

**NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
BOARD OF SCIENTIFIC COUNSELORS (BSC)
May 30, 2019**

**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)**

SEVENTY-SECOND MEETING

BOARD OF SCIENTIFIC COUNSELORS

(BSC) MEETING

May 30, 2019

The verbatim transcript of the
Meeting of the Board of Scientific Counselors

Meeting held on May

30, 2019, 8:30 a.m.

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PARTICIPANTS

(Alphabetically)

KARLA ARMENTI, ScD - BOARD MEMBER
KYLE ARNONE - BOARD MEMBER
MICHAEL BEHM, PhD - BOARD MEMBER
TERRY BUNN, PhD - BOARD MEMBER
THEODORE COURTNEY - BOARD MEMBER
MARY DOYLE - BOARD MEMBER
ALBERTO GARCIA - DESIGNATED FEDERAL OFFICIAL
JOHN HOWARD, MD - DIRECTOR
CHRIS LASZCZ-DAVIS - BOARD MEMBER
GRACE LEMASTERS, PhD - BOARD MEMBER
JUDITH MCKENZIE, PhD - BOARD MEMBER
CHARLES REDINGER, PhD - BOARD MEMBER
MARC SCHENKER, MD - BOARD MEMBER
RONALD STOUT, MD - BOARD MEMBER

DR. SARAH FELKNOR,
DR. KENNY FENT
MARYANN GARRAHAN
DR. THOMAS J. LENTZ
DR. MARGARET KITT
ALEX MAYER
RON MCGRAW
DR. PAUL MIDDENDORF
DR. JOHN PIACENTINO
DR. PAUL SCHULTE
DR. TERRI SCHNORR
JANICE SCOTT-BLANTON
DR. MIRIAM SIEGEL
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WELCOME AND INTRODUCTION, MEETING LOGISTICS

- MR. GARCIA: Good morning. I wanted to welcome everybody to Washington DC to those that come from out of town, and for those in town, welcome also. I want to start the meeting by saying thank you to everybody in DC that helped us coordinate and make this happen. There is a lot of work that goes behind the curtain, so I want to acknowledge those folks that help us with all those logistics.
- The first issue that I want to bring up is the emergency exits. If we were to happen to leave the building for any reason, we will go out to the front of the building and then we'll make a left on, I believe it's C Street, and we'll go to—we'll walk about, four blocks and there will be a baseball stadium, a baseball field on the right, and we'll congregate there. So if we have any emergencies, we'll meet at the baseball field.
- We also want to remind everybody that this is a Federal Advisory Committee and the BSC is a FACA committee and as such, is subject to some of the regulation that rule the FACA committees. One of the things that is important for FACA is that we ensure that none of the board members have any conflict of interest, so when I do the roll call, each of you do express if you have any conflict of interest to the topics that will be presented today. Once you do that, if anything change from your previous statement, then you can let me know.
- Another thing that I want to mention is that we are doing, we are doing recordings of the meeting so we don't—we keep the audio files for us, but all the transcription services, all the transcription of everything that you say in the meeting will be posted publicly. So just letting you know that that...
- And if you don't mind, when you mention a comment on the presentation, if you don't mind saying your name before your comment. That way, the transcription can pick up your name and then match your voice with your name.
- I think we will start with the roll call. I don't know if we have anybody on the phone but once we're done with doing the roll call on the people that are here in the room, I'll ask if there is any board member on the phone. We'll start with Ted and we'll go this way.
- MR. COURTNEY: Ted Courtney, Harvard TH Chan School of Public Health. I'm also—full disclosure—I'm also Vice President of Concorde Health, Inc., which is a startup looking to better potentiate the return to work of injured workers. And fuller disclosure, I also have my own consultancy now, so no conflicts.
- DR. SCHENKER: Marc Schenker, University of California Davis School of Medicine. Professor Emeritus and no conflicts to disclose.
- DR. STOUT: Ron Stout, Procter & Gamble Medical, no conflicts.
- DR. MCKENZIE: Judith McKenzie, University of Pennsylvania Medical Center. I'm a professor there. I have no conflicts.
- DR. LERMAN: Steve Lerman, I am a retired occupational physician and spent 30 years at Exxon Mobil. No conflicts.

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- DR. BUNN: Oh, okay. Terry Bunn, chair of the committee. University of Kentucky, I'm a professor there in preventive medicine and environmental health, and I direct the Kentucky Injury Prevention and Research Center. No conflicts.
- MS. LASZCZ-DAVIS: Chris Laszcz-Davis, the Environmental Quality Organization. Might have a conflict. I'm on Cal/OSHA's Standards Board and we're amidst of a wildfire emergency regulation.
- MR. ARNONE: I'm Kyle Arnone. I'm the Director of Collective Bargaining at the American Federation of Teachers. No conflicts to which I'm aware.
- DR. LEMASTERS: Grace LeMasters, Department of Environmental Health, University of Cincinnati, no conflicts.
- DR. REDINGER: Charles Redinger with the Institute for Advanced Risk Management, no conflicts.
- DR. BEHM: Mike Behm from East Carolina University, no conflicts.
- MR. GARCIA: Okay, so we have one, two, three, four, five, six, seven, eight. We have eleven members in the room. Oh, do we have anybody on the phone?
- DR. ARMENTI: Yes, Karla Armenti. I am with the New Hampshire Occupational Health Surveillance Program out of the University of New Hampshire Institute on Disability. I have no conflicts.
- MR. GARCIA: Thank you, Karla. Anybody else?
- MS. DOYLE: Hi, Mary Doyle, Johns Hopkins. I have no conflicts.
- MR. GARCIA: Thank you, Mary. So now we have one, two, three, four, five, six. We have fourteen members. The quorum for BSC is nine so we can have a meeting.
- PARTICIPANT: Well, that's good since we're all here.
- [Laughter.]
- MR. GARCIA: Yes, so now, looking at the agenda, I don't think that we have anybody signed up for public comments even though we have a big participation on the phone today, and we'll try to stick to the agenda as much as we can. And with this, I will pass it to Dr. Bunn.

AGENDA, ANNOUNCEMENTS, AND APPROVAL OF MINUTES

- DR. BUNN: All right, well I'd like to welcome everyone here for this great, glorious, beautiful day here in DC. So good choosing for a day to have the meeting.
- I'm really, really excited about our agenda today because there are, actually all of the presentations today are all on pretty much new information and being able to look at it holistically and integrated. So I think that that's kind of the overall topic, and a new presentation, the Firefighter Registry that is being established.
- So just to kind of give everyone a general overview of the agenda, we have four primary presentations. The first one will be at 9:20 on NIOSH chemical risk management. At 10:30 on occupational exposure banding, which actually is part of the risk management, and I'm really excited to hear about the grouping of the chemicals. At 12:40 we have research integration initiatives, and then at 1:00 pm, our overview of the National Firefighter Registry.
- I guess before I get started and approving the minutes and stuff, I'd just like to do

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a very quick introduction of everyone else who is in the room besides the board members, and I guess we'll start with you, Dr. Howard.

DR. HOWARD: Oh, yes, John Howard.

DR. KITT: Hi, I'm Margaret Kitt. I'm the NIOSH Deputy Director.

DR. PIACENTINO: Good morning. John Piacentino, Associate Director for Science at NIOSH.

MS. GARRAHAN: Maryann Garrahan, I'm on the detail from OSHA to NIOSH to the Office of the Director.

DR. KENNY FENT: Kenny Fent, team lead for the National Firefighter Registry.

MR. MAYER: Alex Mayer, health scientist for the National Firefighter Registry.

DR. SIEGEL: Miriam Siegel, lead epidemiologist for the National Firefighter Registry.

PARTICIPANT: Beth Whelan, Chief of the the Field Research Branch for the Registry.

PARTICIPANT: I'm Robin Matteucci, I'm with Science Applications International (SAIC).

MS. THOMAS: Marissa Thomas with CDC Washington office.

PARTICIPANT: James (Michael?) with the CDC Washington office.

MS. TOURK: I'm Nancy Tourk, CDC Washington Office.

MS. SCOTT-BLANTON: Janice Scott-Blanton, I work in the Associate Director's office.

PARTICIPANT: Jill Raudabaugh, I'm the data science team lead of the Branch with the Firefighter Registry.

DR. SCHNORR: Terri Schnorr, Director of the newly formed Division of Field Studies and Engineering.

DR. LENTZ: I'm TJ Lentz, I'm Chief of the Science Applications Branch of the Division of Science Integration, Cincinnati.

