with the least located in the Northeast. And there were so few oil and gas workers in the Northeast, I actually couldn't calculate a reliable estimate for the weighted percentage.

Chair Nelson: But on that region, they may have retired to the south. But is there information acquired as to where they lived?

Ms. Robinson: No. So whenever they ask -- so they ask if you've ever worked. And then if you say yes but you haven't worked in the past two weeks, and if you're 65-plus or answered retired, you report your longest-held occupation. But this is just for whenever they answered the survey.

Member Wright: Does that include the (inaudible) B-

Ms. Robinson: Yes, it does. And then the education was -- so most had less than a high school education compared to all other retirees, with fewer reporting a college degree compared to all the retirees. So I'm just kind of showing this. We already know a lot of this, but it just kind of shows that it is representative of the national population is what we would expect.

So this is what is called a forest plot. And so I'm just showing what we call an adjusted prevalence ratio. And it's basically the ratio comparing the number of those with the outcome in one group compared to the number of those with the outcome

in the other group. And it's represented by this square here. So that's our point estimate. And in the lines with the 95 percent confidence intervals, showing us the degree of uncertainty and range of possible estimates. And large confidence intervals are often due to small sample sizes, which I mention there's a problem with this. You can see there's some really large confidence intervals for point estimates.

And if it crosses one, meaning that there's an equal number in one group compared to the other, that means that it's insignificant, so not statistically significant. And for this right here, I'm comparing oil and gas workers to all other retired workers. And so I wanted to call attention to the significant estimates that I found. And so this is after adjustment for race, sex, age, education, and smoking status. So meaning comparing those in oil and gas to all the retirees if they had all of these other potential factors that would influence that the same.

And we found that oil and gas workers compared to all other retirees had 1.5 percent times more likely to report moderate to deaf hearing loss, and over two times more likely to self report poor health status. And again I note the really wide confidence intervals due to the small sample size.

Member Wright: Oil and gas is extraction, not refining, for example?

Ms. Robinson: Yes. So these were the -- I think -- I do believe it is extraction, although it might be both actually now that I think about it.

Member Wright: Because the next codes would be separated for those.

Ms. Robinson: So there was the -- so the general group was Code 21. And then I was able to go down to -- so NHIS has different simple re-codes than the census data. So I was able to look at oil and gas workers, but they're all grouped together. So it

would be refining and extraction together.

Member Wright: Refining isn't in 21.

Ms. Robinson: It's not 21? Oh, well, then it's not there.

Member Wright: I don't think it is.

Ms. Robinson: Yeah, if it's not in 21, then it won't be in here. And then it was just the manual labor occupation. So this is the industry but then just matched up manually for occupation, so extraction workers.

And then the other point estimates I want to draw attention to are those that are greater than one, even though the confidence interval does cross over one, meaning that's insignificant. Potentially, if we had a bigger sample size, we could actually find an association here. So that's a lot of trouble to deaf hearing, fair to poor health status, lung and breathing problems, and any lung condition.

And then looking at miners -- and this is adjusting for the same things, so race, sex, age, education, and smoking status. And when adjusting, miners had significantly higher hypertension, hearing loss of any category -- which we expect and we already know -- fair to poor health status, and lung and breathing problems, with a range of 1.2 to about two times more likely to report these outcomes compared to all the retirees.

And then just drawing the attention to other insignificant due to the confidence interval but with greater than one point estimates. So it was any heart condition, high cholesterol, poor health status, any lung condition, and diabetes/pre-diabetes. So essentially every outcome except for any cancer has a point estimate higher than one.

So in summary, what I found with these retired mining sector analyses in NHIS was that compared to the general retired population, retired miners

show significantly increased hypertension, hearing loss, self reported fair to poor health, and lung and breathing problems, while retired oil and gas workers show increased moderate to complete hearing loss and self reported poor health. And really what we're finding is that although it is a representative national survey, NHIS definitely has sample size limitations. And due to that, it might be obscuring some potential true correlations that we would see.

So the question really comes down to: how do we utilize national survey data knowing their limitations? So what these data have is they have health outcomes and health risk behaviors. They do have demographic information including industry and occupation to some degree and reported access to use of health care services which is also really useful.

But what they don't have and what they're missing is work-related outcomes or exposures, complete employment history as mentioned, and a specific mining commodity. So we can't really get down to that fine level of detail that we can with other data sources.

So in summary, building the framework of a miners' health program project is really seeking to evaluate data and report those limitations, report on miners' overall health, current and retired, identify data gaps where essentially -- and Jerry repeats this all the time to us -- we're trying to know what we don't know.

So what can we do with the data and what can't we do. And then produce scientific manuscripts and translational materials, and use that to identify novel research efforts and address these gaps. So what can't we get from the data that we already have? What more data sources can we look at? And what do we need to know?

So that's it for me, and I welcome any questions. Thank you.

Chair Nelson: Thank you. Mike?

Member Wright: Oh, sorry. You said you can't identify specific commodities. Can you at least separate miners into coal and metal-nonmetal?

Ms. Robinson: No, I cannot unfortunately, not in NHIS.

Member Wright: Can you in the data -- yeah, I guess you could. You could, though, break it down by state, right?

Ms. Robinson: So what I have is -- so there's NHIS publicly available data and then there's NHIS data that you have to request from CDC. And I'm using publicly available data. And on those, it's only by region. So it's only regional.

So that's why I had, like, the south, northeast, west. So those groups because it's considered personally identifiable information. So there's so few that potentially you could find the person that lives in that area that has that industry occupation. So I can't do it with the public data, no.

Member Wright: Yeah, that's too bad because if we could at least -- we could, for example, say if it's Minnesota, it's likely metal-nonmetal. If it's West Virginia, it's likely coal. And the southwest would be copper.

Chair Nelson: Could you break your data out by the regions, though? Because you didn't. You lumped everything together because you didn't have enough numbers.

Ms. Robinson: Right.

Chair Nelson: But was there any -- did you look at how the west was different from the south, was different from the northeast?

Ms. Robinson: I didn't do that with my outcomes or exposures, but that's just because of the small sample size. So a lot of my estimates, there were so

few that they wouldn't have been reliable and I wouldn't be able to report them anyway. So I had to lump them all together in this case. Maybe if I had a bigger sample size, I'd be able to. But not with the 11-year data set.

Chair Nelson: Kray?

Member Luxbacher: I'm certain that my question, your answer is you're limited by your sample size which I understand. But I think one important point to make is that miners are often working in rural areas where in general there is poor access to healthcare which is no excuse. All stakeholders in mining should be working to improve that access.

But if you could look at states, for instance, or regions, then you could look at overall health outcomes in the region for everyone. I'm thinking West Virginia. Then you could say, are these outcomes different than the population? Even though they're poorer than the population of the United States, the outcomes, they may not be poorer than in the state.

Ms. Robinson: Right.

Chair Nelson: Jefferey?

Member Burgess: Tashina, how many years of data are there in this system?

Ms. Robinson: For NHIS, it's been going since the late '50s. So there's been many different iterations of the survey, and it's changed a lot over time. So the main thing that kind of limits how many years you can aggregate together is how much the survey changes year to year. So even though it's been going since the '50s, they change it every ten years or so.

Member Burgess: I imagine, however, there is some questions that were fairly consistent.

Ms. Robinson: For the most part. I'd be a little

hesitant to compare variables prior to the '90s. But there are some that are fairly consistent over the years.

Member Burgess: So perhaps that is what I'm going towards which is could you look at changes over time in terms of prevalence or recording of specific conditions? That would be helpful to know whether perhaps you're having an increase or the stable rates or declining rates in certain topics of interest. So if you're able to do that even just over, like, maybe two periods of time where there were consistent questions, I think that would be helpful.

Member Bowersox: It seems like an overlay of black lung comes from Kentucky. The coal cutting or more rock. Do you find that? Is that a regional thing, I guess, right?

Ms. Robinson: So with NHIS data, unfortunately, so there are specific modules for only certain years that ask about more specific outcomes. Like, they ask about coal workers' pneumoconiosis. But that's not available every year, so I'm not able to look at that unfortunately. It's only 2010 and 2015. And since there's so few miners in the sample, there are too few people to look at.

Chair Nelson: Do you have access to the nonpublic data?

Ms. Robinson: I can get access to it. It's a long process.

Chair Nelson: But what new data would be in it if you did?

Ms. Robinson: So I would be able to have more specific census codes. So I would be able to potentially look at commodity. But again, we're running into the problem with the small sample sizes. And then I would be able to look at states and those are pretty much the two main things.

Chair Nelson: But those are states of current

residents, not states where you worked?

Ms. Robinson: Right, exactly.

Member Wright: So there was a question on the survey from my understanding, what kind of mine did you work in?

Ms. Robinson: So that is a question. So it's all coded using, like, the census codes. But then they're re-coded whenever they go into NHIS. And then that's the publicly available data. So I would be able to look at commodity, but it would have to be from the private data. And then that'd have to be a process.

Member Wright: So it would be possible for the mining group. At least that would make it so it's metal-nonmetal versus coal.

Ms. Robinson: Yes, I have the census codes.

Chair Nelson: So Bob or Kyle or Rick, do you have any questions?

Member Zimmer: No, not really.

Member Horn: I'm all set. That's all. Thank you.

Chair Nelson: He's all set. We're all set too. Thank you very much. Very interesting. Okay. So we're going to hear next about fatigue research. And we invite Tim to come and tell us about what's going on in Spokane.

#### Presentation by Dr. Tim Bauerle

Dr. Bauerle: Great. Thank you so much. Good morning. My name is Tim Bauerle. I'm an occupational health psychologist with the Spokane Mining Research Division here to talk about fatigue. This talk is dedicated to my two month old son who is trying his best to make me a fatigue expert.

(Laughter.)

Dr. Bauerle: So two years ago, I talked to this

group about some pilot research we were doing in the area of mineworker fatigue.

And to boil it down, what we were doing on that pilot project is just looking at: Is fatigue a problem in mining?

If it is, has somebody fixed it?

Does anyone have the silver bullet, the golden solution to it, has it all been figured out somewhere?

And if not, if there are some gaps, where might we start when it comes to addressing fatigue in mining?

