THE U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
CENTERS FOR DISEASE CONTROL AND PREVENTION

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
BOARD OF SCIENTIFIC COUNSELORS (BSC)

SIXTY-NINTH MEETING

BOARD OF SCIENTIFIC COUNSELORS

(BSC) MEETING

September 26, 2017

The verbatim transcript of the

Meeting of the Board of Scientific Counselors

Meeting held on September

26, 2017, 8:30 a.m.

C O N T E N T S

September 26, 2017

P A R T I C I P A N T S

(alphabetically)

KARLA ARMENTI, ScD - BOARD MEMBER
MICHAEL BEHM, PhD - BOARD MEMBER
TERRY BUNN, PhD - BOARD MEMBER
LAMONT BYRD - BOARD MEMBER
SHARON COOPER, MD - BOARD MEMBER
THEODORE COURTNEY - BOARD MEMBER
MARYANN GRUDEN - BOARD MEMBER
JOHN HOWARD, MD - DIRECTOR
MARGARET KITT, MD - BOARD MEMBER
CHRIS LASZCZ-DAVIS - BOARD MEMBER
GRACE LEMASTERS, PhD - BOARD MEMBER
JUDITH MCKENZIE, PhD - BOARD MEMBER
MARK NICAS, PhD - BOARD MEMBER
CHARLES REDINGER, PhD - BOARD MEMBER
BONNIE ROGERS, PhD - BOARD CHAIRPERSON
RONALD STOUT, PhD - BOARD MEMBER

JANICE SCOTT BLANTON
CHRISTINE BRANCHE
DAWN CASTILLO
JOHN CULVENOR
DAN GLUCKSMAN
FRANK HEARL
JENNIFER HORNSBY-MYERS
SUSAN MOORE
ANGELA MORLEY
RENE PANA-CRYAN
JOHN PIACENTINO.
ALLEN ROBINSON
CHRISTINA SPRING
ANGELA WEBER

WELCOME AND INTRODUCTION, MEETING LOGISTICS

MR. GARCIA: Good morning, everyone.

[Off-microphone.]

There is a lot of work that goes into this meeting so I want to make sure that we acknowledge everyone that helped us make this a reality.

The first issue that I want to bring up is safety announcements. So if we need to shelter in place, this is the room to stay. If we need to get out of the building, you can go out of either door, walk along the hallway and follow the emergency signs. Once you get out of the building, you will make a right on the street and then a left to the ballpark. The closest exit will be to my left.

We want to remind everyone that this is a Federal Advisory Committee and we will follow all the FACA regulations, and this meeting is based on that. And one of the important things about the FACA committee is that we ensure that we have no conflicts of interest, and managing those conflicts of interest, at the time I will do the roll call, even though you sent me your OGE 450 a few weeks ago, I'll ask again if you have additional conflicts. So when I do a roll call, state your name and if you have any conflict of interest.

The other thing that I want to remind everyone is that for the second time, we are not doing minutes per se but we are doing a transcription service. So all the conversations that happen during the meeting are going to be transcribed and it will be on the record. I want to try to remind everybody on the line to please mute their microphones so the conversations can flow naturally.

So with that I guess I will start with the roll call, and we might have a couple of members on the phone. I don't know if they have joined yet or not. I see Ted Courtney on the phone. So I will start with the roll call and again, please let me know if you have any additional conflict of interest. Karla Armenti.

DR. ARMENTI: Yes, and no, I don't have any conflict of interest.

MR. GARCIA: Michael Behm.

DR. BEHM: Here. No, I don't.

MR. GARCIA: Terry Bunn.

DR. BUNN: Here, no conflict.

MR. GARCIA: Lamont Byrd.

MR. BYRD: Here, no conflicts.

MR. GARCIA: Sharon Cooper.

DR. COOPER: Hi, I'm on the phone and I just wanted to disclose that I work for the ERC, and I don't think there is any conflict but the discussion on emergency response certainly applies to our Texas ERC so just wanted to disclose that.

PARTICIPANT: Yes, actually that would be the same as me.

MR. GARCIA: Thank you. Ted Courtney.

MR. COURTNEY: On the phone, and no conflicts.

MR. GARCIA: Thank you, Ted. MaryAnn Gruden.

MS. GRUDEN: Here, no conflict.
MR. GARCIA: Chris Laszcz-Davis.
MS. LASZCZ-DAVIS: Here, and I think I've raised the conflict as to whether or not there was a conflict. I got appointed to the Cal/OSHA Standards Board. I don't know.
MR. GARCIA: Thank you. Grace LeMasters.
DR. LEMASTERS: Here, no conflicts.
MR. GARCIA: Judith McKenzie. Mark Nicas.
DR. NICAS: Here, no conflicts.
MR. GARCIA: Charles Redinger.
DR. REDINGER: Thanks, Alberto. I'm here, and no conflicts
MR. GARCIA: Thank you. Bonnie Rogers.
DR. ROGERS: Here, no conflict.
MR. GARCIA: Jas Singh. And Ron Stout.
DR. STOUT: Here, no conflict I'm aware of.
MR. GARCIA: Okay, so while we are done, I am going to turn it over to Dr. Rogers.
DR. ROGERS: So good morning, everyone, and thank you for coming. I guess we are having unseasonably warm weather so it's nice. It's nice to walk from the hotel, and it's such a close hotel, I was wondering if that was there before, so.
PARTICIPANT: I think it's been there, what, about a year and a half, the Hyatt place?
MR. GARCIA: Yes.
DR. ROGERS: Great place, it's very nice. Thank you for having us there. I wanted to take a moment too to have others that are in the room as well introduce themselves and just kind of go around and why don't we start here?
MS. MORLEY: Yes, good morning, everyone. I'm Angela Morley, I'm the Chair of the IRB at NIOSH.
MS. SCOTT BLANTON: Janice Scott Blanton, (inaudible @ 00:06:59) Office.
DR. HEARL: Hi, I'm Frank Hearl, I am the Chief of Staff for NIOSH.
DR. PIACENTINO: Good morning, I'm John Piacentino, Associate Director for Science at NIOSH.
MS. HORNSBY-MYERS: Good morning, Jennifer Hornsby-Myers, Emergency Preparedness and Response Office for NIOSH.
MS. CASTILLO: Good morning, Dawn Castillo, Division of Safety Research at NIOSH.
DR. BRANCHE: Good morning, Christine Branche, Office of Construction Safety and Health.
MS. WEBER: Hi, Angela Weber, I'm in the Emergency Response Office.
DR. PANA-CRYAN: Rene Pana-Cryan, I am the Economics Research and Support Officer.
MR. JOHNSON: Ed Johnson, MMT/video technician, NIOSH.
MS. SPRING: Christina Spring, Director of Communications, NIOSH.
DR. MOORE: Susan Moore, NIOSH's National Personal Protective Technology Lab.
MR. GLUCKSMAN: Dan Glucksman, International Safety Equipment Association.
MS. BENJAMIN: Good morning, I'm so glad to meet all of you. I am Pauline Benjamin, Committee Management Specialist.
DR. ROGERS: John?

DR. CULVENOR: Hi. John Culvenor, visitor from Australia. I'm an engineer working human factors, accidents, injuries mainly, that's what the customers ask for, but very interested in policy, research and broader opportunities to contribute to prevention.

DR. ROGERS: Glad you're here. And he's promised to get me tickets to the Australian Open.

DR. CULVENOR: I think that was nearly it, yes.

MR. GARCIA: And we've got Judith McKenzie?

DR. ROGERS: I guess we all have to sign this, right?

DR. MCKENZIE: Judith McKenzie, University of Pennsylvania Medical Center.

MR. GARCIA: Any conflicts of interest?

DR. MCKENZIE: No.

MR. GARCIA: Thank you, Judith.

MS. ZYLSTRA: Brenda Zylstra, American Society of Safety Engineers.

AGENDA, ANNOUNCEMENTS, AND APPROVAL OF MINUTES

DR. ROGERS: Oh good. Okay, good. Well, again, thank you all for being here. You have the agenda. I do have one announcement but I am actually going to wait till John comes, and do that when he is here. He will be here in a little bit. Apparently he has—Margaret?

DR. KITT: I am obviously not John Howard; I am Margaret Kitt, Deputy Director, filling in till he arrives. He had a minor bicycle accident on Saturday so he is at the doctor this morning. He is fine but needed to get it checked out. I asked him if he wanted me to make up a more grandiose story but he said no, okay, sure, that…

DR. ROGERS: So we will look forward to John arriving. Apparently he had a bad (inaudible @ 00:09:44) you were saying. So glad it's nothing more serious than that. So we have the minutes there. Are there any corrections or additions to the minutes? Do we have a motion to approve?

PARTICIPANT: So moved.

PARTICIPANT: Second.

DR. ROGERS: Our minutes are approved as entered and Margaret, are you going to…?

DR. KITT: I am going to give the opening remarks for Dr. Howard.

DR. ROGERS: Let me just also, before you start, the sign-in sheet, I will just pass that around and you all can just sign in.

DIRECTOR'S OPENING REMARKS

DR. KITT: So first of all, I wanted to thank Dr. Culvenor for joining us this morning from Australia, and Dr. Culvenor is an engineer specializing in human factors, particularly related to occupational safety and health, with particular interest in safe design. And we are always glad to have international visitors to our BSC meeting. We are going to give him an opportunity a little bit later this morning to talk about the work that he does as a consultant.

So Dr. Howard asked me to go over just a few things. You have the remarks in front of you and there is a lot of information, as there always is, thanks to the folks that put these together—Janice and Alberto and Paul and John Piacentino. He

wanted me to just mention a few things to highlight in the opening remarks. Obviously our budget is always first and foremost on everyone's mind. Recently we got some good news from the Senate Appropriations Committee that they were providing an estimated budget for $335.2 million, which equates essentially to our 2017 budget of $335 million. Now previously, back in July, the House had proposed a budget of $325 million, which of course was a $10 million reduction from the fiscal year 2017, an active budget, but certainly an improvement over what the President had projected as a $200 million cut for us in his budget. So right now, we are going to be waiting to see in conference what the House and the Senate decide between, and trying to reconcile those two differences. But in general it looks like it will be fairly good for us for fiscal year '18 so we will wait and see. There really hasn't been any updates since those last numbers were published in your talking points, so.

We've had a number of personnel announcements since our last meeting. Ryan Hill, who was formerly in Morgantown and is the manager of our Oil and Gas Program, was appointed as the first Western States Division Director—permanent Division Director—and he has since moved up to Spokane, Washington and has started out there.

Because Gayle DeBord, Captain Gayle DeBord, retired from DART, Mary Elliott is serving as our appointed interim director for that division for the time being.

In July, Jacek Mazurek, who some of you may know, was appointed as the Chief of the Surveillance Branch in Respiratory Health Division, replacing Eileen Storey, who is scheduled to retire here in a few months.

And a couple of other retirements. Leslie Nickels, who some of you may know from the Research to Practice office, retired several months ago and Christina Spring, who is with us today, is the Associate Director for the Office of Communications at which now the r2p office has moved into.

And one other retirement is Anita Schill, who has been with NIOSH for many years, is retiring at the end of September. So a lot of turnover.

DR. ROGERS: What is she going to be doing, do you know?

DR. KITT: I don't think I know yet.

NIOSH has been, of course, heavily involved in the hurricane responses—Harvey, Irma and Marie. We have had varying numbers of deployed officers and personnel throughout the past weeks. The number varies depending on which day it is, but we have had folks deployed through CDC, Commissioned Corps Officers through the Public Health Service, and actually FEMA asked for a wide-range request for some support and we have deployed some folks in support of FEMA as well.

So we wanted to draw attention to a new publication that is out, the *National Occupational Research Agenda: Second Decade in Review* | *2006–2016*, which is a very comprehensive evaluation of the NORA decade and talks about a lot of the

impacts that were accomplished not only by NIOSH but all of our extramural partners as well, and that can be found on our webpages.

Wanted to mention that the Respiratory Health Division celebrated its 50 years of occupational and respiratory disease research in Morgantown, West Virginia with a big celebration in August. In concert with West Virginia University, we had a really nice ceremony and a set of presentations about respiratory health disease, respiratory health over at WVU. So thanks to David Weissman and their whole division for holding that celebration.

The Health Hazard Evaluation Program, as you know, tries to get all of its reports up online and they have really pushed a big effort this past year and have posted over 1,000 reports that were even completed before 1985, and they are continuing to post those updates on previously published reports so that we will have all of our historical HHE reports available online. It's something that's frequently requested. So they are working very hard to do that.

The *NIOSH Manual of Analytical Methods*, or NMAM as it's well-known, is now out and we have published a brief video that's available online—I just looked at it the other day—which is a 90-second video that really gives a nice overview of what NMAM is, what information is contained within NMAM and helps direct the viewers to different webpages for more information. I think it's on the CDC YouTube channel, and that's a really good resource to get people plugged in to NMAM. So you might want to take a look at that.

The Division of Safety Research wants to announce that the National Occupational Injury Research Symposium or NOIRS, which is always a difficult word to pronounce, will take place again in October of 2018 in Morgantown at the Morgantown Marriott, which is at the Waterfront Place there in Morgantown, and it's the seventh in a series of symposia that have been held by NIOSH since 1997. We are doing it in collaboration with a number of our partners—the National Safety Council, the American Society of Safety Engineers, and West Virginia University and a number of others. And so the opening of the abstracts will be this fall, probably pretty soon, so I encourage you to look for those announcements for the abstract submission process.

I wanted to mention that just in a few weeks, the end of October, NIOSH in collaboration with the Center for Health, Work & Environment at the University of Colorado School of Public Health will be hosting the fourth International Understanding Small Enterprises Conference in Denver, and this is the first time that this international conference is actually held in North America. So I think you can still sign up to attend if you're interested, and that information also is available on our website.

There is a very interesting webinar for the Total Worker Health webinar series coming up actually Thursday, this Thursday, September 28, from 1:00-2:30, on aging and work, and we have three presenters from different parts of academia

that have presentations scheduled, and it's with NIOSH's National Center for Productive Aging and Work, and you can sign up and you can actually get continuing education minutes associated with that.

One more video that's been released was by our Western States Division. It was in partnership with the California Department of Public Health Occupational Health Branch. It's a video to help protect oil and gas extraction workers from the hazards faced when opening oil tanks. So it's related to tank gauging, and the video is called "Protecting Oil and Gas Workers from Hydrocarbon Gases and Vapors" and it's a pretty informative video that talks to the workers and safety and health professionals about the hazards of tank gauging in the oil and gas industry.

And then there is lots of information presented about our presence on social networks thanks to Christy and her office, and a number of publications that are put out.

So there's a lot of information in these few pages, but that's just a couple of the highlights, and yes.

DR. REDINGER: Margaret, a quick question. I am fascinated; I hadn't heard about a potential connection between ALS and occupation, and I'm looking forward to reading that. Is there any sense, is the agency going to keep going looking at that issue or moving forward to see if they are there with that?

DR. KITT: I believe there is some ongoing work that's being done to continue to explore that linkage. I'm not sure if it's within the industry-wide studies branch. I don't know the details of the continued work but we could certainly get that for you. But yes, that's an interesting article. Did you look at the MMWR file?

DR. REDINGER: I haven't, no. I wasn't aware of that.

DR. KITT: We can tell Dr. Howard we'll have lots of questions for him when he gets back if we want to do that.

DR. ROGERS: Questions from the phone?

DR. KITT: We can. Whether he'll have an answer for you is another story.

DR. ROGERS: I was asking if we should ask budget questions. Does anybody have any?

DR. REDINGER: Well, that was good news, what came out of the Senate. We'll have to see what happens—you know, there was a strong vote, what, 29:2 or 30:2 with that? It will be interesting to see. Hopefully the House will come up to the plate.

DR. KITT: We've certainly done a lot of budget exercises to plan for multiple contingencies throughout the last four or five months but yes, we were a bit relieved as well.

DR. ROGERS: Any other questions? I was curious with Puerto Rico, what our presence there was.

DR. KITT: Well, I think we're gearing up for some deployments to Puerto Rico. I think they were trying to—and Jennifer can correct me or add some information here—but I think we are really trying, they are trying to assess the situation, make sure that we can get our own response folks in safely and that there is a real mission for them to really jump into. Although we have not been heavily tasked for Texas and

for Florida, I think over the years, those states have really done a great job in preparing for these types of events, we think probably the much bigger push will be now for the Virgin Islands, U.S. Virgin Islands, and Puerto Rico because they do seem to be in much more dire straits and don't have the same infrastructure that our other states do. Do you want to add anything, Jennifer?

MS. HORNSBY-MYERS: I would add that I believe tomorrow—today's Tuesday, correct—tomorrow I believe eight CDC staff are going to go in sort of a liaison type role and L&O just to find out what's going on. We were able to very quickly, across the CIOs—Centers and Institutes and Offices—across CDC to come up with a Spanish-speaking folks at a senior enough level that they could go in, and I believe they're scheduled to leave tomorrow. So once they get there and do their assessment, I would give that a couple of days, and then I think we'll begin to see a lot more deployments after that. There's a lot of work needs to be done.

DR. KITT: Although everybody is always really anxious to get in and do the work, I think we all know that sometimes being there without really knowing what your mission is going to be can almost be worse because there's too many people walking around doing without a dedicated mission or an objective. So I think sending in this sort of advance team I think is really helpful to make sure that we're not in the way but actually helping, so.

DR. ROGERS: Good luck. We'll be right. Appreciate it. Any other comments or questions? Do we have any TPGs in Puerto Rico, do you know?

DR. KITT: No.

DR. ROGERS: I was thinking about that the other day. I was wondering about that, if we did. I was curious about it.

PARTICIPANT: What's a TPG?

DR. KITT: Not that I'm aware of. I know there is a CDC office there.

DR. ROGERS: Training project grants, sorry.

DR. BUNN: What is it?

DR. ROGERS: Training project grants.

DR. BUNN: Oh, thank you.

MR. ROBINSON: Hi Margaret.

DR. KITT: Is that you, Allen?

MR. ROBINSON: Yes. We do have one TPG in Puerto Rico.

DR. KITT: What is it?

MR. ROBINSON: What's it for, I don't remember what it was.

DR. KITT: All right.

MR. ROBINSON: But we do have one and the people that are part of that program are okay, although their facilities are heavily impacted.

DR. KITT: There is a CDC office in Puerto Rico.

PARTICIPANT: There's always a laboratory, right?

DR. ROGERS: Allen, I am curious about that TPG and are they closed, I guess? I assume they

must be.

MR. ROBINSON: I believe they are. I'll be able to check that and send you guys a quick email about that, but yes. They are impacted. They are not operational right now, but the people that are part of that are all okay and their families are okay.

DR. ROGERS: It's just so devastating.

DR. KITT: Yes, I heard that 60% of the island is still without potable water.

DR. ROGERS: They were showing lines this morning, it was like a mile long just to get water. So okay.

MS. LASZCZ-DAVIS: I've got a real quick question if I might.

DR. ROGERS: Go ahead, Chris.

MS. LASZCZ-DAVIS: These are excellent; they are very nicely done. Are we in a position to share these outside this group?

DR. KITT: Yes, I believe they are public.

MR. GARCIA: They will be public once the minutes are approved.

DR. KITT: And they are posted to our website, right?

MR. GARCIA: They will be posted.

MS. LASZCZ-DAVIS: So that will be soon or?

MR. GARCIA: Well, we are required by FACA regulations to finish the minutes within 90 days after the meeting, so the sooner we get them done the better, but we are required by law to get them done 90 days after a meeting. But they will be public and they won't be changed.

DR. KITT: But there is information in there it sounds like you want to share with some folks.

MS. LASZCZ-DAVIS: Yes, just bits and piece I would just bring out so people outside can begin working behind the scenes with you guys on some things that are ongoing at the state level.

DR. KITT: Yes, I think that would be fine.

DR. COOPER: This is Sharon Cooper. If I could just follow up on that, does the same thing go for any of the materials in our book for presentations today? Can any of that be shared? Is it the same thing?

MR. GARCIA: Yes, the same applies to presentations as well.

DR. COOPER: Okay, thank you.

DR. ROGERS: Any other comments or questions?

PARTICIPANT: One question on the Puerto Rico, or perhaps it's a comment and a question. It appears that over time, there has been a difference of opinion between the CDC and some of the public health folks in Puerto Rico vis-à-vis Zika for example and as companies and other folks are preparing to send teams in, it would be helpful to have as clear a guidance as possible on what the CDC is thinking, particularly about Zika and other infectious disease exposures.

DR. ROGERS: Yes, that's a good point.

PARTICIPANT: Because it will definitely influence, I believe, how some companies will think about the who, who is going to be going.

DR. ROGERS: Any other comments? Yes, Charles.

DR. REDINGER: Just to highlight one thing and Chris, you might jump in on this piece with both of our involvement at AIHA, the American Industrial Hygiene Association, with the program, the partnership with NIOSH on the Safety Matters with young folk, and there's a lot of training material prepared and an outreach effort to go into, let's say, high schools. So for some of us in our communities who have been going out doing health and safety presentations to high school kids, and so it's been a valuable partnership with NIOSH. And Chris, I don't know how much, if you followed that initiative very much.

MS. LASZCZ-DAVIS: I do, and it's one of the reasons I asked the question. There were a few others subjects in here that I thought I would share with others on the outside. ALS is another one. There's a fair amount of work being done on the West Coast. But in terms of the Young Workers' Safety Initiative, it was actually launched on the West Coast under the Department of Industrial Relations. We have a 20-year-old effort that's been well-substantiated financially. They've got leadership academies. They've got webinars. And the only reason I know is when I was on the AIHA board, I went back to California enthusiastically and said gee, look at what we can do, and they said wait a second. We've been doing this for 20 years. So it's been a learning process for me. So what I'd like to do is whoever has got the Young Workers' Safety Initiative within NIOSH, at least connect the people. Because I'm amazed at the resources that have been developed that I think have not been marketed well from California's standpoint to tell you the truth.

DR. KITT: Yes, Paul Schulte's division, EID division, he has got the folks that have been working on that and there's lots of materials there. They have been working with numerous states as well as AIHA and yes, there is a lot of work that's been done.

MS. LASZCZ-DAVIS: Yes, there's a lack of synergy I think that perhaps we are not capitalizing on.

DR. ROGERS: I'm curious, with the AIHA thing, is that just AIHA doing that or is there an opportunity for an interdisciplinary approach to doing that?

DR. REDINGER: I am sure there is. It has been a couple of years since I have been on the board. I think at least a driver in AIHA, a part of it was a couple of people who really had passion, so a recent President of the AIHA, Steve Lacey, which was part of this passion, and so he was one of the drivers behind that. And as far as the interdisciplinary approach, I'm absolutely sure that's…

MS. LASZCZ-DAVIS: I know the training has—they are companion pieces. I don't think you can work with safety and health in isolation.

DR. KITT: And they've also been working with other groups, temp agencies as well as Boys and Girl Scouts of America and other organizations as well.

MS. LASZCZ-DAVIS: STEM programs. It just goes on and on and on.

DR. REDINGER: You know, Bonnie, what I thought of with that is a piece that at least my recollection of those modules is about how to be safe and health in the workplace is what the profession is. But as far as in getting folk excited about the profession,

occupational nursing, so that's just one example. I'm not sure there would be an occupational nursing component to it but…

DR. ROGERS: Well, that's why I'm curious about whether nursing or medicine are involved in that. That could be a…

DR. REDINGER: In my recollection, it wasn't that strong.

MS. LASZCZ-DAVIS: Not yet. But I know ASSE is beginning to have some initial discussions about some involvement in that, and it's fairly embryonic. But like I say, I think it's a seamless (welt @ 00:30:30); it will all begin to fuse.

DR. KITT: I don't know if Paul is on. Paul, are you on, in Cincinnati? There have been a lot of outreach groups they've been working. But there's always opportunities to continue to expand that I would say.

DR. ROGERS: But that might be something I think that could be really useful with the professional societies in particular, to group together and—

PARTICIPANT: I know AOHP's work, they put a program together specifically to go out to like nursing schools, to educate nursing students about occupational health.

DR. KITT: Is that a topic that we've talked about at the BSC meeting, Paul, do you recall?

DR. MIDDENDORF: I don't believe so.

DR. KITT: It might be something to…

DR. MIDDENDORF: No, I'm sorry. No, we haven't. We have a representative from ASSE here who wanted to say something too.

PARTICIPANT: ASSE and AIHA and NSC, we have been working with—there's a group called Intersociety which also includes the occ docs and the nurses, and we have been having these kind of discussions about how to get it out as a larger profession and as Chris said, also within ASSE, we are developing a total worker health committee. Our research agenda, one of our top three things is integrating worker wellness into the safety piece. So there are a lot of things moving forward, but it's always good to come to things like this and talk to the other groups and make sure we're all sharing everything with each other.

DR. REDINGER: So this is about both young workers and infusing occupational health and safety education into young workers broadly as they enter the workforce, but it's also about young workers, young professionals entering the occupational safety and health professions. It's about both of those things?

PARTICIPANT: Yes. At least from AIHA, I think AIHA's focus might be more about this as a profession. So as you're looking for where you may go with your career or your life.

DR. ROGERS: Versus this is a hazard.

PARTICIPANT: Yes.

MS. LASZCZ-DAVIS: And versus what California has been trying to do is the workers, the young people is one area of focus, but the truth is it's really important to get the employers onboard, the small businesses particularly. So we are working with the State to see whether or not from an entry side of things, where high school kids are able to

get their first jobs, they go through required training before they even get out in the workplace. And we're also working with the Chambers of Commerce, we're working with the legislation. Unless you get the employers in the position of having to do these things, you really don't have the push-pull system in place, you know.

DR. ROGERS: No, but the interesting thing is, as you are talking about all these people retiring, etc., and unfortunately we are getting older, like it or not. So we will be departing at some point. But we really do need to have new professionals in occupational safety and health, and that's not just IH and it's not just safety but it's the whole package. So I think that would be a really good initiative for NIOSH to look at in terms of the whole interdisciplinary package. I'm thinking since you mentioned that, take the nurse and the physician and the safety person or the ergonomic person or whatever, and have a discussion at these secondary institutions of education, and let people know what we do.

PARTICIPANT: NACOSH did a big initiative on this last year. I don't know if you're all familiar with the OSHA Advisory Council. And I believe they haven't met yet this year. There's been some sort of—they haven't been able to get together—but their last meeting, they spent probably half the meeting on talking about that. It's probably a year-long project, and so I think there's—

DR. ROGERS: What are they doing though, do you know?

PARTICIPANT: John's going to speak.

DR. PIACENTINO: Hello, everybody. John Piacentino, I'm the NIOSH representative or liaison to NACOSH. And to answer your question, Bonnie, it was—and thank you for reminding folks—NACOSH did look into the occupational safety and health of course. It was an initiative that they started, I would say maybe about two years ago, NIOSH certainly made them aware of several workforce assessments that it had conducted over the years, and provided them with other information and the workgroup is in the process of working on it. And as you point out, there has not been a meeting yet scheduled for this year, so there might be an opportunity to see with this group how to progress the initiative. At the same time, we could certainly make available the information that we supplied to NACOSH and do an update here if that would be helpful.

DR. LEMASTERS: This is Grace LeMasters. We've had, for years and years, an occupational health medicine training program at the University of Cincinnati, as you well know. But many of these occupational medicine programs are closing. Ours may. And I have just seen a steady, steady decline in occupational medicine programs ending and there's no replacements. So I predict a huge shortage in occupational medicine. We also have an occupational nursing program but I'm not familiar with that, but ours has gone steadily down and I wonder what can be done about it. Just nationally is my concern, because 30 years ago it was a very vibrant, occupational medicine. So are you guys thinking about that?

DR. PIACENTINO: Yes, so it's a great comment and in fact, I think it was maybe two years ago,

Sarah Felknor, who is our Associate Director for Research Integration, did a very nice presentation at the American Occupational Health Conference. In this presentation, she addressed the issue not only for occupational medicine physicians but for other professions—occupational safety and health professionals. And again, the presentation maps out what the pipeline of professionals are, issues that seem to be facing the training programs associated with those professionals and trying to think forward in terms of the future. This is something that if the committee is interested in, we could certainly bring that information.