DR. FELKNOR: Sarah Felknor, Associate Director, Research Integration Branch.

DR. SCHULTE: Paul Schulte, Director of the newly formed Division of Science Integration at NIOSH.

MR. HUNTER: James Hunter with RTI International.

MR. MCGRAW: Ron McGraw with the International Association of Firefighters, Division of Occupational Health, Safety and Medicine.

DR. MYERS: I'm Doug Myers from the School of Public Health of West Virginia University.

MS. STEVENS: Stephanie Stevens, NIOSH Communications Office.

DR. MIDDENDORF: And I'm Paul Middendorf, Deputy Associate Director for Science for NIOSH.

DR. BUNN: Okay, well, welcome, everyone. Our first order of business is the approval of our minutes from our last meeting. Has everyone had a chance to review them? Are there any changes, edits to be made to the minutes? Okay. Anyone on the phone have any changes or edits to the meeting minutes? Okay, could I have a motion to approve them?

[Motion.]

DR. BUNN: And a second?

DR. LEMASTERS: Second.

DR. BUNN: Grace. All right, thank you. All right, so I think—well, I don't think, I know that two members are going to be rotating off the board here, and I will turn it over to Dr.

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Howard.

DIRECTOR'S OPENING REMARKS

DR. HOWARD: Yes, so we start. Thanks very much, Terry. So we start out with a little bit of a downer because we do have two members that are rotating off this year. Actually, we have a total of five but only two are present, although Karla is on the phone. So Karla, we'll be sending you the certificate of appreciation by mail but I wanted to personally thank Ted and Judith, who are here, and give them their certificates, which are signed by Dr. Redfield, our Director of the CDC, and myself, and we really thank you both for your service and hope to see you again soon.

DR. MCKENZIE: Thank you so much. Thank you so much.

DR. HOWARD: Ted, thank you very much.

MR. COURTNEY: Thank you, John. It's been an honor and a privilege.

DR. BUNN: There you go.

DR. HOWARD: We do have, in addition to Karla on the phone, Mark Nicas and Sharon Cooper, who couldn't be with us today are also rotating off. But we have had our new slate approved by HHS, which is always a thrill and a surprise, to get it approved. So thank you, Alberto, for putting all of that together.

So you all have sort of a very thick—let's see how many pages is it—seventeen-page sort of notes. I'm not reading all seventeen pages. But it's provided for your information and if you have a question about it, that's great. We started doing this, ooh, five or six meetings ago where we sort of go across the institute, ask them for information from every division what's new, and they provide it to us, in addition to our communications folks, so it's all in one place. It goes on the website and I don't talk about—so I'm just going to highlight a few things.

The budget is always of great interest to everybody, including us. So the new budget for fiscal year 2020 is in its preparation stages right now. The House has been very speedy. Their Preparations Committee in the House conducted a markup of the Appropriations Bill for what's called Labor/HHS, because Labor, the Department of Education and HHS are in one gigantic appropriation, and they did a markup on May 8. The House Appropriations Committee provided a total budget of \$346.3 million for NIOSH. This is a \$10 million increase above the FY19 funding level and about \$156.3 million above the President's proposed budget of \$190 million.

Included in the House bill is an additional \$2 million for education and research centers—as a group, not each, okay. Don't get excited there, folks. \$2 million for Agriculture, forestry and fishing program as a whole, which includes ten centers; and \$2 million for the Total Worker Health Centers, again as a group. Additionally, there's an increase of \$600,000 to support the Firefighter Cancer Registry, an increase of \$100,000 for the National Mesothelioma Registry and Tissue Bank, and \$3 million for other occupational safety and health research.

There's a URL there listed if you want to go to the Appropriations Committee site

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and read the 500-page bill. I think, I don't know what page we're on. Maybe Nancy remembers what page we're on, but we're there somewhere in the middle. The Senate has not yet done their markup of the Labor/HHS bill, so only half of the Congress has weighed in. So that remains to be seen what they will do. As you know, these processes take a while. Hopefully they will get it together by October 1 for the new fiscal year, but sometimes they don't, as you know. So stay tuned. That's all we know for the budget.

We have a number of organizational changes that you already heard about, where people sort of introduced themselves as directors of new divisions, and I'm going to ask Dr. Kitt to go over with you our reshaping initiative which is, currently involves Cincinnati and a part of Morgantown.

DR. KITT:

Well, thank you. About two years ago, we began an undertaking of shaping some of our organizational structure particularly, as John said, Cincinnati and Morgantown affected a little bit. So this reshaping initiative took four divisions which were in Cincinnati and we did some sort of restructuring to go down to three divisions. So we still have our Division of Compensation Analysis that's intact. But then we decided to establish two new divisions there in Cincinnati, combining the three into two, the other three into two.

So we have the Division of Science Integration which is led by Paul Schulte, who is here today, and the Division of Field Studies and Engineering, which is led by Terri Schnorr who is here today. And so we just stood this up May 28, earlier this week, so we're really excited to have what we think is a more efficient structure. Hopefully less administrative burden, except for probably Paul and Terri and a few other people. But so we're excited about that.

And then the other piece of that was the chemists and the biologists formed a Cincinnati Chemical and Biological Monitoring Branch, which was incorporated into our Health Effects Laboratory Division which is led by Don Beezhold in Morgantown. So what this did is it really combined all of our laboratory resources under one division, although it's split between two different cities, and we thought it was really important to have a laboratory and leave those, all of our resources under one laboratory umbrella.

DR. HOWARD:

And then the third part of that reorganization involved just some consolidation of the Deputy Director for Management, which is led by Kelley Durst in Atlanta and it really, that incorporates really all of the different pieces of us, all of our sites, so.

So I'll just add that, you know, one of the advantages I think that I've seen, in terms of the naming of the new divisions, are two. One, in the Division of Science Integration, I think the word "integration" is an important word now, because a lot of times, people look at science and it's all split into its various silos and we look at the way that we do our policy documents and authoritative recommendations, and often there is an integrated kind of publication. And so I think the use of the word "integration" is an important one.

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For the other division, I think the actually having the name “engineering” in a division is extremely important. We, I think, we have all of the engineers except for one or two maybe, in CDC, we have them all in NIOSH. And I know since I’ve been in this job, people always have come up to me from the safety and engineering field asking, well, do you know what the S in NIOSH stands for?

[Laughter.]

So I think the idea of having a division that showcases the engineering expertise at NIOSH is extremely important. So I think those two words in a division title, to me, are very good.

I want to thank Margaret and Sam Glover, who is heading the new branch in HELD, Terri and Paul for their work. You know, when you reorganize things, it can take a lot of oxygen from the atmosphere and it is just a huge undertaking which we culminated May 28 where, after two years of working on this, we’ve now sorted the whole thing out. So those folks have done a great job. I want to thank them. Our next reshaping initiative involves the Mining Program, which we won’t discuss here because they have their own FACA. But they’re undergoing some reshaping too involving our Pittsburgh and Spokane locations. So we’ll be talking to and have been talking to their FACA about that issue.

Any questions on the reshaping initiative that anybody might have? Okay, then I’m going to forge on. Oh, Charles, did you, are you just waving?

DR. REDINGER: You read my mind. Did it affect any FTEs?

DR. HOWARD: I’m sorry?

DR. REDINGER: Did your headcount change?

DR. HOWARD: Well, you know, headcount is always...

DR. REDINGER: It’s always in flux.

DR. HOWARD: A very difficult thing to discuss because there are empty FTEs and filled FTEs. But nobody got eliminated in the process of reshaping. The reshaping is, we started in Cincinnati because of the opportunity that we have for a consolidated campus, where we’re bringing together, hopefully some day, the Taft laboratories on one side of town, the Hamilton laboratories that are other side of town. We have a piece of property that is not yet bought by the government but we’re hoping that will happen soon. GSA is the actual purchaser of it—that is very adjacent to the University of Cincinnati campus.

So one of the things that we wanted to do is to make sure that all of our organization in Cincinnati was prepared and we would offer to the appropriators on the Hill and to the Department the best-organized shaped institution that we could do in Cincinnati. So that was a primary motivation in Cincinnati.

Okay, well, then I’m going to go on with just a couple of staff announcements.

We’re very proud that Dr. Dori Reissman has become a Rear Admiral in the Public Health Service and Assistant Surgeon-General. Her flag ceremony will be held in the Department of Health and Human Services here in Washington on July

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Grady Calhoun has been chosen as the new Director of the Division of Compensation Analysis and Support in Cincinnati. Stu Henefeld is retiring, and been able to do an understudy program so that Grady is shadowing Stu now as Division Director.