Part of that was creating this visual model when it comes to -- what are some pathways by which fatigue manifests itself in mine work. And so you can see some -- I know it's small font. But you can see several different sources of fatigue on the left and some negative outcomes associated with fatigue on the right.

And so we have this nice model. But the question then becomes, okay, are we really telling miner operators that, okay, you have to investigate all these different sources on the left. What are we telling folks to do? How do you manage fatigue?

In my opinion, the problem with fatigue comes down to a problem of measurement. It can't be measured directly. You have to infer it via psychometrics. So what are we actually -- from this, what is kind of the next step in terms of alleviating the burden of fatigue in mining?

And then in October 2018, we started a five-year project, acronym MANIFEST. And really the goal is to provide toolkits to help jumpstart or improve fatigue management systems. So for whatever scale a site is dealing with, how much they want to -- how comprehensive they want the fatigue management system to be, having some recommendations and having some tools that they

can fall back on for assessing and measurement and interventions.

So the research objective that I like to state simply -- or not -- is that the goal is to empower operators with the knowledge and ability to select, implement, and evaluate appropriate fatigue mitigation strategies to support their workers to be well rested, alert, aware, and ready. That's really it at the end of the day. And again, a lot of that comes down to measurement.

We were just talking about health effects earlier on today. And this is about giving operators some tools in terms of how to measure and then manage fatigue.

So I'm going to start backwards in terms of the project aims. Like I said, the goal is to develop this toolkit, freely available online for mine sites to download, use, adapt, whatever they need to for their specific situation.

And then part of this too is evaluating different interventions. Now by interventions, I mean this could be as simple as training mine workforce and supervisors on recognizing the signs of fatigue and what to do if you're fatigued or if you notice a buddy is fatigued. This could be as complex as shift rescheduling or a sleep disorder screening. This could be looking at rest-work cycles, et cetera.

Of course, to evaluate how well those interventions work, we need to develop and deploy them in house in terms of trainings and materials and what have you. And first, to determine which interventions are going to work or not, we need to identify measures.

Again, I'll go back to my point that the issue of fatigue is an issue of measurement. So if we can't have reliable ways by which to measure fatigue in a mining context, then the point is moot to see if fatigue has been lowered or not.

So I'm going to talk about the identifying measures

part because that's kind of where we're at in this project. Right now, we're gearing up for a small data collection study where really I say we're doing the kitchen sink approach when it comes to measuring and assessing fatigue.

We have some EEG or field-based EEG that we're using to look at brain wave activity, heart rate variability, and -- most importantly -- an actigraphy watch. You can think of this as, like, a really souped-up research grade FitBit. This is kind of the gold standard in the sleep and fatigue literature for looking at sleep quality and quantity. And we know that when it comes to fatigue, sleep deprivation is kind of the biggest culprit.

So we have a -- and the nice thing about this one too, we wanted to get one that looked at light, light sensors. So this looks at light exposure as well. We also know that circadian rhythms has a lot to do with sleep and fatigue.

We're also doing a lot of things on a smartphone. The two things on the left, you'll see a psychomotor vigilance task. If you've heard Kristin Yeoman talk about her heat stress study, this is something that she uses. It's a very simple reaction time test. The thing is, it's also the gold standard in literature in terms of looking at cognitive outcomes of fatigue. It is very boring. So it is very susceptible to fatigue.

There's another pattern recognition, a kind of test that we're using. You have to see which shape is the same or different. It's actually pretty difficult even if you're not fatigued.

Self-report surveys via sleep diary delivery, SurveyMonkey. And then we're also looking at a pupillary light reflex test. This uses an iPhone camera and flash to take pictures of the eyes to see how quickly and how much the pupil dilates which can be indicative of cognitive decline -- state-based cognitive decline.

And again, the reason for this kitchen sink approach

is that what gets measured gets managed. We need a reliable way to assess fatigue in the field. And you'll notice that I was careful to point out which ones were sort of the gold standard in terms of the sleep and fatigue literature.

Because if you create a Venn diagram with here's all the things to measure sleep deprivation and fatigue that's validated that the sleep and fatigue researchers accept, and then what's being used out in the field, sometimes different sites will go one side or the other side.

And we wanted to really -- again, this kitchen approach -- compare, okay, here's the gold standard in the literature and then here's kind of some stuff that's being used that has varying degrees of validity. So if we do come to a mine site and they say, no, we're not going to use PVT. No, we're not going to use actigraphy. But we do have this EEG thing. We have some data to compare that to some valid research standards.

And the main point of why we're doing all this is: if we could only use one thing to measure the success of a fatigue management program via measuring sleep deprivation, fatigue, or cognitive decline, what would that one single measure be? How about two?

We're certainly not advocating for mines to hook up their miners to all seven different devices and what have you. We're really seeing what's feasible from a cost, invasiveness, meaningfulness standpoint.

In the next two years, we're going to initiate a full scale data collection field test site. Kind of partner -- the goal is to partner with somebody that has an ongoing fatigue management system, come alongside, see what they like about their fatigue management system, what things maybe they would like to improve, have a baseline sort of measurement at the site level, apply some interventions that might make sense for that specific mine site, and then do a post-test.

So in the next two years if I'm invited back, we want to do a site identification. And then we're also working with greater NIOSH too. There's a working hours and fatigue workgroup inside NIOSH that looks at a lot of different sectors, agriculture and farming, fishing, forestry, nursing.

And they're putting together a special issue, I think, in American Journal of Industrial Health on kind of here's the state of fatigue in these different industries. So we're writing up an abstract that will be going into that compendium, kind of saying, here's where we see the state of fatigue.

And again, select the fatigue measures that we're going to be using. We have a lot of background work, dissemination of background work that we need to kind of get through. Looking at doing a systematic review of the peer review literature, just saying when it comes to addressing sleep and fatigue -- Regardless of the industry, when it comes to addressing sleep and fatigue at the worksite, what works? Most of the literature looks at training. We'd like to look at some folks that have done a step beyond training. Training does have its place, certainly.

We have IRB & OMB hurdles to get over. I'll just kind of leave it at that. And also some prototype interventions developed. We want to develop, like -- we know that training is probably going to be one of the first things that we try or implement. So working with some folks within our mining program to develop prototype training interventions and what have you.

I'm happy to take any questions. I do have some specific questions if you're so inclined. Just based on kind of the things that I was saying in terms of partnering with a mine site and getting a mine site to partner on.

We're open for strategies for identifying partnerships, how to identify a mine site that you want to work with. Or what are some strategies to

kind of find some partners that are curious about their fatigue management system or might be curious about knowing more about fatigue management.

What have you seen used in mine sites to measure and manage fatigue, and was it useful? And there's a lot of -- that's the thing with the big model that I was showing, is that there's a lot of things that affect sleep and fatigue. And my question to the committee is, are there some things that are consistent across different mine sites that you've seen that are consistently associated with sleep and fatigue?

Certainly, sites are very context dependent and things can vary from site to site. But is commute time consistently a fatigue related issues across multiple sites? Is undiagnosed sleep disorders consistent across multiple sites, all of these, none of these, or other?

Chair Nelson: So thank you. Actually, I found myself thinking that, for me, maybe I'm hyperactive. But I talk a lot and I do things. I always have to do things because I get bored really easily.

Dr. Bauerle: I have ADHD.

Chair Nelson: And that's a form of fatigue as far as I'm concerned. Repetitive tasks make me crazy. I want to ask you just one thing about the impact of fatigue because you can be fatigued and there's not an impact on the job --

Dr. Bauerle: Yes, ma'am.

Chair Nelson: -- in some cases. Is fatigue something that is -- and the impact linked to highly automated versus nonautomated operation? So is this -- in terms of impact, is it more critical in nonautomated or highly automated situations?

Dr. Bauerle: Well, there's some interesting research coming out of -- actually, we partnered with NASA's

fatigue countermeasures lab where they're looking at these semi-autonomous vehicles. We have the Level 1 autonomy, Level 5 autonomy. They're looking at that middle level to see how well humans do at that. Okay. You take control of the car, the car takes control. Turns out we're really bad at that.

So I would say probably when -- in terms of human-computer interaction, when the human is either out of the loop or there's information overload or it's a very vigilant kind of task where it's very boring, there's not a lot of physical feedback. Yeah, you're going to run into some issues there.

And that's why -- Drew Dawson is a researcher out of Adelaide in Australia who advocates for a fatigue risk management style where depending on how fatigued the worker is, you kind of move them down to less and less and less risky tasks to where if they're so fatigued, maybe they're making copies that day. Something where if they make a mistake, it's not detrimental.

Chair Nelson: Interesting. Yeah, Kray?

Member Luxbacher: I'm curious, and this is a little bit of a different subject, I guess. But the lack of rest breaks. I think this isn't a mining issue. It's an American culture that --

Dr. Bauerle: Of course.

Member Luxbacher: -- workers don't take rest breaks where --

Dr. Bauerle: Of course.

Member Luxbacher: -- in some cultures, people curl up under their desk and take a nap.

Dr. Bauerle: Siesta.

Member Luxbacher: Are there studies on how effective those breaks are in cultures where they're common?

Dr. Bauerle: I don't know about cultural or cross cultural issues, although there is a really neat meta-analysis that kind of has a heat map where you can look at, okay, if your shift is this long and your breaks are this long and you take a break this often, here's the greater or less risk that you are.

And I think -- I could be misspeaking, but I think, like, a 15-minute break every two to three hours is ideal. So I mean, breaks, rest breaks and also meal timing, especially on night shift, are some niche areas that people kind of put their stake in. But yeah, whether it's sort of management or supervisory driven or if it's the worker driving the, I just want to get done. I want to go through. I want to finish my shift. I got this work to do. Yeah, I mean --

Member Luxbacher: And probably what do you on your break matters too. I mean --

Dr. Bauerle: Yeah.

Member Luxbacher: -- looking at your smartphone or, I don't know, meditating or something, that's a big difference.

Dr. Bauerle: Sure, right. It also makes a difference if it's sleep or if it's fatigue. Fatigue is more driven by the context than by the task. If my job is staring at a computer screen and then on my break I just continue sitting at my desk staring at a computer screen, you're not alleviating that fatigue. You're not switching the context.

Member Luxbacher: It's interesting.