DR. LEMASTERS: Have there been any projections, like let's say five-, ten-year projections? I'd be happy to work on that committee if you need volunteers.

DR. PIACENTINO: I don't know.

DR. KITT: I think Sarah actually might be on the phone. Are you on the phone, Sarah?

DR. ROGERS: Allen is. Allen? We see you. We know you're there.

DR. KITT: You can't hide.

DR. ROGERS: You can't hide; we know you're there.

MR. ROBINSON: Okay, yes. John has the most current information that we have about this issue of occupational physicians and occupational health nurses that Sarah presented was prepared in part in response to working with physicians groups. I think ACGME as a matter of fact, I believe, John, you will remember better than I if that was part of the reason for doing that or not. John?

DR. PIACENTINO: I'm not sure if that was necessarily—I know that the American Occupational Health Conference, the Planning Committee expressed an interest in that beyond just other interactions that we had, meaning NIOSH had, with the American College of Occupational and Environmental Medicine. So I suspect that the two are very closely linked and so the interest sort of continued on.

MR. ROBINSON: It was ACOEM, thank you. So we can get that information to you all.

DR. STOUT: Ron Stout. I had the pleasure of serving as Vice Chair of the American Board of Preventive Medicine for about nine years, working with Judith and John and others, and we saw over that timeframe about a 50% reduction in folks sitting for the boards. With my hat on as Medical Director for Procter & Gamble, it's becoming increasing difficult to find physicians who are schooled in the art of health and safety, and particularly the regulatory response, to provide the insight to our clinics and our employee populations. I could be wrong but one of the largest opportunities that I have seen over time is the difference that preventive medicine training programs—occupational, preventive and aerospace—have from a funding perspective vis-à-vis other residencies. And occupational medicine, and John and Judith could probably give you better details than my poor memory can, depends on NIOSH training grants and similar funding to a much greater degree than any similar programs. We don't get the Medicare funding for these training programs. So as NIOSH funding decreases, the programs dry up, the pipeline

dries up, and the pipeline is almost at the point where that critical mass necessary to have a vibrant community is at risk.

PARTICIPANT: I think it is at that point, frankly.

DR. ROGERS: Yes, I agree.

PARTICIPANT: Just to add to what everyone said and Dr. Piacentino said, as a program director, I think one of the biggest challenges for program directors is funding. I just came from the RAC meeting from one of the programs, a prestigious program, and they were saying, I think for the first time, that we may not be accepting anyone this year because we are not sure that we are having funding. So we can't accept someone and then when they show up, say oh, sorry, by the way, we didn't get funding. I know that the NIOSH funding has dropped tremendously and there is HRSA funding, which actually was quite robust but it only funded a few programs, and I know that at least one program lost funding from HRSA this year in terms of some of their residents. So I think it's a little bit demoralizing for program directors that I talk to because they are all-in, they want to do this, then they have no funding. And then also another situation which I think is going to be remedied is the ACGME, which is the Accreditation Council for Graduate Medical Education, which governs what we do in terms of educating people, and the ABPM, which governs the exam, at least for occ med, the requirements have not been aligned over the past five years. So that's been a source of frustration for program directors.

DR. ROGERS: Say that again.

PARTICIPANT: Their requirements have not been aligned. So the ACGME will say we need this, the ABPM will say we need this, and then the program director is saying, well—

DR. ROGERS: And what happens then?

PARTICIPANT: Well, then you have to do a dance to figure out how to make both happy. And then sometimes the requirements are a little vague and then they go, oh well, we meant this. I don't want to necessarily focus on that but it's just a lot of little things that affect residency programs for doctors and, at least in my experience being—the program directors meet on an annual basis at the conference, and we've had quite a few of them move on and they just said I can't do this any more. And I also feel like as occupational medicine physicians—I don't know if other people in the room feel that way—no one knows what you do. They go oh, you mean occupational therapy? And I just feel like as a group, we just need to represent ourselves in a light, in a true light of what we really do, which is amazing I think. I am in the field, I changed from internal medicine, but I feel like we need to get it out there, and we talk about critical mass, and I'm concerned about that. And I am concerned about people training to be academic occupational medicine, whether it's in the nursing or medicine. We had a nursing program at Penn—we no longer have it—for PhDs. It's just a little sad.

DR. REDINGER: Thanks, Bonnie. Charles Redinger. Bonnie and Margaret, it might make sense to

have this be a topic to get a future meeting, like the state of the profession maybe. With all that's been said, I am sure there's some folk in NIOSH who really have a pulse on this. In the circles I run in, which are narrow compared to the wideness of what's in this room, of industrial hygiene, there are similar sort of statistics with IH programs, and Mark might jump in on this with Berkeley. But certainly at Michigan, just going to alumni rah-rah stuff, is hearing about that enrolments have been down and that even—everywhere—and that there's in some circles even using different labels to define industrial hygiene and say "exposure science". So that's an intriguing thing. So in our different domains of public health or occupational health, what are some of the trends of is it exposure science maybe now and not industrial hygiene? But that I think would be a real robust topic at one of our meetings.

DR. ROGERS: Yes, my question, I didn't know it was going to prompt this sort of major discussion, was just an innocent question about interdisciplinary stuff. But I think, and we're going to have to move on anyway, but I think that is important. And then also, and Allen, I think you and I have talked—or at least I know I've talked with Elizabeth—about this too is where community colleges fit in as well, because we do nothing. And I don't mean nothing in terms of nothing-nothing, but we do very little in terms of education with community college people, whether it's a professional group. But if you look at community colleges, there are very few programs. I don't even know of—I know in North Carolina we have nothing in terms of occupational safety and health types of programs in community colleges, and I don't know how true that is across the country but I think it's a big missed opportunity for us, particularly when you go to work sites and the people who are responsible for occupational safety and health have never been educated in occupational safety and health. And I'm not talking about the professional crowd, but it is what it is. So you've got the history major or the English major or whatever, and they've been thrown into this position, and we need to do something with that I think. It's just an important group of people who are being educated in community colleges because they don't want to go to a four-year program, and they don't need to. They're out there to make a living, and we need to pay attention to that a little bit. Let's take two more comments. John, I know you've been chomping at the bit.

DR. CULVENOR: Bonnie, I realize you want to move on but this is alarming and it's serious and we are at the other end of it in Australia. It began probably 20 years ago and it really is alarming to hear this. We entered a spiral of destruction of education. There were policy settings that caused it and continue to cause it, and if you act now, everyone's interested in it. You said you didn't realize it was going to be interesting. If one realizes it's important, well, treat it as being important because we're out the other end of it and it's no good.

DR. ROGERS: Oh, good. Thank you. Terry?

DR. BUNN: Yes, Terry Bunn. I would just like to have us consider a whole set of thoughts actually on the critical state of occupational safety and health professions overall, a broad category, and trends over time.

DR. ROGERS: Exactly.

DR. BUNN: And projected trends in the next five, ten years.

DR. ROGERS: Even longer.

DR. BUNN: It's grim.

DR. ROGERS: It is grim. John, is that something that you would be…?

DR. PIACENTINO: Yes, we would be happy to arrange, organize a meeting to discuss this. I just wanted to have Grace—you guys are going to do all professions, trends over time and projections, right?

DR. LEMASTERS: Right, I would starting in the Seventies forward, and look at the numbers in nursing, IH, occupational medicine, key elements. Looking at trends over time and then projected if we continue on the track we're on.

DR. REDINGER: Grace, the Sixties might also make sense if the data are there, just because I think there's a bump with OSHA in the Seventies.

DR. LEMASTERS: Okay, I'd go with that. Sixties.

DR. ROGERS: It would also leave time too for discussion of possible brainstorming of strategies. There's so many hands going up; we'll schedule a week meeting for this topic. I thought there was like a lull in the conversation and I thought, well, let me ask this important question since Charles brought it up, but we have no minutes left. Let's see who has not spoken.

DR. GRUDEN: MaryAnn Gruden. One final comment might be not only to look at the trends but what can we do, how can we use the expertise from the folks who are retiring. Are there creative ways that we can tap into their expertise? And maybe they don't want to work full-time. Maybe there is a way to do job share or whatever.

PARTICIPANT: Or to teach. They could teach.

DR. ROGERS: One comment from the phone? Or I shouldn't say one but anybody on the phone, because I don't get to see your face so I can't tell. Good, Mark.

DR. NICAS: Mark Nicas. Just what Charles has said, that you see Berkeley—the only reason there continues to be an IH program at UC Berkeley is because there's NIOSH funding. And if that NIOSH funding goes away from Berkeley but beyond Berkeley, the other IH programs, as it decreases, guaranteed so will the number of students. It's just the way it is. There's no other funding source that the states are putting into it, and to believe that they are is a fantasy.

DR. ROGERS: Well, the whole thing is pretty interesting actually. So we'll plan for that, Alberto, and all right.

DR. COURTNEY: Bonnie, this is Ted Courtney.

DR. ROGERS: All right, Ted.

DR. COURTNEY: Just want to toss in that in this discussion, whenever we are at that point together in the future, just to see if we can loop a guest in from ORC. I think they might be

able to provide some intriguing perspective from the sites that they're interacting with in industry.

DR. ROGERS: Ted, what is ORC?

DR. COURTNEY: ORC is, I would think the folks hopefully would be familiar with it. It's essentially kind of a go-between. There's a number of major member companies. There are three or four people that are in DC that are part of the office there that regularly interact with the large employers and deal with the health and safety issues around these issues.

DR. ROGERS: Okay, thank you and yes, I think that will be really great to have this discussion and expand some thinking on this rather than just focusing on what we're doing now, but really looking I think, as you were saying, Grace, to the future and it's really probably not just five years out; it's more like ten or twenty, as we think about it. Margaret.

DR. KITT: I was just going to say we might want, after we do some presentations and have a discussion on it, if you wanted a subcommittee that wanted to help us address it, that would help put some real focus on it for the group.

DR. ROGERS: And I think as John from Australia is saying, I think it's really—they are kind of scary comments and I think as Mark is saying too, the issue of funding is so, so critical. It's really…

DR. CULVENOR: We are there, and you don't want to go there.

DR. ROGERS: Yes.

DR. LEMASTERS: What do you mean by you are there? You mean you have no programs?

DR. CULVENOR: There is a growth in industrial interests in occupational health and safety, and you would think that would correlate with a growth in education in ergonomics, human factors, it's often perceived as one and the same thing, industrial hygiene, occupational therapy and the like. And yet they've gone in reverse. Those that were emerging and growing are shrinking. Those that start, stop. There's two policy reasons for this. They could be readily changed but there is no motivation to change them, and so it doesn't happen. And there is a huge loss in capability and certainly no gain. It's alarming to hear you talking about this but the good news is, I think you are nowhere near as far down the track of destruction as we are, and you can act at this point and prevent it.

DR. ROGERS: Okay, well, thank you all for the conversation, and unfortunately we do have to move on, so…

DR. LEMASTERS: I'll email you.

DR. ROGERS: All right, thank you.

PARTICIPANT: I'm so sorry. I didn't realize it was going to be a…

PARTICIPANT: Good job,

STOCKPILED SURGICAL GOWNS AND RESPIRATORS

DR. ROGERS: Susan? So Susan is going to be talking stockpiling surgical gowns and respirators.

DR. MOORE: Thank you, everyone, for coming this morning. I am actually really excited to present on this particular topic. I'd like to start out by acknowledging the project officer that leads this work, Dr. Lee Greenawald. She is with me at the National Personal Protective Technology Laboratory here at NIOSH. She is in our Morgantown office and I am in the Pittsburgh office along with the rest of the project team.

Just a little bit about the National Personal Protective Technology Lab, or NPPTL as I will refer to us from hereon. We were created by NIOSH in 2001 at the request of Congress. We are a standalone division within the NIOSH structure, and we have been given a very focused PPE-related mission. We are to reduce work-related injuries, illness and death by advancing the state of knowledge and application of personal protective technologies.

The CDC's Office of Public Health Preparedness and Response recently funded us to specifically look at exploring the effect of stockpiling conditions such as time in storage, temperature and humidity will have on the performance of PPE products that we rely on to protect workers from bloodborne pathogens and from infectious airborne particulates. So we are talking about high-level surgical gowns for this study and particulate air-purifying respirators.

So the question might be, well, why are the CDC and NPPTL and NIOSH so interested in this particular issue? So the fact is, we rely—or 18 million healthcare workers and our public will rely—on these stockpiled facilities in the event of pandemics. And we already know from recent pandemics that what we see is a supply chain disruption. So suddenly there's a huge spike in demand and then there's not enough product to go around on the open market so we have to dip into these stockpiles. But what we've also become aware of, and when I'm talking about stockpiles, I'm talking about PPE that's being stored at the county level, the hospital level, the city level, the state level and yes, the federal level. So there's a lot of different entities out there stockpiling product. And the fact is, this stockpiled product would account for maybe about 20% of what we might need in a large-scale event. The problem is, we see all these different entities being engaged to help with this process and they all have a very, very different level of resources. So with different levels of resources, what we're seeing are different types of conditions that the products are being stored in, and we have absolutely no data right now, no robust dataset, to tell us whether or not these products that are being stored right now are going to remain protective.

The other issue that we're seeing is shelf life. Now in some cases, we see PPE products that are in these facilities and there is no established shelf life for them. So we have facilities asking us questions. Well, how long can I keep it? It is still going to be good in 10, 15, 20, 30 years? We might have to turn this product over. Because there's a cost involved for them. They don't want to turn the product over unless they have to. The other side of this that we're seeing is, let's face it, these

products have been manufactured for a just-in-time use scenario. The manufacturers never intended to manufacture these products to have them stored for over a decade in some stockpile facility.

So as we are starting to become more and more aware of this concern with stockpiles, what we are seeing is manufacturers becoming concerned about their liability concerns on that side and saying, well, I need to put a shelf life on a product if I haven't already because I need to make sure this product will remain protective if you are going to store it for these times. So we are starting to see shelf lives being put on. So now this means product might have to get turned over even faster than some of these facilities anticipated and the truth is from a research perspective, we don't really have seriously advanced aging methodologies in place for these types of products. So it's a very not super-mature area of research.

So this is where we are as a nation sitting there thinking, well, what are we going to do? Are these products going to be protective? What does it look like from a cost perspective and emergency response planning perspective to turn the product over?

No, I want to take a moment to acknowledge this is not the first effort that NPPTL has gotten involved in related to stockpile issues and it's not the first effort that we've worked with the CDC on to address stockpile issues. So back when some of the early supply chain issues started becoming evident, we worked at looking at respirators for reuse and extended use, to see what kind of guidance we could give there. We've already been in contact about face shields that have absolutely no shelf life and asking for some guidance if these face shields might be considered protective. We also are looking at doing research right now to look at modelling techniques to help with this advanced aging research area. And also, we are looking at the use of elastomerics, which is a multiuse respirator type, to see if having a multiuse product could help when there's a shortage. So these are all the different things we have invested in, we are investing in, in this area. So it's not new that we're getting in the game. It's not new that the CDC is working with us on it. But what is new is this particular project.

So the objective of this particular project is to provide evidence-based recommendations for particulate air-purifying respirators and Level 3 and 4 surgical gowns, and specifically we want to provide recommendations in three areas. The first area is around shelf life. We want to provide some research and information around shelf life, specifically when it comes to being stockpiled. Best practices for storage practices—we want to be able to provide evidenced recommendations around storage practices. And the third one, which will take a little explanation, is post-market conformity assessment at the point of use. So not everyone in the room is really intimately involved in the PPE world so I want to take a minute to make sure everyone knows what those terms mean.

MR. GARCIA: I'm sorry, Susan. Can everybody on the phone please mute your microphone? We're getting a lot of feedback in Susan's presentation.

DR. MOORE: Okay. So the third thing – I want to just define some of these terms. All right, so conformity assessment, it's very simple and simply means that a process was used to ensure that a product conforms to an established performance requirement – conformity assessment. The post-market piece means that we're looking at products that had already reached the marketplace, so it's a product already in the marketplace and we want to ensure that it meets or conforms to the performance standards. And the last piece there, at the point-of-use, really there's two types of post-market conformity assessment that we see. One type is what we call a product audit. A product audit is when you purchase a product off the open marketplace from the distributor or the manufacturer and you test it immediately to see if it conforms to those requirements. If it doesn't, that's a sign that there's a problem in your manufacturing or distribution cycle. If you take a product from the point-of-use, okay, you're in the field, and you then test and evaluate it, what you're really looking at is, under use conditions, does the product remain protective? So where you would see this kind of conformity assessment would be for multi-use products, so can be used multiple times at the point-of-use, so there's care and maintenance involved; or products that have been stored for very long periods of time before they're actually going to be used. So stockpile type things on a Navy ship, if they're having escape respirators, in mines for escape respirators, that's where you might see a point-of-use post-market conformity assessment. So the thing that we're looking for here is we want to provide evidence-based recommendations to help guide stockpile managers in how they can, for a cost-effective way, sample their own inventory, test it for what the most important things might be, and give themselves confidence that their facility and their conditions are going to ensure the products they house are protective. And so the objective has three pieces that we'd like to provide evidence-based recommendations for. That's the shelf-life, storage practices, and how you might go about doing this kind of a conformity assessment in the post-market.
We have three specific aims for this study. The first one would be to develop a sampling protocol that we could apply for any of these different types of facilities, and then actually collect products from a number of collaborating facilities. We then want to test and evaluate—oh, I guess we're getting some feedback again.

PARTICIPANT: No, I think it's somebody's phone.

DR. MOORE: Oh. We want to test and evaluate the APRs and the surgical gowns that we have collected from the stockpiles. Again, we're looking for stockpiles that would be representative of what's common in the United States. And then for the respirators, you know, it's actually part of the performance requirements, they're tested to certain standards, but to test for fit is not part of the performance standard, that's part of an OSHA requirement. So we have included that, so we're

not just testing the respirators to the performance standards, we're also testing them to make sure that a fit can be maintained. And then the third step is analyzing and interpreting the data, looking to see if the performance of the respirators and the gowns under common stockpile conditions, what does it look like over time and also what factors might we be able to identify that are contributing to degradation over time when in a storage facility?

So to do this study, what we first did is we convened a NIOSH PPE stockpile partnership. I just want to take a minute here and talk about who our partners are working on this effort. The first kickoff meeting for the partnership happened in April of this past year. You can see there's a number of federal agencies involved. Within the HHS, we have the Assistant Secretary for Preparedness and Response, ASPR. We also have CDC's Influenza Coordination Unit and the CDC's Strategic National Stockpile. Of course, NIOSH. We also have the FDA, we are working with the surgical gowns and with the respirator piece for healthcare workers, so we're working with the FDA and OSHA. We also have representation from state, county, hospital, and city stockpiles to sort of get that diverse perspective of what resourcing looks like for those particular entities. And we have included a manufacturer's association, the International Safety Equipment Association to represent a manufacturer's perspective. And The Joint Commission has also joined our partnership.

So what we did first, we pulled this partnership together and we talked about what the sampling strategy and plan should look like. We got input from the partnership. We also did a Federal Register notice to get input from the public. And we thank our partners very much because they really helped distribute that and promote the Federal Register, so we got more responses than we had planned. They connected us with stockpile facilities so that we could interview some of the stockpile managers and get an understanding of what conditions were like. And also those folks provided us with sample environmental inventory data, so we had an understanding of what true inventories look like and true conditions look like in the United States.

So with that information—

DR. REDINGER: Quick question.

DR. MOORE: Sure.

DR. REDINGER: This is a little bit outside my bandwidth. Charles Redinger. I'm aware of companies keeping stockpiles. I almost am a little embarrassed to ask the question. So agencies keep stockpiles also? Is it mainly for first responders or are there layers of, if there's—and maybe I'm jumping ahead with what you—

DR. MOORE: Nope. Let me go back. It's easiest here. So what you'll have is you'll have hospitals that will maintain their own stockpiles for their workforce. You will see counties, they may give those for their county public health workers, they may also have a plan to distribute those out to the public in an event. You also will have, at

the state level, the same thing. It could be for state workers that are responding to something. It could also be for the public. And at the federal level, we have the strategic national stockpile which would support many different needs, depending on the event.

DR. REDINGER: Great, thank you.

DR. MOORE: So with the input from all these different sources, what we identified is that there's really three different types of facilities in the US, and we based the definition of these facilities off of whether or not they were able to meet the manufacturer-recommended storage conditions for temperature and humidity. So the first group we're defining as a group that meets these recommendations. And the reason we believe they meet these recommendations is they have environmental controls in place to meet those conditions, and they can demonstrate that they meet those conditions because they maintain monitoring data that they can share to prove it. They also always tend to have a very robust documentation and SOP procedure, and they can show you any chance they may have deviated at any period of time from what those conditions are, and exactly how quickly they brought them back into place. So these are the facilities that meet the recommendations as we've defined them.

Then we have a second group of facilities we found and these facilities we've said may meet the recommendations. The reason we say they may meet is we find that there's a whole group of facilities that have few environmental controls or they actually have no controls in place, but their local ambient temperature is very mild in fluctuations and it's actually within the range of what's recommended for storage conditions by the manufacturers. So they believe that they're meeting this, even though they're not controlling for it. Some of these facilities have a little bit of monitoring data to share. Some of them have none. So they may meet the conditions. We aren't necessarily sure we can prove it.

And then there's a third category, and this is the category we're saying were really unlikely to be meeting the storage recommendations, and these are facilities that have no environmental controls in place, they're not monitoring anything, their ambient climate is definitely outside of what the manufacturer's recommended temperature and humidity storage would be. You know, we're talking about a closet in a building or a big plastic tub outside somewhere, either in the Southwest where it's really hot, or the Southeast where it's hot and humid, or the North where it gets extremely cold – definitely outside of the parameters that we're looking at, where it could be a completely unregulated warehouse in one of those facilities too. So these are the three types of facilities that we've found, and we have found collaborators that fall into each of these facilities.

So we have eight stockpile facilities that have been willing to collaborate with us on this study. Two of them fall into our "meets recommendations" category. They have provided their temperature and humidity data, and they have provided their

inventories to us. We have two that fall in the "may meet recommendations" and four that fall into the "unlikely to meet recommendations". For these six, what we've done is we've purchased data loggers, sensors, temperature and humidity sensors. We're shipping them to these facilities and they're going to put them up for 12 months. And so we will make the assumption that it's a typical 12 months, and however long those products were in, if they were in for eight years, we would assume it was eight years that represented kind of the fluctuations we saw for those 12 months. So they are getting those data loggers right now and putting those up, and they have all provided their inventories to us.

What we're doing for sampling, okay? When we look at their inventories, we are looking for where they have at least two production lots of one of the products. The reason we wanted to have two production lots is, if we find something that doesn't meet the standards, we want to be able to rule out that it was just a bad production line, so we want to have two production lines so that we can see if it's a consistent finding. So the first rule was we had to have access to two production lots within the facility. The second thing was we were looking first with respirators to find respirator models that were common amongst all the facilities. If we could find one that was common, we wanted to test it because it would allow us to do between-facility comparisons. So that was the first thing we looked at. We also came across if there was more than one size within a single facility, and we decided that, for the purpose of this study, we would take only one size. We wouldn't take multiple sizes of the same model. With the smaller facilities, what we found is, compared to the larger facilities, some unique inventories, you know, they didn't have the same types of respirators. So you're going to find that we didn't really have a lot of choices with what respirator model we were taking; we just took whatever they had. Last, our goal was actually to take respirators from three separate time points, but when we looked at the inventories, we found out that nobody had inventories in the 0 to 5 year range. You can see we have 0 to 5, 5 to 10, and greater than 10. And really that's because their inventories seem to be largely big, lump purchases and stuff that happens after a pandemic event. Everyone gets concerned, they dump a bunch of money into it, and they all get these inventories all around the same time. So you're going to notice that they all kind of got things around 2008, 2009 sort of timeframes, and they're sitting there, and that's a very consistent thing we found across all of them.

You're going to notice that I have up there, we took 53 respirators per lot. Later we're going to get into the test methods so you understand why 53 different respirators were needed from each production lot, but it just gives you an idea of the quantity that's necessary, per production lot, for each model, under each of those time point conditions.

For the surgical gowns, I would like to point out that, of the eight collaborating facilities, only five of them are stockpiling either level 3 or a level 4 gown, so we

could only get samples from five. The selection of models was very limited. Again, you pretty much are taking whatever model they have. And because it was very limited, we had multiple size options. We did decide to take multiple sizes in this case because we thought, well, perhaps there might be something different with the seaming or the tying attachments that will come through here. So we took the multiple sizes in this case. For the surgical gowns, we were able to find in the inventories all three time points represented.

So this is what it looks like. Now, I want to say this is an early study, right? We actually just sampled from the first facility in August, so just this gives you an idea though of what's coming. So of the eight facilities, if you look on the left, you're going to see the green is "meets recommendations", yellow is "may meet", and the red is "unlikely to meet the recommendations", in that far-left-hand column. And then across the top, you can see all of the different respirator models that will be included in the study and this is based on those inventories. If you look at the blue boxes, the light-shaded blue is the time range of 5 to 10 years and the dark blue is the 10 years or more scenario. So what you want to do here is—in the study, there will be 12 different models represented, so that's a good thing, because unlike a drug which might be composition-based, respirators are performance-based in how they're designed. So you can have lots of different materials and interactions that come together, and still give you meeting the performance recommendations. So we want to have a big variety of models for a study like this, so that's a good sign that we were able to get 12 different models. I want to point out that 11 of the 12 are N95 filtering face piece respirators. One of them is an elastomeric with a filtering particulate cartridge. Okay, so that's one that we were able to find. It was the only elastomeric that we had in the eight facilities.

The thing to look at when you think about the analysis part that's coming up is, if you look at—I don't know if this has the ability to point. If you look at the second column, the N95—

MR. GARCIA: You press the middle one. You press that round button in the middle, the big one.

DR. MOORE: The big button, oh, there it is. If you look at this column right here, okay, the N95 3M 1860, what you're going to see is that seven of the eight facilities stockpile that one respirator. So what that gives us the opportunity to do is do a between-facilities comparison on that particular product because, remember, our ultimate goal is to really understand how facility conditions will impact performance, so it gives us a good chance there. The other thing to recognize is that, in some of the facilities, like right here, this "may meet recommendations", there are two time points for the same model, also under some of the "unlikely to meet recommendations", so that's great because that gives us the opportunity to do a within-facilities comparison on the exact same respirator model. Okay, so these were really great things that we were able to find on the inventory we were very

happy with. If you go along each column, what you're going to see is, for the other respirator models, there are fewer between-facility comparison opportunities and within-facility comparison opportunities. The other thing you'll notice is, under the same conditions, so if you look at this first row of "meets conditions"—and this thing just doesn't light up very well. Whoa, it just went rogue. If you look at the first row with the green "meets recommendations", you're also going to notice what we have the ability to do is we'd be able to compare, under the exact same facility conditions, two or three different respirator models to see if we see any difference, and that could help us understand if the underlying materials that are used might perform differently under stockpile conditions.

I want to point out here and for the gown something that's really important. I just want to remind everyone. Manufacturers do not make these products to sit in storage for ten years plus, okay? So when we're making these comparisons, these comparisons are not to be interpreted as their product's not working, this manufacturer's product is better than that. That is not the way to interpret this. We are looking at the effect of storage conditions on products that have been proven to meet the performance requirements for their purpose, which is day-to-day use in our healthcare and other industries. So I just want to point that out for everyone listening.

In total, we will sample and test 3,710 respirators in this study.

For the level 3 and level 4 surgical gowns, there will be a total of 900 gowns that are sampled. This looks very similar. You can see that, even though we only have five facilities, they do span all three different categories. We have two that meet the recommendations, two that may meet it, and one that's unlikely to meet it. You're going to see again the gown that's stored across four of the five is the Level 3 Medline Proxima, so that allows us to do some between-facilities comparisons. For this one, we were again able to get the three time points, so you're going to see the opportunity to look at similar time points as well.