We have a new Association Director for Facilities Management, which at NIOSH is a very important job because we're in eight different states and four time zones, and a lot of buildings, including the Pittsburgh campus that has multiple, multiple buildings. So Nicholas, Nick Gibson, is our new Associate Director for Facilities. He took Denzil Slaughter's position, who retired.

Dr. Kitt retired from the Public Health Service as a retired Admiral now and so she has continued, thankfully, to work at NIOSH and continues as Deputy Director.

I did want to point out a few things in this long seventeen-page New Programs and Initiatives. The first one I wanted to point out is sort of distributed in several different places in the seventeen-page. Probably most of it is on page 13 under the Opioids Coordination Efforts. As you know, we've talked about opioids before in this committee, and I even remember Chris's question about whether this is an international problem or just a US problem. It certainly is primarily a US problem but we've been seeing Canadian and Great Britain issues come up recently.

But I wanted to point out a couple of issues with regard to the coordination effort that we have. We have a large group of folks at NIOSH that are contributing to this. Some of you have seen our naloxone factsheet that we put on the website a few months ago, and then just last Friday, we were able to place on our website what we call Medication-Assisted Treatment for Opioid Use Disorder, with an emphasis on workers. And this is, we've been working on it for quite a while and it's on the website now and we gave you a copy of it. We're very anxious to see whether or not that can be taken up by folks who are interested in providing workers, especially in the industries that have been shown in studies to have high rates of opioid overdoses and use, such as construction as a big industry.

The other thing I wanted to point out is an upcoming meeting that is being held, on page 6, of workers' compensation experts that will be held July 10 in Cincinnati. Our Center for Workers' Compensation Studies is bringing together a number of experts, including Dr. Gary Franklin from the State of Washington who has written, going back many years, articles on opioids.

So I wanted to give a shout out to everybody at NIOSH that's done such tremendous work in this area. I also wanted to point out that Maryann Garrahan, who is here in the room and on detail from OSHA, has been very avidly educating everyone at DoL about the materials that we have, and DoL has started to use much of our materials in terms of their efforts to draw attention to the opioid issue. So I just wanted to point out those issues and to again thank everybody for their effort at NIOSH to bring this together. It was sort of a fire drill that we started a few

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months ago, grabbing people as we could into a coordination group, which is the best way to get work done at NIOSH because we are so geographically and temporally distributed, so we have to do these sort of coordination groups to get work done.

Any questions on the opioid effort that we're doing? Hopefully you can hyperlink the medication-assisted treatment workplace solutions through your network and get that out to everybody.

I wanted to—we're going to talk about Future of Work Initiative when Sarah Felknor comes up to do her presentation so I'm going to skip over that. I did want to say that we have started an artificial intelligence interest group. Some of you may know that the Center for Workers' Compensation Studies actually produced a paper in the *Journal of Occupational and Environmental Medicine* that won an award recently as one of the best papers of last year, using machine learning, a type of artificial intelligence methodology, to look at industry and occupation coding and I think carry over a million worker compensation claims from the Ohio Bureau doing it, I think, three hours as opposed to the six years that it would take a person to do it.

So we're starting to use that in many different areas, for instance in the Health Effects Laboratory Division, there are pathologists that are using machine learning techniques to see patterns in pathological samples that they're looking at. So we're starting to see this sort of pop up throughout the Institute, and we formed an interest group to bring together scientists who are working in this area. So I wanted to point that out.

In terms of upcoming conferences, I wanted to highlight on page 3 the International Conference on Occupational Stress and Health, which we partner with the American Psychological Association and the Society for Occupational Health Psychology for the thirteenth International Conference on Work Stress and Health 2019, and that's going to be held in November in Philadelphia.

There's also a discussion forum on a topic which is of increasing interest to a lot of people in occupational health, and that's the issue of fatigue. There will be a meeting in Coeur d'Alene, Idaho, which actually sounds like it's far away but it's only 30 minutes from our Spokane building. Margaret and I drove from our Spokane building to Coeur d'Alene and it took us just 30 minutes. So Idaho is not that far from Spokane.

And that meeting is going to emphasize working hours, sleep and fatigue. It's an issue that is cropping up more and more, and I think that will be a very exciting meeting to have also.

So there's lots of other information that is contained in this review of where we're at here in terms of issues going on at NIOSH. I did lastly want to call your attention to our sort of dashboard there on page 15 of all the social media outreach that we do in terms of keeping track of those things. And not only in

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Facebook and Twitter and Instagram and YouTube, but also our eNews subscribers and our Total Worker Health newsletter subscribers. We've had a very good uptake with our Research Rounds newsletters. We now have 72,000 subscribers to that. And our blog views have increased also in terms of the comments that people are leaving with our blogs.

When we first started the science blog, we thought we'd be doing maybe once a month, and now we're doing it several times a week. One of the things that we've done as a pattern of behavior is that when a science article is published, we encourage the scientists to do a blog on it. As you know, not everybody takes subscriptions to these scientific journals, and it gives the authors an opportunity to translate the scientific article into understandable conversational English and then that gets taken up by other media channels. So that had taken a couple of years for scientists to catch on to the advantage of doing that, but now they are very interested in doing that, and we've had some really great science blogs that have been taken up by *Wall Street Journal*, *New York Times* and other media outlets as opposed to the actual paper itself, which often requires a subscription to the journal to access, so it's difficult.

So I'm going to stop there, Terry, and just open it up for discussion and any other questions that folks will have so we don't get behind today in all of the great presentations that we have.

DR. BUNN: All right, thank you very much, Dr. Howard. Are there any questions for the—yes.

DR. STOUT: Dr. Howard, Ron Stout. With the rapidly changing regulatory situation with marijuana, how is NIOSH thinking about the marijuana safety-sensitive functions in the workplace, etc.?

DR. HOWARD: Well, you know, I think the issue of cannabis in the workplace has been something that NIOSH has been thinking about. The Health Hazard Evaluation Program in the Division of Field Studies and Engineering has done how many HHEs?

PARTICIPANT: Maybe a half a dozen.

DR. HOWARD: Half a dozen HHEs where we've gone to industry sites that are producing cannabis for commercial purposes, obviously in states that have approved medical or recreational cannabis laws on the books. When we first did that, it was something that we had to check on in terms of the legal position that we have because, as you know, the federal government in the Controlled Substances Act still lists cannabis as a Schedule I drug. And so we obtained approval to provide the health and safety information that we did on those HHEs. The Workers' Compensation Center is interested in this topic, as you probably, your question probably indicates. For employers who do, who have a drug-free workplace program that incorporates urine drug testing or hair follicle testing or whatever they test, the fact that cannabis is a legal drug in that state can be—can complicate their program.

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We do not have any reviews going on of employers' drug-free workplace programs or urine testing or anything like that, but we are aware that from a workers' compensation perspective, it is an issue.

DR. STOUT: Thank you.

DR. BUNN: Yes, Marc.

DR. SCHENKER: Yes, just to follow up on that, cannabis is the number one agricultural commodity in California now, by far, and employs up to 200,000 workers. So it is a major issue and I'm glad to see that there's some support. In fact, I've been supported by our Ag Center to look at health of the workers, but I would add that in the chaos going on with the legalization of cannabis, health and safety of the workers is a minority concern and I think it needs more attention.

That said, my question really had to do with workers' compensation, and I was glad to hear that there's going to be a meeting in Cincinnati addressing this, because it seems to me that it's in the news often in a negative light these days about people who are excluded, who should be covered, and that's of concern. I mean, the system is meant to be no-fault and cover everybody in the workplace and yet that seems to be tested. So I don't know how much that's going to be addressed, but I hope that that conference and the group in Cincinnati is grappling with that issue.

DR. LERMAN: Steve Lerman. On a related topic, cannabis and also the medication-assisted treatment of opioids, in addition to workers' compensation, I think companies who are struggling with fitness for duty determinations, and in this worksheet, there is a small section on fitness for duty determinations, expanding and providing more guidance there, and perhaps on when people do have cannabis in the workplace, is the law evolved where that's going to be permitted and how to determine fitness for duty in these cases in the workplace is going to be very challenging, and I think guidance from NIOSH would be very appreciated by any employers.