Chair Nelson: Mike?

Member Wright: Yeah. First, let me say how important this is. We've had three members killed in the last four years by falling asleep at the wheel after shifts that were at least 12 hours. We also had one member killed by a nurse who had worked almost 24 hours and fell asleep at the wheel and

went off the road into a group of people who were repairing a gas line.

Dr. Bauerle: Oh, geez.

Member Wright: So it's really important work. One of the things that I don't see on your list is whether the shift schedule, in particular the weekly work hours, are voluntary or involuntary. And I think that's important because I'll give you one example.

Alcoa about seven years ago did a study of their plants. They had enough workers to make this statistically significant. They found that the injury rate went up after 60 hours.

And so they instituted a rule that you couldn't work more than 64 hours in a week, four because it's a nice multiple of eight. And the injury rate did not go down. And we concluded the reason for that was that they were taking people who would voluntarily work longer hours, telling them they couldn't, and replacing them with people who did not want to work that many hours.

And when people are forced, first, they're more likely to be fatigued in the first place. And second, they're distracted. You want to be at your kid's baseball game and you can't. So we thought that whether the overtime was voluntary or involuntary was a really important variable. So it might be worth building in.

Dr. Bauerle: That's a good consideration, especially when we're looking at our systematic review for sure. I think it gets into job control and demands.

There's some -- for example, there's some studies that have been done in Nordic countries, I believe, where they do surveys on morningness and eveningness, kind of this phenotype of are you a morning or evening person, and assigning shifts that way. There's a lot of lit out there on person-job fit with that regard. So yeah, I think --

Member Wright: One more really quick thing.

Dr. Bauerle: Yes, sir.

Member Wright: Somebody at NIOSH -- if they're not looking at this now, it'd be interesting to do a case study of the impact of API 755 which is the --

Dr. Bauerle: Absolutely.

Member Wright: -- fatigue management.

Dr. Bauerle: I agree. Absolutely. I find myself referring to that a lot.

Member Wright: For other people, that's the fatigue management system that it's a recommended practice of the American Petroleum Institute.

Dr. Bauerle: I think they just came out with an update.

Member Wright: I think so.

Dr. Bauerle: Yeah, that would be really interesting to look at.

Member Wright: We actually wrote it in some of our contracts.

Chair Nelson: Okay. Ron?

Member Bowersox: I got a question. What about working a steady shift versus rotating shifts?

Dr. Bauerle: Certainly, there's a lot of literature on the rotating. Well, the rotating can be more difficult or more taxing physiologically depending on how much time off you have to recover between the rotating shift. There's a lot of literature to suggest that consistent night shift work isn't the healthiest.

So for this study, going in, one of the issues that we said early on is shift scheduling has so much to do with sleep and fatigue. But do we want to be the shift scheduling study where we go into a mine site and say, hi, you know your shift schedule. We're

going to completely change it and mess it up.

But I think it's something that when we synthesize the literature and get out this backlog of information, yeah, there's a lot of literature out there just on how do you schedule a smart shift. A lot of biomathematical models that people use that given Variable A and B and our Mine Site C, this would be a better shift schedule, so --

Chair Nelson: But I mean, I think if you get opportunistic about identifying partners and they're using that kind of a method, then you can study it -  
-

Dr. Bauerle: Yeah, absolutely.

Chair Nelson: -- to a certain extent. And I think also remote locations might be interesting --

Dr. Bauerle: Yes.

Chair Nelson: -- because that's a totally different environment. I haven't worked it in a mining context, but I worked on the Alaska pipeline and I was night shift forever. And I know that I got strep throat an awful lot.

Dr. Bauerle: Oh, yes. Absolutely.

Chair Nelson: Jefferey?

Member Burgess: Tim, to your first question to try to do this --

(Simultaneous speaking.)

Dr. Bauerle: Yes, sir.

Member Burgess: -- with first time partners. And perhaps to be able to answer that most effectively, can you tell us who -- are you able to share with us who your current partners are in terms of sites where you're working on these issues?

Dr. Bauerle: I don't know if I'm able to do that. We

--

Member Burgess: So let's turn it around. I mean, how many companies are you working with and in what general areas?

Dr. Bauerle: We've had -- I wouldn't say working with. We've had -- for the full study, for, like, the baseline intervention, we've had discussions with about I'd say two or three. Hey, this sounds interesting. We're interested. That's kind of where --

Member Burgess: Where you are?

Dr. Bauerle: Yeah. So we haven't had -- like, the first step would be a letter of interest or a letter of intent, right? And we haven't gotten to that point.

Member Burgess: Why -- so is it that you haven't been able to identify a sufficient number? Or is it just you're in the process of working with willing partners?

Dr. Bauerle: Can you repeat the question?

Member Burgess: Yeah. So are you at the point where you know you're going to be able to work with these companies? Or you're looking for additional companies?

Dr. Bauerle: Oh, no. We don't -- we're not at the point where we have the feeling like, oh, this place for sure is going to work with us for the full study. We're not at that point. We're still at the point of, again, getting a letter of -- and finding a mine site that is interested and willing to kind of have a back and forth with us about what their level of interest is and how we might be able to partner. So we're not --

Chair Nelson: So you need help. Okay. They need help.

Member Burgess: Well, that's what I'm thinking about. So I realize that there's a number of issues that mining companies and labor would say are

important. But that doesn't mean that necessarily translates to finding willing partners to be able to work on a topic. So this is not specific to fatigue.

Dr. Bauerle: Sure.

Member Burgess: I think it's a general issue.

Dr. Bauerle: Oh, of course.

Member Burgess: And I think it would be something that as a group it would be nice to be able to figure out if there was some simpler way to identify companies than what we generally do which is you spend an awful lot of time reaching out to find partners. So we're facing the same situation. I think we're making some progress now looking at alternative fuels. And in NIOSH R01, we have.

And it just was just a lot of looking, talking with people, talking with people who they know. I'd like to know from the committee is there some more effective way or is that just the way you have to do it?

Member Luxbacher: I am not aware of a more effective way. I wish I was.

Chair Nelson: Making friends.

Member Harman: Or are you looking for an industry partner that does or does not have the monitoring program in place now for fatigue or does it matter?

Dr. Bauerle: I would say at this point probably one that does. I think -- first of all, we're willing to talk with anybody that's willing to chat with us about fatigue. But given that this is a five-year -- if this were a ten-year study, partnering with somebody that doesn't have fatigue management or measuring system in place might be fine. But I think partnering with somebody that has already started some measurement management initiatives might be a bit easier given the time.

Chair Nelson: Melanie?

Member Calhoun: Okay. So agree with Kray. I think this is an American issue. So how does it impact your study when you're seeing people who are taking uppers, stimulants, over the counter stimulants to stay awake for these extended hours? So how does that impact, like, a fatigue study?

Dr. Bauerle: The most common fatigue countermeasure is right here.

Chair Nelson: Yeah, but it's not on your list.

(Laughter.)

Dr. Bauerle: It isn't, correct. Yeah, that's actually a really good point. Yeah, I think it does affect the -- it's a variable that we're asking about when we're tracking miners. What's your kind of caffeine issue? And then on the daily diary study, asking, okay, so when's the last time you took any alcoholic drinks, any caffeinated or stimulant? -- what have you.

I think for the larger study, one of the ideas that I like is taking volunteers to do sort of like a sleep consultation -- a sleep plan basically. Kind of what they do with the astronauts on the ISS, you kind of sit down and say, okay, when do you work? When are you home? What does your schedule look like? And you kind of create a sleep plan for them.

Now part of that might be getting into more behavioral health issues. Like, okay, maybe this is when you can take a 15-minute walk for exercise. Okay. What do you have for a snack here? Maybe you have a smaller meal here.

And so getting into stuff like caffeine cessation. I absolutely think caffeine is addictive. So maybe a part of that is, okay, why don't you reduce your caffeine intake? Caffeine has a half-life of six hours. So if you're taking it at the tail end of your shift to get through, that's definitely affecting your sleep. So yeah, I think it's a good point.

Chair Nelson: We're running a little late on the

agenda. But I want to give Kyle or Bob or Rick, any questions?

Member Horn: No, no questions from me.

Chair Nelson: Okay, good. So we thank you very much.

Dr. Bauerle: Thank you.

Chair Nelson: And I'm at least alert myself. When I go to visit mines, I will ask them. That's what we should do.

Dr. Bauerle: Thank you very much.

Chair Nelson: Thank you. Okay. We're a little bit late, but we've got two more presentations after a break. And we're going to break now, and we will reassemble at 8:25. Is that okay? Excuse me, 8:25 in Denver which is 10:25 here.

(Whereupon, the above-entitled matter went off the record at 10:12 a.m. and resumed at 10:28 a.m.)

Chair Nelson: Okay. So we are reconvened. Anybody on the phone, Kyle, Bob, or Rick? Okay. We are ready. And our next presentation is going to be by Lisa, and she is prepared.

Dr. Steiner: Just wait --

Chair Nelson: The slides will be up.

#### Presentation by Lisa Steiner

Dr. Steiner: They're exciting slides. Well, hi again today. This is the morning session, and I wanted to just give an update prior to Emanuele giving you great data and content of what's going on in the Field-Based Respirable Crystalline Silica Monitoring Approach.

So what we decided to do was conduct a review of this particular project. It's an area that we might be going even more heavily into. So I wanted to give

you a background on what we do when we have something that's very sensitive or that needs to have a little bit more review after it's begun is when we chose to do this one.

I want to talk about this process and the benefits of the opportunity that this mechanism provides. This mechanism is available through the CDC. So we followed the guidelines for this to the T. And we want to dig a little bit deeper into this area and give a more critical review at this point.

Now we thought this was the best time in the process to do this. So our researchers have gained a significant amount of knowledge and they've been furthering their knowledge. And we wanted to take a critical look at where we were with this area of research.

So in a general sense, this type of review, you try to get an objective and expert comment on how relevant, sound, and appropriate that the work is. And you want to reveal anything that's a shortcoming because we're responsible for providing the best science, the best quality science for the best foundation of decisions.

And we want to consider the risks of the study or to suggest any alternative or innovative approaches to the study that we're not seeing already. So we want to get a hold of the experts.