So sample collection. This is what the sampling plan is, but now sample collection. What we're doing is we're actually sending our NIOSH researchers to each facility and they will collect the information themselves, because what we've looked at is we want to find factors that might contribute to the degradation, right? So we want to be able to determine what's going on in the facility so we can note any potential factors that might contribute, so we can correlate it to what we find in the test results. We have based what these factors might be on a previous convenience sample study we did with respirators, conversations with manufacturers, and conversations with the stockpile managers.

We went to our first facility this past August, collecting items, and so the pictures that you see here are going to be from the first facility. This facility meets the recommendations. It's like the best-of-the-best type facility you're going to see. So you shouldn't expect that all the other facilities will look like the pictures you see

here. But the first thing that we're going to do at each facility is we are going to inspect the site or facility itself. In part, we want to verify that the data we received was correct and it does reflect the category we placed the stockpile in. We also want to start seeing if there's any evidence that there's other chemicals around that could be part of contamination. That's important because, while this facility is a standalone facility, there's other facilities where they lease space right next to somebody else and it's one big, open warehouse, and you have no control over what that other group in your warehouse might warehouse there. Okay, so it's important to look around and see what kind of chemicals or moisture, if there's windows that might bring in sunlight, or if there's some other activity going on that might generate a lot of dust. These are all things that we're looking for. Yes?

PARTICIPANT: I just noticed on your questionnaire, it says, everything says "potential exposure", but what if they have exposure to moisture? What if you see moisture? I mean, that's a little different than: does it have the potential? I mean, I'm sure some of these facilities, you're going to see moisture damage, right, and sunlight?

DR. MOORE: Yes, mm-hm. So we use the word "potential" because there will be some cases where we suspect, but can't hard-and-fast prove it, right? And so we want to say, even if there's the potential that we would mark "yes"—and every time we mark a "yes", we take a photo so that we would have photographic evidence to go back and refer to any of these things. So if we saw potential for chemicals, like if we saw chemicals that were shared right on the pallet right above it, and we saw that some of them were open or there were boxes torn, we would have a picture to show us exactly what it looks like. Because when we go back, anything we find that's not passing the requirements, we're going to go back and see if we can find any trends around what the facility conditions were for it, so that's why it says "potential". We won't be able to prove if it actually got exposed to a chemical.

PARTICIPANT: Well, no, you won't be able to prove if the gown or safety mask was, but you can certainly see if there's mold or water on the ground, right?

DR. MOORE: Yes, yes, and that we would mark a "yes", and we would take a picture of that, and we would note where it was relative to the pallet that we took the samples from, absolutely.

PARTICIPANT: I see.

DR. MOORE: So you can also see here, in this particular facility, they did have the temperature and humidity sensors that they claimed they had throughout the facility, so we had them show them to us and see where they were positioned. So this would be the facility inspection that we would do. The next step would be actually looking at the pallet with the sample we're interested in. So if you look at the top-right picture, what you're going to notice is there's two pallets stacked on top of each other at the topmost part of the rack, okay? So the things that would be interesting there that we'll pick up on this checklist is that topmost pallet, you'll notice that it's very, very close to a direct UV light source. So we would mark that down and we'd have

a picture to show. The other thing to notice is the far back wall is an exterior wall, so it's so close to an exterior wall, we might see a difference in the ventilation patterning that we'd want to pick up on. Other things that we noted here is the bottom pallet would fall under a pallet that was under load, okay, because it had a compressive load on top. It's very common for them to stack the pallets. These are the types of things that we'd pick up on doing a pallet inspection, also the fact that these pallets are shrink-wrapped, where that's not always the case. These are the types of things we're trying to document when we're doing the pallet inspection.

Now, just to go back here, you see this pallet and you're going to notice there's lots of different cases inside, okay? So the next step would be to cut that shrink wrap and then pull out one of those cases, okay, the case where the samples we're interested in would be located. So what we do is we look for damage to the case. Is a corner dented in? Has it been torn? Has it been opened? Is there fading on the box that might suggest light from direct UV or sunlight? We also do a tissue test for dust. We take the tissue and we wipe it across the top to see, and we take a picture of how much dust we noticed on the particular case. So these are some of the things that we're looking for and marking when we do the case inspection.

We then do the inspection of the individual box or bag. So depending on the respirator manufacturer, inside that case, they may have small boxes that will contain maybe 20, maybe 50 respirators per box, or they may have a bag that's a sleeve like this. So what we do then is we identify the specific box or bag that we will be taking our samples from and we do a similar inspection to determine if there's any issues. Maybe the bag is open, the box is torn open. We see water stains that tell us it got wet somehow. Those types of things we would mark, again, take a picture so that we have photo evidence to refer to after we see some of the results.

So after we've collected the samples, the next step is to actually bring them into our labs and do the testing. This is our testing plan, so for the respirators—remember, I said we have 53 per production lot. That's because we have to run through these seven different types of tests. But the first thing we do is we actually continue our visual inspection process and we visually inspect the specific respirator that's going to be tested for each of these test methods. We look for evidence of a weird odor, mold, dented-in nose cup, cracking straps, straps pulled away, all of those types of things we would again mark, take photographic evidence, and we keep any respirator where we saw damage, we keep it in a bag to refer to later.

You can see the other test methods that we use. These are the test methods that NIOSH uses for its certification and approval efforts for these products. The inhalation/exhalation, exhalation valve leakage, filter efficiency are all part of that.

The other thing we're going to do is quantitative fit testing so that we can see if the respirator now can keep fit after being stored in the stockpile, and if it's not able to keep fit, we're going to test the straps, do tensile testing to see if the material properties and structural properties have changed which might be causing the lack of being able to make a fitment.

For the gowns, we'll be doing the level 3 and 4. We need 50 per production lot. Again, we'll do a very similar visual inspection, we'll look at water resistance and viral penetration type tests and looking at sterility. So we've been working with the FDA on which test methods are most appropriate and they've asked us to add something on sterility, and we're still trying to figure out exactly how we would incorporate that request, so we're in a dialogue with them about that. Yes?

DR. BUNN: Yes, Terry Bunn. I was just wondering, so all of these are tested on-site?

DR. MOORE: All of these are going to be tested on-site, with the exception of, under surgical gowns, number 4, the bloodborne pathogens. We're going to go to an accredited third-party test lab for that because we don't normally do that and the effort it would take from a safety perspective to transition our lab to do that would be a lot of time and cost for just this study. There are accredited third-party labs that do this on a regular basis, so we're going to work with them to have that particular test done.

DR. BUNN: So I assume you have certain packing standards then and shipping standards to have those tested for the outside testing for that one?

DR. MOORE: Yes, well, yes, in fact, we are still working—because we have not sampled any gowns yet, so we haven't worked out what that process will look like logistically with them. But to give you an idea, when we sampled the respirators from the one facility, we literally drove them back that day in our van and dropped them right off to the facility. And we're not taking them all at once and storing them at our facility. We're taking the first piece, so we just sampled the respirators, we're testing the respirators from that first facility, and then we will go to the next facility. So we do not store them in our facility for any length of time other than the few weeks it takes us to do the testing. So when we were at the first facility, we took all the data and marked the boxes around everything that we wanted so that we could get it very quickly the next time we're back without interrupting them.

DR. NICAS: This is Mark Nicas. I'm not clear about something. Let's say for the respirators, are you saying that, when you go to a facility and collect your samples of respirators, you're not transporting them to the NIOSH lab for evaluation, you're going to transport them to a third-party evaluator?

DR. MOORE: No. The respirators, everything for the respirators will be tested at a NIOSH facility. The only thing that’s not tested at a NIOSH facility is, for the gowns, the numbered test listed number 4 there, ASTM F1671, that’s the bloodborne pathogens one. It's biopenetration and we don't normally do that at our facility. It's a lot of issues to transition to do it just for this study. It's the only one that'll be

done by a third party, accredited third-party test lab.

So with this being the test plan, I do have today—we just tested a sample of these products for the respirators in August, and so we're not complete with all the tests yet, but we do have the current results for them from this first facility. So as a reminder, this facility is one that meets the recommendations, okay? These are preliminary results. We have not gone through a process of let's sit down, let's review everything we've got, all those pieces. So all the caveats, that we are very early in this, we haven't gone through all of our sequential review of the data with the project team and everything because we haven't even finished this, but we wanted to share kind of what we're seeing and give you an idea of what types of data we will get out of the project so you understand where we might be able to go with our recommendations.

So the first thing to see here from the first facility, on the left-hand side, you can see the model and manufacturer of what we found. So there was the Gerson 1730, manufactured in 2006, in the stockpile for six years. Now, we do not have any information, that gap between when it was manufactured and when it enters the stockpile. We often don't have any idea what was going on with the respirator at that time, so it's very important that we keep track of the manufacture date and the date in the stockpile. The stockpile, may I just say, in some cases, they can tell us who they got the product from and why, but they can't tell us in all cases. For this one, we completed the visual inspection of the respirators. There was only one that we had a visual inspection concern and it had a bent-in nose clip at the top. For this particular facility, it was interesting, for their 3M 1860s, they had two that had been in the facility for eight years, but they were manufactured in different years, and so we actually took both to sample for this because one was manufactured in 2008 and one was manufactured in 2009, so we thought that might be an interesting comparison to look at, both in the facility at the same time, but a different experience potentially before coming to the facility. It could give us some information about the distribution process and where they are before they come. We saw no visual inspection concerns with those products. And the last one is the Alpha Pro Tech, manufactured in 2008, six years in the stockpile, we have not looked at these yet, so there's no information on that.

For particulate filter efficiency, exhalation resistance, and inhalation resistance, you are going to see that, for both lots from this facility, we see that every respirator so far has passed, okay? For the quantitative fit testing, what we're going to do is we will—we're getting our IRB right now, we can't do that until we actually get the approval, but what we're going to do is we will bring in subjects, buy the same respirator on the open market, see and verify that, for that subject, they can get a fit to that respirator that was purchased off the open market. That becomes the control; we verify they were able to fit this respirator. Then we will give them that same respirator model from the stockpile and see if they can

continue to have a fit, and of course we'll measure the data, and if there's any trending towards getting away from being able to be fit or not with the stockpile. So that's how we will do the fit testing. Again, I said if we find that it's not able to make a fit, we will tensile test the straps themselves, do structural material property tests, to see if significant changes in the straps might be the reason that we're not able to maintain a fit and rule that out as a reason. Yes?

DR. NICAS: Yes, I had two questions. So these are obviously binary outcomes, not your quantitative fit test data, so do you look at evidence that there's a change over time? I mean, because you have your approval testing and certification data for these models, right?

DR. MOORE: If it changes over—so you mean compared to the—

DR. NICAS: Well, in other words, your filter efficiency. I mean, you had your original filter efficiency testing and now you're looking at this filter efficiency, so do you look at that, where there's a change in time?

DR. MOORE: Yes, so actually what we're going to have is we will have controls that are purchased off the open market that we test right now. So we won't refer to our approval data. What we are going to do is we are going to purchase the products off the open market that's the same model, and we will run a control for every single one of these, we can compare then if there has been any drifting over time, and that is something we plan to do. So in addition to just the binary yes/no, we will do that piece. Just because we're not at a point yet where we can start talking about the data in that terms, I didn't want to bring it up yet today.

DR. NICAS: So last question. So are you going to do an anthropometric panel for your fit testing?

DR. MOORE: Actually we have not gotten so far as to finalize our strategy for the panel, so any advice or input that this group may have towards that is fine, we haven't finalized that.

So that's our first facility. So, you know, if we're looking at the analysis plan, I kind of tried to lead everybody down this path earlier of what within-facility and between-facility comparisons might look like. Remember we had that table with the columns and stuff, so you see now the type of data that we're going to get, you know the distribution across the facilities and how we might be doing comparisons. We're really hoping in looking at the influence on performance and fit for, you know, what type of facility, how many years since it's been manufactured, how many years it's in the facility. Was the pallet shrink-wrapped or not, does that make a difference? If it has a localized source to dust or UV or something. We would hope to be able to make some comments on these issues. With the type of data that we have from these types of facilities, we're looking to say, you know, how do the performance results we're seeing here compare to what was expected for approval and certification? Is there evidence to support extending shelf life? Is there evidence to support developing shelf life

recommendations where none exist? And what are some best practices for stockpiling? So from the data that you've seen here today from the different types of facilities, these are the types of questions we would hope to provide evidence-based recommendations around.

For a timeline perspective, we plan to have all of the respirators from all eight facilities done by November of next year and then the surgical gowns would follow in January of 2019.

Some potential considerations, so we're at the early part of this and we're here today to talk about it because really you can kind of see this data is probably going to take us in one of two directions or both directions, and there's a lot of things to be thinking about right now so that we can be prepared as an institute to offer the correct support and the type of support that the community might need from us. So here's one scenario: our data may show that, for certain facilities, there's evidence to support extending shelf life or the manufacturers will decide what their shelf life is. If that happens, you know, what role might NIOSH take in supporting a voluntary shelf life extension program for respirators or gowns? I say supporting because there's many, many different models and ways of getting there, and that would be something that might be worth just chatting about a little today is what might those different models look like? We know what voluntary shelf life extension programs look like in other areas, lessons learned from some of those models perhaps would be good to talk about. The other scenario which, again, these both could come out depending on the type of facility, we may find that the data suggests that we have a lot of stockpiled products in this country that we should not expect to be protective of healthcare workers or the general public. And if that happens, how does NIOSH help drive the need for change in emergency response planning around these products, that are distributed across the country, that people are planning to use right now, that we may find—I mean, they're spending a lot of money to maintain these products in some cases, and if they're not going to be protective or if they can't be guaranteed to be protective, what does that mean we should do to support a drive for change as an institute?

I'd like to close by acknowledging all the different contributors to this project. I mentioned already the project officer, Dr. Lee Greenawald, out of our Morgantown office. I'm the senior scientist on the project. Our statistician is Dr. Patrick Yorio. And our public health advisor is Ms. Kerri Wizner. Pat, myself, and Kerri, we're all in our Pittsburgh office. I also want to point out some of the consultants on the project and give a special thanks to Anita Patel from the CDC Influenza Coordination Unit and Sue Gorman from CDC's Strategic National Stockpile who have helped us develop the concept, get the right partners on board, and have given us feedback and support along the way. With that, I'd like to close. Yes?

DR. KITT: Thank you, Susan.

DR. BUNN: Yes, Terry Bunn. Just a couple of questions. The first one and that's a good—

well, I don't know if it's a concern, but are there standards, like manufacturer standard formulas for the production of the straps for the respirators, like they have a standard composition? Are they all this formula by the plastics manufacturer, you know?

DR. MOORE: No. So it would all be a proprietary choice. And again, the requirements are performance-based, so we don't prescribe how they would bring together their materials to reach the requirement. And so also keeping in mind that fit requirements is not part of our certification as NIOSH; that's something OSHA requires that the employer do to verify fit. I can tell you that we've done some quick analyses—I shouldn't say quick. We have done some analyses of a convenience sample in a different study and we're finding that the lengths of the straps are highly variable from the same exact model, and so because they don't have to have a specific fit to pass, that's an OSHA requirement, that's something of interest to note, that we've seen that kind of variability just in the length. So you take the material properties themselves out of it, just the length is continually changing, you're obviously changing the structural properties.

DR. BUNN: Okay. And then my second question is—this is a great testing plan and I wondered if there are any plans, or maybe it's already been done, about testing of gloves.

DR. MOORE: For gloves. Yes, so it's interesting, and right now of course the fentanyl issue is very big, what's going on, and I do know Dr. Greenawald, again, she is working—Jennifer might be able to comment a little later in her presentation, I'm giving you a heads up (inaudible @ 01:36:21). But we are looking, we, NPPTL, submitted to CDC's Office of Public Health Preparedness and Response looking for an opportunity to start testing gloves relative to the fentanyl hazard. So it's separate from this particular effort, but definitely related. So it's not looking at stockpiled stuff; it's looking at what's available on the market right now. Because really I think only one manufacturer is even sort of suggesting they claim they might address the fentanyl hazard. Is that correct?

MS. HORNSBY-MYERS: To my knowledge.

DR. MOORE: Yes, so that's a different issue there.

DR. REDINGER: Two quick questions. You may have said this and I was just reading or writing at the time, but with the timeline, you indicate the end of the testing of November 2018 and then into 2019. What about the final analysis? Maybe you said that and I just missed it.

DR. MOORE: Yes, no, so we're looking at—as far as our analysis plan, what we're going to do is, for each facility, for the respirators, we'll do a report. And we're now producing all of our post-market conformity assessment research that NPPTL is doing, it's all coming out in a new—we've got like a new format we're using so that people understand where to find it and it's called PPE CASE, Conformity Assessment Studies and Evaluations, PPE CASE. And so those reports will be coming out. So

when we complete and we get all the results for the first facility for respirators, it'll be published as a case study of that particular facility, so we'll make it available to the public at that time. We'll do the same for each subsequent facility and the gowns, and then ultimately we will write one large document that would be a NIOSH-numbered pub. that would detail all of the findings and would be like a best practices type approach. So we'd have all the results in it along with what we found for storage, stockpiling conditions, what we feel would be maybe best to recommend moving forward. And our target would be around 2020 for something like that to get out the door.

DR. REDINGER: Great. Then second quick question—and Charles Redinger, I forget about the transcript. As far as the standards, so Terry mentioned, you know, just brought up the topic of standards, and whether it's an ANSI standard, ASTM, NIOSH, or whatever, or recommendation, in that whole arena, are there any standards which talk about shelf life?

DR. MOORE: None that I'm aware of that would dictate what shelf life—I mean, shelf life really is… So first, NIOSH does not have any requirements for meeting a shelf life. NIOSH does not require manufacturers to even give us a shelf life. We recommend that they may want to consider one now that we've seen what's going on with the stockpile arena. Because at the end of the day, the manufacturers stand behind that product, and if we were to take a product that was maintained under storage conditions and it wasn't working, we would go to them and talk to them about why are you not meeting the approval requirements anymore? So, you know, they have a concern in this too. I mean, like I said, their product was never intended to be used in this way, and so they want to make sure that people understand where they think their product could be used. So it's really dependent on their decision around what they think their product could sustain as far as time and whether or not they choose to put that on. I mean, at this point, we don't have any requirements for them meeting any particular shelf life.

DR. REDINGER: Thank you.

DR. ARMENTI: Hi. Karla Armenti. What are your plans to engage the manufacturers, you know, going forward? I see them as having a role in either one of these considerations.

DR. MOORE: Absolutely. Let me go quickly and just skip back to who's on the partnership. So as a reminder, the ISEA—and Dan is behind you there. Hi, Dan. He's representing ISEA.

DR. ARMENTI: Okay, okay, no, I thought so, okay, that's the representation.

DR. MOORE: So they're on the partnership. And what we plan to do as far as making sure the partnership is engaged and has the opportunity to present back to us what they think, we plan to at least twice a year present to them the findings as we go. So we're planning maybe around a January timeframe for the second partnership meeting and that would be where we'd present to them the results from this first facility. It gives them an opportunity to comment back. The other way, because

the ISEA of course doesn't represent all manufacturers in the PPE space, from the respirator perspective, at least, we are planning to, at our upcoming November meeting that we have this November, it's a public meeting to all manufacturers involved in the respirator space, we are going to give them a heads up that this project is going on and the types of information and data that might come out of it. And at the end, we always do, like, a panel discussion, we'll let them ask us questions about where this might go. We will continue to keep them updated from the respirator perspective as we go at those annual meetings. And of course we're working with the FDA and the FDA has talked to us about when and how we might share different information with different groups. So we would rely on them to help us with what the right timing and venue might be for engaging some of the other types of manufacturers for the gowns.

MS. LASZCZ-DAVIS: Chris Laszcz-Davis. Actually it follows Karla's question, are either the manufacturers or end users been involved in the conceptual design of this whole project? I mean, I hear report-outs, but were they involved on the front end?

DR. MOORE: Yes, so this partnership which included the ISEA and it includes… So we met with them in April, and what we did is we had a written sampling and analysis plan that was like 15 pages long, very detailed. It wasn't like a quick, cursory thing. It was a very, very detailed explanation of what we want to sample, how we want to sample, and what we did. We gave it to all of them in a written form. We presented to them, we gave an hour presentation of what the study design and our intent was, and then they were all given, from each organization, not each individual, each organization represented here was then given a written document that they gave us like a peer review of their thoughts. And so it was anonymous to us. Our Associate Director for Science at NPPTL handled it. And they would give us their comments. We asked about 12 different questions about the study design and they gave us feedback on what their concerns were.

DR. ROGERS: Comments from the phone? Mark, when you asked the question, whatever you were asking, I was curious because the issue of the ANSI standard that's being worked on, if you could comment on that relative to this as well, I mean, if you're able to?

DR. NICAS: Sure. So what Bonnie is referring to is that there is an ANSI Z88.15 subcommittee. Z88 is the ANSI respirator committee, and Z88.15 is a subcommittee that was formed to consider issues of respirator fit capability for half mask respirators. And I'm not sure of the whole history, but really it was kind of meant in a way to advise NIOSH on how it should proceed and making sure that half mask respirators that are marketed in the US have some kind of minimum measure of fit capability for wearers. And so it was long-recognized for the last 40 years, that when you're evaluating the fit of a respirator on people, that you should be evaluating it on an anthropometrically-representative panel because many different people in the population could wear this respirator. So you

now have manufacturers usually make several sizes of the same model of respirator so they'll fit small, medium, large faces. So the subcommittee is sort of wrestling with the idea of what is the criterion for adequate respirator fit capability? So I'll leave it at that. I have my own views and other people have their own views. So it enters into this in the sense that, you know, when you're evaluating the fit capability of these respirators in storage, what criterion are you going to use? I mean, you just don't take one person and do a respirator fit test and say, "Hey, you know, that certainly looks good," but, you know, you want to test it on a number of people. And so I didn't know what you had in mind.

DR. MOORE: So coming back to your original comment and to your comment, Bonnie, really what we're looking at is, when we do the actual study design for the fit test, the question is going to be: well, you know, are we just basically going to look for the first ten subjects that fit to the control and then see if they fit to the one that came from the stockpile, or are we going to find—and I use the number ten arbitrarily—are we going to find ten subjects that represent the distribution of anthropometry that fit and then check to make sure they fit? And so we haven't really gotten into that discussion yet. I would say though, in this case, we have to keep in mind this is research and not something for approval and certification. And so the research question here is does it affect fit? So my personal response in this moment, not having talked to the project team, would be I don't think it would be necessary to have the full anthropometric panel for this research project to answer this question. I completely recognize the importance that's going on in that work relative to the approval and certification piece. That would be my initial reaction.

DR. NICAS: So the original reason I raised my hand was to ask a question. So I'm sure that a large manufacturer like 3M is well aware that its respirators are stockpiled, and given that knowledge, I'm wondering have any of these manufacturers done their own research on the maintenance of the effectiveness of their respirators under storage conditions? And if so, have they shared that data with you?

DR. MOORE: Yes, so a really good question and there was so much to get into this, we didn't want to get into it. The real question here is, well, of the ones you have, you said some have shelf lives and some don't. Do any of yours have a shelf life? So of the 12 models—because this has become more of a recent issue, right? And if you take a look, these things, ultimately, on the other chart, we were seeing they were manufactured 2006, 2007, 2008. It's a more contemporary issue we're facing. So what we found, for example, with 3M and 1860, I think it was either 2012 or 2013 that, in light of what was going on, they published a notice to all of their users that they considered a shelf life of five years for this product, so they were considering it to be a five-year shelf life. So in that case, if you take that five-year shelf life, then they have products here that have exceeded the shelf life. So across the board, what we have is at the time these products were made, none of them had shelf life criteria associated with them. Since then, some manufacturers have

provided shelf life. In general, not speaking to this specific population, but in general, shelf life designations that, when the respirator manufacturer does provide one, they range somewhere from two to nine years. So you might say on average they use five, but that's not a guarantee. It ranges from around two to nine years.

DR. NICAS: But are those years based on data? I mean, I'm no lawyer, but if I were a respirator manufacturer, I wouldn't be recommending a shelf life of nine years without any data, just based on sitting around a table and saying, "Yes, what years do you think we should assign to that?"

DR. MOORE: So I can't speak to the specific data that they may or may not have. Obviously they understand what their liability issues would be if they were not accurate in their statements. I can tell you that we recognize and the respirator community recognizes that bottom right-hand bullet, that advanced aging methods used to help establish it really are not in a mature science state, and for that reason, we currently have a study being led by Dr. Dana Rottach where he is specifically looking at developing models and things to help better predict those issues. So that should tell you something, that people recognize it's an area of science that needs more research. I cannot tell you how they've arrived at their current designations.

PARTICIPANT: (Inaudible @ 01:48:13).

DR. MOORE: I believe Dana has and I can't answer the question. I don't know, Dana, are you on the phone?

DR. ROGERS: Guess not.

DR. NICAS: I would imagine they would've provided it in a confidential manner. I'm just wondering if they provided it at all.

DR. MOORE: So they've provided no data. They may have anecdotally over the phone said, "Based on this…" Yes.

DR. ROGERS: Other comments or questions?

DR. BYRD: I do have one question. This is Lamont Byrd. In looking at the stockpiling facilities that did not meet the criteria, were any of them—I think you used an example of stored in a closet. Were any of these facilities, you know, that basic?

DR. MOORE: Yes. We have one facility where it is a broom closet. It's a county, it's a county-level facility, it's their office, and they stockpile it in a broom closet with all the cleaning agents and things like that. We haven't gone there yet to collect our pictures, so I can't say if there's any chance of chemicals contamination or anything like that; we haven't gone yet. But we do know it's simply an air-conditioned office with a broom closet, all their cleaning chemicals, custodial stuff is kept in the same closet, and they've got a couple boxes in there.

DR. BYRD: Yes, the reason why I ask is because you mentioned—I looked at who you targeted in terms of stockpiling, but I think as Charles Redinger indicated, there are companies that stockpile, there are other organizations that stockpile, and so I

think that the information you gather in this research would be really useful to those other kind of organizations.

DR. MOORE: And while I'm not going to release who the stockpile partners are, I can tell you that we have stockpile facilities that—so for example, we have represented large, economically wealthy states in the population. We have counties that may have economic challenges. We have a state that is not a large economic powerhouse that's involved in the study. We have geographically very dispersed participation.

DR. ROGERS: Yes, I think it's really interesting to hear all of this with these partner people that you have. I assume this means that these hospital stockpiles, that you're getting the stuff from them.

DR. MOORE: No.

DR. ROGERS: You're not?

DR. MOORE: So the partners are different from the collaborating facilities. It should not be assumed that, if they're a partner, they're one of the facilities we took from. That's not to say we didn't collaborate with any of the partners on that, but it should not be assumed that all of the facilities up here are collaborators. Those people are on the partnership to represent the perspective of those entities, to give us feedback on the sampling plan, and just helping to understand how the results might impact what they do, or helping to understand how we might be able to draw recommendations that are practical and realistic for implementation.

DR. ROGERS: So the facilities then, are they all hospitals?

DR. MOORE: The collaborating facilities?

DR. ROGERS: Yes.

DR. MOORE: No.

DR. ROGERS: What are they?

DR. MOORE: We have facilities at the county level. We have facilities at a state level. We have facilities at a federal level. We have a facility that would fall into the hospital level. That's how it would distribute.

DR. ROGERS: But would you have like nursing homes or home health care or anything like that?

DR. MOORE: They would not…

DR. ROGERS: They would not be there?

DR. MOORE: No, I don't believe the one hospital-related facility, I don't believe the sample would come from there. We haven't been there yet, so I can't answer that question about the one facility.

DR. ROGERS: And would you consider a place like Home Depot as a stockpile facility?