DR. HOWARD: I think you raise a very good point. You know, the issue about drug testing is a surrogate really for impairment, and impairment is something that is often very difficult to get your hands around when it comes to impairment due to drugs. For alcohol, a general audience could probably recite a number of impairment criteria that can be used to tell whether somebody is intoxicated generally by ethanol. There's a test for it that is used by law enforcement, breathalyzers. There's a blood test that is incorporated in law. So impairment is richly sort of characterized for that particular chemical.

But for cannabis and for many others, it's not. So it's always been, I think, a struggle for anyone who has done fitness for duty determinations, people who serve as medical review officers, or employers trying to figure out whether this worker is impaired enough to be a threat to others or themselves in safety-sensitive positions. I think cannabis will bring that issue of how do we determine impairment more to the front.

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DR. BUNN: Yes, Charles.

DR. REDINGER: Yes, thanks, Terry, and thank you, Dr. Howard. I just have a shout out, so I like that term that you said a few minutes ago. So I was happy to see the Future of Work Initiative, certainly when we got the packet with the presentation that we'll be giving later today, there are a few slides on the Future of Work. So really an important topic that we're all familiar with.

And the other is, it got a smile on my face. Many of us when we get our journals in the mail, you know, whether all of our different professional societies, so I got the *American Journal of Evaluation*, and you know, we look at these to see is there anybody we know who's publishing, is my article in there, what topics are there or whatnot. But I got a smile when I saw this article from you all here at NIOSH, and you had mentioned this work that you had been doing on contribution analysis.

DR. HOWARD: Oh

DR. REDINGER: So it's in the current issue of the *American Journal of Evaluation*.

DR. HOWARD: Oh, wow.

DR. REDINGER: So it's in the June issue, and the title of it is "Using the Contribution Analysis Approach to Evaluate Science Impact: A Case Study of the National Institute for Occupational Safety and Health." So a good job on what you've done there. Well done. It's very clear, important work.

And I couldn't help but think, and about three years ago, Dr. Schulte gave us a presentation on translational research and what the Agency has been doing in that space, but if we were to stack up all the government agencies who do science-related work, I would be intrigued with thinking that NIOSH is really at the head of the pack, on looking at these issues. And I know there are government-wide initiatives on certainly translational research and certain contribution analysis sort of things but again, just neat. As one of the members of this board, just demonstrating that the Agency's head is in the game on looking at the effectiveness and that connection between the ideas and then the outcomes. So again, thanks for all that.

DR. HOWARD: Well, thank you, and you know, that work is really centered in our Office of Policy Planning and Evaluation, which we've called that, and Lore Jackson-Lee is the head of that office. And I think that the issue about evaluation culture has really diffused through NIOSH, starting way back in 2004 in the Bush Administration when they came up with their PART process, their Program Assessment Ratings Tool which they tried to get at this issue of yes, you're doing all these activities but what has been the real outcome in terms of, for us, reducing injuries, illnesses, etc. We've often found that that ultimate outcome is very difficult—it's easier to measure but it's really difficult for us to say, well, we had a hand in it, and exactly how we had a hand in it. And so we've, you know, centered around intermediate outcomes, measuring what we can measure what our contribution is, and contribution analysis I think is where we are right now. And so I'm glad the article

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appeared because we want to do more in that area.

DR. BUNN: Yes, actually—Terry Bunn—I think that, you know, we had that initial presentation two or three meetings ago.

DR. REDINGER: Yes, it was a while.

DR. BUNN: On contribution versus attribution, and maybe, you know, maybe the board would be interested, based on the article that has come out, you know, kind of how this has further progressed down the line in the area of research, evaluation research, so.

DR. REDINGER: Sure.

DR. HOWARD: And it's also I would suggest, maybe a little bit outside of the boundaries of some of our wheelhouses. You know, we're technical folk.

DR. BUNN: Right.

DR. HOWARD: And so we're looking at the molecular stuff and that protection. I don't mean to sound too glib when I say it that way. But at this level, the more meta level you might say, of is it all working is I think very valuable and very important.

DR. BUNN: Yes, Ted.

MR. COURTNEY: I just wanted to echo, as somebody who has been an advocate on the board for kind of making sure we have the view far enough out into the future. I know John's been an advocate and spokesperson for the Future of Work, but delighted to see that this is here as a new initiative. The AI feature here also is really exciting. I wanted to just add, thinking about the Cincinnati campus consolidation, is there an opportunity as you're looking to buy and build a new space, to build a different sort of space than maybe the traditional spaces that NIOSH has been inhabiting, that emphasizes driving collaboration a little bit more? And by that, I don't mean just taking the walled offices out and sticking everybody in an open plan. That's now how—that doesn't work so well either as a strategy—but having collaboration spaces, even potentially for a place like NIOSH with the number of engineers you have, having maker spaces that are distributed through the facility where people can collaborate, do small-level modeling, do some prototype building, things along those lines just to sort of become more of an engine of participatory innovation as you look to move into the Future of Work?

DR. BUNN: Thank you. Are there any comments on the phone? Okay. I would just want to make one last comment myself, kind of continuing. I'm so glad to see this workplace solutions document, the MAT for opioid use disorder. I guess my question specifically pertains to those small employers who don't have employee assistance programs or anything like that. Are there plans for dissemination maybe to partner with like local health departments, you know, as recommendations for small employers to be able to—or, you know, with healthcare facilities in the local areas to get these employees who need help in seeking treatment to be able to find it, you know, adequately and still be productive employees in the workplace?

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- DR. HOWARD: Sure. We're open to any suggestions that anybody has.
- DR. BUNN: All right.
- MS. LASZCZ-DAVIS: Chris Laszcz-Davis. Actually I'd like to dovetail those comments. I think the challenge we all have, regardless of where we work, is deployment and impact . And the truth is, small to medium businesspeople rarely get the benefit of much of the work that is done, simply because we don't have the mechanisms to deliver them as well. So I think the state health departments are a good venue but I think we've got to consider outreaches that are non-health department-related, and I don't know whether those are chambers of commerce or what have you, but that's where the small and medium businesses go to get a lot of their information. So it's a paradigm shift that I think that we need to embrace at some point, because the small and medium businesses don't get the benefit of all this, as much as we'd like to think they do.
- DR. HOWARD: Well, you know, I think you're certainly right, Chris. I mean, the challenge of the small employers is always with us, and one of the things that we're going to do is we are going to meet with the Chamber here in Washington soon, and we hope to outline to them all of the materials that we have, and we're hoping that they will then be able to cascade down from the National Chamber through their series of networks, to those smaller chambers of commerce that are affiliated with them. So we're hoping that that avenue may open up a number of different channels for us.
- MS. LASZCZ-DAVIS: That's great.
- DR. BUNN: Yes.
- MR. COURTNEY: Just before we leave that, it seems like there could be an opportunity there to deliver the state consultation programs through OSHA, another distribution point, you know, and promulgation point and promotion point for that type of—what available resources are there, what other resources we can...
- DR. HOWARD: Yes, that's a really good point. Maryann and I met with Doug Kalinowski, who is the Head of State Cooperative Agreement programs at OSHA, and they—he and his staff—are very interested, and we are providing materials. Unfortunately, this year is not the year for the OSHCON, which is where all the consultation programs—they only do that every other year now. But we are hoping to be on their schedule for their meeting next year.
- DR. BUNN: Do I have any other comments on the phone? Okay, we have about three minutes left or whatever. Just in case anyone, I forgot to ask if anyone has any announcements that they would like to share before we start our first presentation?
- Okay, I guess we'll move on to our first presentation by Dr. Schulte on the overview of NIOSH risk assessment and management activities for chemicals.

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NIOSH CHEMICAL RISK MANAGEMENT

DR. SCHULTE: Well, thank you and welcome, everyone. I'm going to talk today about NIOSH's efforts in risk assessment and risk management of chemicals. And for a long time in different venues, we've looked at these individually, but they've hardly ever been considered in their entirety, and so this is a chance today to look across all the different kinds of chemical risk assessment and risk management programs that we do, and to get your feedback on that entire package—what we're doing, what maybe we're not doing, what we could do better. And so this is going to be a 30,000-foot presentation and I'm not drilling down into any of these particular programs but I'm giving you more of the overview.

Now, we are quite concerned most recently in occupational safety and health of psychosocial, growing psychosocial problems, the continuation of safety threats in terms of traumatic injuries, the continuation of musculoskeletal problems, but we don't want to overlook the fact that a third of the workforce is estimated to be exposed to chemicals at their work. So over 50 million people.