Specifically for this area, we wanted to ensure that we had our underlying research and the data processing results and the validation was appropriate. And we wanted to gain more knowledge of the minerals and processes from the expertise beyond our own expertise.

And we do realize that there are some gaps in terms of skill sets that we need to approach outside of our organization in order to make this the best that it can be. So we wanted to ensure that we had the right priorities and the focus of our research was correct. So I'll just go over real quickly. I know this

is a little bit of a busy slide. But this is the review process very succinctly.

So first of all, we need to know what kind of questions we had. It didn't mean that we were limiting ourselves to that as the input from our expert panels. But we wanted to have a pretty good idea of where we thought we needed them to go.

We had nine total questions and most of them, the six of them were very basic. And they're also reflective of what we normally ask on a project when we introduce a project and go out for external review anyways. And then we had three very specific questions about methods.

So I'm not going to really go into those yet because the report is not out yet. But just want to tell you how we approach this so there's some general -- do we have the right resources? Do we have the right skill sets on there, things like that? And then the specific questions were more about PCA/PLS methods, things like that, that we wanted ask these experts.

So once we had our questions in place, we knew kind of what kind of characteristics that the experts needed to have. And so those, that's a list there, mineralogy, spectroscopy, FTIR, analytic chemistry, x-ray diffraction, chemometrics, modeling PLS/PCA, and mining.

So we went, sought out people over academia, government, and even some consultants. So we identified based on their expertise, but we also had conflict of interest that we considered. And we wanted diverse viewpoints meaning that we didn't want everybody from University of Idaho, for instance. We wanted to make sure that we had well defined, very diverse group of experts.

So then we provided them with some preliminary materials a few weeks ahead of time. And they had our pubs, any related pubs out in the world. We had the project proposals and those reviews from the

project proposal when the project first started a couple of years ago. And then we had those review questions.

So they got all of these things prior to coming to the research lab on May 9th. They all came for a half a day. So we gave presentations. We had demos. And so they spent a good part of maybe four to five hours there. And then we had discussions following.

The requirement of the CDC shows that each one of them needs to have their own individual feedback. So while we had this makeup of this expertise, we had two facilitators and two observers that were in the room as well.

The two facilitators took the individual feedback from these experts from those questions and then our researchers, Emanuele being one of them, also responded to those reviewer comments individually. So now you're up to date where we are right now with this report. I have the draft report with me here today.

But we have a summary of our responses by question so that we can see all of the responders and how they differed in their discussions on a particular question. And then we also will provide an overall report and anything that we think that we should change or dig deeper into with our own research. And there were a few things that came out of that which were very important. And Emanuele is going to talk about those.

But the idea is that we -- and in general, these types of reviews, because it worked out very well. And what I thought was an aside that I wasn't really expecting but Jessica may have been. Since Jessica had called for this, I think she probably had a pretty good idea that people would have lively conversations.

And I had two of the people that -- two of the experts that attended that came up to me afterwards and thanked me because some of them

have been not actively working in research. They had just been these gurus of a particular area and said, this was very invigorating. This was one of the best things I've ever participated in. And to see other people's viewpoints and the respect that was shown amongst these experts was incredible.

I'm not sure that was something that was a big outcome, but I enjoyed that just that they enjoyed it. And we need to take this broadened outlook at this very complex issue and make sure that since it's high visibility research that we're very informed and that our approach is spot on.

So we're likely to do some of these in the future. But of course, we'll be selective about what we do. It does take resources and it takes some energy from our own employees as well. But we do think that it's a really great process to participate in. And that's all I have. Are there any questions on that process, or --

Chair Nelson: I understand that you are looking at the recent program. But from yesterday and from the external review, the idea the process and impact evaluation, setting the stage for that, was that reviewed or could it be put in so that they can actually comment on the outcomes --

Dr. Steiner: So --

Chair Nelson: -- that's wrapped in the impacts?

Dr. Steiner: Yeah, this happened before the mining review. But I'm sure that might be a piece of information we can send along to reviewers in the future of that area.

Dr. Kogel: Yeah, at this point, these are completely separate processes. And this was a very focused, in depth review. It's really a technical peer review. And so it doesn't get into things like evaluation. It's really very specific around those six questions and kind of doing a deep dive to understand are there any gaps or anything that we need to be

considering from an outside expert's point of view around technical aspects of the research.

So I don't know that the evaluation -- though that's an interesting question and that's something that's great that you asked Lisa because she's actually involved on a NIOSH-wide committee that Amia is really trying to really understand how to better do evaluation at NIOSH. All those things we talked about yesterday. And so that's --

Chair Nelson: But we can talk about --

Dr. Kogel: -- maybe something to think about.

Chair Nelson: -- when you frame your research to frame the outcome for the same time period. So it's just --

Dr. Steiner: That is a goal and --

Chair Nelson: -- to think about.

Dr. Steiner: -- we've been working kind of backwards towards that in our project proposals as well. It's just getting -- it's kind of a change of culture for us. And hopefully just wanted to give you an idea that we're willing to take these deeper dives and they are beneficial to us. And you may see some of that in the future.

Chair Nelson: Any other comments or questions? Okay. We're ready. Part two.

#### Presentation by Dr. Emanuele Cauda

Dr. Cauda: Yes, that's part two from what Lisa said. So I'm going to go a little bit deeper about really the details of what happened in the external technical review.

I think the stress needs to be it was a very high level technical scientific review. So not much about with the understanding of the need, with the understanding of what we were doing. And so they had in the outcome.

But really the main question we know very well is, are we doing the best that we can from a technical perspective to develop the technology which is the Field-Based Respirable Crystalline Silica Monitoring Approach?

So I think we had a few presentations about this technology and this monitoring approach to this group in the past couple of years at least three times. I just want to remind that the monitoring approach, the way we envision it, it is composed of several components.

Everybody is talking about the fact that we have a software which is FAST and that's one component. We're going to have portable instrumentation in the field. So how well they perform these portable instrumentations. Are they all equal? They are not all equal. That's another component.

Samples are collected with a dust sampling cassette. We have a new dust sampling cassette. So the cassette itself, in the introduction a new cassette is another component of what we are doing.

At the same time, we don't forget about the training portion because we are bringing a laboratory in the field. So we are asking operators in the future to perform activities that are similar to what happen in an analytical lab. And they are not ready to do it and they are not trained to do it. So the preparation of a NIOSH document that is almost ready is going to help them implement this technology in the field.

But everything considered, the most important part is still the analytical method which it was the purpose of this standard review. If we want to rephrase the word, analytical method, I'm going to use the most common question that we always receive. That is, how confident are we in the data generated by this new method in the field? How close are the data? How close is the estimation of our report in the respirable dust samples by using portable instrumentation?

So, when we got into this review several months ago, we knew the following. The fact that the method at the moment can detect the presence of alpha quartz in respirable dust samples, whether they are collected in coal mines or in non-coal mines. So the method can detect alpha quartz. We can say, yes, alpha quartz is there or is not.

The method can also estimate alpha quartz concentration in respirable dust samples collected in any mining environment, coal, non-coal. And actually, I know that that's not the purpose of this group. Even non-mining, there are people in the Department of Energy that have been using this methodology for a year and a half at this point. So it's not even a mining methodology.

What we know is the quality of the estimation is measured at the moment using the standard analysis as a reference. It means MSHA standard analysis, NIOSH standard analysis, laboratory standard analysis.

We have confidence in the estimation of our methodology when samples are collected in coal mines. And this confidence is relatively high at the moment because there's a very low complexity of samples in mineralogy, in coal mines. And the analytical technique that we use in the field is very similar to the analytical technique used by MSHA in the lab. And it's still an indirect technique.

The quality of the estimation for samples collected in metal-nonmetal mines is affected by variable mineralogy of dust samples. And I think if I can say this last bullet was the main overarching topic of this review that we had in May with these experts.

So what can we do at the moment? What can a monitoring approach do for samples that are collected in an environment where there's a complex mineral content, so for complex samples? What FAST is proposing at the moment is to collect samples, analyze them in the field, test the quality of the analysis in the field by the standard analysis

because the method is nondestructive so you can create a correction factor.

And when you go back to the same mine, you apply the correction factor. And so you can do much better, meaning you can be as good to the standard analysis. And this was published last year for a case study we did in several copper mines in New Mexico.

Now the big assumption of this approach is that we are assuming that the mineralogy in the dust is consistent in space and time in a single mine. Well, just talking about Georgia, Atlanta actually, a few miles from here. When we collect samples in a quarry and we analyze the alpha quartz content in respirable dust. One day, we see the different locations, we have percent of silica from 5 percent all the way to 30 percent.

So if the silica content is so variable, you can assume that the mineralogy content is very variable as well. So the assumption that we're making for the correction factor is probably going to be not so good in that environment. So it's just a tentative approach for now while we're working on better methodologies.

And that exactly was the research areas that were identified by this project review about the development of these analytical technique for the field-based method. The main topics that were found was the characterization of respirable dust samples.

The second topic was the improvement of the FTIR analysis. So in the infrared analysis done by the portable instrumentation in terms of analysis parameters. And then to advance the calibration validation with standard materials. And I'm going to show what I mean about this in a couple of slides.

And finally, the implementation -- development and implementation of advanced modeling techniques to deal with complex variable systems meaning

samples with a lot of variables, a lot of minerals altogether.

So I'm going to show what we learnt and we had the opportunity to focus on in terms of analysis of the activity that we're doing on these different areas. The first was the characterization of respirable dust samples. The idea is the characterization of the mineralogy provide information about interfering compounds.

Still to this point we use x-ray diffraction to investigate mine dust samples and also standard material. And we are preparing a publication to show how variable is the respirable dust in mining operations in around 150 cases. This means 150 samples.

But the review -- the expert review by the panel told us that we could do better than that, meaning using x-ray diffraction is not enough. Most likely, we should add microscopy. We should add elemental composition analysis. And reason being it is also x-ray diffraction is not perfect. Or we cannot trust any type of results we get from x-ray diffraction as the true characterization of samples.

At the same time, we need to modify the way we are collecting the samples to be analyzed in order to provide more material to the analysis for characterization. And that was something that we are doing at the moment, changing the protocols.