DR. MOORE: Well, it depends on how long the product would stay with them and how quickly it moves off the shelf. So they could potentially be in certain communities, perhaps, if they keep products for that period of time. I think what's important is, because we have found contributors that meet all three of the scenarios, what we'll be able to say is what happens when you're unlikely to meet these requirements, what happens if you kind of maybe can, but can't guarantee it? And we will go there

and we will know what their conditions are. Remember, we're sending them data loggers, so even if they can't tell us, we'll be able to know over a 12-month period what's really happening in that facility. So what ultimately I see happening is, when we get to that large document that provides recommendations, is these different facilities, we would give them enough information for them to figure out where they fall, understand what their conditions are, and whether or not there's an issue of concern. Great point, though, as we get into that and we start talking about what the implications are of our findings, these large do-it-yourself places where people in the public may go to get these products, we would have to consider that. Now, we are working with the CDC right now on a study where we're looking at can the public be provided everyday items like bandanas and things like that to help reduce exposure in a large-scale event? So we are actually, my understanding, although I'm not familiar too much with that study, is that we are purchasing it from them so it would come from their shelves, but I don't know that the study design would allow for that kind of analysis. I can't speak to that.

DR. ROGERS: Thank you. Okay, I think we're at the end of the discussion and we do need to wrap it up here, but thank you for that really, really good presentation.

MR. COURTNEY: Bonnie, before we leave—this is Ted Courtney.

DR. ROGERS: Go on, Ted.

MR. COURTNEY: Are you guys there?

DR. ROGERS: Yes, we're here.

MR. COURTNEY: I'm sorry. I just wanted to kick in, it's a little bit of an extension of this project, I think, but just something to kind of bring forward. When the materials are retired or kind of ruled ineligible, kind of where do they go? You know, do they pop up in a developing country? You know, (inaudible @ 01:54:18)? But even more importantly, is there a resource recovery, waste stream elimination opportunity here as these things are retired without having been unboxed? Is there a way for that to be some kind of a positive economic proposition to kind of setting more rigor into the retirement process? So just something to think about on the end of the project.

DR. MOORE: Yes, thank you. It's a great comment. I will say, while not an official partner, CDC's Remote Countries Office, I think it used to be the West Africa Office, their name has changed, I think it's now Remote Countries Office, they're not an official partner because we were focused on US stockpiles, but they are in contact with us and we told them we'd share the results and understand what the international implications of the results might be. So hopefully your concern about them ending up on the international market for third-world countries or something would be addressed by communications with them, although they're not an official partner because we were focused on US-based stockpiles.

DR. ROGERS: Thank you, Susan.

MR. COURTNEY: Right, and that’s kind of taking the negative angle. And the positive angle side,

like I'm saying, there may be some opportunity that works out well for resource recovery, materials recovery from this stockpiled material that makes it a more economically advantageous proposition for people to be more rigorous about the retirement process, which is advantageous to protection overall.

DR. MOORE: Yes, and hopefully maybe with conversations through the ISEA's representation and also through the public meetings we have with these respirator manufacturers, they might be able to let us know if a recycling option would somehow reduce their costs, that it would be helpful, or maybe if products get recycled, maybe they can be purchased again at a lower cost or something. That could be something that we can explore with them as a—I think that comes into the second question of what do we do if we find some of the products aren't protective for driving a change in emergency response? And what you've given us is one pathway to consider for how we, NIOSH, can help drive and facilitate something that's going to help the PPE community and the practical reality of it, so thank you.

DR. ROGERS: Okay, we'll take a break here and I think we'll just come back at 10:35 because we have an early lunch. Okay.

[Break.]

DR. ROGERS: So we'll go ahead and start. Ted and Sharon, are you still on? Maybe they're still in the bathroom. If you don't mind, I'd like to make a couple of announcements just before, since Dr. Howard is here. Well, two things, I mentioned I wanted to make an announcement, but I have two announcements now to make. So welcome.

DR. HOWARD: Thank you.

DR. ROGERS: So Dr. Howard is here for those that are on the phone. We're always delighted to have you here. And I don't think we announced last time, but, you know, Dr. Howard has been elected to the Collegium Ramazzini and I wanted to let everybody know that. It's such a great thing to have Dr. Howard—he's just a wonderful person. I just can't speak highly enough of you and that's such a nice thing to have and congratulations.

DR. HOWARD: Thank you very much, and thank you for nominating me.

DR. ROGERS: You're welcome. I wasn't going to say that.

PARTICIPANT: No, it's disclosure, we're a very transparent administration now, so we disclose everything.

DR. ROGERS: But I also wanted to say, you know, when you are nominated for that, it often takes a couple times before you are elected, and Dr. Howard was elected on the first go-around, so it was really a testament to all the wonderful good work that you do.

DR. HOWARD: Thanks.

DR. ROGERS: It's really quite dramatic. And also, I wanted to also announce that Alberto has disclosed that he became a citizen of the United States.

[Applause.]

DR. ROGERS: And we're so delighted to have you as a citizen of the US. It's great. And Alberto does wonderful work as well. And I told him I wanted a flag like that, because he got one of those, I have to get one of those, so it's great. But congratulations.

MR. GARCIA: Thank you.

DR. ROGERS: That's a big accomplishment, I know that is, it's just very difficult. So anyway, those are nice awards and it's just a pleasure to have such wonderful people to work with. So anyway, we shall move on and we're going to talk about robots, I guess, Dawn.

MS. CASTILLO: We are.

DR. ROGERS: So Dawn Castillo is here and is going to be talking about robots.

NIOSH'S RESPONSE TO INCREASED USE AND COMPLEXITY OF ROBOTS

MS. CASTILLO: Terrific. Thank you, Bonnie. So good morning. I very much appreciate the opportunity to share with you our response to dramatic changes in robotics technology.

So this presentation reflects the collective work of a multi-disciplinary group of NIOSH researchers from key divisions, programs, and centers. Divisions are denoted in the parentheses in blue and they include the Division of Safety Research, which I'm affiliated with, the Division of Applied Research and Technology, Education and Information Division, Health Effects Laboratory Division, and the Pittsburgh Mining Research Division. Programs and centers are included in parentheses in red font and they include cross-sector programs of Traumatic Injury Prevention, Musculoskeletal Health, and the Healthy Workplace Design Program. Industry sector programs that are represented include Transportation, Warehousing & Utilities; Construction; Agriculture; Manufacturing; and Mining. And centers that are represented are Nanotechnology, Motor Vehicle Safety, and Sensor and Direct Reading Technology. And then finally the Prevention through Design Program is represented. This group has been meeting over the last 16 months to chart NIOSH's response to advances in robotics technology and their use in the workplace.

For the presentation, I will provide background on the issue of robots in today's and tomorrow's workplaces, provide information on a new virtual center that we are establishing to address robotics, provide information on what we've done and are planning, and I'll wrap up with questions for you to help guide us as we stand up the center.

So first the issue of increased use and complexity of robots. Tradition industrial robots have been around for decades and there are established and recognized procedures for working safely with these robots. This includes general guidance issued by NIOSH in the 1980s, later guidance issued by NIOSH specific to automated mining equipment, guidance for OSHA inspectors, a number of standards such as ANSI/Robotics Industry Association Standard on Industrial

Robotics Safety, and associated standards such as machine guarding, Underwriters Laboratories' standards for certifying robots and robotic equipment. And at the risk of oversimplification, the paradigm has been to keep industrial robots separate from human workers while the robot is performing its task.
Because worker injury data do not include codes to clearly identify injuries associated with robots, it's difficult to identify them, and ultimately we need to rely on keyword searches and manual review. We reviewed data from the Bureau of Labor Statistics' Census of Fatal Occupational Injuries and identified 61 deaths for the 20-year period of 1992 to 2015. We also identified investigations of deaths and serious injuries investigated by NIOSH and OSHA, and those investigations suggest that the injuries that we do see have resulted from failure to follow established safety procedures. In the scheme of things, this number of deaths over this time span is not large and it's dwarfed by other causes of worker injury, however, it is disturbing that these deaths continue to occur despite known protection strategies and it points to the value of increased education about established safety measures.
This figure is from the International Federation of Robotics. It demonstrates that, beginning in 2010, there has been a sharp upward trend in the supply of robots. The International Federation of Robotics further projects 12% annual growth over the next few years and a breakthrough during this time period in human-robot collaboration. They anticipate that compact and easy to use collaborative robots will drive the market, that there will be increased use by small and medium sized companies, and expanded use in sectors other than manufacturing. Finally, they anticipate increased use of robots for work that is tedious and unsafe for human workers.
Here is a picture of a new type of robot, a collaborative robot designed to work alongside and in conjunction with human workers. As noted in the previous slide, it is projected that this new type of robot, which is currently being used in manufacturing settings, is going to increase in sales in coming years. And clearly the paradigm of keeping the human worker separate from the robot does not work for this type of robot or other types that I'm going to show you in subsequent slides.
Another new application of robotics technology are wearable robotics or prostheses. They are being designed and tested for military applications and they're being marketed in industrial settings. The wearables are designed to reduce physical loads on workers and to amplify or transform worker movements. And the market for this specific technology is projected to grow by more than 200% annually over the next few years.
Another new type of robot are mobile robots designed to deliver materials in a variety of settings such as warehouses, hospitals, hotels, and retail settings. And these robots are designed to move in the same space as human workers, and in

some settings, patients, customers, clients, and the general public. The picture at the bottom of the slide notes that, in some situations, the burden is on the workers to yield the right of way to the robot.

Remote-controlled and autonomous ground vehicles are increasingly being used to conduct work that is difficult or dangerous for human workers. This includes autonomous mine haulage vehicles and self-driving tractors. Different from mobile robots used indoors, these types of robotic vehicles operate in less controlled environments and they also may include human workers or vehicles driven by humans.

This slide shows a projected trajectory for moving through phases of automated vehicle technologies, with responsibility for monitoring the environment by a human and progressively proceeding to the vehicle being in primary control. The estimated timelines for moving through this trajectory vary, though it does appear imminent, and the end game is that we would be in a society that would be completely automated vehicles without human drivers.

So partially-automated vehicles are increasingly available, and they include features such as electronic stability control and autonomous emergency braking systems, and in these systems, the human driver is in primary control. Human factors experts have expressed particular concerns about the transition from where automation takes over for extended periods of time under certain low-risk conditions, and in the case of the emergency, the system will prompt the driver to reassume control. There are questions about how quickly this can happen to avoid a crash. There are also concerns about a mixed system that includes human-controlled vehicles and autonomous vehicles, with the human-controlled being less predictable than the autonomous vehicle.

Commercial vehicles appear to be on the fast track for full automation. Autonomous commercial trucks and transit vehicles are currently being piloted in several states.

While drones have been around for some time, they've been primarily used in military settings and for recreational purposes. It is projected that sales of drones for industrial purposes are going to increase, with the highest sales projected for use in construction, agriculture, insurance claims, offshore oil/gas and refining, and use by police and fire departments. Drones are being used in pesticide application, wildfire control, construction, and crash investigations. It is also projected that they will be used in indoor settings such as in warehouses for use in taking inventories of products.

Finally, it's projected that future robots will have advanced use of artificial intelligence, be able to assess their environment, make complex decisions, and have increased autonomy. It is projected that robots will expand from blue collar to white collar and managerial jobs, and this shift exacerbates concerns and fears regarding worker displacement, though those in the robotics industry counter that

there will always be a need for human workers and these technologies will create new types of jobs.

These rapid advances in robotics technology have the potential to increase worker safety and health through expanded use of robots for work that's dangerous for humans and in the use of robotics systems to augment worker abilities. However, there are also concerns that will be addressed in subsequent slides including a likely increase in injuries. The old paradigm of keeping human workers separate from robots is not applicable for newer types of robots such as collaborative and mobile robots that work in shared space with human workers, and we will need to refine and develop new protection strategies. There are concerns that rapid advances in technology may outpace standard-setting and finally there's concerns about worker stress associated with dramatic changes in workplaces and the potential for job displacement.

As I showed you earlier, despite known protection strategies, we continue to have deaths and serious injuries of workers from contact with traditional industrial robots. Anticipated increases in sales and use of traditional robots can be expected to lead to increased injuries in future years, especially if use increases in small and medium sized businesses that will not have experience with these machines and do not have the safety and health capacity and resources of larger businesses. We have little experience with the new types of robots such as collaborative and mobile robots, and there is the potential that they may introduce new hazards for workers or exacerbate existing hazards. Since new types of robots are just now entering the market, there will be a lag period before these cases appear in our data systems and it will be important to monitor trends in injury data.

Numerous standards related to robot safety are currently being revised, including the ANSI/Robotics Industry Association's Robot Safety Standard and the Underwriters Laboratories' certification standard. Refinements are being made to encompass the collaborative and the mobile robots. There are efforts underway to develop a new standard for the wearables and to create guidance for use of automated vehicles in occupational fleets. These standards are important to foster prevention through design.

This comic illustrates fears about human workers being subservient to and replaced by robots. These fears are real, regardless of whether such forecasts are correct or overblown.

So now for how NIOSH is addressing these dramatic advances in the number and complexity of robotics technology. We are in the process of establishing a virtual Center for Occupational Robotics Research. The center will implement recommendations made by the interdivisional workgroup described early on in the presentation. And shown on this slide is a draft website under development for the center. The center's mission is to provide scientific leadership to guide the

development and use of occupational robots that enhance worker safety, health, and wellbeing. The center will address traditional robots given projected increases in their numbers and a demonstrated need to improve the use of established safety measures, and new and emerging robotics technologies including collaborative robots, mobile or coexisting robots, wearable robotics, remotely-controlled and autonomous vehicles and drones, and robots of the future which may use advanced artificial intelligence.

So given NIOSH's relatively limited resources and expertise with rapidly advancing robotics technologies, it will be critically important that we leverage our resources with others with common interests and that we prioritize our work in areas not being addressed by others. There are several federal agencies very engaged in addressing worker safety associated with robotics technologies. These include defense agencies that are developing and testing guidance for exoskeletons and automated ground and aerial vehicles, the Department of Energy which is promoting the development and testing of exoskeletons and robotics to negate the need for humans to work in hostile environments, and Transportation who is leading efforts to develop guidance and regulations for autonomous vehicles. For these situations, we will closely coordinate with those agencies to help influence their research agenda and be in position to translate their research and guidance for workers at large. On the flip side, there are several work settings and applications of robotics for which worker safety and health is being minimally addressed by other federal agencies or academic centers. This includes robotics being developed to increase productivity in construction, agriculture, and mining, the use of drones indoors such as in warehouses, and autonomous vehicle technologies in specialized vehicles such as fire trucks. We are planning to prioritize our research in these areas where worker safety and health has little attention from others and otherwise would fall through the cracks.

In addition to leveraging resources externally, the Center for Occupational Robotics Research will coordinate work with other NIOSH programs with intersecting interests. The Robotics Center's steering committee has representatives from other key NIOSH centers and efforts, and they will be responsible for this coordination. This includes a couple members who play key roles in the Nanotechnology Research Center which is building connections with the Advanced Manufacturing Initiative, a well-resourced public/private initiative that includes a couple of robotics centers. These steering committee members will have lead responsibility for facilitating connections with the Advanced Manufacturing Initiative robotics centers. Key players in the NIOSH Center for Motor Vehicle Safety are also on the Robotics Center's steering committee and will help coordinate work across those centers. Additionally, the two centers have nominally parsed out responsibility for addressing autonomous vehicle

technologies. The Center for Motor Vehicle Safety will have lead responsibility for addressing technologies on public roadways, while the Robotics Center will have the lead for ground vehicles off roadways and drones. Finally, one of the Robotics Center committee members is also a member of a workgroup looking at NIOSH's role as mines increasingly use robotics technology and become digitized. As the mining workgroup progresses, we will delineate areas of primary responsibility, as was done for the Center for Motor Vehicle Safety. Additionally, as we discussed at the start of the presentation, Robotics Steering Committee members are also affiliated with key industry sector programs including construction, agriculture, manufacturing, transportation, warehousing, utilities, and mining.

The center plans on doing its work in partnership with academic researchers, trade associations, robotics manufacturers, employers using robotics technologies, labor organizations, and other federal agencies. We have established some productive partnerships already and have plans to expand these partnerships.

Center activities include monitoring trends and injuries, evaluating robotics technologies as sources of and as interventions for workplace injuries and illnesses, establishing risk profiles for robotic workplaces, identifying research needs and conducting research, supporting the development and adoption of consensus standards, and developing and communicating best practices, guidance, and training for safe interactions between human workers and robotics technology.

I would now like to turn from the conceptual framework for the center to what we have done so far and what we are planning in the near term. As I noted previously, we have begun to establish partnerships for our work. We have been regularly participating in a National Science Foundation led interagency group that is charged with coordinating federal research and development to advance robotics and intelligence systems. Participation on this group has helped us understand the breadth of federal engagement in advancing robotics and it's been very useful in identifying federal partners with mutual interest. We have participated in a series of meetings led by the National Institute of Standards and Technology and Defense agencies exploring the potential of exoskeletons to improve worker safety and identifying potential negative consequences associated with this technology, and this work is leading toward the development of a standard for wearable robotics. We have been in regular communication with an OSHA workgroup on robotics and participated in each other's meetings to learn from each other and to identify potential collaborative work, and I'll discuss one of these collaborations in the next slide. We have also been participating in meetings led by the Department of Energy Office of Environmental Management to develop a technology roadmap that would address safety and health issues associated with cleanup of contaminated sites associated with the nuclear

weapons program. And the Robotics Industry Association is a member of the NORA Traumatic Injury Prevention Council established last year and contributed to the inclusion of a draft strategic objective to prevent injuries related to human-machine interaction for current and evolving technologies.

So Dr. Howard will be signing onto a new OSHA/NIOSH/Robotics Industry Association alliance next week. This alliance will include Robotics Industry Association training of OSHA and NIOSH staff on new robotics technologies and protection strategies, collaborative work to develop guidance materials that address new types of robots, and the identification of research and needs and opportunities for field research. I participated in a call last week with leaders of NIOSH-funded Education and Resource Centers to discuss ways in which NIOSH might help raise awareness among the centers, and we plan to continue initial discussions, we started with several academic centers, and to develop at least one memorandum of understanding per year with an academic center to identify mutual interest and set the stage for collaborative education, research, and outreach.

We have conducted preliminary analyses of the Census of Fatal Occupational Injuries which has identified an estimate of current robot-related injuries as well as very difficult coding challenges in order to be able to track these injuries in the future. We've also identified fatalities investigated by the NIOSH Fatality Assessment and Control Evaluation Program, or FACE, and deaths or serious injuries investigated by OSHA, and a link has been added to the NIOSH FACE webpage to identify robot-related cases.

Per a request from the Bureau of Labor Statistics, NIOSH surveillance experts are currently reviewing the Occupational Injury and Illness Coding structure, or OIICS, used by BLS and others, and we'll be making recommendations for modifications to that structure, and our plan is to include recommendations to address challenges in being able to identify and monitor robot-related injuries. We plan on publishing injury summaries using existing data and we are interested in conducting FACE investigations for events involving new types of robots. This will be dependent on the identification of cases, cooperation from employers, and preferably cooperation from manufacturers.

NIOSH staff are participating on several committees and groups that are addressing robot safety. This includes the ANSI/Robotics Industry Association robot safety standards, ANSI standards on machine and construction safety, and under development, ANSI/ASSE fleet safety standard technical report with recommendations to employers for managing fleets with autonomous vehicle technologies, and meetings to start development of an ASTM standard on exoskeletons.

PARTICIPANT: Quick question. Do you know whether ISO is in this space?

MS. CASTILLO: ISO is very much in this space.

PARTICIPANT: Has ISO started a technical committee?

MS. CASTILLO: So ISO has a technical report with guidance for the collaborative robots, and so one piece of empirical research behind that was they incorporated data on tolerance for pain, so they did research to, you know, identify how much contact there could be and how much pain, and that's incorporated into the ISO standard, and then the US standards are utilizing that ISO standard.

PARTICIPANT: Thank you.

MS. CASTILLO: Yes. So steering committee members for the Center for Occupational Robotics Research are connected with several NORA councils and other NIOSH programs and have influenced the inclusion of robotic research needs and some NORA agendas and the draft NIOSH strategic plan. The agenda developed by the NORA manufacturing council, which is currently out for public comment, includes the need for research to examine emerging risks from new technologies and explore ways in which new technologies can advance occupational safety and health in manufacturing. Other draft agendas that will be posted for public comment in the near future similarly include research on emerging technology and robotics, including the traumatic injury prevention agenda and agendas for construction and the transportation, warehousing, utilities sector. The draft NIOSH strategic plan includes robotics-related research goals for multiple industries including agriculture, construction, mining, oil and gas, and transportation, warehousing, utilities. And for the future, we are planning on publishing a request for information to get stakeholder input on relevant ongoing research and critical research needs.

The impetus for the NIOSH workgroup on robotics was a commentary written by senior NIOSH researchers, including Dr. Howard and Frank Hearl, on trends in occupational robotics and the importance of proactively addressing potential safety and health implications for these new technologies. This commentary was published in the *Journal of Occupational and Environmental Hygiene*. These authors wrote an associated blog that was posted in November of 2015. NIOSH researchers have also posted two blogs on wearable robotics, a general article and one focused on the construction industry, and collectively these three blogs have 38 comments.

In mid-October, three NIOSH scientists will be giving a panel presentation at the National Robot Safety Conference. We're very excited about this opportunity to share our perspectives and to network with attendees at this meeting, which are largely from industry. I will also be giving an invited presentation at a continuing education meeting for occupational medicine physicians from Ohio, Western Pennsylvania, and West Virginia next month. We anticipate publication of an article authored by Dr. Howard on drones in construction. And finally, we plan on including occupational robotics research as a topic for the 2018 National Occupational Injury Research Symposium being planned for next October.

So I appreciate your attention. I hope that you have found the information useful.

The Center for Occupational Robotics Research is in its early stages of development and we would very much appreciate BSC and put in suggestions. And to help get the discussion started, we have posed four questions for your consideration. We are interested in your thoughts on refining the niche we have laid out for the center. We would appreciate your suggestions for key partnerships to pursue, and suggestions for raising awareness and engaging the occupational safety and health community, and we are interested in your thoughts on priority research questions. And with that, I will open it up for any questions or suggestions.

DR. ROGERS: Thank you, Dawn. I want to ask the people on the phone first. Ted, Sharon, do you have any comments, questions?

DR. COOPER: Yes. Hi, Dawn. Thank you for an excellent presentation and another demonstration of the essential role that NIOSH plays in studying emerging technologies. Just a couple questions. One is the most basic, and maybe I only have it, but just the nomenclature of robotics research. So when I first looked at this, I thought of the traditional robots, but I didn't think of the drones. And when you talk about refining NIOSH's niche, I wondered about providing a definition of robotics research and its breadth and depth in terms of inclusion. And my second comment was, and maybe it's not a priority research question, but eventually, as cars become more involved with this, I'm wondering about the injuries that will occur from workers renting cars and not being trained in this kind of technology, and also fleets that are bought by companies.

MS. CASTILLO: Yep, thanks, Sharon. So robot definitions, so there has been a standard definition that's been used by ISO that deals with the number of axes and movement, however, there's discussion about the need to update that definition given the new types of technology. We made a conscious decision to include the drones and the automated vehicles because the overlap of the safety and health issues, while they may not strictly meet the definition, we thought that it was important to try to leverage those resources. In terms of the issues you raised with cars and these new technologies, and I had noted that currently available cars have a number of automated vehicle technologies, and it has been shown that consumers aren't necessarily aware about the capacity and the limits of those. So our Center for Motor Vehicle Safety has been encouraging people to utilize a site that's called *My Car Does What?* to help educate you. So that would be one way of training the worker for cars, you know, a rental car that they rent or alternatively something that's part of the fleet. And then I also noted that there is an ANSI/ASSE technical report being developed with guidance for employers on how to manage occupational fleets with autonomous vehicle technologies and we're represented on that committee.

DR. COOPER: Great, thank you.

DR. ROGERS: Ted, do you have any comment?

MR. COURTNEY: Bonnie, I've got a question.

DR. ROGERS: Okay. Go ahead.

MR. COURTNEY: This is Ted, Ted Courtney. Hi, hi, Dawn. Excellent presentation. Thank you. I'm excited to see the division and the institute are getting into this phase.

MS. CASTILLO: Thank you.

MR. COURTNEY: My observations are the things that—I guess one question I have is where you have got basically (inaudible @ 00:31:17) and the sort of external exoskeleton type of thing in DOD and DOE primarily, where do wearables, if you will—let's set apart industrial hygiene monitoring equipment for a moment in that definition, but where do wearables and worker interaction with wearables fit in? Do they fit into this center or do they fit in a different location within NIOSH?

MS. CASTILLO: So the wearables do fit within this center, but we are focusing on—so there's two types of wearables. There are the ones that are automated and then there are ones that are manual. So this center is going to focus on those that include the robotics technology, though the researchers who are looking at the non-powered ones are part of the center as well and, you know, clearly, again, we want to leverage expertise and resources, but the focus here is on those that are automated. And these wearables have been piloted and being used in the military. They've also been beginning marketed to the construction industry and we are also seeing some piloted, like in Home Depot stores. There was a lot of attention a few months back to a pilot of wearables in Home Depot and it was developed by Virginia Tech researchers.

MR. COURTNEY: Great, yes, I'm aware of the pilot, actually. So my other point has to do with just, as you're developing expertise, to stay very close to the issue of machine learning and deep learning because I think one of the profound issues that's going to be developing over time is that automation is entirely one thing when the machine behaves as expected, so there are problems of the different meta models between the device or the system and the human in the system, and that's bad enough, but when you throw in machine learning, the machine's behavior in a sense cannot be learned by the human because it keeps changing. The machine behavior evolves. So I think somebody who can sort of track and can stay kind of tasked into work ongoing in machine learning, because that's definitely the direction that a lot of things are being pushed and that will mean that the automated behavior is not predictable necessarily. And that's quite an intriguing space, how humans collaborate with a system that's changing its behavior over time because it has big implications for, well, the robot did this the last time we were in this scenario and now it suddenly didn't do that. And that's kind of an important risk space, I think. The other space I'd like you guys to think about is robotic process automation, or RPA, and how that may infiltrate into safety critical systems. So while, you know, somebody might get hurt by an autonomous vehicle or a drone, if you have RPA put in a system that's safety critical, that has to do

with, let's say, emergency response or, you know, something along those lines, you could have actually a much bigger system-level risk exposure because, you know, for example, you go from human operators taking emergency calls to a box taking emergency calls or, you know, taking emergency maintenance calls and things like that, and just to what extent that sort of automation influences the safety and the sort of fragility, if you will, or resilience of those kinds of safety critical systems.

DR. REDINGER: A question for Ted. Ted, this is Charles Redinger. A question for you: when you say machine learning, is another label for that artificial intelligence, or do you think of those as being different?

MR. COURTNEY: Yes, AI is a much bigger space. I mean, machine learning is kind of a fundamental base to AI and then you can get into stuff like deep learning and, you know, it basically is just the whole idea that the system is doing its own learning which means, over time, its behavior will change. Like automatic emergency braking is going to operate very routinely and predictably, it just won't happen very often, so you won't get to sample it very much as a human, but at least, when it operates, it will tend to operate on sort of known models. With machine learning, the thing is a black box and so you don't actually know what decision the machine will make in a given situation.

MS. CASTILLO: Yes. So thank you, Ted, for those great comments. As we've built up and looked at how we're going to establish the center, one of the things that we've recognized is that we have really unique and important expertise, but within the institute and within many of our traditional partners, they don't have expertise in things such as machine learning and deep learning. So that’s one of the reasons we think that developing partnerships with academic centers, for example Carnegie Mellon, is really important so that we can leverage that. We're also looking at, you know, should we be in a position to do so, we'd like to bring in fellows from those robotics training programs to work alongside of us, so again we can take advantage of their deeper expertise in these areas.

The issue with the robotics systems, this is something that is critically important. It's not just, you know, what's been programmed into the robot, but the system that they're working in. And one of the ways that we're beginning to see this play out is that there are a couple digitized minds and we've already seen some issues within those minds on how things can go awry in terms of the parts of the system not being adequately accounted for or the sensing devices on the machines not being sophisticated, not looking, you know, in a 360. And then one of the things Dr. Howard asked me to point out is that we do also have linkages with our Direct Center for Reading and Instruments, so again, we can leverage those resources. The sensor technology is a really important piece of the robotic awareness.