Now, the health effects of those exposures are harder to track, and indeed, the data are limited. Up here are some data from the period of 2011 to 2015. You can see 71,000 illnesses and 4,800 or so chemical-related fatalities. And then with regard to chronic diseases, that's where the real problem is located in terms of estimation. In terms of cancer and cardiovascular, neurologic, and there are various estimates. Current range is about 2% to 8%. But many investigators have pointed out the severe underestimation of chemical-related health problems, particularly chronic health problems.

I just want to clarify that I'm not going to be talking about doing research on the health effects of chemicals. Many divisions, laboratories and offices in NIOSH do research. This focus is going to be on the risk assessment and risk management aspect, sort of the downstream part of the occupational safety and health continuum—risk assessment and characterization and risk management.

And so I'm going to talk about these 12 different areas. Some are related; some are disparate. But they reflect essentially the majority of the risk assessment and risk management efforts that occur in NIOSH.

The cornerstone—I'm going to go back here. The cornerstone of what we do involves generating recommended exposure limits or RELs and that whole effort, and that's been a historic underpinning of much of NIOSH's risk assessment and risk management activity. NIOSH has been mandated by the OSHA Act to describe levels that are safe for various periods of employment. We work directly from that mandate.

These are the substances that we have currently under investigation and development for recommended exposure limits, and they reflect a different range of issues. Butyraldehyde is a widely used substance in the healthcare industry as a disinfectant. 1-bromopropane is a substance that was thought to replace many

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of the fluorocarbons which are ozone depletors, but it has its own occupational safety and health problems that may not have been considered in the environmental view. Manganese, where we're looking at neurobehavioral effects as an endpoint, a slightly different approach than we usually use with more frank physiologic effects. Diethanolamine, which is a widely used intermediate and substance in the chemical industry. Again, going back to the continuous concern about lead and reflecting on the fact that the current levels of control are too high, and looking for neurobehavioral cardiovascular and kidney changes at lower levels, they are to generate a new recommended exposure limit. TDI, which is a widely used sensitizer and one of the highest volume nanomaterials, silver nanoparticles. So we have activity going on on all of these right now.

Driving our development of recommended exposure limits are a number of factors, and the next two categories relate to that. One is the chemical carcinogen policy. Prior to 2016, NIOSH labeled known carcinogen such as asbestos, benzene, cadmium as "potential occupational carcinogens". We thought this language didn't reflect really the knowledge base and so wanted to revise the policy to reflect where we know more.

And then we also went, had a different view of how we should provide guidance in terms of lifetime risk to cancer, and we have a new approach for that.

I'm not going to, and as I said, I'm not going to drill down into each of these but just briefly, in 2016, we issued the new policy. It had three key components—a carcinogen classification component, a new way of thinking about management called the Cancer Risk Management Limit, and a way to consider analytical feasibility.

And so briefly, for classification, instead of putting our resources into classifying substances, we thought we would use the classifications of authoritative organizations such as NTP, EPA and IARC. Also instead of thinking of our recommended exposure limit for carcinogens, we would acknowledge the fact that in chemical carcinogenesis, there is generally considered no safe—no non-zero risk level of exposure.

And so essentially, we would acknowledge that, but we would say it's important, given that there could be risk to the lowest levels of exposure, that controls begin at a 1 in 10,000 working lifetime risk level as a starting point, the exposures that coincided with that.

And then we thought, well, you have to be able to measure it before you can do something about it, so when you can't measure it at that level, we would default to the level of quantitation in terms of paying attention to analytic feasibility.

So that was the—that was one driver of how we develop our guidance. Another, our risk assessment practices of quantitative risk assessment. Now, you may not be able to read this on the screen but I think you have the slides, and these next two slides are just to give you the flavor of the range of quantitative risk

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assessments that NIOSH has done going back to the Nineties. And when we do these, we publish them in the scientific—peer-reviewed scientific journals. And the methods we use were shown in those journal articles, but we've never really shown our process in one comprehensive report, and in this era of being more transparent, we have developed a document that's just about to be published, "NIOSH Practices in Occupational Risk Assessment". This was put out for public comment in June of 2018 and we're about to wrap it up.

Now, we hope this will be a resource for the occupational safety and health community in particular—in general—and a textbook for practitioners in particular. This is what the contents of the document look like. We go through the classic steps of risk assessment as adduced by the National Academy of Sciences, and particularly we focus on uncertainty and sensitivity analyses and the importance of attending to sources of errors in risk assessments and identifying the assumptions that underpin a risk assessment. So we hope this will be a widely used document.

Now, in addition to the classic work that we've been doing, we're working in the growing area of nanoparticles and advanced manufacturing. We've given presentations to the boards before about the importance of studying nanoparticles and the potential toxicity of smaller particles versus lower particles—smaller particles versus larger particles. And since the early 2000s, nanomaterials have been part of commerce and that volume is continually growing. Early on, many organizations around the world, including NIOSH, have issued cautionary reports that until we understood the hazard, we needed to take precautions, and NIOSH was a pioneer around the world in leading to developing risk management and risk assessment guidance, again working at this end of the continuum. This document, "Approaches to Safe Nanotechnology", started out in the early 2000s as a web conversation with NIOSH because of the uncertainty in the field and finally, by 2010, had coalesced into a substantive document that has been revised a number of times and has been widely used around the world.

Subsequent to that then, we got even more detailed in providing guidance, and this is for production and downstream handling processes.

There was a lot of concern early on when we didn't know what the health hazards of nanomaterials would be of what kind of medical surveillance the workers should have who are dealing with this, and indeed, in 2010, we developed a NIOSH guidance document on medical surveillance and hazard surveillance. It was so early with this new technology that we wanted to make sure people were not only just—were aware of what they were using, let alone what they were going to do about it. If they didn't know that they had nanomaterials in their workplace, they couldn't take the next step. So that was part of this document.

And then, as we followed what was happening with the technology, we saw that there—this came out of the Eighties but it grew into the Nineties and exploded in

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the 2000s—the capability of moving individual atoms, here 35 xenon atoms—in a way that you could do something purposeful with them, and in this case, the researchers spelled out the logo of their company, but it illustrates the capability of making things a molecule at a time rather than the way we usually make things, where just we chop stuff down to make the final product. And in an era of sustainability, we have a vast amount of waste. If you start building things in an additive fashion, you have a lot less waste.

So nanotechnology and advanced materials is now a major component of additive manufacturing, and additive manufacturing has a lot of other hazards, many of which we're familiar with in occupational safety and health, but what we're starting to see is classic hazards in new settings that may need attention, or we're seeing a lot of small organizations developing additive manufacturing processes that are not well-versed in occupational safety and health, and consequently they don't know the standard history and practices of dealing with this diverse range of hazards. So we're working on guidance in that regard.

And then all of this is a precursor to the whole growing field of advanced manufacturing, and many of you may have heard Chuck Geraci speak about this, where advanced materials, using nanomaterials, and other kinds of science are being brought together in advanced manufacturing based on digitalization capabilities and the use of AI, robotics, automation, are making and changing the whole manufacturing environment. So and that could be a whole seminar in and of itself, but that's where we are. That's where nanotechnology is evolving to. We're still working with classic hazard issues related to individual nanoparticles, but we are looking at it now in this broader picture.

Another area where we've done an awful lot of work, and one of our historic and classic efforts, is the development of IDLH and skin notation profiles. IDLH—immediately dangerous to life and health values—is something that NIOSH has done since its history. In 2013, we refined the process with a protocol for how to assess the literature to develop IDLHs, and we've been putting out them in batches each year.

We also developed a protocol for how you identify, in the NIOSH Pocket Guide, whether or not there are skin-related issues—absorption, irritation or more serious skin effects—and we also developed skin notation profiles. So these profiles, as we develop them, we put them out for public comment and then we modify them, and they're widely used and the information goes in the NIOSH Pocket Guide.

We did have an interesting case with one that we were doing for the widely used substance peracetic acid, used in poultry processing, used as a disinfectant in healthcare, and we put out a profile for public comment, and stakeholders came back and said they thought that the data to make the IDLH was too limited and in fact was lacking in the scientific literature. Started a cross-instituted process—a cross-institute research study—but instead of starting at the front end of the study,

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we started at the product. We said we want to develop an IDLH, or a short-term exposure limit, a STEL, and so we want to conduct a risk assessment that will allow us to do that. What are the gaps in the scientific information that need to be filled by investigations and research that will give us the answers to do this? And so we developed a cross-institute process to do this, and that's going along nicely and we're in collaboration with the producer industries, with the chicken industry and we're still having a little trouble getting access to work sites but we are making good progress.