The fact that we should consider also clay characterization in the minerals and also that focus also on amorphous content. Respirable samples might have some amorphous content. They're non-minerals. Oh, sorry. They are not crystallinity. They are not -- sorry. They are not compounds with crystallinity. But they are there. They might have an interference of analysis.

And we need to investigate the use of different labs to assess the variability of the results, meaning that it's possible that the same sample sent to multiple

labs might generate different results. And that's crucial when we use this information to develop our technique.

And the fact that using probably somebody with higher knowledge, definitely higher knowledge in geology than we do. I'm a chemical engineer, for example. A recently hired geologist in our branch would be helpful for this characterization.

The second portion is we are doing an analysis in the field with an infrared analyzer and FTIR. We still need to analyze a sample collected on filtered media, the dust sampling cassette. But problem we could do a little bit better in terms of generating a higher quality of data, raw data that are fed into the model for the quantification of our reports.

These are very specific information about infrared analysis. But basically we can -- and this is a genetic spectrum generated by a respirable dust sample. And this tiny area here is alpha quartz.

We could increase the number of scans. It means we can analyze more scans from the same sample. Instead of doing 40 seconds scan, we might end up maybe in an analysis time that is 80 seconds or two minutes.

At the same time, the effect of the filter media on the spectrum can be significant. Do we need to change the way we're doing it? Do we need to analyze all the blank filters first and then analyze blank filters with dust after to minimize the effect of filter. That can be a possibility that we are investigating.

And finally, to do FAST collection processing procedures. These are various things, mathematical techniques to crunch the information in this spectrum to generate useful information for the calibration. And the side effect of this case could be the need to adjust FAST, the software, to adopt these new techniques.

So this is really to improve what type of raw information we can get from the portable instrument in the field to be as good as possible for the analysis of a sample for quantification of alpha quartz.

This slide if I may say and I'm sorry to say can be even as more boring than the previous ones. But it's really crucial because there are some standards. There are standards -- there are ISA standards, ASTM standards to do standard analysis in the lab. And every standard analysis in the lab use standard material generated by NIST.

So anybody that is doing analytic methods requires standard material. And for crystalline silica, these are NIST material which are very expensive. There are commercial products like Minusil that are being used and they are subproduct of NIST. Actually, they are the original product of the NIST and the NIST is the defining one.

The size of the solution of the standard material is valuable and should be accounted. And just to make a note, for example, all analytical labs in the country at the moment, they are either using 1878a or 1878b to do the standard analysis.

They are not exactly the same and I stop it here, meaning we don't know if they generated the same results for crystalline silica from standard analysis. But we need to use this material to calculate our methodology as well.

The review indicated that we need to do better in terms of be clear about our limit of quantification. So what is the lowest level that we can measure with our technique? And we also need to understand and create a metric to indicate at a lower level when a sample is not acceptable. An operator needs to have clear information. You analyze the sample but the sample is not good, meaning there's not enough material reject the result.

And then also when is the sample too much? When

there is too much dust on a filter that there's an assumption called thin layer for spectroscopy that this assumption is not valid anymore. And they can be less important because if you have a sample that has three milligram cubic meter concentration or four milligram concentration, you know you have a problem with silica. But it's something that from an analytical method we need to do.

So the idea at the moment is we are using these methods to test how good is our analysis, the MSHA methods, the NIOSH methods. Also the point is there's a need to use these methods to compare the field-based method. At the same time, there's a lack of concern to understand which one is the best one.

And so there's a possibility we might need to end up being independent in terms of quality of assessment for our method from any standard analysis, meaning we are going to know how good we are because we did enough on creating the model that we are using.

And that bring us to the last portion of the review that we had. There was about the multi-variate analysis quantification approach. It can be called partial least square econometrics. There's a lot of them and there's a lot of theory about predictive modeling.

I spent a couple of weeks in Germany in October, and I'm slowly becoming less and less skeptical about these black box. The main concept is we are fitting the model with our data from the field. So the exterior spectra of different independent samples, and we know -- we have the metrics of characteristics for these samples.

So we know the best we can about these samples. And that's why the characterization of the samples is so crucial. On these two information, x and y, get into the model, and that's an example of PLS metric for quartz, calcite, and dolomite.

We can have an estimation of quartz accounting for

the variability of the spectra  $x$  that describe variables in the  $y$ . So we can describe why the spectra is so different based on the characteristics that we know so well because we can do a very good characterization of the samples.

So why this matters and why this is all linked with the previous slides. The fact that we need to add independent samples to feed the infrared spectra for the model, meaning that we need bulk samples. We need to feed the model with samples that are independently different so they are not from the same operation. They are not from the same geology. They are not from the same environment or commodity.

Definitely these acts would benefit from improving the spectra that we can have, so our technique in the field. And these  $x$  samples can be both real mine dust or synthetic mixtures or calibration samples.

At the same time for the  $y$ , it's very crucial to have accurate characterization of the mineralogy of the  $x$  samples. So when I talk about characterization, that's why it's so crucial. There are other variables that we haven't considered at this point but we might need in the near future which is particle size distribution of the dust in the respirable samples or the quartz component of respirable dust. Because if  $x$  is changing based on the particle size. If we know, can calibrate for this change in  $x$ .

And finally, the good news is the model can gradually improve as new information are provided so they can be learning constantly, this constant learning for the model. And I like the sentence at the end that, for me, a model can be only as good as the quality of the data used to create the model. So if the information and the data for  $x$  and  $y$  are not as good, we cannot expect the model to be good.

So going to the main focus of the model we have based on the information, one of the information we

got from the view is these number of samples that we have in terms of bulk dust from 57 mining operations in 15 states. And you have an agenda here about the type of commodities.

So that's not bad. As I said, overall, we have around 130 samples from different -- even like different mines from the same state and commodity they were using for this publication. But that's where we want to be in four years.

We are trying to get to the point where almost 500 samples from different commodities, from different states so that we can really feed  $x$  in the model to well characterize information about the model for what we are trying to do for alpha quartz.

And so this I think is almost my last slide is we need any help that we can get. We need bulk dust samples, meaning we don't need to be on site. We can send a package with a jar like this one for grabbing a sample.

We have very clear information about what to do, what not to do. And we work very well with Lisa to make a way of collecting and obtaining these samples that is totally de-identified, meaning when we get the package back, we don't know where it's coming from. We don't know from which operation it's coming from. We just know the state, the geology meaning the type of commodity so that can use it to feed our model in terms of characterization.

So any help that we can get from operations. Or we are trying to engage with contacts we have, state associations, big operation mines in the country would be greatly appreciated.

And that's my last slide which is really summary remarks. So the analytic technique that we have at the moment is capable of identifying and estimating alpha quartz in respirable dust samples. And that's in any mining environment and also outside mining. So we can estimate.

Now if you want to do better, meaning if you want to improve how accurate is this methodology, we need to deal with the variability of the characteristic of the samples. So mineral composition is one. Size distribution of the samples could be the next one.

And these are the topics that -- the main topics of the project review that we have. Really again the characterization of the particle dust samples, the fact that we are planning to do better and to improve the analysis parameters for the particle instrumentation, and trying to understand the pathway to do calibration validation with standard material or standard methods as well.

And finally, the multi-variate analysis approach for quantification models that's been indicated as the way to go right away, whether they're trying to correct mineral by mineral or compound by compound.

And with this, I think this was my slide. So I can take any questions.

Chair Nelson: Okay. Thank you very much. Any questions or comments?

Member Burgess: So you mentioned that you're working with various associations and organizations. Have you had any luck with that in terms of having them send out the samples for you?

Dr. Cauda: Yes. So yeah, absolutely. We had a little bit of luck. Like, the fact is we've been working on this for several years at this point. So we already have a lot of mines and companies, for example, in the metal mine industry. We have a lot of connection with metal mine industry.

The problem at the moment, at this point is trying to fill the gaps, like, small operations in certain states. So that's the main issue that we're dealing. But we don't need to travel to those operations. We just ship in the package, grab a sample, send it back.

Member Burgess: Have you worked with the National Stone, Sand, and Gravel Association?

Dr. Cauda: We did. So we worked in the past. That's something that we actually have been going to publish a paper about this stuff. Initial analysis of those samples, that in my opinion is the most interesting area aggregates because it's where the variability can be the highest. But also there are so many operations in every single state.

So we're working both with big operators and small operations through NSSGA. But any -- it's almost like any type of contact information that will avoid us to do cold phone calls and cold emails would be great.

Member Burgess: I was thinking that the association send out the samples --

Dr. Cauda: Yeah.

Member Burgess: -- that they have that perhaps the operators might feel a little bit more comfortable with providing samples because then they wouldn't be shipping it directly to you. There would be less of an ability to wait for an individual.

Dr. Cauda: Sure. So sending almost asking and partnering with NSSGA for them to send the packages that we prepare with the understanding. Anything like that would be absolutely an excellent idea. I mean, we have good communication with NSSGA, with Dale Drysdale. So that was already one idea that we have, absolutely.

Chair Nelson: Okay. So it's about 11:00 o'clock. So we're going to have to move on. Thank you very much.

Dr. Cauda: Thank you.

Chair Nelson: And we have one final presentation on the canopy air curtains. Randy?

(Pause.)

Presentation by Dr. Randy Reed

Dr. Reed: Okay. I'm Randy. I'm going to present to you the canopy air curtain research, and we've been doing this for quite some time.

I kind of wanted to go over a quick evolution of the canopy air curtain. This started back in the 1980s under a contract with Donaldson company. And it was originally done for continuous miners back when they had cabs. And so a lot of work was done with that. And when they did field testing, the range of results was anywhere from 30 to 70 percent reductions in dust.

So eventually this idea of the cabs went away on continuous miners. And the thought was let's supply this to roof bolters. And we've been working with JH Fletcher with this. They've been great to work with on this. And they came out with this first generation canopy that was built into the canopy of the roof bolter.

As you can see, this design is different from the NIOSH design that had uniform airflow across the canopy and had perforated holes and provided uniform air flow for the operator. This used slots around the perimeter, and it was supposed to protect and keep contaminated air from infiltrating.

When we tested this in a lab, we got 14 percent reductions. We did a CFD analysis on these slots and found that the gaps between the slots was allowing contaminated air to get into that protection zone. And we did another CFD analysis where we looked at the double row of slots but staggered. And that showed that that would solve that problem which led to the second generation which has this perimeter design on it.