DR. ROGERS: Ron?

MR. COURTNEY: Excellent, thank you.

DR. STOUT: You mentioned the ISO work on, you know, force and pain thresholds. What industry is finding is that there is probably a benefit in standardizing the measurement and the analytical approach to force. Some regulatory bodies like TÜV and others take divergent approaches to measuring force and you end up coming up with very different ways of integrating these collaborative robots. So I think a request might be from industry is to develop a standardized approach to force measurement.

MS. CASTILLO: So one of the issues, in addition to standardized methods for force measurement, there's also the shape and the size of the part of the robot that comes into contact or the item that's being held by the robot. So something that's got a blunt surface is going to require less force, but if you have something that's very sharp, you don't require much force at all to have a penetrating injury.

DR. ROGERS: Terry?

DR. BUNN: Yes, Terry Bunn. Just have a great presentation. As far as looking forward as to what key partnerships might be formed, the key research questions, just wondering, historically, what were those injuries that you observed, those 61 injuries or fatalities? What industries were they in and do you know, like, the job activities that were being performed that led to those deaths or injuries?

MS. CASTILLO: Yes, and so one of the things I'd note is that we have plans to analyze existing data, and so one of the first datasets I've asked them to look at are the investigations so that we can mine that data. Most of the traditional robots have been in manufacturing settings, auto manufacturing. From my cursory review of the circumstances, they often involve failure to follow lockout/tagout, so you're doing maintenance on the robot, you have a human in that space for that reason. The other things that have happened is you'll have a traditional robot and you'll do some type of change to the system around it, and there's gaps that come in in terms of your protective envelope, and so we've also seen some injuries that way.

DR. BUNN: Yes, because I was wondering whether they're due to robot failures, robot errors, you know, servicing, quality control issues.

MS. CASTILLO: So that's what we've seen from the cursory, but again, we need to document that. Where we've seen potential issues with these new collaborative robots, there have been examples of programming failures, yes.

DR. BUNN: Yes, so that may inform, where you're seeing those injuries, as to new partnerships that may need to be formed as well as those new research questions based on the pattern of injuries that you're seeing.

DR. ROGERS: Go ahead, Mark.

DR. NICAS: Well, I had a question, actually. Now, I know that there's collaborators in academic research and I was just wondering what kind of incorporation of health and safety awareness is currently stuck into engineering schools in terms of thinking about the design of products, because this is robotics, or the design of new products, and what awareness is being given to undergraduates about the

need for that? Because my own experience is there's pretty little awareness.

MS. CASTILLO: So that's our understanding and our impressions. I noted that we've got a few researchers who are presenting in the next couple weeks at the National Robot Safety Conference. We're looking forward to the opportunity there to learn what their exposure is. Because we have some assumptions, but we haven't had, you know, a lot of discussions with them, and so I think that will be helpful. That whole conference is focused on national robotic safety, but it doesn't include the standard players that, you know, we're all familiar with from the engineering field. So there's lots to learn still.

DR. ROGERS: Michael and then Charles.

DR. BEHM: That's a great comment. I think that also maybe textbook publishers would be a collaborator as well, too, to see what you could do to integrate… Because there's really nothing that happens…

DR. ROGERS: All right, so we have Charles, Karla, and then Lamont.

DR. REDINGER: Thanks, Bonnie. Charles Redinger. To the third bullet on raising awareness, you know, next year, next fall, the International Occupational Hygiene Association conference is going to be here in the United States and it'll be here in the DC area, and so I'm not sure if that's the first time it's ever been in the States, but that's a big deal. So there will be, gosh, a thousand occupational hygienists and safety folk here in this area. Obviously there's opportunities for papers, you know, papers, but to get with the collaborators of that event, AIHA is heading that up for IOHA, is thinking outside the box, of maybe some focus groups beyond just this topic, but also a world café model, like cutting-edge emerging issues, and maybe in the world café model, this could be one of four or five key topics that could be there. And I asked that question of Ted about AI—in reading this, and I don't know a whole lot about that other than to know what I read, it's like artificial intelligence is here and it's going to keep rocking forward. So the extent to which that space impacts here, artificial intelligence, I'm sure that's something is on your radar.

MS. CASTILLO: Yep. And thanks for the heads up about the International Industrial Hygiene Conference.

MR. COURTNEY: They're in that formative stage now. The committee is together and they're rocking and rolling.

DR. ARMENTI: Well, to ask another question about surveillance, that's what Terry and I do, I'm not familiar enough with some of this coding structure, but I'm wondering how you can better document injuries versus only fatalities. I don't know if there's information in an OSHA log that, you know, in your partnerships with OSHA, you get more information or maybe that, you know, your work with BLS is going to get to that going forward with coding. But what about the ICD-10 coding? Now there's an awful lot, you know, more detail in all of those codes and I wonder, I don't know off the top of my head, if one of them identifies a robot-related injury.

MS. CASTILLO: Yes, so right now we're focused on the occupational injury and illness coding

structure because we've got an opportunity to address it.

DR. ARMENTI: Right.

MS. CASTILLO: There are challenges in identifying fatalities, not just the non-fatal injuries, so there is no single code to identify a robot. You have different types of machines that can be robotic or non-robotic. So our experts right now are looking at it and trying to—and then we've got the issue of the definition, which I know is a bit fluid. So they're working through those issues right now, you know, coming up with—so our comments to the Bureau of Labor Statistics are due in January. We are not going to have a proposed solution, but I think what we're going to end up doing is proposing that you bring experts together to tackle this and perhaps in a baby step process.

DR. ROGERS: Lamont?

MR. BYRD: Yes, Lamont Byrd. There are a couple of other groups that you may want to consider partnering with. You didn't mention anything in terms of the autonomous vehicle work, which the Transportation Research Board is doing a lot of work on autonomous vehicles. And one of the issues, working with the Teamsters and working in the transportation industry, this is an area that is of significant concern to us, but one of the problems, a concern that we have is that legislation, especially on the state level, is outpacing technology at this point. And I think it would be helpful, you know, especially in some cases, if NIOSH could, you know, share some thoughts with some state legislators to just let them know where we are in terms of the technology, because that is a huge concern for us. In terms of some priority research questions, when we look at, for example, in autonomous vehicles, the idea of platooning, platooning is a huge issue, and at some point there will be an expectation that a driver, operator, whatever you want to call that worker who's in a trail vehicle, being vigilant enough to respond to an emergency situation. I would think it would be helpful for NIOSH to maybe take a look at how the stress of working in that kind of environment could impact on a worker.
And then one other thing is, in the vehicle world, you have these highly automated vehicles, all of this technology, and there are electromagnetic fields that are probably present in these vehicles, and what kind of impact in terms of exposure that might have on the workers who are operating these vehicles. Just a couple of ideas.

MS. CASTILLO: So thank you very much, and I will take these suggestions back, and talk with the Center for Motor Vehicle Safety, and parse out how we might handle that.

DR. ROGERS: And then Chris. I just had a couple things here. So I didn't see any information on there about industries, more of the service industry. At NC State, our ergonomic safety person has been doing robotic research in terms of medication delivery displacing nurses, really, and giving medications. And there are lots of issues, obviously, that are related to that, whether it's displacement or errors, and we have enough errors going on as it is, and I don't know if that's an issue or not an

issue. Maybe it would be better. I'm not sure. And then, you know, as we speak about the future too, I mean, is there some intention of training occupational health and safety professionals who are robots?

MS. CASTILLO: Oh, that's interesting.

DR. ROGERS: Well, I mean, it's a—

MS. CASTILLO: So the robots in the service industry, we are seeing it. And you noted healthcare, we're also seeing it in retail settings or robots that would deliver your pizza.

DR. ROGERS: In airports.

MS. CASTILLO: In airports, robocops that would be able to detect bombs. So they are popping up everywhere and it—

DR. ROGERS: I'm wondering if NIOSH is thinking—maybe Dr. Howard could say something about training robots in terms of occupational health and safety. I mean, if robots are delivering medications in a setting, is that an option for the rest of us to not—

MS. CASTILLO: We don't need to worry about the workforce of the future?

DR. ROGERS: Well, I mean, you know, I think it could be a topic in terms of the workforce of the future and then how would that work. I mean, I have no idea. But you were asking questions.

MS. CASTILLO: That has not come up with our workgroup yet.

DR. ROGERS: You were asking for questions. And then one of the other issues, and I think it's always an issue for me, being a bioethicist, that most of the time the ethical issues are not addressed.

MS. CASTILLO: So there are huge ethical issues with robots and there are groups that are beginning to address them. And it's interesting, the depth of some of these discussions. So some of the ethics that are being discussed in Europe are whether or not there should be rights for the robot. There are issues with liability. If something goes wrong with the programming of an autonomous vehicle or a robot, who is it that's responsible? Is it the manufacturer? Is it the person who's put that robot in that environment? Huge challenges.

DR. ROGERS: They are, but, I mean, when you think about suggestions for key partnerships, I mean, there really does need to be, I think on almost really every committee that NIOSH has, some ethical person that addresses many of the ethical issues that are related to research, education. And now we're talking about this AI business, and I heard on the radio, I was driving and I was, like, having a heart attack listening to it because they were talking about this artificial intelligence and that they have now—I don't even know where it was, but they were talking about they have these robots that have been programmed to, you know, make decisions that humans cannot control and they're trying to figure out how to now deal with that. So to me, that's a big ethical issues. It's kind of major. But a lot of this is stuff that happens, particularly in the healthcare environment, where you have all the technology and then the ethical ramifications come after that, and it's a problem. So anyway, that's just that. That's just food for thought. Any other thinking—Chris,

yes?

MS. LASZCZ-DAVIS: Just a real quick question. Chris Laszcz-Davis. What kind of private sector partnerships do you guys already have?

MS. CASTILLO: So the one that Dr. Howard's going to be signing next week includes the Robotics Industry Association and so that's among the first partnerships that we are extremely interested in because of their advanced knowledge and their pulse on the field, and we want to be able to leverage that to help bring us up to speed.

MS. LASZCZ-DAVIS: Well, the reason I ask is, you know, I've heard artificial intelligence being brought up, but I haven't heard virtual reality being brought up at this point yet, but, you know, partnerships with Google and others in the Silicon Valley area, they seem like logical partnerships at some point.

MS. CASTILLO: And absolutely, and that's a great suggestion. And, like, Google is connected and some of the software companies are connected to the autonomous technologies that are coming forward.

MS. LASZCZ-DAVIS: Right, right.

MS. CASTILLO: You've got people that jump ship and go and—yes. Thank you.

DR. ROGERS: Okay, any other BSC comments or questions? John?

DR. CULVENOR: Dawn, thank you. My name is John. It's a very valuable project, I think, and the kind of leadership that this organization is probably famous for and it's very worthwhile. Just a suggestion on input, we can learn a lot from failure, perhaps we can learn a lot from success as well. We all traveled up to this floor in an automated, guided vehicle, mostly very comfortable, and the reasons for that is that the elevator is one of the most standardized pieces of equipment in society. It's something I've been called to look at a bit, like many other structures and machines around us, and we're comfortable in its use because it's intuitive and we're safe in the machine because of first-rate engineering, reliability, and close adherence to standards. And I wonder if a machine like that, an automated, guided vehicle that's proved very successful is something of a benchmark to use.

MS. CASTILLO: Thank you.

DR. ROGERS: Okay, I think we will—that was an interesting discussion.

PARTICIPANT: It was.

DR. ROGERS: But some of the ethical issues—you know, it's not just related to, you know, rights of robots or something like that, but it really adds a lot of stress for the worker. I mean, it's really a lot of stress for the worker, dealing with robots, but also being displaced by robots. It's an issue that needs to be, I think, carefully examined, so…

MS. CASTILLO: Yep, so I'll just comment that it's—so there are psychosocial issues with stress. There's also psychosocial issues that come into play in terms of how the workers are trained to make sure that they adequately understand what the capability and what the limitations are of the robot, and some research that suggests that humans will assume that the robot is more capable, more situationally aware than

it is. So there are lots of issues. Thank you.

DR. ROGERS: All right, so let's break for lunch and then we'll come back at 12:35, so you'll have a full hour. And do we have anybody for public comments? No, but John, yes, okay. Thank you.

[Break.]

DR. ROGERS: So we're going to go ahead and start. We have just a few minutes and Alberto wanted to bring up some logistical issues.

MR. GARCIA: I just wanted to make sure we have on the record that in the morning we had 14 BSC members participating, and the quorum was 9. So we had a quorum in the morning. And I want to make sure that Ted and Sharon are still on the line with us.

DR. ROGERS: Ted and Sharon? Are you here?

DR. COOPER: Yes, I'm here.

DR. ROGERS: Okay. I guess Ted will join us.

MR. COURTNEY: Okay, now I got you.

DR. ROGERS: All right. Good. Thank you.

MR. GARCIA: Okay. Okay.

DR. ROGERS: Is that it?

MR. GARCIA: I think that that it's. Yes.

PUBLIC COMMENTS

DR. ROGERS: So we're at the public comment section and, you know, this morning John Culvenor who's from Australia introduced himself, but I have asked him just to say a couple of comments about… since he's here just to give us a little bit on himself and… if that's okay with the rest of the board. Go ahead. Michael, did you want to say anything?

DR. BEHM: Thank you for allowing me to bring John as a guest. John's been a colleague of mine for a decade maybe, which actually we met through a little NIOSH project that was out of the Prevention Through Design Division in 2009. So just a little bit of money to get us together and we have published a little bit together. I have used John's dissertation in integrating some things into the engineering program at East Carolina. And so we have been able to publish a few things. So it's been small investment; really helped me and my thinking, and hopefully likewise to John's, I'm not sure. But one interesting thing about John that you need to know is that he is a 2003 Ig Nobel Prize winner in physics. And if you don't know what the Ig Nobel is, please Google it or go to improbable.com. And I had the pleasure…

MS. GRUDEN: Can't you just tell us?

DR. ROGERS: Thank you, MaryAnn.

DR. BEHM: Our original plan was to have Paul dress as a sheep. John won the Ig Nobel Prize for measuring the forces required to drag sheep over various surfaces, and he spoke at the Ig Nobel ceremony. I was in the first row two Thursdays ago, and it's free online. So you can see his little speech that he gave. He gave a couple speeches.

DR. ROGERS: Oh, okay. Thank you.

DR. BEHM: He's an interesting character who has influenced me in mostly positive ways.

DR. MIDDENDORF: As I understand it the Ig Nobel Award, and correct me if I'm wrong, John and Michael, Ig Nobel is given for projects which on first blush make you laugh and wonder why the heck did somebody fund this kind of research. But then when you get into it and you understand more about it you really see the logic and reason for it, and it's very, very well done research. So…

DR. CULVENOR: Yes, thank you, Bonnie. Thank you, Mike. And thank you, Paul, and you're absolutely correct. It will be, perhaps, inescapable to not mention the Ig Nobel, but first of all thank you, again, to Dr. Howard, Dr. Rogers, and Mike, and all the members of the committee for allowing me to be here. It's a privilege to visit your country and a privilege to set foot in a place of this standing and be among the intellectual capacity that's obviously here; quite inspirational and very important, the role of the institution here. It affects the United States and it affects the entire world.

My occupation is as a sole practitioner and, like many businesses, most even, I do what the customers ask. So while I'm capable and interested to do work in the fields of design, research, policy initiatives, and accident analysis, the phone mainly rings because of legal pain and people wanting to have this pain somehow resolved. So my role is to shine light on the problem through science, and hopefully that light helps the parties better see what the issues are. And everything is built upon a platform of science. I consume hundreds of papers per year, guidance, standards, etc., to build a proper platform to jump off in terms of advice. And this could be all sorts of things from tissue dynamics to standards about machines, forklifts, cranes, scaffolding, all types of things, elevators, escalators, and problems of vibration and noise, the problems of diseases, carpal tunnel syndrome, and trigger finger, and all kinds of things that might have occupational inputs.

So I'm a consumer of the kind of work you do or the kind of work you lead, the kind of work you initiate, the kind of work you fund, the kind of work you direct. It's all vital. It's vital for the people that it affects and it's vital for economic efficiency because we can't give proper advice on anything unless it has a firm footing in science. The wellbeing of the economy, if we want to put it in such crude terms, is properly grounded in the work that's done, led, initiated by an institution such as NIOSH. We won't go forward economically, socially, or any other way through ignorance.

So that's my work. But what interests me in terms of being more effective is opportunities in the more public realm and where they come up I take them with relish, things like to be involved in the standards committee and to produce a very minor standards on handwashing in healthcare facilities which might do something about a minor input to reducing infection rates in hospitals or the

SHAPE-Sharing Project which I'll mention in a minute, or something such as an opportunity to contribute to the… there's a process in Australia known as the Royal Commission, and there was a royal commission into the building and construction industry, and along with two or three other people I wrote the discussion paper, in particular, I was given free range to write about anything that was of interest of contemporary nature in the construction industry, and so I injected the topic of Safe Design because I thought it was interesting and I thought it mattered, and it might have been one of the few things that the industrial combatants might have agreed upon. Lo and behold, they did. And that created, I think, some impetus because it found its way into the Royal Commission's recommendation which, of course, partially I wrote because it was engaged by the commission itself. And so I found them to be quite sensibly written, many of them, even though they came out under the Royal Commissioner's name, Terence Cole. But it produced some effects that I can see in the industry. I can see people talking about this topic, engaging on it, doing something about it. And so it's to drop that ink in the stream where it affects more things is what really I'm, in a way, more interested in than my own work, so to speak. So the chance to be in this place, because it's a very important place, it's profound in its effect, and thereafter if there was ever any opportunity to contribute, as bold as it might be, if you happen to think that I might be able to contribute I simply want to be here and say that I'm interested and available. And the one final thing I have to do, there's an enormous amount of things that our countries have in common, mostly in common. But there's one thing we have that's a distinctive—a token gift is one thing that represents a difference in our nations and probably will remain a difference because it doesn't taste very good is this jar of Vegemite.

DR. ROGERS: Thank you, John. It's nice having you here.

DR. CULVENOR: I have forgotten to talk about the Ig Nobel. Oh, goodness. Shall I? I suppose I shall. It's an interesting story in occupational sciences because that's what it was about, and I don't think you can be really funny unless you're being serious. And the title of the paper was an *Analysis of the Forces Required to Drag Sheep Over Various Surfaces*. Funny straightaway. It strikes you as being an academic sojourn with little practical relevance. But, of course, if you're a sheep shearer that's your world; moving sheep is your world. So barely anything else matters. And detailed work on that, that was very good. It was very effective. It was interesting and, what's more, as far as I know, hearing snippets from the industry, people actually do the things that resulted from it. And one of the findings, probably the one that swung it for the people at Harvard, was that sheep slide easier downhill.

DR. ROGERS: Thank you very much. And we're glad you're here. Okay. Thank you for the Vegemite. You're going to try that, right?

DR. CULVENOR: Not right now.

DR. ROGERS: Okay. All right. So this afternoon we're going to be focusing on, I guess, disaster emergency stuff, and so thank you for presenting, and it's going to be on the responder.

NIOSH DISASTER SCIENCE RESPONDER RESEARCH PROGRAM: OVERVIEW

MS. WEBER: Thanks for being here. I really appreciate the invite. I'm going to give a brief overview of our program, the Disaster Science Responder Research Program. Now that you talked about Vegemite I think we should add that to the stockpile. They have a good shelf life. But, so this program is pretty new. It was actually presented to the board in 2014. My presentation today's going to be broken into three parts. I'm first going to give a background, a little bit, why Dr. Howard and others wanted to start the program. And then I'm going to go over briefly the strategic plan we have in place; our strategic goals. And then finish by going over… we're really excited. We have got six projects ongoing now. So we did that in a relatively short period of time. So I'll give a brief overview. And then, lastly, open it up to questions to the board members.

So how does NIOSH respond to outbreaks and emergencies? How do we get involved in that? Briefly, the Disaster Science Responder Research Program—I'll refer to that as the DSRR Program—is located within the Emergency Preparedness and Response Office. And we're in Atlanta. That allows us to work closer to the other CDC Centers and the Emergency Operations Center. Whenever that's activated we coordinate with all the other centers at CDC, and we provide… our goal is to protect the health and safety of the emergency response providers as well as the recovery workers. The office, itself, was created after 9/11 and there's various types of responsibilities involved, anything from helping to deploy NIOSH responders to the field as well as providing technical assistance. We also write a lot of the guidance documents. Finally, what I'm going to talk about today, though, is how we're looking at research opportunities. During these responses you collect a lot of data, but it's not hypothesis-driven research. And during the responses you identify a lot of gaps, but then they're on to the next response, the next disaster, and it takes a lot of effort to stick with those gaps that were identified and follow through, and try to get the research put in place that's needed to address those issues.

So the Disaster Science Responder Research Program, I mentioned, was started in 2014. That same year after it was, like I mentioned, it was presented to the BSC in June, and then in July there was an external stakeholder meeting that NIOSH held with representatives from academia, health departments, and the responder community. The goal of the workshop was to get feedback on the feasibility of starting such an initiative, and after the…we have the report by RAND. It's published on our website. And one of the biggest takeaways from that meeting was that instead of looking at the goal going in, was to look at what were

the research gaps, what should we be researching. But the big takeaway was, how are you going to do it? How are you going to do rapid IRB? How are you going rapidly fund things such as Hurricane Sandy, all these others? So that was a big takeaway. You can read more about that on our website.

I wanted to first go over a little bit of background. What is Disaster Science Research? So during any given response a lot of data's collected. These four represent those data. There's non-research activities such as rostering, credentialing responders; there's public health investigations such as case reports, cross-sectional studies; and then if those studies identify a gap or something that needs further research we might have a pilot investigation and responder health research. So the things I'm focusing on with the DSRR Program is those last two.

And so this is a paper that was published by NIOSH in the *American Journal of Disaster Medicine*, and those four studies represented here, on the left side are those first two, general data that's collected as part of any investigation or response, and what you learn from those will lead you to pilot investigation, potentially, to see if a larger research project is needed. But then there's a lot of considerations and this paper's really dealing with how do you do research during an ongoing response? We're also identifying gaps that we have learned from other responses where we can do research outside the scope of an emergency which is much more easier to do.

So I put a picture up here of the West African outbreak just to remind myself that one example of this, there was a big research proposal by NIH at the time where they wanted to do some aerosol sampling. We were looking at how is this disease being spread, but when we looked at all the considerations—ethics was mentioned this morning—the ethical considerations of the safety of those investigators themselves would have been a big concern. They would have had to go into that environment and then what do you do with the samples? How do you ship them for analysis? So that project didn't go ahead. There's a lot of considerations that take place, anything from science to ethics.

This topic is not something new to NIOSH, and NIOSH has done research on a variety of types of emergencies over the years, but this program, again, is the first time we have dedicated resources. I'm serving as the program coordinator, and then we have an eternal steering committee. And so it's the first time that we're really putting focus on this area.

So a couple of definitions. When we talk about responder research who is the responder? So we're considering everyone from the traditional responder, EMS, fire, police, to staff like volunteer organizations like American Red Cross, healthcare workers, construction and utility workers. That's going to be a big issue for the hurricane and flood clean-up right now. And we're interested… this is just a graphic of a lot of different disaster types just to get the point across that we're

looking at all types of disasters as well as the scale of the disaster. It's not just large scale incidents, we also are finding that we can learn a lot from some of these smaller scale incidents. I have an example of one further into the presentation where a novel agent was introduced and a worker was infected. So we're looking at all kinds of things that are from small scale to large scale.
So I mentioned the internal steering committee we have. I started in this new position as the coordinator in March 2015, and then at the same time an internal steering committee was stood up. We have representation from a variety of divisions throughout NIOSH. Those staff were chosen based on the division's past experience in getting involved in emergencies depending on what type of research they did, and we also have tried to target different disciplines. So we have engineers, exposure assessment, industrial hygienist, a variety of types of disciplines represented there. During the first year we spent the majority of our time doing the programmatic stuff, identifying what our strategic goals would be and what type of research projects we wanted to do. We're also continuing to participate in several different federal interagency working groups. I gave two examples there. The first one is…they're both led by ASPR. The first one is the Science Preparedness Research Interagency Team, otherwise known as SPRIT, and that gathers to look at different research needs. It meets on a regular basis, but then when there is an incident they have additional meetings where we'll identify research needs, and during Flint, the lead contamination, where ASPR was actually the incident commander on site there, that was the first time I knew where they had made an effort to come back to the agencies and ask what research would we want to do. And it was a way to feed all that information up to the… get it to the field. We're also continuing to meet with stakeholders and partners. If we can't do the research internally we want to know what everyone else is doing, and we also are looking for feedback of what people think we should be looking at in the future.
So these are the strategic goals our internal steering committee have identified. I have the first two highlighted because that is where we have spent our time so far. We're brand new. So we have identified some critical topic areas. We wanted to choose things that would apply to a lot of different disasters to make the best of our limited resources, so that what we learn from one could be applied to others. And we also want to, again, going back to that stakeholder meeting, the major feedback we had was looking at challenges of how we're going to do the research. So again, that's rapid funding, rapid IRB, safety of the responders.
So this will be more… I'm going to hit a lot of high level summaries, and then leave it up to you if you want to ask more questions about the particular projects. There are six projects I'm going to over. The majority of these are being done outside the scope of a response. And then we had one where we were actually deployed real time, and we learned a lot of lessons from that of what we need to

work on in the future.

So going back to that first goal of identifying what we wanted to research; how do we do that? We looked at the gaps that were previously identified during some of the responses. We have reviewed internal after action reports from responses and exercises. Many times that information does not get published. And so that was very helpful to look at. We also prepared one-page research project summaries. And I wanted to highlight this as one of… probably the biggest success story we have had so far. A lot of times in emergency response it's not like other type of research where you have a lot of time to think about it and put it together, something happens, in our case, and you're asked by CDC leadership maybe, "Okay, we need some ideas, and we have got 24 hours." Sometimes it's less than that, and you have got to present to them a one-pager often of something you want to do. And by preparing these ahead of time, a forecasting, what we think might come up really allowed us to be very competitive with others in CDC for funding that came in. And so that's how we have addressed most of our topics that we have identified thus far. And also a big thing for us is identifying potential funding sources.

So the first study I wanted to highlight… again, I'm just going to briefly touch upon this and you can ask questions at the end… or during, right now. So the first one was by NPPTL, the National Protective Laboratory that Susan presented from today. So we wanted to look at during these responses for infectious disease outbreaks, there are many novel hazards. We don't know a lot about them, and then the PPE demand is really high. Everybody, when they're scared of something, when everyone wants to put people in the highest level of protection and how can we do a better job of doing a risk assessment to look at what are those medium and low risk workers, and can we put them in lower levels of PPE. And so the solution is NPPTL is wanting to use control banding, which many of you know is more from the chemical side of the house for this infectious disease risk assessment. So the outcome of this, by doing this, we want to be able to develop a mobile app, that would be free, and it would be on NIOSH's website, and it would help people select and prioritize which respirators they want to use. In that green highlighted area on the bottom, because I don't have a pointer, we received this money from OPHPR, that's the Office of Public Health Preparedness and Response at CDC, and we actually did this. What CDC OPHPR is trying to do, they have learned this rapid funding issue. So they used a broad agency announcement and this was the first pilot study of trying to do that in the context of a response; how can you do that faster to get money quicker to people? So this served two purposes: it helped us practice this and learn from that and how can we use that at NIOSH, as well as the project itself.

So this was a figure. I want you to pay attention to the red squares. Basically this is the control banding part. You want to look at the disease properties as well as

potential exposure route that people have. So we want to look at things like distance to source; what kind of task are they doing? Is there a way to put them in a lower risk category? And then look at: are there control technologies either through isolation and elimination, engineering, administrative? We want to look at those controls instead of putting people in the highest level of PPE as the primary preventive measure. And we think that will also save money and the supply of respirators as well as other PPE.