The next area where a lot of this information is captured, as I have said, and most of you are familiar with, is the NIOSH Pocket Guide and the NIOSH Manual of Analytic Methods, historically two of NIOSH's most influential publications. The Pocket Guide has been going since 1974. For many years, it was the second most requested US government publication out of the Government Printing Office. It's still in paper form, still fits in some pockets if you have big pockets. Maybe a pocket in a turnout coat. But we've gone, we've gone digital and just last week, at the AIHce conference, we debuted the app, the iPhone app and the Android app for the Pocket Guide. And so you can get it on your phone as well.

Similarly, another authoritative resource is the NIOSH Manual for Analytic Methods. It's been widely used. It's in its fifth edition. It is one of the seminal documents that investigators and regulators and decision-makers use when thinking about the quality of an analytic method for assessing chemicals that are—or sample workplace and in workers' breathing zones.

Next is the whole area of respiratory protective devices and I'm not going to—we have a whole laboratory, the National Personal Protective Technology Laboratory that deals with this. There's three particular areas related to chemical and particulate hazards. One is the work they do to evaluate the canisters in respirators, a critical component in respirators, and the need to have authoritative guidance on that is paramount.

Similarly, NIOSH has a long history of working with a lot of different agencies on chemical, biological, radiological and nuclear air purifying respirators and giving guidance and assessment of those respirators.

And then finally, for most occupational chemicals in the workplace, NIOSH develops respirator recommendations based on a decision logic that NIOSH has perfected over the years.

So the whole area of personal protective equipment for chemicals has been broadly covered in this, particularly in this dedicated laboratory.

Next, and you're going to hear a lot about this today, is one of the most exciting bits of work that NIOSH has done in many years. it's development of occupational exposure banding, and the need that we're showing with this picture, all of these red squares are the amount of chemicals that are in commerce. The yellow square or the orange square is the ones that have recommended exposure limits

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or occupational exposure limits—clearly a mismatch, and there's no way that going through the current process we're ever going to develop OELs for all of these. And in the interim, we need a consistent process to characterize the hazards so that risk management decisions can be made by employers and risk managers. So we're just about to put out on the street this document on exposure banding, and you'll hear a lot more about it from Dr. TJ Lentz, who will follow me and give an in-depth presentation.

Just briefly, exposure banding means binning chemicals according to their toxicity and potency in five different bins—their order of magnitude bins, I'm not going to belabor that other than to say that one critical caution that we want to give is that an occupational exposure band is not meant to replace an occupational exposure limit. An occupational exposure limit is developed by a considered evidentiary process of broad assessment. An occupational exposure band is a short, effective, valid method to scan the literature and find out what's available to make a best estimate of what would be a safe exposure limit. So the two are different. And the OEB is only meant as a starting point to inform risk management decisions, not to replace OELs.

Moving on then, to take a bigger picture, we can zoom out and look at some of the guidance NIOSH has developed in the whole area of thinking about chemicals in terms of Prevention Through Design, and with regard to green chemistry. Prevention Through Design, as the name implies, is designing out hazards, and that includes designing out hazards related to chemicals. And so we're working at the top of the hierarchy of controls, with the elimination and design-out, in some cases, with regard to substitution. And even in terms of engineering controls, of designing out one approach to get it to a better approach.

We started this initiative in 2007, developed a plan that's been widely distributed, then seven years later, we took stock of where we are. We were so excited by some of the accomplishments. There is a national ANSI standard for prevention through design. We have the lead program of building certification to now include workers as resources to be conserved. There's a lot of exciting efforts going on. Mike Behm on the council has certainly been a major collaborator with us in that regard.

Here are some of the kinds of things that have come out from the Prevention Through Design program that relate to chemicals. The whole issue of asphalt fume has been a controversial issue because of its potential carcinogenicity. One of the first things we did was we looked at highway-class pavers that were blowing smoke in workers' faces and we just redesigned the exhaust system to get the emissions out of their breathing zone. We worked with the industry that's come up with a warm mix asphalt. They can maintain the same functionality of asphalt at a different temperature, changing the amount of emissions, particularly volatile carcinogens. So that's a classic case of Prevention Through Design.

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NIOSH has been participating with a group across the government and outside of the government—the Inter-Agency Chemical Alternative Assessment—looking for different alternatives to hazardous chemicals. Particularly, we focused on nanoparticles in our—we focused on Prevention Through Design in our nanoparticle work. We had a conference some years ago called Molecule to the Market. The interesting thing with nanomaterials is you can maintain the functionality of the nanomaterial and still possibly mitigate the toxicity by certain design of physical chemical characteristics in it. So we've been promoting that. And then we have a long history with ceramic fibers and the ceramic fiber industry, working with them to think about altering the chemistry so that ceramic fibers which may have a similarity to other kinds of fibers that are toxic could be designed so that they dissolve faster. So they have a faster dissolution rate. And so these are all classic examples of Prevention Through Design related to chemicals. This is just a copy of the first effort we did with the asphalt pavers. We also looked at the whole area of green chemistry. The classic 12 principles of green chemistry are all aimed at natural resource-related issues and sustainability, but you can think about workers in each of these, and we developed a whole program of green jobs should be safe jobs, and we had a number of meetings on this and put out guidance in that regard.

DR. BEHM: Paul, just a quick clarification. I think you actually just said this, but that Prevention by Design is a large initiative within the Agency, and this is just a focus on the one vertical column of that related to chemicals.

DR. SCHULTE: That's right. Yes, that was just—yes, it's a larger, much larger than chemicals.

DR. BEHM: There's a lot of stuff beyond chemicals.

DR. SCHULTE: For sure, yes. I was just focusing on the chemical. Thanks for the clarification. One frontier issue that's coming up is the whole area of exposome and exposomics and Cumulative Risk Assessment. There's—and another term that's in the literature now is “Total Worker Exposure”. The clarification of what these fields actually cover is still under development and advisement. But they both, in my mind, and this is just, this is my take on how to make some sense out of all this. They both lead to risk management, go through, they drive risk management and they lead to Total Worker Health. And the reason for that is, the reason for that is that they talk about the totality of chemical exposures, of other, of all exposures that workers have. And historically in occupational safety and health, we've spent a lot of our time focusing on one chemical at a time and the importance, not because we didn't realize there were multiple exposures, but it's a difficult animal. It's a difficult task to deal with. And indeed, right now, people are groping for how you make sense out of the multiplicity of data points you would get if you started to look at multiple exposures. This is what is known as the correlation, the exposome correlation globe, and the thicker the lines and the frequency of the lines, there's correlations in blood of different materials or

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correlations with various other factors.

Cumulative Risk Assessment brings this even further because it not only looks at the many exposures at one time, it helps, it provides for thinking about looking at then over time and from preconception to death, if you will, all that time. And how do you get your head around something like that is the challenge of work. NIOSH put out a basic fundamental piece that TJ Lentz led on looking at the integration of occupational and nonoccupational risk factors, and there are some good examples—relatively basic examples in here, chemicals and noise and so forth. Two other areas that I wanted to mention that have come onto our—have been enlarged in our radar. One is collaboration on TSCA. TSCA has been around, now its official name is the Frank R. Lautenberg Chemical Safety Act for the 21st Century, or it's the new TSCA. And why it's grown in our attention is that it stipulates specifically that workers are a susceptible population. Workers have always been in TSCA but they're really identified as an important subgroup here. And also TSCA not only looks at new chemicals but existing chemicals, and that's a change from the old TSCA.

Well, EPA has to do this, and they have to put out so many assessments and evaluations per year, and they're on a time-limited bit of legislation, so they asked NIOSH and other agencies to help them. And so we've been working quite closely with them on assessing, developing methods and assessing risk assessments for each of the chemicals that they're doing. And this is taking much more time and effort than we had anticipated, and it seems to be growing. They're doing ten this year but they have to do twenty a year, and it's going to get gargantuan.

The last thing that's got a lot of our attention is the exposure of workers to hazardous drugs. As you well know, many millions of workers, healthcare workers, are exposed to hazardous medications—nurses who give chemotherapy to patients—and in that process, the workers, the healthcare workers, may receive exposure to these materials in small amounts. So what we want to do is develop some guidance that would sever the exposure, the hazard and exposure of these materials from the risk of more serious effects—cancer, reproductive and other effects. Many of the workers in healthcare are in reproductive, prime reproductive years, and that's critical to protect.