We told Fletcher that the uniform design would be better, but they persisted in wanting to have this perimeter that has high air flow. And uniform air flow underneath is lower air flow.

This has two slots staggered, so it prevents the contaminated air from getting in. We didn't conduct any lab test on that. We did lab tests on this one where they went to a single row. But they told us they designed those nozzles so that no air flow could penetrate into that uniform air flow. And when we did the lab results for this, we got 50 percent reductions.

So we went out and conducted field tests, and we conducted them in Illinois. And the first field study, you can see we got dust reduction zero all over the place. We got -150 percent to 50 percent -- 52 percent.

A lot of it was due to the roof bolters. They're moving around a lot. They're going in and out of the canopy. But probably the majority of the problem was we incorrectly placed the samplers. And we had gravimetrics on the front of the guy and we placed a PDR 1000 which is instantaneous on the back. We thought that was for comfort. And well, it didn't work out too well.

And we also noticed that the highest dust concentrations were 0.4 milligrams with the majority being less than this. And so there's diminishing returns of we're trying to prevent dust exposures and low exposures. You could potentially re-entrain more air or more dust.

So we did do a maximum potential dust reduction. What we did is we hung a gravimetric directly underneath and we got 41 to 92 percent reductions that way. No measurements downwind of the continuous miner.

Field Study 2, we corrected that. We placed everything on the front of the operator, still variable. We got 3 to 60 percent reductions. Again, low flow, low concentrations at 0.6. When we did our maximum potential, we got 40 to 79. We did solve the problem with the negative because we had everything in the same location.

Field Study 3, this is where we went downwind of the miner. This mine had three supersections. Our highest concentration was 1.4, 1.5. We were -- over three days of testing, we were going all over the mine at different supersections trying to get downwind of the miner. We were only able to get five measurements downwind of the continuous miner, and three were open cross cuts. And our reductions were anywhere from 11 to 40 percent.

We did have negative reductions on this one. But what we found out was that Fletcher has a design where they can adjust the flow of the canopy. And that negative reduction, when we saw that, we looked at the flow and it was down low. It wasn't at max. So one of the operators reduced it, and that's where the negative reduction came in. We'd still like to do some more testing with roof bolters downwind. But we're having difficulty finding places.

So we start thinking about this. Okay. So we're getting reductions at the operator. Are we doing something that could mess up the ventilation? Are we doing something detrimental with this down flow of air?

And so we did some CFD analysis. And what we're finding out is when the bolters are out, when their bolt swung out, the canopy is actually acting as a pathway, an extension in the line curtain to force the air up to the front. And this is both when they're back and then when they're at the face.

When they're in, you've got this air flow recirculation. And the canopy, I don't think it's detrimental because I think this would occur anyway without the canopy. But you can see the air flow kind of goes across and makes a half figure eight and goes back out. Doesn't sweep the face as much, but it does allow sweeping the face when they're up close.

So we kind of thought that we're not causing any detrimental effects to the canopy -- or to the ventilation. This is blowing ventilation. And that's

when all the testing was done on the roof bolter canopy air curtain with blowing ventilation.

So we decided, hey, this might be an interesting idea to put on their shuttle car operators. We've done some previous testing to shuttle car operators and blowing face ventilation or one of the more impacted positions for respirable dust.

So we created an RFP and this is under contract with JH Fletcher also and Marshall University. So we looked at the lab results, and we had them look at their cabs. We built a simulated cab here and this is our lab testing there.

And Fletcher and Marshall looked at the number of shuttle cars out there and found that 10SC A or B were the most common shuttle cars, and those are manufactured by Joy. One is a center drive, one is an end drive. That's the difference.

So in our lab, we changed the ventilation air flow. And we thought, well, shuttle cars are going to be traveling fast. Six miles per hour is their maximum speed. That converts to, like, 500-some feet per minute. And so we thought that they would have to meet this 850 which would be our 500-some feet per minute plus the mine ventilation air flow.

And so we did our testing at 120, 400, and 850. And you can see we got pretty good reductions in the lab. This canopy is a uniform canopy. It provides uniform air flow. It's an 18 inch by 18 inch canopy. So it'll fit underneath the canopy of the cab. We got 74 to 83. When we increased to 400, we got 39 to 43. And then we went to 850, pretty poor results, down to 16 -- 6 to 16.

So we started thinking about this. Do we really need 850 feet per minute? So we went out to a couple mines that were going to cooperate with us on this. And we found that the highest velocities encountered were actually 540 feet per minute and 638 at each mine. And it only occurs for a very short duration when you're tramming, so it's not

really a big problem.

We did find that the highest dust concentrations encountered were during CM loading. And the next highest was tramming, but it was much magnitudes lower than the CM loading. And the feeder was generally the lowest.

If we had encountered these 850 feet per minute velocities, it was Marshall did a CFD study on that and showed what the air flow -- what happens to the air flow when it encounters -- this is 825 feet per minute of ventilation flow. It shows it shearing and being shifted back. So we had a solution that we could overcome the 850 feet if we needed to just by shifting the canopy forward by about nine inches or so.

So our two mines that we went to, to study backed out. So there was a long delay in the contract because we're trying to find a mine. And finally got the Francisco mine in Indiana that's owned by Peabody. They're willing to cooperate.

There's a room and pillar supersection. They use battery powered Ramcars. We did two studies there. The first study, we had problems. This shows the canopy that's installed. It's an end drive car, and you can see the canopy is welded onto the shuttle car canopy.

And we have the blower, and this is the intake filter right here. There's a filter that's a MERV 13 filter, I believe. And that's the intake, and this is a -- I want to say it's a 1,000 CFM blower. We could get up to 800 CFM out of the canopy.

When we did the first study, we had the hydraulic pump. We plumbed everything into one hydraulic pump. Well, running the blower and operating the shuttle car with that one pump, the pump wasn't enough to -- couldn't provide enough hydraulics to run both systems.

So it would rob the canopy with the blower. So

anytime they were loading with the CM, the blower basically shut down. Anytime they were unloading the feeder, the blower would shut down. When they were tramming, anytime they turned, the blower would shut down.

So our solution was to add this second stage pump here, this is an independent pump that runs just the blower. It goes into the same hydraulic tank system. And basically that solved our problem.

Currently, we completed the study, and the analysis are looking pretty good. Behind the CM, we're getting 60 percent reductions. When we were at the feeder, we were getting, I think, over 30 percent reductions in respirable dust. And when we were tramming, we were getting 20 percent reductions.

Okay. Go ahead.

Chair Nelson: Can you finish up in, like, about five minutes?

Dr. Reed: Yeah. I think I only have a couple more slides here. So the next thing is the ANFO canopy loader -- canopy air curtain. This is to protect blasters from DPM. Blasters are one of the most affected by DPM, and this is a project that Jim Noll (phonetic) is kind of heading up and I'm helping him with this.

We used a canopy that is the same canopy design as the shuttle car canopy or curtain but it's three foot by three foot. And there's two of these that are going to go onto the cage because the cage is six foot wide. So this will cover the blasters on any part of the cage.

We have to have a large blower because the blowers will be down here on the machine. And we got a hose that will be going up to the canopies. And we redesigned -- Fletcher redesigned a filter housing. And this is to protect against DPM.

So we've completed some lab testing. This is the

actual canopy, one of the canopy air curtains right there. The highest -- we did some particle counts. The highest reductions were inside the canopy and at the borders we had lower reductions which makes sense because of the interpretive zone out at the edge.

This is our facility underground in the Pittsburgh Research Mine. And we barricaded this off, and this is where we're doing the testing. We have a generator that provides DPM into this area. And we have an exhaust system that pulls air out at the same rate that air is flowing in.

This is showing the testing here, and the DPM reductions are anywhere from 81 to 90 percent at the center. And that's an unmodified canopy. The modified canopy are higher. With the modifications, we add a three inch lip around the entire perimeter of the canopy and that seems to direct the air straighter downward.

So basically the future work is that we're going to complete the analysis of the shuttle car canopy air curtain. We'd like to do a test on the center drive car, but we haven't been able to find a place willing to work with us on that. We want to do some more CFD analysis of that.

The ANFO loader canopy air curtain, Fletcher has an ANFO loader that they're willing to allow us to install this at their plant. And we're going to do some testing down there at the plant to make sure it's operational and that we get the same particle counts. And we want to do some CFD analysis of that.

And we also want to field test the ANFO loader at the site. And in the future, we want to look at use for LHD scalars. And another thing -- final thing would be test canopy air curtain filters. And with that, that's it.

Chair Nelson: Thank you. Thank you. Any questions or comments?

Member Harman: I have questions. These are all for the bolters?

Dr. Reed: Yes.

Member Harman: Did you see their ability between the intake and return?

Dr. Reed: Yes, there was. The return side always had less reductions than the intake side.

Member Harman: Which is intuitive?

Dr. Reed: Yeah.

Member Harman: And what was your frame of reference for the percentage of reduction? Was it the permissible exposure one?

Dr. Reed: Basically what we did was we took the outside versus the inside is what our frame of reference was. So we measured what was outside the canopy air curtain and what we had and compared that with the samplers on the roof bolter operators who were underneath.

Member Horn: And the relationship between the air flow and the health of the miner, did you guys find a correlation?

Dr. Reed: Air flows of the canopy?

Member Horn: Yes.

Dr. Reed: Yeah, the canopy air curtain, if you can maintain at least 400 CFM or more air coming out of the canopy, you had better protection. We had some tests where the canopy was adjusted low. This has even occurred on the shuttle car.

They had an adjustment and they lowered the adjustment. And when we were getting -- I think it was, like, 125 CFM out of the canopy, the reductions were much lower. Eight hundred CFM sounds like a lot of air coming out of it. But when you put your hand under it, it's really not that

much. It doesn't feel that bad.

Member Luxbacher: Why were they adjusting it? Was it noise or comfort?

Dr. Reed: It was just new to the mine and we don't know why they were adjusting it. They kept it adjusted at the same rate while we were there. It was just when they went to night shift, they turned it off is what happened.

Member Horn: Okay.