The second study I wanted to briefly mention, this is led by the NIOSH Division of Surveillance, Hazard Evaluations, and Field Studies in coordination also with ATSDR and the National Center for Environmental Health. And this was to look at radiation exposures. If you have a release of radiation in those first few hours after the response you don't know what kind of concentrations are there, and so modeling can help fill that gap in the absence of other data, and the idea would be to use this to assess exposures of those workers working as first receivers and volunteers at shelters, evacuation shelters to estimate what exposures they may get from the people leading the hot zone. There's a manuscript in review and we hope that will be published by the end of this fiscal year.

The other project I wanted to briefly mention is looking at exposure assessment plans for the first 72 hours following a disaster. Some of you may be familiar with the term "citizen science," and this is kind of looking at this approach for workers; how could we put in the hands of workers a way to measure their own exposures? If you think of something like a World Trade Center or haz waste kind of responders. They go in and if you have some unique exposure in an event, the people doing really any type of sampling can't show up until a week or two later. And so you miss those very unique, highly concentrated, most poorly characterized exposures first off. We don't get that information. You look at World Trade Center, we don't know what they were exposed to in those first few hours. So the solution here is that we're working with… this contract was just awarded, and we're going to look at different… the development of different concept of operations; how would we do this? What is feasible? What kind of sampling would be feasible, both environmental and biological monitoring? We're partnering, also with NCEH on this and we're co-leading this with the Division of Applied Research and Technology at NIOSH. So the output of this will be a model exposure assessment plan, and then we would hope, as a separate project, to pilot this in actual disaster. We probably would target, initially, like a fire response to a haz waste spill or something like that, something smaller we could get that's more practical and evaluating it.

The fourth one I wanted to highlight was an actual event where we were working under the context of an ongoing response where we deployed, and so this involved not just the science part but actually the logistics of it. And it brings up a good point about money. We used money that NIOSH already had in HELD, the

NIOSH Health Effects Laboratory Division. They have developed a lot of sampling methods as well as assays for the detection of different influenza viruses. They have done a lot of their work, historically, in hospital settings. This was a very unique situation that had not been documented before. It was last December they identified H7N2 which is an avian influenza strain as a source of an ongoing outbreak among cats in an animal shelter in New York City, and that quickly spread to other shelters throughout Manhattan as well as in Pennsylvania because they're trying to get these cats adopted, and then a couple of cats died. And they looked at the assays, but H7N2 isn't part of the normal panel. So it was a real mystery for them. In the meantime, no one was wearing PPE including respirators, and one shelter employee, a veterinarian, became infected. It was all mild disease. We're very, very lucky. What they did to solve this, because the shelters had to keep bringing in all kinds of animals, they're finding chickens, I mean, you name it, it's going to these shelters. And so they took the entire feline population in the New York City shelter system, over 500 cats, rented a warehouse in Queens and moved them to the temporary quarantine facility to treat them until they got better. Not all cats passed away from this, and many were rehabbed. And we worked with ASPCA on this project. This was very interesting; learned a lot. They served as the incident commander of this warehouse facility. They have a large staff of emergency response personnel. So if you think of dog fighting and other things that ASPCA gets involved with, animal cruelty, it's usually they're responding to just give food, general care for these animals. And in this case they were being asked to take care of these cats, feed them, treat them, change the litter, basic things like this, and they came from 33 different states. Because it was a warehouse there was no controlled ventilation and we had no idea what the risk of ventilation exposure. A lot of people were saying, "Oh, it's just at the cat height, if they can't cough it out," but we knew that avian influenza virus is persistent in the environment, and when you see in the photo the construction paper on the floor, for example, somebody's going to pick that up, it can be re-aerosolized, and we have a manuscript, and that is drafted right now. We looked at air samples and surface samples throughout the hot zone, as well as the warm zone, where people were donning and doffing PPE, and also their meeting space where we shouldn't find no contamination. And almost all of the samples taken inside the hot zone were positive. These were air samples that ranged from height, to the cat breathing zone height to human breathing zone height. We looked at the viable and non-viable. The non-viable samples show a lot, it's hard to sample for viable virus, but we did find that in some of the samples. And, luckily, their containment worked well. We did not find contamination outside that hot zone.

DR. ROGERS: So is this considered zoonotic diseases?

MS. WEBER: Yes. Yes. So another project we just got, it was through a competitive process

HHS has. It's called the Ignite Program. This program itself is looking… it's identifying things in government where bureaucracy gets in the way or these big picture topics never get solved because there's never money or it's just… if it can't be done perfectly nobody wants to touch it all. So how do you get around this need for rapid fit-testing in the midst of a response? It was interesting all this stuff, like Susan's study this morning, all of the care and detail going into looking at the… how the PPE is holding up over time. When it comes to an actual disaster a lot of these N95s are handed out and no fit-testing is done at all. And it's because of some of the logistical issues, and it's not just the fit-testing itself, it's the medical clearance that's involved with the OSHA training and the training… it's the training of how to use it. So you start thinking about that and you start listening to the end users of why they're not doing it, and it's quite understandable. So this is a three-month program and we're looking at innovative approaches of how we could address this. And so it's been a longstanding problem. It came up as part of the avian influenza study, but it doesn't take a big response; 300 responders in that situation is small. Look at the hurricane, thousands of workers responding. But it's even a problem for smaller responses such as that. So the goal is to look at the policies and procedures, and identify ways that we can make that process faster, cheaper, and really help so we can insure that workers are actually being fit-tested instead of being sent in just with any… whoever donated what respirator for that particular response.

And, lastly, this has not been funded yet, but this is something we're really excited about and we want to look at, specifically for this, we're working with the interagency board which is the group that is populated by EMS, fire, and police, all the first responders, and we want to look at a rapid method to detect mental health risk among law enforcement officers. And their suicide rates are actually higher than deaths associated with traffic incidents and other violence. So this is a big issue for police. You can look at the current political climate. They are under a lot of stress. And so we want to look at… the proposal is that we would look at increased rates of PTSD and depression. There's, obviously, other symptoms, health outcomes, but we were focusing on that, and we know that this would… while we're looking at police officers we know this applies to any disaster type. Stress was mentioned during Don's presentation. And so we think this will apply to a lot of different response and recovery workers, you look at the recovery workers for these hurricanes. They're going to be deployed for a long period of time. That's a different type of stress than the acute stressors. So we're hoping that this gets funded. We'll know soon and we're just going to keep trying at this, but the end goal is to develop a mobile app. A lot of the questions come up, well, police officers aren't going to want to admit that they might be under stress. What our proposal is doing is looking at their exposures. So it's not, 'how do you feel?' it's what, 'what did you witness today?' So what you witnessed or were involved in

that's your exposure; 'did you see someone shot?' So what we're doing is taking an existing mobile app that's used for medical, EMS type personnel and adapting it to specific exposures that a law enforcement official would have.

And then, lastly, we are addressing some of the major challenges, as I mentioned. Angela Morley is helping us out on developing a rapid IRB protocol and Beth Whelan, who co-chairs our steering committee, is taking the overall lead for that. But we're looking at ways where we can get an IRB cleared by our board within—is it 24 hours? 48 hours—and looking at protocols. We're at the very initial stages of doing this, and so we are looking at a lot of different potentials of how to best address that. We're also exploring rapid funding options; it's hard to do. One of the things after Hurricane Sandy they talked about is that all these agencies should have seen money ready to go if something happened. Well, that's a very difficult thing to do with limited resources. And so we're looking at rapid broad agency announcements is one of the things we're very much targeting because it offers you a lot more flexibility in what you do with those proposals. Now, so how do we quickly get those protocols peer reviewed? And so that's a big issue for us. I just wanted to acknowledge this is a list of our steering committee members. As you can see they're from across many different divisions at NIOSH.

And these are the questions we'd like for you guys just, obviously, open it to any other questions, but these three were primarily something that's coming up. The first one, this need for occupational surveillance data during a response. If you're familiar with NIOSH's the NORA, the burden need and impact, right? We don't have a lot of burden data because during responses it's very difficult to do research. So we need basic information on surveillance to know who is getting hurt, exposed, and why and what to even target what… do we need research? Is it policies? Is it training? And so this is very difficult to do in a response. It'd be good if… it'd be perfect if we can use existing data. If you create new data that means another team you send to the field, and it quickly burdens the overall response.

The second question is, how might we prioritize research topics. I have shared a little bit about what we have done so far, but we need to have more moving forward. As you can imagine there's all different types of disasters, all different types of workers, and how can we best prioritize our resources moving forward? A lot of for us is dictated of what response is happening at the time. So we can forecast what we want to do, but it really depends on what happens, and then we react to that. But we can do a lot of planning in advance.

And then, lastly, we're in hurricane season. We'd love to hear if you have any ideas and research. Some of the things that are coming up for us, at least, are, again, the surveillance issues as well as if you take Houston, for example, the chemical exposures that could happen to some of those clean-up workers with the refineries being flooded.

So I'll open it up for questions.

MS. GRUDEN: I have just a comment. You know, NIOSH really does have a lot of broad tentacles, and if you think of the ERCs that you have, and I'm wondering if, in some respect, each of the ERCs could put forward, you know, they could be designated to be the contact in case of a particular problem, like if you have an ERC in Texas, you know, that they would be the first order of contact if that situation occurred. How many ERCs do you have now?

MS. WEBER: I don't…

PARTICIPANT: Eighteen.

PARTICIPANT: Eighteen.

MS. GRUDEN: Eighteen. Well, that's quite a support system that you have in place. I remember when Deepwater Horizon occurred. I got a call from NIH immediately about what kind of health surveillance program should we put in place down there. I mean, that's, you know, if the ERCs were made aware that they are going to be… they should have put aside money for something like that. I mean, that's one idea. Using what you fund already to help you with some of this. And then the app, you know, you have a lot of NIOSH trainers for fit-testing. Those folks are probably people that might be interested in and, at least, being consultants or developing a videotape system or being a resource contact person if you needed someone. I mean, how many fit-testing trainers do you have? I mean, I know one very well in Cincinnati, but…

MS. WEBER: Yes. You know, I don't know the overall number of the trainers total, but one of the things that we're doing with that particular project is how can we make it faster, the fit-test itself. And so part of our team has those people on there. So we have some of the fit-testing folks on there. And then what we're going to do is really focus on how to shorten that, and then the idea—a lot of people are bringing up different options of what we can do. We're trying to still define the problem versus jumping straight to the solution. So we are looking at, with a massive response like that you're going to have to train the trainer and get out a lot… so it'll take a lot. That's a whole other topic; all of the planning.

MS. GRUDEN: But it's the videos, you know…

MS. WEBER: Yes, I like that idea. That's a great idea.

MS. GRUDEN: The video system, you know, the tentacles keep spreading like a tree to harness all your resources. You have a lot of resources.

MS. WEBER: I agree. And the other thing you brought is the ERCs designating a topic area for each. What NIH has utilized a lot is using the ERCs, who have that local outbreak. So it's not topic-based, it's regional-based of where the disaster happens, those universities doing that research, and so there's a whole Gulf Shore study… the ongoing study. Yes.

DR. BUNN: Great presentation, Angela. Terry Bunn. As far as looking at novel approaches one thing is maybe NIOSH should consider like standing MOUs with like state

health departments to be able to partner with them to look at their statewide data sources that they may have available on a semi-rapid basis. I mean, for instance in Kentucky we are working with a number of partners for our… or it could be at the national level just partnering with general CDC on the ESSENCE data that they receive so that you can analyze that right away or get the state counterparts for that as well as looking at other data sources such as mortality data, maybe through NEMSIS to get the EMS data, you know, on a rapid basis to be able to assess the injuries and stuff that are occurring with these, which brings up another thing. You were talking about IRB approvals for specific projects. Have you guys considered the opposite way? Kind of like a standard public health approach that you would adopt, have a standing IRB or you can just, you know, pretty much cross off the names. Instead of saying hurricane, flood or, you know, ice storm and have survey templates that have been developed, data collection systems that have been developed that you can employ and deploy as standard responses to these, and that you can customize, but that would really, really, hopefully, rapidly accelerate the IRB approval process to like within 24 hours, you can even do that.

MS. WEBER: Yes. For the IRB proposal comment we have taken that approach. We know what types of surveys. Some will be just a survey. Some will be maybe an exposure assessment study. So we're trying to lump them into what we know we may do. So it might be an engineering control study. But, Angela, since you're here in the room did you want to add anything for the IRB?

MS. MORLEY: Yes. I think the just-in-time protocol as it's call or the generic protocol, right, is really one very important strategy, and (my new @ 00:48:37) strategy is that we are coming forward to ensure rapid and robust review. There are a number things, Angela said, you could plan for in advance. We have an ethical framework that's guiding kind of the IRB review and the development of generic protocol to make sure that well in advance we can, at least, address some of the ethical considerations that we know to be inherent in research with workers as well as in the disaster setting. We're also just, as a more complete response, we're building the capacity of our own IRB to be able to identify and address ethical considerations quickly and efficiently, and we're considering a single IRB dedicated to this effort. And we're also on the initial part of our strategy, we're looking at developing criteria and procedures for rapid decision-making; is it research? Does it warrant rapid review? How fast should the review take place? So there are many different decisions that we're trying to anticipate in advance and, at least, identify what considerations are relevant. So it's a great project and I appreciate the opportunity to be involved. Thanks.

DR BUNN: Yes. I mean, I would consider all of them. I mean, we have always taken… we're bona fide agents of the State Department for Public Health, and almost everything that we consider as an initial response turns into research, so you might just

receive research approval from the start. And then my other question has to do with what you're looking at as far as additional research topics. I mean, Harvey brings to mind, of course, looking at those immediate chemical exposures that may have occurred as well as electrocutions, you know, just rescue workers trying to reach stranded people in boats that are hitting the power lines that are, you know, flooded. So just stuff like that that you can pick up within these different data sets.

MS. WEBER: Yes. It's interesting with a hurricane… every disaster's different. The hurricane is how do you define the worker? How do you capture the workers? There's some people that start to be volunteers. We have people coming from all parts of the country to help and when it's in that initial response mode there might not be a clear incident commander, and people are just going out. And so that's a big challenge. Clearly a big challenge is a need, is to work with the local, whether it's health departments or other groups, responding agencies and having this all set up well ahead of time and know what you're going to do. We were talking about this and maybe it's something, a project, with SouthON and even NEON. With these hurricanes we know they're going to happen all the time. What can we put in place to gather surveillance data? Maybe that's nice—not that there's anything nice about them—but you know when they're going to come. So there could be a quick phone call, "Okay, let's do what we put in place," and have that feeding in. It's really challenging like in Hurricane Sandy to retrospectively go back and try to find that information almost a year later is what happened, and even thought that funding for that was a success, and it was still many months to get that disseminated.

DR. BUNN: Well, just to add to that, too, I was going to add, you know, New Jersey's done a lot around Hurricane Sandy using syndromic surveillance and keywords, and developing some sort of algorithm. I mean, maybe that can be applied more broadly or in different settings. And, also Poison Center data. We get runs of occupational or work-related events, but that would be people calling in and asking questions.

MS. WEBER: Thank you.

DR. COOPER: Can I add one more question/comment on this topic?

DR. ROGERS: Go ahead.

DR. COOPER: It's Sharon. I just wanted to expand what you're talking about right now to ask how you might, ahead of time, coordinate resources and communication? Because emergency response has an organized protocol about who's in charge and how to communicate, but in the past researchers conduct over each other, and it's not the very primary response that they're in, but in Texas, in the past, it happened where NIEHS, NIH, and the State Health Department were all funding projects on the same topic without really the collaboration of each other, sometimes not even the knowledge, and academia was in there as well. So what I'm thinking now even

with the current hurricane is, how can you coordinate the research? In Houston I'm very aware that there are people there from everywhere and the ERCs involved and projects are being proposed. But how do you coordinate that so that you're not funding something that somebody's already asking for funding for or is there's some second level coordination protocol that could be put in place among federal agencies, the State Health Department, locally academia, and responders?

MS. WEBER: I think that's a really important point, and something we have talked about, and I think it's, you know, those things that are within your control and then there's those things, these big picture things, how do you starting addressing them? One of the things we want to do on our steering committee we have talked about is writing a recommendation that what you're bringing up is a reflection that the National Response Framework that's followed for the response itself that lays out all the federal agencies' roles and responsibilities for the U.S., does not contain anything on research. And so we have talked about when… but it's like when are they going to revise that? And we want to make sure—and others at CDC recognize this, too—that we'd like that to actually be involved there where it's a policy, it becomes part of the response itself. I think if you don't have that it's going to be a continued problem of not an overarching strategy in what the best… how to prioritize the research. You get so many people going out and doing different things, and a lot of them could be, maybe not meeting the needs of the community and the workers, but more of an interest of the researcher. And so you run into that as well. And the other thing that has come up in response to Harvey, because of this problem you might have a lot of people doing different studies. They could all be doing exposure assessment studies, for example, but they're also all using different methods, collection methods, assays, and so then you walk away you can't even analyze and compare the data to each of the investigations. So it is definitely a very big problem and one that people are talking about, but it's going to take a larger effort beyond NIOSH's role… only our role on that. So thank you.

DR. ROGERS: Chris.

MS. LASZCZ-DAVIS: Chris Laszcz-Davis. Just three things real quickly. I promise, I'll make them quick, too. The first has to do with communications. So I mean, communications is absolutely critical during emergencies and so much of it breaks down, and I mean the electronic, the cell phone, the transmission, what have you. Is anybody doing any coordination work in that arena? I mean, that's pretty critical. I mean, this is all research activity and activity in the community, but if you can't talk to each other what happens? And that happens a fair amount. I mean, if you listen to what's going on in Puerto Rico, it's huge.

The second item is private sector. Have you guys ever gone back to the private sector? I hate to think we're going through a sequential series of disasters. I can't

wait till we get to California. But the question is: have you guys ever had an opportunity to go back to the private sector and ask them what would have been good to know, you know, looking back what would have been good to know on the frontend, so we could have managed and embraced the situation more constructively? That's the second item.

And the third is, CERT responders. We haven't talked about CERT responders at all. They're the first line of… they are the first line of emergency response in a community. And what is it the CERT responder would like to know that would help them do their work better? I mean, there are hundreds of thousands of these folks all over, and the communities have been told for the first seven days it's the CERT responders.

MS. WEBER: Yes. So to start with the CERT responders. we have talked about that. Gayle DeBord, who has since retired, was on our steering committee and brought that up. I think that she might be serving as one of those now. So I think that's a good idea. We have thought about them in terms of the collection of data, a different angle to that, but I like that idea that you brought up of what they would like to know. I think that's a whole of looking at what kind of training they're getting and how does it differ from region to region, and all the disasters, you know, wildfires in California versus hurricanes in Texas. How does that differ? So I think that's a great point because they are first, and they could also be a study population from a research perspective.

Private sector, that brings up like Deepwater Horizon and like BP. And, Margaret, I think that you were leading EPRO at the time of Deepwater. Is that a good example? Do you know of any feedback from them?

DR. KITT: Well, we spent a lot of time talking to lawyers. And it was productive outcomes. A lot of feedback. I don't know if we got an awful lot of direct feedback, you know, the putting into place surveillance information that we could collect and share across companies was a little bit difficult to set up originally, but we got to a point where we did, we were able to share that.

MS. WEBER: We have talked about private sector in terms of helping us do surveillance in the midst of a response. That's going to be variable depending on their role. And you mentioned communications during emergencies. So there are a lot of partner stakeholders that we met with that they're looking at general communication issues on the ground. One of the things that we have looked at as a potential research project moving forward is effectiveness of communication. Why do we see deaths from carbon monoxide all the time, year after year? Is it that they're not getting the information, not following the information? So we would like to see some work done in that area of the effectiveness of communications. Are they following guidance? So I don't know if that's…

MS. LASZCZ-DAVIS: Mine wasn't really directed at effectiveness, although that's important.

MS. WEBER: It was more between the… you were talking more about the responders

communicating with each other?

MS. LASZCZ-DAVIS: No. Actually, I was really talking about…

DR. ROGERS: Citizens.

MS. LASZCZ-DAVIS: Pardon me?

DR. ROGERS: Citizens.

MS. LASZCZ-DAVIS: Citizens. I'm sorry. The first point about communication really had to do with the hardware associated with communications. A lot of things just don't function. So who's doing work in this arena? It may not be NIOSH's work, but you have a role in of this? It's good to have the content information, but if you can't get it out and you can't get the communities and the private sector, and the government talking to each other during an emergency.

MS. WEBER: This a lot of work in that area. I know NIST has got a large project, looking at the hardware involved.

MS. LASZCZ-DAVIS: Yes, and I don't know who's work that is.

MS. WEBER: Yes.

PARTICIPANT: DHS works on that as well.

MS. WEBER: DHS gives a lot of funding out to various partners in that area.

MS. LASZCZ-DAVIS: So it's your fault.

PARTICIPANT: That's NIOSH.

MR. COURTNEY: Bonnie, this is Ted.

DR. ROGERS: Oh, one minute, Ted.

MR. COURTNEY: Yes, one minute, really quick. So my thought, I think disaster response for 9/11 in New York City with Southern Baptist Disaster Relief and Red Cross, I'm wondering about opportunities you'd have there because I think any of the volunteers would be willing to participate as a (inaudible @ 01:00:48) or, you know, keep a diary or anything along those lines, if you asked them. So kind of an approaching news organization about having just-in-time deployable study designs. I think you could have a rollout with the response for those workers because I think they're a very interesting case of contingent workforce, which John talked about, actually, earlier this week in Boston, community workforce exposures in kind of unique aspects there where they're not necessarily professionals not heavily trained.

The other thing I will just point out is are there opportunities to take advantage of kind of a growing ecosystem of Internet of wearables or Internet of things where, for example, you'd have an aggregator like Fitabase which was then (Gatorbase @ 01:01:32), but now Fitabase which allows you to approach Fitbit wearers and basically invite them to participate in the study, get their permission, and then look retrospectively at their exposure for the factors that Fitbit is actually collecting. So if you're trying to look at something like sleep disruption from a disaster for particular types of responders, you could potentially lever an existing dataset like that which is being passively collected, essentially, already.

MS. WEBER: I love that idea with the Fitbits. The 72-hour study I mentioned is looking… that DART is involved in is heavily looking at wearable sensors, but I love the idea of looking at what community members own all on their own already. And the volunteers, we have talked about American Red Cross. That's on our to-do list to meet with them. ASPCA, the project I mentioned, those are all volunteer responders. And so we definitely can look at that more. I think that that volunteer base is the most at risk. These responses are scaling up, and so you can always have that base of employees and volunteers appropriately trained, fit-tested, trained in use of other PPE, but when it expands to a larger group they may not be ready and be there for higher at risk.

DR. ROGERS: Ted, my apologies, I didn't mean you only had one minute. I was just going to ask for a minute. So anyway. Judith.

MR. COURTNEY: That's okay. I got it all in.

DR. MCKENZIE: I just had two comments. One in terms of the volunteers. I think since 9/11 there's been the Medical Reserve Corps in New Jersey. There's also a similar organization in Pennsylvania. So these may be groups with whom you could engage. And my other comment is on the mental health risk with law enforcement officers. It's great to get the risks, but I think the real challenge is going to be getting them to seek help because of the stigma as we all know with mental health and people thinking I may not be able to work anymore, and that's… the word defines them, plus it's their livelihood. So I think we all know that they face these things, but it would be nice to sort of quantify or document, but then how do you get beyond on that, I think is a challenge.

MS. WEBER: Yes. So that particularly project, what's really unique about the mobile app that we're wanting to… it's cheaper to adapt that to this particular study than create something from start. And one of the ways… it serves two purposes. One will be personal identifiable information; it'll go to that individual worker, that they were exposed to these things. And how it would work, it would tell them if those exposures have been… if there's scientific evidence that that exposure leads to, for example, PTSD or does it not. And then it helps them triage if the follow-up is needed or not. And, as you know, this particular project, we can only fund that part of it, and then they'll revert to what they normally would do in their police department, but a follow-on, a whole other topic area is this treatment. Some of them can get their own personal… see a personal physician for this, others would use the department's, and then that brings in your issue with confidentiality.
The other component that this mobile app allows for is aggregating the identifiable data that would go to like the medical director of the police department or a safety officer of some kind, and it wouldn't tell me who may have been exposed, but it'll show that an increased number of people, things like that. So they'll know, even if that person doesn't report exposures, they'll know something happened that day and can follow-up in that way. But the whole point we're trying to get… the

treatment is another challenge, but we're trying to work around by looking at exposures again, and not the actual outcome of a diagnosis. But, still, it is a big concern. It's difficult to do.

DR. ROGERS: Margaret, you had something.

DR. KITT: I just wanted to add, I think one of the real additional benefits of the research that we do with different organizations whether it be the companies, the oil and gas companies or the animal welfare organizations or law enforcement, associations, it's building those relationships that really helps us during a response itself because they become used to working with us, and then it just facilitates that engagement in others. So there's multiple benefits.

MS. WEBER: Yes. And the IEB for that mental health study, our involvement in the IEB has allowed us already to identify a study population, so it's coming from a police chief that's very active in occupational health and safety issues, and so that helps all of that.

DR. ROGERS: Well, thank you very much. One other population, even though ASPCA is like a volunteer group, the shelters that also provide, and they are workers at the shelter, so they do provide a lot of service during times of these types of crises. So that's another good group. Anyway, thank you for that.

PARTICIPANT: Very informative presentation.

MS. WEBER: Thank you.

PARTICIPANT: Thank you.

PREFACE - FENTANYL EXPOSURES TO EMERGENCY RESPONDERS

DR. ROGERS: All right, and last but not least. Jennifer, you're not speaking?

MS. HORNSBY-MYERS: I am.

MS. CASTILLO: So I'm going to, before Jennifer gives her presentation I'm going to let you know how it fits into a larger set of activities related to the opioid epidemic. So the most recent data show that despite concerted efforts opioid overdose deaths are still on the rise. The Department of Health and Human Services' Secretary, Tom Price, has named the opioid crisis as one of the Department's top priorities. In conjunction with this over the last several months CDC's been working to coordinate response activities across the Agency. And NIOSH formed a workgroup in May to support NIOSH contributions to CDC's response.

So the workgroup includes representatives from key programs and divisions including the HHE Program, World Trade Center Health Program, Emergency Preparedness and Response Office, Education Information Division, Economics Office, Total Worker Health Program, Office of Policy and Program Evaluations, Surveillance, Health Communications, Division of Safety Research, and Clinical Workers Compensation Studies. I named off all of those programs because it's reflective of how complex this issue is and how multifaceted it is.

The workgroup's charge is to coordinate work across NIOSH, and with CDC; to explore associations between work and the opioid epidemic; and to identify potential expansions of NIOSH work.

The workgroup is conducting an inventory of intramural and extramural activities and has begun to identify priority research questions and needs. And we have identified multiple and complex associations between opioids and worker safety and health. These include work injuries and illness being the reason that opioids are prescribed in the first place; safety and health issues for workers using opioids both licitly and illicitly; workplace characteristics that may influence the use of opioids; and then the subject of Commander Hornsby-Myers' presentation exposure of emergency responders to very potent forms of these drugs such as fentanyl in the course of their work activities. The workgroup will be making recommendations to the NIOSH leadership and we'd be happy to report on this at the future if the BSC is interested.

We requested the opportunity to present on Fentanyl Exposure to Emergency Responders at this BSC meeting because of concentrated work in response to a large volume of request and inquiries from stakeholders. And so with that I'm going to introduce Jennifer.

FENTANYL EXPOSURES TO EMERGENCY RESPONDERS

MS. HORNSBY-MYERS: So thanks, Dawn. So I appreciate the perseverance. You have the afternoon nap time as well as a chemical that was designed to put you to sleep. So we'll have to push this one downhill for sure.

So who has not seen some sort of news clipping talking about how deadly and dangerous, and horrible this is if you just look at fentanyl, carfentanil, or any of the other families of fentanyl. Any hands? No hands.