So what NIOSH has been doing since 2004, we've been issuing a list of hazardous drugs in healthcare settings, and we've been revising that every two years. And that went along, and it was a useful resource by many stakeholders. One of the groups that took note of this was the United States Pharmacopeia, an organization that overviews what's going on with therapeutic drugs, and has started to think about citing NIOSH guidance as part of their rules, which then may trigger state or jurisdictional or regulatory impacts. And so a spotlight has been shone on what NIOSH is doing, and so our efforts in this area have had to increase. We are developing a policy and procedures document that will list how

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we're dealing with these materials. We're separating the risk management from the hazard classification part. We're going to put out a whole new document on risk management guidance for handling hazardous drugs in healthcare settings, and we're continuing to have a broad partnership with various agencies and organizations.

So that, in a 30,000-foot rapid-fire fashion is the majority of the risk assessment and risk management efforts that we do. I may have omitted a few but that gives you the majority of them.

So what we would be interested in hearing is what you think about all of that. Do you think we have the right priorities? Should we focus on any particular area more than we are? And particularly, what areas are we not working in that you think we should be working in? And so that's my presentation and I'm willing to hear any comments or questions.

DR. BUNN: Thank you, Dr. Schulte, for a very enlightening presentation of all of the good work that's being held in a number of different areas, and really presenting it in a cohesive fashion.

DR. SCHULTE: And thank you for mentioning, I'm sorry, I didn't mean to interrupt, but this is not me. This is, I'm just the voice of many people, and there's many more who aren't even on this who I would like to acknowledge who have worked on this.

DR. BUNN: So do we have any questions on the questions, or comments on the questions related to Dr. Schulte's presentation?

MS. LASZCZ-DAVIS: Chris Laszcz-Davis. How do you receive feedback as to use of any of the fine products that are developed?

DR. SCHULTE: We do a number of different things. It dovetails in part with some of the contribution analysis discussion, but certainly we evaluate and monitor continuously downloads, all the things off our electronic media that we can track, we track. We talk to stakeholders continuously in informal fashions at professional conferences, particularly at the AIHce conference and the ASSE conference, at our booth, sometimes we do informal polls about certain topics. So those are the main ways that we get information. And we respond to any stakeholder requests that we get for issues related to a particular bit.

DR. BUNN: Grace

DR. LEMASTERS: Yes, Grace LeMasters. You mentioned reproductive there at the end with antineoplastic drugs, and of course that's a classic one I know that NIOSH has been working on. But there's just a whole lot of pregnant workers in every area of occupation and especially since women have been flooding the workplace, and my concern is that I don't know if there's been a lot of emphasis—and maybe you could enlighten me on that—on the pregnant worker and the exposed fetus because as we know, all low molecular weight substances can cross the placenta. And it's like we think about workplace exposures but it's still like in the field of doctors prescribe medication to women, the normal prescription is for a 70 kg

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- man and not pared down to women's size. And I'm wondering along those lines is if there's a lot being done for the fetus that is exposed in so many workplaces.
- DR. SCHULTE: Right, yes. You're exactly right. That is an underserved area, I believe, in occupational safety and health in general, though I think NIOSH has been involved in a goodly amount of research and the Division of Field Studies and Engineering has been addressing that. The part I was talking about was specifically for healthcare workers particularly. But maybe Terri has more she can add about what we've been doing in the bigger picture, or—and in some ways, I don't know if we've dedicated enough resources to that.
- DR. SCHNORR: Yes, this is Terri. As you know, the study of reproductive health is really challenging as related to work, but what we've done over the last many years is collaborate with CDC's birth defects registry branch and have utilized their information on exposures and industry and occupational to really try to look at some of those relationships, and we have a good body of publications on relationships between specific exposures and specific birth defects that come from that. So we do have that body of literature and we continue to partner with them.
- DR. LEMASTERS: I mean, this may be unrealistic but when recommended exposure limits are developed, is the fetus considered as an exposed worker when they're...you know, to cover the exposures that are crossing...?
- DR. SCHULTE: You're right, Grace. That is not an area that in our history of developing recommended exposure limits we have focused on specifically, and it may be a deficit that needs to be looked at.
- DR. BUNN: Judith.
- DR. MCKENZIE: Judith McKenzie. In terms of your first question, chemical guidance priorities, I think adding the hazardous drugs is important, at least for the clinical occupational medicine community, because we've been doing some work looking at what are people doing in terms of surveillance and prevention, and there's nothing they've been doing. And we've been trying to look to NIOSH for guidance but to date, there's no standardized way of the different healthcare systems, how they protect workers who handle hazardous drugs, mostly nurses. And I think that this is a big issue right now for physicians who take care of healthcare workers who handle hazardous drugs. We're trying to develop our own guidance. I know that there are different committees across the nation doing things in their own geographical area, but the research has shown that everyone's doing something different or people are doing nothing at all, and it's mostly a reactive process. If there's a spill, we clean it up, we say go to occupational medicine, see if anything's wrong, but clearly nothing is going to happen immediately; it's what happens long term. And surveillance, there's no standardization. So I think that having this as a priority is important, at least within, for the healthcare workers who take care of the healthcare workers who handle these drugs.

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- DR. SCHULTE: Good, well, thank you for that. I think in the guidance document that we are developing on risk management, we will touch upon that a bit, at least maybe put a marker for further research. Thank you.
- DR. BUNN: We have a question on the phone. Karla?
- DR. ARMENTI: Yes, it's Karla Armenti. I'm just wondering—I know this might be a totally loaded question—but is NIOSH considering expanding its review, I know we'll learn more about the Firefighter Registry later today, but I am wondering about the PFAS and the PFOA exposures obviously tied to the aqueous film forming foams that are often used by firefighters. I think military personnel is another population that could be highly exposed. And it all gets convoluted by all the issues around water contamination actually throughout the country, but I'm on the seacoast in New Hampshire and it's a huge issue here, and we've been working with the Air National Guard to help them understand what it means to be exposed to the PFAS and PFOA substances but in addition, all of the other occupational chemicals, the workplace chemicals that they've been using their whole lives. And we're really grappling with that now. So I don't know if that's an expansion of some of the work that you're doing already but I'd love some feedback on that. Thank you.
- DR. SCHULTE: Well, certainly that's an important area. You're asking questions that relate to the research aspect; I was focusing on when there is research, how you think about it and give guidance. But maybe Terri Schnorr could say a little bit about the initial thinking that they've been doing from the research side.
- DR. SCHNORR: Yes, so this is Terri, and Karla, we've talked about this but we are initiating studies to try to look at certainly the question of PFAS exposure in firefighters but also to look at some of the newer short-chain compounds and where those are used, which industries use those. So those exposure type studies will be beginning. There's pilot work, but they'll be beginning in the coming year.
- DR. ARMENTI: Okay, thank you.
- DR. STOUT: Ron Stout. Not specifically addressing your questions but perhaps a question of my own, and apologies if it's an ignorant one. I'm not entirely clear why OEBs can't replace OELs. My background for years was in the pharmaceutical industry, etc. and a thoughtful approach to OEBs gets you 80 for the 20. And I think some would suggest that the OEL is a false precision. You might want to parking lot that for the next presentation but...
- DR. SCHULTE: Right. OEBs, occupational exposure band, are the bins that I showed you. A lot of that grew out of the pharmaceutical industry where you had biologically active materials that you were making anew, and you didn't have a big toxicity framework in some cases and you had to make some decisions based on limited evidence. Whether that can fit—why OEBs can't replace occupational exposure limits is because they don't go through—maybe with some exceptions of the pharmaceutical industry—they don't go through the rigorous assessment for

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quality and quantity of evidence and then the utilization of that evidence in a way to model potential risks at different levels of exposure and then the ability for stakeholders and the public to give feedback on that, and then the finalization of the occupational exposure limit. That's a totally different process than a scan of the literature, electronic scan of the literature, and using sort of a set of decision-making criteria to see which, what are the most toxic endpoints, at what levels, and then making some quick assumptions. So I appreciate that there is utility and there is certainly, there is the interest in maybe using these, but it's totally different.

Also the occupational exposure band, hazard banding, is not a governmental or authoritative organization-generated activity. It is an activity done by the risk manager/employer, for their purposes, and there can be different ones at different places, and it's a totally different process. It's a tool to help decision-makers, risk management decision-makers make a decision in the absence of real solid information. But it isn't, I don't think it replaces that.