#### Public Comment

Chair Nelson: Okay. Any final questions? Well, thank you very much, Randy. So we are to a public comment period. Is there anyone from the public that wants to make a comment? We have someone. Please come up and grab a mic.

Mr. Cooper: Fantastic. Given the time, I won't be long. I'm Monty Cooper with Crowell & Moring in Washington. My question is with regards to the miner health program that Jeff presented on earlier. And I've participated in some of these conversations, and I think it was briefly mentioned once.

But I'm curious about whether you have thought about how you might be able to work with some of NIOSH's existing research efforts and particularly NIOSH's National Occupational Research Agenda, or the NORA councils, and particularly with NORA mining sector council. They released a report back in June 2015 and looked at silica and silicosis. I think they had research objectives. And I know recently there was a cross sector council on hearing loss. This is in 2016, so some sort of health issue.

So I'm curious as to how -- if you thought about to how to, sort of -- you're incorporating some of their research and any thoughts overall about that.

Member Burgess: Monty, I'll take it from my

perspective and other members to ask in their own process if they want to follow up. I see the HAMP workshop as just one additional source of information to be added to all the other sources of information that NIOSH has collected about mining health.

So they've had previous stakeholder processes. I agree that there is the NIOSH, NORA mining as well. So I would not look at the recommendations in this workshop as being greater than any of those others. It's just one piece of the whole.

Mr. Cooper: And just in terms of so I understand. So it will be miner health, the NORA councils. Are there others sort of similarly working on these issues or those would be the two large ones related to health?

Member Burgess: I'm not sure if Jerry is still on or not. Probably not. So Jessica, do you -- I know that there have been other prior stakeholder meetings that have been held. But I can't remember the details.

Dr. Kogel: Yeah, so there have been stakeholder meetings held for probably the last three, maybe even -- yeah, over the last three years. There have been a number of different stakeholder meetings. And I think the way Jeff is articulating is correct. This workshop was just one piece of information that will be used to inform the strategic plan.

And so we had a number of different efforts leading up to that. And of course, we consider the larger NIOSH -- this miner health program is trying to pull together all of the health related research that is specific to mining that happens under NIOSH together sort of in one platform so that we're at least communicating across NIOSH and maybe even coordinating in some areas as well.

So all of that has a bearing on this miner health program. So we're considering all of that.

Mr. Cooper: And that makes sense. It sounds like then between that and then with NORA. And then your other sort of health focused sort of research ideas, you can then begin to kind of implement --

Dr. Kogel: Yeah, yeah.

Mr. Cooper: -- things that will help. Thank you.

Chair Nelson: Any other public comment?

Mr. Johns: Can I just add? So just in response, if I could, Monte. I mean, in addition to NORA, I mean, for the miner health program and other programs, we'll reach out to divisions within. So go directly to working with MRD, working with RHD, working with DFSE where appropriate. So we're looking for input from everyone in NIOSH.

Chair Nelson: Any other public comments? All right. So we have -- any other public comments on the phone? Okay. Thank you.

Member Bowersox: My ride is here to the airport.

Chair Nelson: Okay. So let me ask you real quickly, though. Just real quickly. Since you are going to be here at the next meeting, what would you like to hear about at the next meeting?

Member Bowersox: Some more on silica for sure.

Chair Nelson: All right.

Member Horn: Can I join in that request?

Chair Nelson: Sure.

Member Luxbacher: I agree. And I think it needs to be a focused conversation with the committee, not just presentations in terms of what's going on. But it seems like everybody has got a unique perspective and really wants to engage in a committee conversation.

Member Horn: Yeah, and I think the input in terms

of criteria and doctor evaluations and definition of disease, all the things that -- those are all things I'd like to cover. And it may be too much for one meeting, but I think it'd be very helpful.

#### Closing Statements by Members

Chair Nelson: Okay. Got that down. Other subjects that people would like to hear about next meeting?

Member Burgess: I'd like to finalize the HAMP report and have Dr. Bob Horn or another individual from NIOSH talk about how they want to take the input from that meeting and the other meetings to move forward the miner health program.

Chair Nelson: Okay. I suggest that the committee might hear more about the partnerships, particularly the new ones that they have started. So particularly the automation and new technology, how's that going. Because they were going to try to do it, and you said maybe quarter one but probably quarter two. So a status update. Anything else anyone wanted?

Member Burgess: I wanted to bring up the question of the timing of the next meeting and the duration. So perhaps, Ron, before you go, do you have a strong preference in terms of how many meetings we have during the next 12 months, whether it's one or two and whether that should stay a day and a half or change.

Member Bowersox: Two is fine with me. Two meetings.

Member Burgess: And day and a half?

Member Bowersox: Day and a half is fine.

Member Burgess: Okay.

Member Bowersox: Day and a half is fine with me.

Member Burgess: Well, I think -- I know you have to go, but we are probably going to continue this to

see what other folks feel too just to see whether we should stay with the same format or not. Thanks.

Member Bowersox: Fine.

Chair Nelson: Okay. But one thing I think that we should have is that by that time, NIOSH will have responded to the external evaluation, right? So a discussion about the NIOSH response to that evaluation.

And I suggest if there's going to be a respirable mine dust research center because that was referred to several times in here. I think it would be interesting to know more about what that is and how it would be charged, how it would be organized. But I won't be here, so --

Member Bowersox: So I just want to thank you for everything you've done for us --

Chair Nelson: Well, I thank you.

Member Bowersox: -- as a chair. Have a happy holiday and a safe trip home.

Chair Nelson: Yeah, everybody. You may want to talk a little bit about money for a Mace facility. If there's more about the design, have some ideas about what the costs are. By then, maybe started shoveling. So those are the points that I have been summarizing. Any other issues that people want to have --

Member Horn: Yeah, if also we're going into more detail with regard to the regulatory structure related to silica, maybe a little bit more of a definition or identification of a partnership between MSHA and NIOSH in relation to feeding information into MSHA.

Chair Nelson: Okay. Any other issues? Yes.

Member Wright: Yeah, this isn't about the next meeting. It's sort of -- I guess it's permission. We developed a survey instrument that we are starting to use in our mines. And what it's meant to do is to

look at the strength of their safety and health system. Some might call it the strength of their safety culture. We don't use that word because I don't think the word is entirely meaningful.

And the way it works is you get together a group of miners and managers and you either give them cell phone software or the kind of clickers that all of our kids are familiar with from school. And you ask a bunch of structured questions. There are about 120.

And you sort of look at every aspect of the mine's program and you try to see what kind of survey results you get. And the two questions are, is there a difference between what the miners think and what the managers think, first. And second, what kind of answers do you get to questions about, for example, the right of workers to refuse unsafe work and there is various technical aspects.

What I'd like to be able to do is send that to members of the committee, not as an official MSHRAC function or anything. But we're just looking for feedback from people who know something about mining. I'm not sure if that violates some kind of FACA rule or something to use the mailing list for that purpose, but --

Member Luxbacher: I think just consider us your friends and give us whatever.

Member Wright: Is that okay with people? No problem with that? Okay, good. It won't be right away because we're still validating some of our mines. So it might not even be by the time of the next meeting. But I hope it will be.

Chair Nelson: Good. Okay.

Member Wright: Thank you.

Chair Nelson: Thank you. So you want to carry on the conversation about the next meeting?

Member Burgess: That will be great. Thank you. So

I'd ask the NIOSH folks to bring us back to the description of the duties that we have for our MSHRAC group. And I think it's helpful to revisit this every once in a while to make sure that we're all on track for what we should be doing.

So again, our main purpose is to provide advice on the conduct of mine safety research. And for Kyle or anyone else who's on line, this is -- we can send this information out to everyone. But I'll just read it.

Committees shall evaluate the degree to which the mine research activities in NIOSH conform to those standards of scientific excellence appropriate to federal scientific instructions in accomplishing objectives in mine safety and health.

Two, the mine research activities, alone or in conjunction with other known activities inside and outside of NIOSH, address currently relevant needs in the field of mine safety and health.

And three, the research activities produce intended results in addressing important research questions in mine safety and health, both in terms of applicability of the research findings and translation of the findings.

So I mean, I think that most of the activities that we've been doing are in line with that. Just thought it would be useful to refresh it. And with that in mind, I just again wanted to come back to how we want to conduct the meetings for this next year.

So we heard from Ron. He's happy with it the way it is, two meetings, a day and a half each. But I'd just like to hear from the rest of the committee members whether that's also what they would like to hear or they have some other alternative.

In the past, there have been times when the committee only met once a year. There's nothing magic about a day and a half except that people can get out on the second day. It could be done in a day as well.

We've had a lot of presentations from the various researchers within NIOSH about the things they do. Another question would be whether we continue to need to do that or whether we should focus at least for this next year just on particular issues where we have one discussion.

So I mean, just I'd like to hear from everyone on what would be the most useful for them in this upcoming year. I could go around the table. Tom, do you have feelings?

Member Harman: The functional portions, I think, at this meeting were the silica discussions and the technology presentation. I believe it's more important to focus on controlling dust exposures than studying dust exposures. I think it's interesting what the studies are and what the exposures are and the characteristics. But I think we've kind of moved beyond that. And certainly it's about disease, what it is today to a more robust control protocol.

Member Luxbacher: In terms of the meeting format, I think a day and a half is essential because if you try to pack it all in one day, you'll just fatigue people and you don't get meaningful feedback.

I want to continue to hear from NIOSH researchers, but I would appreciate more time to discuss their work. And maybe you have, like, three presentations in a row that are about dust or that are about automation and then there's a 30-minute discussion period with a committee or something like that. But I don't know that we have enough time for discussion.

Member Burgess: I'll add kind of for the issue of one or two meetings a year.

Member Luxbacher: I'm happy with two. I sort of think that it depends on how much feedback do you want from us if you feel that you need one or two.

Member Burgess: Mike?

Member Wright: I think two makes sense. I think a day and a half makes sense. I also think that it would be good if on the afternoon of the second day there is something like a mine visit. Or if we're at one of the labs, going into the lab and looking at some of their research on a voluntary basis for people who want to do it.

And I agree with Tom that as we discuss silica. This really isn't about the structure of the meeting but a comment. That the health effects are an interesting scientific question. But for the purposes of protecting miners, really the control technology is the important issue at this point.