So focusing that in from all these headlines and news stories that we see, what are we, as NIOSH, concerned about? And we're concerned about the worker. Our parent agency, CDC, is concerned about the end user and how we can rehab and keep this from being occupational exposure to anyone. However, our side is the reality that that is going on, this new drug has been introduced, and how do we deal with it from a worker's perspective. So how do we protect our law enforcement, our EMTs, our healthcare professionals from the top to the bottom, and even how do states and locals, especially at the county level, deal with this issue which is costing them a tremendous amount of money, a tremendous of amount of time, and a tremendous amount of resources both physically as in dollars and mentally as in the difficulty of having their… people forget that sometimes these EMS workers are bringing back people that they know, people that are parts of their communities. So how do we, also deal with that piece of what's going on here? That said…

PARTICIPANT: What's a gray death?

MS. HORNSBY-MYERS: Gray death. Sorry. That is the slang for fentanyl and carfentanil. It comes in a powder. It looks very much like… actually, I'll skip ahead because someone… let me go back, actually. So if you see the spoon there, this stuff is a very fine gray powder. It looks like concrete dust. So in a bag, sold, or however, the street name for it has become "gray death." And law enforcement, in particular, has picked up on this particular vernacular for it, which I think explains some of the things that we do see and reports that we do see in the news media that are out there. So that's…

PARTICIPANT: Thank you.

MS. HORNSBY-MYERS: Sure. No problem.

PARTICIPANT: Can I ask one question, please? So why is it necessary to have a drug that is 10,000 times more potent than…?

MS. HORNSBY-MYERS: So as I understand it, if you're an addict—no, seriously, if you're an addict… so this started… it's introduced from users of cocaine and heroin, okay? So what has happened is that this is another drug that's in the same class. They're opioids. They're all opioids. The purpose is that it gives a better high; it gives them longer relief; and it's enjoyable; and they're addicts and they can't quit. It's also extremely addictive just like the morphine and cocaine. However, they're probably already addicted from the other two, so I don't know that it's actually making addiction rates go up. However, this stuff, as I understand it from our DEA colleagues and other law enforcement, this is being manufactured as fentanyl by China, and it is being illegally brought into the country with the purpose of mixing it in. There's economics behind that as well. This amount of cocaine, we'll say is $10,000. This amount of fentanyl is $3,000. So if I mix a little bit of this into this I can charge the same amount, but make more money. So that's the impetus from those who wish to sell point of view. And the users have a tolerance.

So the Moscow Theater. Everyone is familiar with the Moscow Theater. That's when Russia used fentanyl, a mixture of fentanyl and carfentanil to subdue the terrorists. You may recall some of the people who were in that theater got up and walked out. They had no effect or minimal effect; could probably point those folks out as either, for legitimate reasons or illegitimate reasons, were taking fentanyl or carfentanil because they had a tolerance. What our law enforcement officers, in theory, don't have is a tolerance. They don't have that level, so we call it "naïve." So the workforce that we're concerned about, for the work that I'm doing, the very narrow piece that Dawn introduced, is from the naïve population of workers that are dealing with this.

So the next challenge, because, yes, fentanyl is used every day, all day, in every hospital across the United States and the world. So there's tons of

data on how fentanyl acts in that arena. However, there are no data as to how it works when it's crushed and put into a spoon or to a bag to sell. So what we do know is that, you know, there's tons of reports in the news of responders having exposures to opioids. There's a lot anecdotal reports in the media that are causing a real fear in the responder community. They're afraid when they see this stuff whether or not they're going to get exposed. We know that responders need guidance to protect themselves. I know that NIOSH receiving multiple calls and emails every week from first responders is still true. It's been going on since July. We get calls from all over the country just, "What do I do?" "How do I deal with this?" "How do I protect myself?" So that's what we know.

However, this is a much bigger challenge, is what we don't know. How are they exposed and how frequent? So we see all these news reports, but are they real? I mean, did it really happen? I know from some sheriffs' departments, you know, because I talk to the sheriff where it happened versus what you see in the news are two totally different stories, but it's the telling of the story, the fish story, you catch a fish like this and by the time it gets to the news it was Jonah the whale. So there's lots of activities that are out there, but which ones have a highest risk for exposure? Are there other factors that are out there? And I put a double asterisk by that one because one of the biggest elephants in the room with this is if I told you that an amount of something that you can't see could kill you, if you thought you had been exposed to it, would you react whether or not you had truly been exposed to it? Would you be inclined, perhaps, to have what we probably misnomer as a panic attack? Just stress yourself out because you believe, oh, my god, I have been exposed to this, and I have got nothing? I don't have my Narcan. I don't have any way of knowing. So I think that, at least, some of the reports that we see in the news are probably psychosomatic versus an actual exposure. However, those are just as important because that police officer or EMS is equally incapacitated. It does not matter why he or she is incapacitated. So one of the things we're really fighting out there is how do we deal with that? How do we get the message across to first responders that, yes, there are risks, but yes, they are manageable? Especially when you start out with somebody saying it's gray death, you know, and 10,000 times… it'll kill 10,000 elephants before it'll knock you over. So it'll clearly knock over.

So the other thing we talk about is which exposure route is most likely or least likely to lead to a negative health outcome. And, for us, the biggest threat through inhalation is respiratory depression. There are lots of signs and symptoms that go with it, but that one is life-threatening. If you cease to breathe that is very bad. So that's the one that we have focused on. We

believe that probably most of the exposures that are out there are dermal because you touch things all the time. If you're performing CPR on someone, you don't do that without touching them even with bagging and all that stuff. So if you're physically touching it, we do believe that they're probably getting exposed. However, the data that are out there show that dermal is really not going to cause respiratory depression. You would literally have to lay in it for eight to ten hours, not take a bath, and then you only start to get minimal because it just doesn't cross as a powder. It's not going to cross your skin. I mean, our skin is a very good protectant. Now that… all the caveats that go with that. If you have a gaping wound then that's different. But trying to convey that because the law enforcement, in particular, community believes that dermal is the most dangerous and is the route of exposure that is causing them to have the respiratory depression. They believe that. And we don't believe it, but we don't have data to convince them.

One question that we started out with was how responders can modify their current operating procedures to protect themselves. So what do they do for morphine and cocaine? What do they do for those drugs? And we'll just amp that up for this. Well, guess what doesn't exist? Standard operating procedures for dealing with it. Their procedures are focused on convicting a perpetrator. That's what their policies and procedures are based on. So how they do what they do, how they bag and tag their evidence, etc., etc., how they do field testing is based on that, not any health and… from a health and safety perspective. So…

PARTICIPANT: I have a quick question.

MS. HORNSBY-MYERS: Yes.

PARTICIPANT: Based on what you know what is your guesstimate, okay, as to how many real fentanyl exposures to law enforcement happened over the course of a year?

MS. HORNSBY-MYERS: Absolutely no idea.

PARTICIPANT: Zero to a thousand.

MS. HORNSBY-MYERS: No. I do believe they exist. There are cases out there. There was on in Stafford, Virginia where we have some federal law enforcement colleagues who helped us, at least, speak to the department where it happened. So we believe that that was… we believe it happens. We do believe that it happens. However, I have absolutely no idea what the answer to your question is. Part of the other issue is that the stuff coming in from China has anywhere from five to one hundred percent purity. So we don't know in different pockets… when you see these pockets as we have seen Ohio and West Virginia, and Kentucky we don't know what quality. Usually it's toward the 100 percent when we start to see the big clusters happen.

DR. REDINGER: Jennifer, quick question. Charles Redinger. With your last comment about law enforcement and their goals which makes sense, but I would image a lot of first responders are actually the EMTs.

MS. HORNSBY-MYERS: They are.

DR. REDINGER: I mean, so maybe I don't know enough about that profession, but they do have some protections they… I mean, even if it's basically just gloves, but they're not naïve to things. I mean, certainly even blood borne pathogen issues.

MS. HORNSBY-MYERS: Right. Right.

DR. REDINGER: But this is a different kettle of fish.

MS. HORNSBY-MYERS: We put them together. They are together because the EMTs also believe that dermal is the greatest potential harm to them, and we have been trying to educate… I mean, it is a little bit easier, it's a lot easier to work with them when we get into the PPE realm because they understand universal precautions, they understand gloves, they already have gloves, for the most part. So they're an easier audience, if you will, from that perspective than law enforcement, at least, especially at the state and local level. Just, in general, a lot of our stuff with fire and EMS, you know, they wear PPE. For a police officer they don't wear… if they do it's a bullet proof vest or it's a helmet, or it's something like that. It's not to protect their breathing tract.

DR. REDINGER: Thank you.

PARTICIPANT: Just kind of on that line, too, I mean, if it's a dust that's on your skin, you know, it's still a solid in a way. Can't you breathe that in, and that's where you get the severe exposure?

MS. HORNSBY-MYERS: You can, and you…

PARTICIPANT: Or off your clothes.

PARTICIPANT: Yes, yes. I mean, I guess, I immediately kind of assume that it was respiratory from the dust that was on them, you know, in those cases.

MS. HORNSBY-MYERS: We don't know. We are concerned about dust. When we get to the section on PPE I'll talk about why we delineate in the different categories, and one is dust versus not. If you don't see dust then one way… if you do see any, you know…

PARTICIPANT: Beware.

MS. HORNSBY-MYERS: Right. And if you see a lot then…

PARTICIPANT: Get out.

MS. HORNSBY-MYERS: Call somebody else kind of a thing. So any more questions on this?

DR. BUNN: Yes. I just want to make a comment as to whether they have been truly exposed or not. Of course, the way to tell whether they have actually been exposed is whether Narcan is effective in reducing… in reversing their overdose. If they stop breathing and they are reversed by Narcan they have been exposed to opioids.

MS. HORNSBY-MYERS: Correct.

DR. BUNN: So that's kind of one true test, and we are seeing it in Kentucky. We picked it up in a number of… well, through our ESSENCE system where they have been reversed, and so it's… yes, it may not rise to the level of, you know, real, real concern, but on the other hand, there is concern because we are seeing those exposures occur. And a lot of them have already implemented standard operating procedures in light of these exposures that are occurring.

MS. HORNSBY-MYERS: Yes, that is very true. I was going to mention some of the stuff that you're working on in a couple more slides. There's definitely… this is real. I mean, what percentage is psychosomatic versus an actual exposure? I don't know, but I know that they both occur. That's what I know or think I know, anyway. So what we have been trying to do is back in the fall of 2016, just amongst us federal agencies, if you look at the ones that's… the Department of Justice, the FBI, and DEA were actually a part of the Department of Justice, but there were also headquarter folks there. HHS and DHS got together because literally from this threat that's out there, the emerging threat, the guidance amongst those agencies varied from if you see powder or don't see powder, or if you just think fentanyl is there range from absolutely no PPE literally all the way up to SCBA across the agencies. So literally. So everybody did the risk assessment and came up with you could not get a wider set of guidance out there across the different federal agencies. So the White House brought us all together and said, "Okay, we need to all get on the same page. We need to talk this through and let's figure this out." So we came up with an interim guidance that we worked with the Interagency and everybody agreed to that kind of cut the middle. We went with NIOSH's recommendation for an N100 or a P100 for respiratory protection if you saw powder, but if it got bigger and wider then you needed to call, basically, Hazmat. We told folks that they needed to, quote-unquote, "do a risk assessment," but that's really all that guidance said. It was really pretty bare bones and pretty minimal. We were just trying to get something up that, at least, the federal agencies could agree with, and then we took that and put that on our webpage as well, so that it would be forward-facing to first responders. That really needed updating, so as quickly as we could get it updated, because telling somebody to just do a risk assessment, especially if they have any idea what that means, is not very helpful.

So our webpage now talks about the different categories… I'll just go ahead… well, and the other thing that we have worked with the Interagency Board on. So this was our webpage—just a screenshot—it's out there. We talk about… there's several tabs on the left-hand side. You can see the "Protecting Workers at Risk" is really the main tab. This is the front page where it just tells you what the problem is. "Illegal Use of Fentanyl" tells you

just how many people are overdosing and using this stuff, and then other resources that you can find. But here's really the meat of what we do. We broke it down into four job categories: the Pre-Hospital Patient Care, re EMS. So an EMS responding to overdose scene. That's the first category. "Law Enforcement," which is basically a traffic stop or a law enforcement officer coming upon the same type of scene as EMS, but as a law enforcement versus an EMS personnel that's now dealing with this overdose; "Investigation and Evidence Handling," because now you have to pick it up, you have to bag it, you have to tag it. They were field testing. We originally said, "Don't field test," but now we have learned that because of statutory limits they have to field test because if they don't field test and at least have a presumptive positive, they can't keep whoever it is that they suspect might be doing things they shouldn't be; and then the fourth category was "Special Operations and Decontamination," and that, think about a large milling operation where they actually are taking pills, making them into powder. So there's tons and tons of powder or a small amount of liquid, any amount of liquid, because this does come in liquid form as well, we categorize—NIOSH—as a special operations. And, again, the exposure levels are minimal, so you think you have a reason to believe that fentanyl's involved, but you don't see any fentanyl laying around. There might be a needle or something like that, but there's no product, per se. Moderate is small amounts, are visible. High is large amounts. And, no, we didn't quantify small and large because we didn't know how to. Quite literally, for you and me, a small amount of this could cause respiratory depression very quick. But, you know, we just didn't know how to quantify. We tried, we just didn't know how to do it. Again, because we don't have tox data for fentanyl in this form.

So this is basically just a quick screenshot of what we… you'll see on that one tab it basically, again, breaks down. We do tell EMS and law enforcement if they think it's a, quote-unquote, "high," it's not recommended, just leave, call Hazmat or whatever your local protocols are for dealing with things that don't…

DR. NICAS: But they're saying how clean—this is Mark Nicas. How does one visibly distinguish between fentanyl and cocaine, heroin? I'm assuming they could be all different colors, you know, brown, gray, black, white.

MS. HORNSBY-MYERS: We don't. It's powder at this point. Fentanyl has become so pervasive across the U.S. For a while it was an East Coast thing, and the West Coast was like, "That's just not us. We're not going to do that." But now, pretty much, the entire country… and with the amounts of product, it's literally coming in, in… the volume is basically shipping containers size, I mean, of this stuff, that are coming into the country. Hopefully, most of those get caught, but

they don't all get caught. So…

DR. NICAS: But if you see powder you just have to presume it's fentanyl…

MS. HORNSBY-MYERS: Correct.

DR. NICAS: As opposed to pure cocaine. Right?

MS. HORNSBY-MYERS: Correct. That's the assumption that they're working on these days. It's just…

PARTICIPANT: If it's gray or if it's white, or it doesn't matter?

PARTICIPANT: If it's anything.

MS. HORNSBY-MYERS: Anything. If it is a powder and it's a clear overdose and it's a drug, it is assumed to be fentanyl, from their procedural point of view.

PARTICIPANT: And lots of times the heroin and the cocaine are cut with fentanyl.

MS. HORNSBY-MYERS: Correct. Or carfentanil.

PARTICIPANT: Well, yes, or carfentanil, which you mean like one granule to increase the high.

MS. HORNSBY-MYERS: Yes. I don't how much you guys have looked at this, but you can… DEA has a photo of an amount of fentanyl that can kill you, and it's like two grains of salt, which also leads to the perception that…

PARTICIPANT: Anxiety.

MS. HORNSBY-MYERS: Right. Anxiety, that's a good word. That's a good word. So what are we doing? One of the things that we have actively tried to do, we put a blog out as well, and we basically, shamelessly, tried to get any states and locals out there, anybody having an issue with this, to invite us in to do an HHE, so that we could help, do the Health Hazard Evaluation Program, so that we could actually gather data. What is it like when you're doing a raid? What is in a squad car after you have accidently spilled a bag of this or you have had to do what you have had to do? We have had, I guess I would call it, minimal success with that. We have had two HHE requests. One of them is from a federal agency who was just trying to protect their own workers, and I doubt there will actually be fentanyl exposures or fentanyl found during that, it'll be more of a process type thing, just helping them through their process. We are working with a jurisdiction that did have, what we believe to be, a legitimate exposure. That is ongoing. So we still don't have data from those things. We are also working with the White House through the National Security Council, Director of Law Enforcement, developing one-pager for first responders trying to get, again, just another document out there that is directed at law enforcement that just helps them understand what the true risks are and how they can… their PPE will protect them if they follow their standard operating procedures and they do what it is that they're supposed to do; trying to just pull that fear back a little bit with education and understanding.

Probably the most productive thing that we have done is a coordination role. So we had, again, all those telephone calls from all over the place from

people that we know and get passed on through CDC info to NIOSH. I, actually, had two… literally, in the same day I had two sheriffs' departments in two separate counties in Florida who are literally… share a border who were having the same questions. And one was actually doing a pretty good job and had some pretty good protocols in place, and had actually asked us to look at those. We're like, "Yes, you know, that looks good. It matches up with what we do." So we basically just hooked those two departments up. "You guys are next door to each other, you know, you know what you're seeing." So we have done that kind of a thing. We have done that with… I even did that with Canada, two different provinces in Canada. We're like, you know, "How do I deal with this? How do I deal with this?" First hooked them public health Canada, and then hooked them with each other as well as the RCMP, which has done a lot of work in this area, and actually has a very good website, as far as I'm concerned. It talks about risk assessment and things like that. I think they were faster than the rest of us in getting something up online for first responders. And then in Kentucky, we were working with you. We had the opportunity to work with Dr. Bunn and her group in helping to input into a survey that they were creating. And at the same time I'm getting phone calls from the Public Health Department in Kentucky and I'm like, "Well, wait a minute." They wanted to create a survey. I'm like, "Well, why do you want to create a survey? Because there already is one." And I got silence on the other end. So I was able to hook you guys up. So hopefully, that'll be a partnership that'll move forward and provide data for the rest of us as well that can help us all in this.

Again, we just have tremendous gaps in knowledge. So what routes of exposures are the most likely/least likely? How do we decontaminate responders and equipment? Should law enforcement field test? Are there other workforces that need guidance? And the answer is, of course, I mean, there's healthcare workers, parks and sanitation, which I didn't even think of. That was a great comment that came through our blog, you know, "I'm a parks worker and we're finding all this paraphernalia. What do I do with it?" That was a forehead slapper for us and just never even though of that. So there's so… it just is so… and librarians. Apparently, librarians have to deal with this because people… it's a public space and the homeless go in to use. So there's just… it's…

PARTICIPANT: I was thinking in hotels as well in the bathrooms there.

DR. BUNN: That's exactly right. That's happened in Louisville. They have implemented procedures there, as well as shipping, UPS. We had an incident there where heroin boxes cracked open on the line at the UPS facility in Louisville.

MS. HORNSBY-MYERS: The Postal Inspection Service is also dealing with that. They have actually implemented a process where if they believe that… so if they catch it they

realize that it's a package that is containing illegal material, there's the US Postal Inspection Service tags those, grabs them, and will do what they call a "controlled delivery." They'll say, "Hey, Dr. Rogers, I have got your package." "Yes." And as soon as you grab it, they grab you. But what they started to do is if they think it is a greater volume than what an N95 could protect them from they actually open the package, take the actual true drug out, put in a, what they call, a sham, and then deliver the sham. They don't like to do that because that causes them legal problems. But because of this they have decided, "Oh, well, you know, we don't want the exposure." So lots of different workers are doing different things to deal with this.

So within the institute we really only have one ongoing funded project in DART, and it's to do a wipe sample to field test to help law enforcement. It's a lateral flow assay. It's in its infant stage. It is moving forward, and I have already mentioned the input that we provided to Dr. Bunn's group at University of Kentucky, ERC.

So now it's your turn. So we have lots of questions as you can tell. I mean, so how do we prioritize these gaps? We can't answer all these questions at the same time. We're not getting the information through the HHE process that we had hoped to. So how do we gather data to find out what's out there? But I think there are some answers out there and some things that are ongoing that can feed into that. Okay. But what are the routes that exposure for law versus EMS versus fire? How do we decontaminate? The Interagency Board that Angie mentioned, also has a really nice document on fentanyl and how to deal with it that they put out for their workers. It's very similar to ours. Theirs goes into even more detail in the table than ours do, but all the recommendations lay very nicely across each other. But I think the biggest thing for me is, you know, that standard operating procedures, I'm going into this and I'm assuming that they have already got procedures in place that they can follow and just modify, and they don't. So how do we… that's a gap that I don't know how to bridge. I mean, maybe this will force those things to be developed. Perhaps this is the substance that will push that within the different departments and agencies. But I still think the higher ups will do well, the New York Cities, the Chicagos will all do well. But how does Smallville USA deal with that?

DR. REDINGER: Yes, just one suggestion. Charles Redinger. And this was many years ago when I was doing work with FOH, Federal Occupational Health. We had worked up a procedure for DOJ drug labs. So it's a different setting, but that's probably nestled and maybe it surfaced within the DOJ circles. But they were mindful of this issue, certainly the laboratory stage, and that's probably sifted in and it's probably sifted up into what you're doing.

MS. HORNSBY-MYERS: It has. The issue isn't that there aren't protocols, in my opinion, because, like

you said, we, as a federal government—those of us in the federal government the Department of Justice and Department of Homeland Security with TSA and the customs and border do have policies and procedures, and those are different, but they're an awfully good starting point. But how do you get those from there down to here? How do you get… how do you not just get it there, but get them to follow it; get them to understand and get the training that goes with it? It's not just giving them a piece of paper and says, "Here, do this." We all know that's not going to work. And how do we convince them that if they put on their gloves… I know just one anecdotal call… I had a call. The ACMT, American College of Medical Toxicologists, put out a paper and it basically said you do not need to worry about the dermal exposure, here's why. And it's an exceptionally accurate, helpful well-written… I thought it was the best thing that ever came out. It was like here we go, now we can help these folks understand. I get a call from a place that had an exposure, who basically said that the ACMT threw them under the bus for discounting their exposure. That was the reaction from the end user from that paper, not the same as we scientists have, but you're telling me that I made it up and it didn't happen. And so it pushed them even further away. So they don't want to listen to what we have to say. I know that's one department and one group, but it's someone who actually had an exposure and believed that it was dermal. I defended it. I said, "I think it's a good paper." And I said, "Just do me a favor, keep your gloves on, but throw on your respirator as well."

DR. ROGERS: Grace, and then Chris.

DR. LEMASTERS: It seems like the very first gap there is, is understanding the extent of the problem. When someone asks, "Well, is it a hundred? Is it ten?" I mean, don't you need some way of developing a surveillance system to try to find out what the extent of the problem is and how would you… I mean, would you go about that like national surveillance system? I mean, that could be big news, you know, if NIOSH had a national surveillance system of possible fentanyl exposures with responders and they could have an easy fill-in one page questionnaire or something that all goes to all police departments, medical responders. I mean, you really want to know how serious is this to… if it's five, then maybe you don't spend much time on this. If it's 5,000 then that puts a whole level of emphasis on what NIOSH should be doing. And right now we don't know if it's five or five thousand, right?

MS. HORNSBY-MYERS: We don't. We started putting together… I was working with HHS ASPR, and we were trying to put together a database of just incidents that were reported in the news, just using the media that are out there, and just, you know, states and locals and wherever they were putting out a report. And we were gathering four or five, or six of these a week. So that's all I know, is that four,

five, or six of these a week make the news across the U.S.

DR. LEMASTERS: Well, even if you start with that you can follow-up with the news and go to the story to gather some information. That takes a lot of resources, I agree. But somehow the extent of the problem is the first question in my book. I mean, before I would write a grant, to study anything or to do… I would have to convince someone that there is a problem. Right?

MS. HORNSBY-MYERS: Agreed.

DR. LEMASTERS: And we don't know if there's a problem. Right? A big problem. It could be five, two, five thousand.

MS. HORNSBY-MYERS: It could be. It could be.

PARTICIPANT: One just to build on that, I wonder if talking to some of the folks that worked on that FOG database that they put together for the oil and gas fatalities. They sort of created this system by looking at reports and it was a lot of work, but it really brought about some more surveillance data to see how big the problem of engaging and other issues were. So it might be worthwhile to talk to the Western States Division folks just a little bit about that, if it's even feasible, I don't know, but it might help.

MS. HORNSBY-MYERS: Yes, we could look at it. I mean, I know that we basically just tried to come up with guidance, and if we get a call we at least point people and we're just having a consistence set of guidance. That was just the quickest thing we could do. But you're right, I would love to know. And I think that there are things and efforts out there.

DR. BUNN: Yes. Well, I mean, she was first, and then I was going to raise my hand up.

DR. ROGERS: Chris, did you have a comment?

MS. LASZCZ-DAVIS: My comment, really, was the same one that…

DR. BUNN: Oh, okay. All right. Well, first of all, in Kentucky we actually just passed a law this last legislative session to make drug overdoses reportable conditions. So it's through our emergency departments where it is supposed to be reported to the State Department for Public Health. So that may help to start when you're looking at those ones that require the reversal by Narcan where they'll be reported. The second thing when you're talking about knowing, again, the extent, the magnitude of the problem, through our work with us… actually, we are also in the State Health Department which is kind of… I was surprised by it. As far as the survey goes, we're surveying to assess the extent of the problem, to identify the problem to find out what standard operating procedures are already in place, what the first responders see as gaps, looking at whether they're firefighters, EMS, law enforcement in a number of states. So through SouthON and through the ERC, through us at the University of Kentucky, at (KBRC @ 00:37:45). The ERC is funding Virginia, Georgia, Mississippi, Louisiana, and then we're conducting a survey in Kentucky as well to give it a better handle on the extent of the problem, at

least, in the Southeast region to start out with. And then the last thing you were asking about, you know, how can we get this information down to that level, the volunteer firefighters, stuff like that. A lot of communities do have the drug-free coalitions at least, which most of them contain representatives from law enforcement, you have the coroners, you have your fire departments, and that may be an avenue to work with the drug-free coalitions of America and present at those meetings, and to actually provide them the information that they can get down to the coalition level.

DR. LEMASTERS: How about Poison Control? Do you do that? I mean, there's Poison Control Centers in most major cities. I just wondered if tapped into that.

DR. BUNN: Yes, we have, but what we have found in Kentucky is that the Poison Control Center actually is more like a subset of what you would see in an emergency department because in Kentucky, I mean, you get all kinds of calls for children, but when you're talking about adult exposures, the majority of the Poison Center calls, actually, are derived from hospitals when they don't know the exposure that the individual had. So in our case it's more a subset of the ED data anyway.

DR. ROGERS: Mark.

DR. NICAS: Yes, I have a question. Are there reliable dose-response potency data for fentanyl? So if you give whatever it is, you're going to get the route suggestion, SCIB, inhalation, and what the potency is. I mean, this paper you mentioned on the dermal exposure must have had some set of data about potency.

MS. HORNSBY-MYERS: There's a whole lot of data on both fentanyl and carfentanil, maybe not some of the others, in the medical arena. So if you're in the hospital setting then what it would take. If you have a patch, what it would take. But to the illicit drug, no, there are no data that we can say, you know, I mean, I know what DEA says as far as two grains of salt, basically, but there are no… I mean, the toxicity does show that it is extremely toxic, but that's about all we can say. When they were starting looking at it from the hospital point of view when they were working on mice and things like that, to get that dose-response curve, it doesn't take much.

DR. NICAS: But pharmaceutical companies don't have comparative route exposure, route data, they don't…

MS. HORNSBY-MYERS: They don't from misuse. They have, if you take a pill, which you're supposed to take for pain relief, they have that, but they don't have… if you crush that up, mix it with some other stuff and then light it on fire and smoke it and inject it, they don't have that. It doesn't exist.

DR. ROGERS: Sharon or Ted, do you have any comments or questions? One minute—no, I'm just kidding. All right. John, you have a…

DR. CULVENOR: This could be profound. The wrongdoers in society, if this is toxic to dogs,

could use this to, largely, remove the entire… or one of the key limbs of the drug detection system by sprinkling it in lots of places. So is it toxic to dogs just as humans?

MS. HORNSBY-MYERS: It is. There's actually K9 programs going on now that are trying to teach the dogs to sniff it out, but also then trying to come up with a way… so if a dog is incapacitated they usually IV to bring it back with a Narcan. You can't just spray it up their nose. They're working on things to bring the dog… it's multifaceted, and sort of intriguing.