Member Burgess: So Melanie?

Member Calhoun: With this being my first time, I have no problem with how you all were. This meeting works perfectly for me. Maybe it's because this is where I'm from. So I was happy to see my family. But no, I agree. And I do like hearing the research that NIOSH is doing.

Although I'm in Arlington and we work with NIOSH a lot, there's a lot of times I don't get to hear about what NIOSH is doing, like, how Doug presented about the DPM monitor. I really wasn't familiar with that. So I think for me coming from an MSHA perspective, the research that is going on, it's good that we get to hear that. And we get to hear it at an early phase in which they had started the research. So that is valuable for MSHA.

So I'm fine with that, and I'm fine also with the day and a half as well.

Member Burgess: Thank you. Is anyone still on the line?

Mr. Randolph: They dropped off for a couple of minutes. Are you back on line?

Chair Nelson: Kyle?

Mr. Randolph: Hang on. Okay. I can hear them through my speakers. They can hear us, but we can't hear them.

Chair Nelson: So can you tell us what they're saying?

Mr. Randolph: Okay. Hang on. Can you guys -- can somebody respond? I think I have to switch to this other device.

Member Horn: Okay.

Mr. Randolph: Is this Kyle and Tom still?

Chair Nelson: Who's on line?

Member Horn: Bob Horn.

Member Zimmer: And me.

Chair Nelson: Okay. So Bob, do you have any comments on Jefferey's question about frequency and duration of meetings?

Member Horn: I can do quickly on duration. For someone who is on the phone, the duration works really well except for one break where I seemed to lose you guys in a hail of noise. But other than that, being able to communicate with you and it was good having the day and a half to let us go into some more detail that I would find more difficult to follow otherwise.

Member Burgess: Great. Thank you. Kyle?

Member Zimmer: I don't have any more comments.

Member Burgess: Thank you. All right. And that's all the information I need for helping plan future meetings. So thank you, Priscilla.

Chair Nelson: Okay. Any other comments in closing?

Member Horn: Let me -- sorry.

Chair Nelson: No, go ahead. Who was on? Kyle?

Member Horn: It's Bob Horn again. I can't be too quiet. I apologize. One of the things that I would like to discuss next time if possible, we talked about silica and silica exposure and implication with regard to black lung, all of the things that I learned a lot about.

What I would like is some topic at the next meeting about the partnership between NIOSH and MSHA in relation to the creation of new regulations or providing new information flow as to the Region 4 regulations. So that going forward, we have a uniform approach for evaluations which I think is very critical.

Member Burgess: Bob, I appreciate your interest in that area. But I'm not sure that it is consistent with the description of our duties. So I know we didn't send out this slide to you, but we don't have legislation explicitly mentioned in our activities.

Member Horn: I'm not talking about -- I'm talking about the regulatory relationship between MSHA and NIOSH.

Member Burgess: Again, I'm not sure that that is pertinent to our description of duties.

Member Horn: But how then do you define what NIOSH is going to research without knowing what the implication of that research will be?

Dr. Kogel: This is Jessica, Bob. The process that we use for that is an established process outside of this committee. So for example, we respond to MSHA's RFI just like anybody else, so --

Member Horn: Yeah, I know that.

Dr. Kogel: So that's --

Member Horn: But see, what I'm saying is maybe in that response, which I didn't think about, talking a little bit about what we are doing or what we're recommending in terms of research might be

helpful. I don't know if it's proper or not. I don't know if it's within the purview of the structure -- the regulatory structure. But what I'm trying to approach and trying to address almost from the beginning of the short time I've sat with this group is to say, hey, let's share information.

Dr. Kogel: And we totally agree with that, and we do. And actually, we presented at a previous MSHRAC meeting some of the mechanisms that we use for sharing prior to you being on the committee just so that the committee was aware. But we have a number of different ways that we share information between the agencies.

And just kind of to give you a very brief highlight of what those are, it's everything from individual interactions between MSHA and NIOSH at our various locations. We're actually co-located in Pittsburgh, so there's opportunity for daily interactions between researchers and various MSHA people who are located at that same site up through regularly scheduled meetings between leadership of both organizations. And then there are a number of other mechanisms in between.

MSHA is very engaged with us on partnerships and vice versa. So there's information flow. There's also we share reviews of each other's publications. So they provide peer reviews for what we publish and vice versa.

So we are happy to provide that sort of update again when the time is right with many committee members.

Member Horn: Okay. Yeah, I'd appreciate that because my problem again being I'm probably the dinosaur in the room. I remember before NIOSH/MSHA divisions that that kind of information flowed in a regulatory direction and gave industry an opportunity to respond to regulatory initiatives and the research that was being done. And that would be Bureau of Mines, I understand.

But in terms of trying to make business or environmental or labor regulations, having the tie between the two structures and having people aware in a more consistent way I think would just be helpful.

Chair Nelson: Yes, Michael. Would you like to have a final comment?

Member Wright: Well, it doesn't have to be final. But look, I mean, a big piece of my job is advocating for better regulations. That isn't the job --

Member Horn: Okay, Mike. I didn't hear you.

Member Wright: I'm sorry. This is Mike Wright. A big piece of my job is advocating for better regulations. That's not the job of this committee. The job of this committee is --

Member Horn: No, I understand.

Member Wright: -- what we need for good regulation which is good science. And I think the only overlap really is asking, what do we need to know to better protect miners, whether it's through regulation or through best practices or by any other method?

And I think even though NIOSH was created to do research which fits into safety, there needs to be a separation between what NIOSH does and what MSHA does and what OSHA does. And I think we've hit that separation appropriately so far.

Member Horn: I guess the only thing I would add, and I appreciate what you just said, is what we can learn about where the inputs are that form the basis of the later regulation by MSHA and learn what's been shared and the partnership.

Chair Nelson: And we can ask questions. There are -  
- I think there's an assigned person from MSHA who is sometimes attending.

Member Wright: Like today.

Chair Nelson: So it's not -- I mean, we're very permeable. Okay.

Member Wright: And I do have one more comment. I think Priscilla has done a magnificent job as the chair of this committee.

Member Luxbacher: I second that.

Member Wright: We've been blessed in the past with really good chairs. I think we'll be blessed with Jefferey's tenure. But I think Priscilla has been very much in that tradition and you've done --

Chair Nelson: Thank you so much.

Member Wright: -- a terrific job.

Chair Nelson: It's been a pleasure to be with you all. And I'm not dead or going away. So if you find a very special, special task for me that you ever want me to do, please call me. But it shouldn't be about silica dust.

Dr. Kogel: So can I add one last thing? So this is when I would have an official certificate to give you.

Chair Nelson: Yeah, where is it?

Dr. Kogel: However, Pauline is in the back hiding. It's not your fault, Pauline. It will be mailed to you because we didn't want you to have to carry it on the airplane.

Chair Nelson: Oh, this is so thoughtful.

Dr. Kogel: But on behalf of NIOSH, I would like to present you -- here's your certificate.

Chair Nelson: Thank you so much.

Dr. Kogel: And to thank you very much for your leadership, your energy, all of your insights, and just what you've done to keep us on track. So I want thank you.

Member Horn: You also talked about that.

Dr. Kogel: I want to thank you very much for everything that you've done, Priscilla. And we will miss you.

Chair Nelson: You will miss me.

Dr. Kogel: We will miss you.

Chair Nelson: You will miss me.

Dr. Kogel: We will hear your voice in our sleep.

Chair Nelson: Trying to keep myself awake.

Dr. Kogel: So thank you very much for everything you've done.

Chair Nelson: Thank you all. And there's always more work to do, so you're not going to run out of things, right? And there will be more changes, I think, in your time on the committee and that's good too.

Dr. Kogel: Yes.

Chair Nelson: So thank you very much.

Member Burgess: Sorry, Priscilla. We have one more item. It's when the next meeting will be.

Chair Nelson: A location. Any thoughts?

Member Burgess: So since it's going to be approximately -- since I've heard from everyone that they like the two meetings a year, it would be about six months from now. So I'm looking in May potentially. I wonder if the last week in May works for folks or not. I'm just throwing that out.

Chair Nelson: That's around Memorial Day.

Member Burgess: That is Memorial Day, exactly. So towards the end of that week?

Dr. Kogel: Yes.

Member Burgess: That would be the 28th and the 29th which would be a Thursday, Friday, or 27th, 28th.

Chair Nelson: Memorial Day is what day?

Member Burgess: The 25th, Monday.

Chair Nelson: What about the week before that weekend?

Member Burgess: Or the week after, the first week of June?

Dr. Kogel: So what we've done in the past is sometimes we've come up with several different options and then we follow up with just a quick email poll basically of the committee.

Member Burgess: Okay.

Dr. Kogel: And maybe that's the thing to do. So people can go back and check calendars.

Member Burgess: Sounds great. Do we need to discuss the location or should we also --

Dr. Kogel: Yeah, so I think just as a reminder to the committee, what we've typically done with location - - and this is not at all written in stone. You can completely revise this. And we actually didn't do it this way this time now that I think about it.

But usually the spring meeting has been in the east and the fall meeting in the west. And we've tried to go to different NIOSH sites. And that way we can have tours of laboratories and then visit different mines which we do with every one of these meetings.

So we've done the rotation, I think, of all of the potential NIOSH sites at this point I think at least once. So it's really up to the committee. Oh, that's right. We haven't done Cincinnati. Thank you.

Dr. Kogel: Well, yes. So it's up to the committee

really.

Member Burgess: Does anyone have a preference for the location of the next meeting if it'd be in May or June? Maybe we'll just send out some options along with your answer for the dates as well.

Dr. Kogel: Okay.

Member Burgess: Thanks.

Member Horn: Have we done a meeting recently in D.C.?

(Simultaneous speaking.)

Dr. Kogel: So a year and a half ago, Bob, was the last time we did Washington.

Member Horn: Okay. I mean, I just threw it on the table.

Member Burgess: Great. Thank you. We'll definitely consider it. Do you want to do the last, Priscilla?

Chair Nelson: You want me to do the lights?

(Laughter.)

(Applause.)

Adjourn

(Whereupon, the above-entitled matter went off the record at 11:50 a.m.)