PARTICIPANT: That's awful.

DR. ROGERS: Any other…

PARTICIPANT: You want to read an interesting article, it just came out: *The Science of Addiction*, and it's fascinating because it discusses in detail about the brain and how the brain is affected and the pictures are good, the stories are good from birth, children to adults.

PARTICIPANT: Is that the current issue of *Science*?

PARTICIPANT: It's *National Geographic*.

MS. HORNSBY-MYERS: The other issue, too, is one of the things that the EMTs have changed their protocols and they're trying to get law enforcement to do it, too, typically you need two doses of Narcan to bring you back. If it's an addict that they know is an addict and they're assisting, they're actually asking that they only give them one because, apparently, the reversal of this also makes people very, very, very mad, and they come out of that high very, very, very violent. So they're giving them just enough to keep them alive and get them to the hospital so they don't come out swinging. So it's just multifaceted. So we do need data, but I do think we know enough to put something out there, and that's what we tried to do, but it still needs work. We still need a lot more information for our first responders.

DR. ROGERS: Well, thank you very much.

MS. HORNSBY-MYERS: Thank you.

DR. ROGERS: It was sort of a depressing…

MS. HORNSBY-MYERS: Yes, sorry. But no, there's a lot of good people working on it. We'll get it figured out. How's that? We'll get it figured out. Put your thinking caps on and help me figure this out.

PARTICIPANT: It's so sad. It's so sad about the animals, though. I mean, it's just awful.

DR. KITT: Michael and I decided next meeting we have to end on a much more upbeat—

DR. ROGERS: Well, thank you all very much. The presentations were really excellent today. I think at some of our meetings we—I mean, we always have great presentations, but sometimes they're informative… I don't mean these are not informative, but they're more informative versus… I mean, I think today we just have our work cut out for us. And in terms of really sort of digging

into some of the issues and the research that really needs to be done that really hasn't been tapped; the characterization of problems that we just don't know, really, too much about. So thank you for that, for everybody who made those really great presentations.

I wanted to say too, Allen provided us with that there is the TPG in Puerto Rico. It's a master's program in industrial hygiene. So Dr. Sergio Caporali is the PI. So I don't know, AIHA may be interested in communicating with them if that's an issue.

PARTICIPANT: Thank you.

DR. ROGERS: But I just wanted to share that. So I don't know if there are any other comments or any comments. I guess we'll touch base with people in terms of our next meeting via something, email or whatever. But I do want to always thank the staff who provide us such helpfulness. Alberto, thank you so much. And he passes on those minutes to me. Thank you for that; to review those. Pauline, thank you for all your help with the logistics; getting everything done. Ed, you're always helpful with the AV; appreciate that. And, Michael, with the transcription. So again, thank you, everybody, for all their help and I know people have schedules they have to get out on time, but I really appreciate all the comments. Comments are really good and helpful; really providing a lot of direction, I think, for NIOSH in terms of both research and education, and service… well, I guess service makes it three. So thank you all, again. Have a good and safe trip home. No fentanyl now. Michael.

DR. BEHM: Can I ask one thing, for future agenda items, can we talk about that, please?

DR. ROGERS: Well, I think we…

DR. BEHM: Or do we need to just send you…?

DR. ROGERS: Send those on. And I think, John, you weren't here this morning, but we had sort of an interesting discussion about workforce issues. The board was very interested in having that as an agenda item in future. Dwindling workforce in occupational health. We are adjourned.

[END MEETING]

G L O S S A R Y

ABPM	American Board of Preventive Medicine
ACGME	Accreditation Council for Graduate Medical Education
AIHA	American Industrial Hygiene Association
AOHP	Association of Occupational Health Professionals
ASSE	American Society of Safety Engineers
BSC	Board of Scientific Counselors
CDC	United States Centers for Disease Control and Prevention
DART	Division of Applied Research and Technology
DOE	Department of Energy
DOL	Department of Labor
DOT	Department of Transportation
EPA	Environmental Protection Agency
ERC	Emergency Response Center
FACA	Federal Advisory Committee Act
HELD	Health Effects Laboratory Division
HHS	US Department of Health and Human Services
HRSA	Health Resources and Services Administration
IRB	Institutional Review Board
NACOSH	National Advisory Committee on Occupational Safety and Health
NIH	National Institutes of Health
NIOSH	National Institute for Occupational Safety and Health
NORA	National Occupational Research Agenda
NPPTL	National Personal Protective Technology Lab
OMB	Office of Management and Budget
OSHA	Occupational Safety and Health Administration
PPE	Personal Protective Equipment

Appendix A

Department of Health and Human Services
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health
Board of Scientific Counselors (BSC)
Agenda: Sixty-Ninth Meeting

NIOSH Offices
395 E Street, S.W., Suite 9000
Washington, DC 20201

Conference Number: 888-397-9578
Participant Code: 63257516
https://odniosh.adobeconnect.com/nioshbsc/

Tuesday – September 26, 2017

Time	Topic	Presenter
8:30 am	Welcome and Introduction Meeting Logistics	Alberto Garcia DFO, NIOSH
8:40 am	Agenda, Announcements, and Approval of Minutes	Dr. Bonnie Rogers Chair, NIOSH BSC
8:50 am	Director's Opening Remarks	Dr. John Howard Director, NIOSH
9:20 am	Stockpiled Surgical Gowns & Respirators	Dr. Susan Moore Senior Scientist NPPTL, NIOSH
10:20 am	Break	
10:30 am	NIOSH's Response to Increased Use and Complexity of Robots	Dawn Castillo Director DSR, NIOSH
11:30 am	Lunch	
12:30 pm	Public Comments	Alberto Garcia DFO, NIOSH
12:45 pm	NIOSH Disaster Science Responder Research Program: Overview	Angela Weber DSRR Program Coordinator, EPRO, NIOSH
1:30 pm	Fentanyl Exposures to Emergency Responders	CDR Jennifer Hornsby-Myers Senior Scientist ,EPRO, NIOSH
2:15 pm	Summary & Wrap-up, Future Agenda Items, Meeting Dates, Closing Remarks	Dr. Bonnie Rogers Chair, NIOSH BSC
2:30 pm	Adjourn	

Appendix B

Board of Scientific Counselors
Washington, D.C,
September 26, 2017

Budget

The Senate Appropriations Committee provided a total budget for NIOSH of $335.2. This amount is equivalent to our FY2017 funding level of $335 million.

The House of Representatives in mid-July provided a total NIOSH budget of $325 million in their "mark up." The House "mark" is $10 million below the FY2017 enacted level of $335 million for NIOSH, but $125 million above the President's budget request of $200 million.

The next step in the FY2018 budget process will be a "conference" between the House and the Senate appropriators to resolve any differences between the two budget proposals, including the $10 million difference in the House and Senate "marks" for NIOSH.
Dr. Howard will present the most current budget information at the time of the meeting.

Organizational and Personnel Announcements

In May, **Ryan Hill, MPH (CDR, USPHS)** was appointed the first full-time director of the Western States Division (WSD).

Larry Elliott was appointed Interim Director for the Division of Applied Research and Technology.

In July, **Jacek Mazurek, MD, MS, PhD** was appointed as Chief of the Surveillance Branch within the Respiratory Health Division, replacing Eileen Storey who is retiring in November.

Retired:

In June, **Leslie Nickels** retired from NIOSH. The Research to Practice and Communication Offices have now merged into the Office of Communication and Research to Practice, with Christina Spring serving as the Associate Director of the office.

CAPT Gayle DeBord retired in June.

Dr. Anita Schill will retire at the end of September.

New Programs and Initiatives

Hurricanes Harvey and Irma Response

NIOSH is supporting the federal government's response to Hurricanes Harvey and Irma. NIOSH is staffing the CDC Occupational Health Task Force, coordinating with OSHA, responding to requests for information from stakeholders, and pushing worker safety and health messaging through our normal communications channels. NIOSH has deployed a total of 13 staff members to support the federal government's response (4 currently in field/9 staff returned, 11 through USPHS and 2 through HHS/CDC), and 5 staff selected for possible FEMA deployment.

NORA

As a partner in our work on the National Occupational Research Agenda (NORA), we wanted to reach out to you and share with you our new publication, *National Occupational Research Agenda: Second Decade in Review | 2006–2016*, a report of the activities, effectiveness, outcomes, and impacts of a decade of NORA work by NIOSH and by you, our partners.

The report outlines the progress and impact made in addressing occupational safety and health research needs over the second decade of NORA. During this decade, the focus of NORA was on moving research into practice in the workplace, with an emphasis around ten industry sectors. This report highlights the work of NIOSH and our partners in achieving this impact.

In addition to the main report, the *Sector and Cross Sector Program Supplement* report provides specific results on the work of each of the ten NORA sectors and twenty-four cross-sector programs, which were developed by NIOSH to support the NORA sector goals.

NORA is a partnership program to stimulate innovative research and improved workplace practices. Participation in NORA is broad, including stakeholders from universities, large and small businesses, professional societies, government agencies, and worker organizations. We look forward to continuing our work with you on the third decade of NORA, as we focus on what the future of occupational safety and health research will be in 2020 and beyond.

Respiratory Health Division

A report was published in the July 2017 *Morbidity and Mortality Weekly Report (MMWR)* documenting US silicosis deaths among young adults (http://dx.doi.org/10.15585/mmwr.mm6628a2).

Surveillance Branch completed the spirometry training video "Learning Curves: Technical Procedures for Spirometry Training in the Occupational Setting," which is offered to NIOSH course sponsors, posted to the NIOSH's Respiratory Health at Work and Spirometry web pages, and will be promoted through @nioshbreathe Twitter and NIOSH social media.

In July 2017, Surveillance Branch staff traveled to Zambia at the invitation of the Government of Zambia and in response to a technical assistance request from the World Bank to evaluate issues with health surveillance of miners. The team assessed working conditions in the Northern Zambia copperbelt region and provided recommendations to the Ministry of Health on how to improve worker health surveillance in the country.

In September 2017, a manuscript on the level of concordance between chest radiographic classifications of A and B Readers in a national surveillance program was offered to U.S. coal miners. This manuscript has been highlighted in *This Month in Radiology 's* edition of Radiology as a feature article by the editor.

On August 10, 2017, a symposium was held commemorating 50 years of occupational respiratory disease research in Morgantown, WV (https://www.cdc.gov/niosh/respiratory/symposium50.html).

Division of Surveillance, Hazard Evaluations, and Field Studies

Division of Surveillance, Hazard Evaluation and Field Studies

NIOSH has released two new health hazard evaluation reports on workplaces that are growing steadily and for which little is known about the potential hazards: vape shops and cannabis farming. In both, we focused on describing the potential exposures and identified a range of issues from ergonomics to chemical handling that could pose a risk to employees. More information can be found at https://www.cdc.gov/niosh/hhe/reports/pdfs/2015-0107-3279.pdf and https://www.cdc.gov/niosh/hhe/reports/pdfs/2015-0111-3271.pdf

NIOSH recently authored an MMWR article (Beard et al, 2017) that examined Amyotrophic lateral sclerosis (ALS) and Parkinson's disease, both progressive neurodegenerative diseases, by occupation using data from the National Occupational Mortality Surveillance (NOMS), a population-based surveillance system that includes approximately 12.1 million deaths from 30 U.S. states. The study found that workers in white collar jobs (especially computer and mathematical; architecture and engineering; legal; and education, training, and library-related jobs) experienced a higher proportion of deaths from these diseases. Although the reasons for the findings of this study are not understood, it provides information for future targeted studies to identify risk factors for ALS and Parkinson's disease.

The NIOSH Health Hazard Evaluation Program routinely receives requests for older health hazard evaluation reports that have not been previously available on the NIOSH website. In 2017, NIOSH has posted over 1,000 reports for evaluations completed before 1985. We are continuing this effort with the goal of making all historical health hazard evaluation reports available online.

NIOSH recently completed data collection for an exposure assessment study investigating firefighter turnout gear and sock hoods after repeated exposure to smoke and heat, followed by laundry or decontamination. This study was funded by FEMA and CDC Foundation and is a collaboration between the University of Illinois Fire Service Institute, Underwriters Laboratories, and NIOSH. Turnout gear worn by mannequins were placed inside a chamber filled with combustion aerosol. Testing was conducted to measure contamination breakthrough, as well as degradation to the fabric, over a total of 40 exposure/cleaning cycles. This study will provide critical information on turnout gear protection and longevity under realistic firefighting conditions and maintenance regimens.

Division of Applied Research and Technology

NIOSH Manual of Analytical Methods

The NIOSH Manual of Analytical Methods (NMAM) published a new guidance chapter titled "Analysis of Carbon Nanotubes and Nanofibers on Mixed Cellulose Ester Filters by Transmission Electron Microscopy." NIOSH scientists have carried out many studies on the microanalysis of airborne carbonaceous nanomaterials, and this research has led to numerous related publications and guidance documents.

A brief video titled "Introduction to the NIOSH Manual of Analytical Methods, Fifth Edition" has been released. Running about 90 seconds, the video was produced as a brief overview of what the NMAM is, what information can be found within it, and directs the viewer to the NMAM webpage for more information. The video can be found on the CDC YouTube channel. It had over 100 views in the first week of posting. The new chapter and the four updated methods can be found on the NMAM website, www.cdc.gov/niosh/nmam.

Updated version of NIOSH Publication *Elements of Ergonomics Programs* now available online

The updated webpages for NIOSH document *Elements of Ergonomics Programs* outlining practical strategies for identifying and correcting ergonomic deficiencies in a variety of workplace settings (excluding Safe Patient Handling and Mobility (SPHM)) is now available.

DART researchers collaborated with Kansas State University for testing within airplane cabin platforms to conduct research related to the delivery, prototype refinement, installation and initial testing of an updated IsoPass prototype. ISOPASS is a passenger isolation system, applicable for long-range/transoceanic flights when a potentially-infectious passenger (suspected to be ill with MERS, SARS, Ebola, Pathogenic avian influenza, or other infectious diseases of significant concern) becomes symptomatic in mid-flight and the potential to land and get the passenger de-boarded and into a healthcare treatment facility is not readily available. Currently there is no protection for such scenarios, beyond asking the sick passenger if they are willing and can tolerate wearing a surgical mask.

The ISOPASS system will be easily deployed by flight attendants, is being designed with flight-attendant and passenger acceptability in mind, and will collectively reduce the potential for airborne, droplet, contact and fomite dissemination of pathogens.

EPHB hearing loss prevention researchers conducted measurements of firearm noise suppressors at a site in Rudyard, MI. Fourteen rifles, pistols and a shotgun were tested with and without firearm noise suppressors. The rifles and pistols were tested with both supersonic and subsonic ammunition. The purpose of the study was to understand the noise radiation characteristics of suppressed firearms and the exposure levels at the shooter's ear. The study was conducted in conjunction with researchers from Western Michigan University, the University of Northern Colorado, Northern Illinois University and Central Michigan University. The data will be used to describe the auditory risk for suppressed and unsuppressed weapons' noise and will allow the development of an acoustic standard to describe the noise reduction performance of firearm suppressors.

Hazardous drugs documents

DART researchers have successfully licensed technology and methods for the near real-time detection of surface contamination by antineoplastic drugs. The NIOSH monitors, which use surface wiping and lateral flow immunoassay for measurement, were demonstrated to be sensitive and accurate in the laboratory and in healthcare workplaces. The licensee, a global medical technology company that is a leader in patient and healthcare worker safety, plans to introduce the devices commercially in early 2018.

Division of Safety Research

NIOSH, along with co-sponsors National Safety Council, American Society of Safety Engineers, Society for Advancement of Violence and Injury Research, Board of Certified Safety Professionals, and West Virginia University (School of Public Health and Benjamin M. Statler College of Engineering and Mineral Resources), announces the next National Occupational Injury Symposium (NOIRS) (https://www.cdc.gov/niosh/noirs/default.html), which will take place October 16-18, 2018 in Morgantown, WV at the Morgantown Marriott at Waterfront Place. NOIRS 2018 is the seventh in a series of symposia hosted by NIOSH since 1997 which have had

strong support from the occupational injury health and safety community. The symposium will provide a forum for the foremost occupational injury researchers and practitioners to present their latest findings and methods and share their occupational injury prevention work and knowledge, and is designed to strengthen the fields of occupational injury research and practice by facilitating exchange of scientific knowledge and providing opportunities for professional education and networking. NOIRS 2018 will announce the opening of the abstract submission process in the Fall of 2017.

Division of Safety Research staff collaborated with health communications students from West Virginia University (WVU) to develop and test motor vehicle safety messages with law enforcement officers. As part of this effort, 18 students (12 undergraduate-level from Advanced Health Communication and 6 graduate-level from Health Communication Dissemination) conducted in-depth interviews with police leaders and conducted a nation-wide survey. Findings are being used by NIOSH to refine messaging and develop a toolkit for small- to medium-sized law enforcement agencies. The partnership between NIOSH and WVU was highlighted in the Eberly College online magazine (http://eberly.wvu.edu/news-events/eberly-news/2017/06/13/communication-studies-students-promote-law-enforcement-motor-vehicle-safety?mc_cid=9ae2569554&mc_eid=314d3cfae6), on WV National Public Radio, and is expected to appear in the September issue of the American Public Health Association journal *The Nation's Health*.

The Division of Safety Research celebrated its 40th Anniversary on June 14, 2017. A NIOSH Science blog, *40 Years of Safety Research*, helped commemorate the anniversary, and includes some history on the Division and examples of accomplishments through its 40 years (https://blogs.cdc.gov/niosh-science-blog/2017/06/14/dsr-40/).

Education and Information Division

Chemical Risk Management Updates

Peracetic acid research: NIOSH is conducting a cross-Institute research effort to investigate workplace exposures to peracetic acid. Peracetic acid is an antimicrobial agent used as a sterilant in healthcare setting, food processing (e.g., poultry plants), and wastewater treatment. Research efforts are focused on: 1) validating sampling and analytical methods; 2) field studies to assess

workplace exposures; 3) animal studies to characterize the toxicity of acute exposures; and 4) engineering controls. Data and information generated from this research will provide the basis for NIOSH recommendations, such as an immediately dangerous to life or health (IDLH) value or short-term exposure limit (STEL).

Young Worker Updates

The U.S. Department of Labor, Employment and Training Administration (ETA) recently added "health and safety" as a foundational workplace competency in their Generic Building Blocks Competency Model. With the advice of NIOSH and OSHA, ETA updated the specific competencies to be included in the newly added building block to better align the competencies with the foundational workplace safety and health competencies being promoted by NIOSH and OSHA.

The American Industrial Hygiene Association (AIHA), through its partnership with NIOSH, is using Safety Matters, a joint NIOSH-AIHA program to raise awareness among young people about workplace safety and health. As part of this effort, AIHA was contacted by the Office of Research Services, National Institute of Health stating their interest in having Safety Matters delivered by the United States Public Health Service (USPHS) Commissioned Corps (CC) Environmental Health Officer's (EHO's) as part of the Surgeon General National Prevention Strategy (NPS) – Prevention through Active Community Engagement (PACE) program.

EID and the Montana Department of Labor & Industry, Safety & Health Bureau signed an MOU to work collaboratively to improve workplace safety and health education and outreach being conducted for Montana's young workers through the sharing of efforts and expertise.

4th International Understanding Small Enterprises Conference

The Center for Health, Work, & Environment at the University of Colorado School of Public Health and NIOSH will be hosting the *4th International Understanding Small Enterprises Conference* in Denver, Colorado from October 25-27, 2017. This is the first time this conference is being held in North America. It represents the culmination of more than a decade of efforts to build the NIOSH Small Business Assistance Program. The theme of this year's conference is worker well-being and sustainable business health. Researchers, occupational safety and health

professionals, students, small enterprises and stakeholders from around the globe will come together to understand the unique occupational safety and health needs and challenges facing small businesses and to share their research and research-to-practice successes.

Emergency Preparedness and Response Office

Emergency Responder Health Monitoring and Surveillance™ (ERHMS™)

NIOSH released the first version of ERHMS Info Manager™ software. This software is a custom built product that emergency responder organizations can use to implement the Emergency Responder Health Monitoring and Surveillance™ (ERHMS™) framework. The software product facilitates a rapid assessment and intervention related to health monitoring and surveillance of emergency responders before, during, and after deployments by helping to automate data collection, analysis, and reporting. The software will help decrease the time required to identify causes, determine risk factors, and inform implementation of appropriate interventions for those who manage the health and safety of responders.

National Personal Protective Technology Laboratory

Action Plan for NIOSH's Respirator Approval Program

The National Personal Protective Technology Laboratory (NPPTL) oversees and administers NIOSH's Respirator Approval Program. A team of NPPTL experts has been established to develop an Action Plan that supports the continued improvement of this Program. The scope of the effort includes approval and post-market aspects of the Program design, manner of execution, and measurements of performance. Sources of input to the effort include: 1) stakeholder perspectives; 2) analysis of current workflow steps and decision logic; 3) analysis of "active working time" and "wait time" for each step; 4) exploring other federal and private sector conformity assessment programs; 5) previous external reviews that included recommendations for this Program; and 6) an independent review conducted by a NIOSH Doctoral candidate. At a public Manufacturer's Meeting this November, NPPTL will provide an overview of its findings. NPPTL will then determine how to best address these findings with the developed Action Plan

representing NPPTL's recommendations and aligning with NIOSH's continuous improvement values and will include those Actions that NPPTL intends to implement.

NIOSH Research Results in Changes to Industry Standard Test Methods for Personal Protective Equipment (PPE)

In July 2017, two revised test methods (F1670/F1670M-17 Standard Test Method for Resistance of Materials Used in Protective Clothing to Penetration by Synthetic Blood and F1862/F1862M-17 Standard Test Method for Resistance of Medical Face Masks to Penetration by Synthetic Blood (Horizontal Projection of Fixed Volume at a Known Velocity) were published by the ASTM committee F23 on Personal Protective Clothing and Equipment. These test methods standards are widely utilized by safety professionals and personal protective equipment (PPE) manufacturers to select and design PPE used by healthcare workers and first responders to reduce exposures to infectious bodily fluids. The key additions made to these test methods involved changes to include proper characterization, measurement, and handling of synthetic blood. To support these changes, the committee relied upon preliminary outputs from NIOSH/NPPTL research. Next, the team will be working with ASTM F23 committee members to improve the penetration cell used to conduct the liquid and viral penetration tests.

Total Worker Health

Total Worker Health Research Methodology Workshop

More than 71,000 stakeholders subscribe to **TWH In Action e-news;** active Twitter and LinkedIn accounts keep our diverse audiences informed.

The next Webinar in the **TWH Webinar Series** is scheduled for Thursday, September 28, from 1:00 to 2:30 pm Eastern time. The webinar is co-sponsored with **NIOSH's National Center for Productive Aging and Work**. The 90-minute webcast features Drs. Donald Truxillo, Alyssa McGonagle, and Ruth Finkelstein, presenting three perspectives for interventions to address the challenges and opportunities posed by an aging workforce. To date more than 2240 OHS professionals have received training via this webinar series with >900 receiving CEU credits. Almost 600 have already enrolled for the next event. More details available by googling TWH webinar.

The 30-member **TWH Affiliates program**, welcomed 4 new partners in 2017: the National Security Agency, the Ohio Bureau of Workers Compensation, the Association of Occupational Health Professionals (in Healthcare), and, just this month-- the Communication Workers of America.

Western States Division

Updated Regional Commercial Fishing Fatality Summaries

New Tank Gauging Safety Video Released

WSD, in partnership with the California Department of Public Health, Occupational Health Branch (CDPH-OHB), recently released a video to help protect oil and gas extraction workers from the hazards they face when measuring oil storage tanks. The video, Protecting Oil and Gas Workers from Hydrocarbon Gases and Vapors, weaves together a narrative of the health and safety risks involved with this activity, and how employers and workers can reduce injuries and fatalities from exposure to toxic gases and oxygen-deficient atmospheres. From 2010-2014, there were at least 9 deaths associated with exposure to a mixture of hydrocarbon gas and insufficient oxygen when the thief hatch at the top of the storage tank was opened. The results of an overexposure can be immediate; the gases affect eyes, lungs and the central nervous system, and can cause the heart to have abnormal rhythms resulting in dizziness and disorientation, loss of consciousness, and even sudden cardiac death. The new video highlights crucial information that is covered in the 2016 NIOSH-OSHA Hazard Alert: Health and Safety Risks for Workers Involved in Manual Tank Gauging and Sampling at Oil and Gas Extraction Sites.

WSD Partners with Memorial University, Newfoundland, to Organize the 5th International Fishing Industry Safety and Health Conference (IFISH 5)

The Western States Division and the Center for Maritime Safety and Health Studies is partnering with Memorial University, Newfoundland, to organize IFISH5, June 10-13, 2018, in St. John's, Newfoundland and Labrador, Canada. The previous IFISH conference was held in 2009 in Reykjavik, Iceland. New for IFISH5 will be the expansion of the conference to include both aquaculture and seafood processing industries. This conference brings safety and health researchers from around the globe to present the latest research and discuss ways to improve the

health and safety of workers in these industries. Anticipated topics for IFISH 5 will include studies highlighting collaboration with industry, evaluations of interventions, improvements to protective gear such as personal flotation devices, fisheries management and safety relationships, and the economic impacts of occupational safety and health.

Social Presence Statistics

NIOSH continues to expand its presence on social networks.

Social Media and Public Outreach Accounts and Services	August 2016	August 2017
Facebook	119687 likes	129285 likes
Twitter	@NIOSH account 325197 followers	@NIOSH account 325728 followers
Instagram	589 followers, 246 posts	1077 followers, 781 posts
YouTube	467843 views 194 videos	467843 views 208 videos/clips
LinkedIn	Started in November 2016	567 members
Website Views	1,459,275 site views in August 2016	1,252,322 site views in August 2017
eNews Subscribers	58391	67493
TWH Newsletter Subscribers	64037	73961
Research Rounds Newsletter	56979	65282
Science Blog	Total blog entries: 355	Total blog entries: 423

	Total comments: 6108 Blog site views (August 2016): 35041	Total comments: 6976 Blog site views (August 2017): 34778

NIOSH Publications

July 2017

- Young Worker Injury Deaths: A Historical Summary of Surveillance and Investigative Findings
- Workplace Safety and Health Information Dissemination, Sources, and Needs Among Trade Associations and Labor Organizations
- ERHMS Info Manager™ User Guide

August 2017

- **Program Performance One Pagers**
  - Musculoskeletal Health Program
  - National Center for Productive Aging and Work
  - Immune, Infectious, and Dermal Disease Program
  - Prevention through Design Program
  - Manufacturing Program
  - Center for Maritime Safety and Health Studies
  - Agriculture, Forestry and Fishing Program
  - Public Safety Program
  - Nanotechnology Research Center
- Emergency Medical Services Workers: How Employers Can Prevent Injuries and Exposures
- Protecting Oil and Gas Workers from Hydrocarbon Gases and Vapors Video
- **NIOSH Skin Notation Profiles**
  - Arsenic and Inorganic Arsenic Containing Compounds
  - Disulfoton

- Heptachlor
- 1-Bromopropane
- 2-Hydroxypropyl acrylate (HPA)
- Dimethyl Sulfate (DMS)
- Tetraethyl Lead (TEL)
- Tetramethyl Lead (TML)
- Trichloroethylene (TCE)

September 2017

- **Program Performance One Pagers**
  - Cancer, Reproductive, Cardiovascular and Other Chronic Disease Prevention Program
  - Hearing Loss Prevention Program
  - Healthy Work Design and Well-Being Program
  - Engineering Controls Program

Center for Construction Research and Training (CPRW), National Construction Center

Certification Statement

I hereby certify that, to the best of my knowledge and ability, the foregoing minutes of the September 26, 2017, meeting of the NIOSH Board of Scientific Counselors, CDC are accurate and complete.

October 10, 2017
Date

/Bonnie Rogers/
M.E. Bonnie Rogers, DrPH, MPH, COHN-S
Chair, NIOSH Board of Scientific Counselors