DR. BUNN:

Right. Michael first, sorry.

DR. BEHM:

Sorry. Hi, Mike Behm. Great presentation, Paul. A couple of weeks ago, I had the opportunity to visit one of these vaper or dual manufacturers that make these vaper cigarette cartridges things, and this place grew from two people four years ago to over 50 currently and I mean, quite frankly, it was a pretty abysmal place to work. And I was just curious if from the manufacturer standpoint, I guess this industry is growing. I'm not sure of the numbers, but I assume that it is, and I guess just from a manufacturer standpoint and then also from the secondary exposure standpoint of certain workers, is NIOSH looking into anything with that?

DR. SCHULTE:

Again, these are, a lot of these are great questions that are at the front end of the occupational safety and health continuum. I've been talking about the back end.

DR. BEHM:

Okay, sorry.

DR. SCHULTE:

But I can again turn...

[Laughter.]

To my friend and colleague Dr. Schnorr, who might have some ideas about health hazard evaluations or anything that they've done or not.

DR. SCHNORR:

We have done a few health hazard evaluations in vaping shops. I don't think we've done any in the manufacturing type facilities that you've mentioned, so that's an interesting idea that I could take back. But we have done those, and those are published on our page, and I could point you to those later.

DR. SCHULTE:

I was going to ask, what was the abysmal characteristic you were...?

DR. BEHM:

Oh, it was just the odor of the place. I was only, I did a 30-minute tour and I had a headache for the rest of the day, and it was, and my, I had to wash my clothes twice.

PARTICIPANT:

Wow.

DR. BEHM:

I'm glad I didn't wear very nice clothes. It was... Well, and so yes, and so

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- DR. SCHULTE: honestly, from a—in fact, the university got called to see if we could help, but they were being audited by their, one of their, who they supplied to along the supply chain, and you know, just from kind of, you know, they... Again, they grew from two people four years ago to over 50 now and they really didn't have anything in place. And yes, it was just, my head, ugh. It gave me such a headache and, yes. That illustrates the classic issue that I mentioned earlier of, with advanced manufacturing in a lot of these, and even nanotechnology companies start up and then they go from 2 to 50 people, they're interested in making their, proving their principle and making their product. They have no infrastructure for occupational safety and health, and we've tried to start to develop guidance documents for those kinds of companies, but clearly distribution to them and getting them to be motivated to follow that is lagging way behind.
- DR. BEHM: Yes, and again, the access to the small business but it was interesting, you know, just in terms of that access that that—their interest in occupational health, remotely as it was, was driven by the person, the company that they supplied to, which I thought at least that was...
- DR. SCHULTE: Which is a strategy we've been using...
- DR. BEHM: Remotely positive, yes.
- DR. SCHULTE: The supply chain influences.
- DR. BUNN: Yes, actually, you may even want to think about that as additional, you know, dissemination or compilation of chemical risk assessment documents that are directed towards the flavoring industries that could be useful to directing towards those in the e-vaping industry, which of course uses a lot of flavors now, so. Charles.
- DR. REDINGER: Yes, thank you, and I've got a follow-up on what Dr. Stout asked about his question a minute ago, why don't we come back to that in the next session on banding. Dr. Schulte, thank you so much for the presentation, and over the years, I've seen you speak many times, and you've always got neat diagrams, even going back to the IOHA presentation in Rome I think it was 2010, you had some pretty nice ones.
On slide 39, I think that's one to keep pushing on. That was the one where you've got the diagram of exposome.
- DR. SCHULTE: Oh right, yes. Yes.
- DR. REDINGER: So this is on holistic approaches to protecting workers. I think a really nice start at how to relate these different concepts—Total Worker Health, risk management, Cumulative Risk Assessment and then this exposome Total Worker Exposure piece. I'm curious and a bit suspect with this concept of TWE, Total Worker Exposure. So at the last, at the American Industrial Hygiene Conference and Exhibit, there was a number of presentations on this Total Worker Exposure topic. It's been in this space now for I'm going to say a year or so maybe two. The topic of exposome has been around for a while, you know, ten years, whatever. I'm still

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not—I'm still wrestling with what's the difference. I guess I would say to the Agency, one is I think for this diagram on slide 39 is that the circle at the top of exposome—sorry, Total Worker Exposure—I'm not clear what the difference between that is and let's say CRA. So Todd Niemeyer gave a presentation at the Pacific Conference last January where he talked about a couple of the efforts that the Agency has with that. Total Worker Exposure, we all know that there are different types of exposures—chemical exposures, radiation exposures and those sorts of things. How they interplay, in my thinking, gets down to CRA. But I don't, I guess I'm cautious, curious and I guess I have a concern that some people at least, not just on the industrial hygiene front, are pushing this concept of TWE when it's potentially confusing things. And it's still pretty early conceptually. So I don't know if that's either a clear question or clear feedback but just someone, boots on the ground, observing this stuff, I just think we need to proceed with caution and, at least for my thinking, at some point it does get down to the CRA. Because it's how do all these things come together to impact the worker and then Total Worker Health.

DR. SCHULTE: Exactly, and hence my disclaimer when I showed that slide that we're just trying to grope with the uncertainty right now, and I say the same thing at the AIHce presentation.

DR. REDINGER: Yes, exactly.

DR. SCHULTE: I don't think there are clear definitions of what those different terms mean, where they overlap, how you measure them, what you do with the information. I mean, we're early in the development of that kind of thinking. I think it's useful thinking to think of a broader construct than just a single exposure, but how you get beyond that and look at chemical, psychosocial, chemical/nonchemical, and what's the difference between the exposome, which was developed as a term in 2005, and Cumulative Risk Assessment which EPA has been using for the last ten years coming out of their team studies, and then this current term Total Worker Exposure which I'm not totally sure what it means, and how that relates to the concept of Total Worker Health. All of that needs clarification, so you're right to point that out.

DR. REDINGER: Thank you.

DR. BUNN: Yes.

DR. SCHENKER: Marc Schenker. I want to come back to the comment about the small employers, and I think that is the environment that has the least resource and perhaps least incentive to be addressing these issues. How does NIOSH think about this, because clearly you could set your bands or have your exposure limits, but if you have a small employer who's financially marginal and doesn't have the expertise, it's going to have little impact there. And the flip side is worse health outcomes.

DR. SCHULTE: Well, we acknowledge that, first of all. Last October, we held a conference in Denver on dealing with small businesses. It was the first international conference

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on small businesses held in the occupational safety and health field and it was just, proceedings were published in, earlier this year in the *Annals of Work Exposures and Health*. But your point is well-taken.

With regard to banding particularly, the use of the output of the banding process by small businesses is still a problematic issue, and we're developing information to help translate that information to the small business decision-maker. But to the extent that they have the resources will be the limiting factor, or the wherewithal to use that information, and they will need to have, in some cases, professional support to utilize those bands.

But it's a hard nut to crack. I think the small business issue has been the biggest problem of the occupational safety and health field historically, and we've tried to promote activities to deal with it, but we have a long way to go.

DR. BUNN: Steven.

DR. LERMAN: Steve Lerman. So I applaud NIOSH's efforts to reach out to small businesses and help them, but what I'm hearing about a company that went from 2 employees to 50 employees, at 50 employees they're no longer really a small business and while NIOSH continues to have an important role in helping, I think part of it is with—it's the wrong agency. OSHA has to look at these not-quite-so-small businesses that fall under their realm, and there's a limit to what NIOSH could do in the absence of that.

DR. SCHULTE: Yes. Yes.

DR. BUNN: Ted.

MR. COURTNEY: So to have a couple of different pieces off the talk—an excellent talk, thank you. First one, which I think we've been pootling around in the course of the discussion is kind of how, like a future vision question, how are you kind of tracking not just emerging chemical risks but how much mindshare are you able to put towards emerging chemical engineering and bioengineering trends? So in other words, where are your—rather than identifying something bad after it's produced, where are the trends that take production in future where people are trying to extend the chemical process? It's tough to get great intelligence about that but to the extent you can get intelligence about that, it allows you to respond more from an anticipation standpoint. So that's just something I wanted to kind of add to the equation.

Let me put the other two quickly as just suggestions. So you mentioned peracetic acid, difficulty getting some industry access. This is maybe something you've already done but National Chicken Council, National Turkey Federation could be places just to seek and see if they can help you with access.

DR. SCHULTE: Right. We're working with the National Chicken Council.

MR. COURTNEY: You're working with them?

DR. SCHULTE: Yes.

MR. COURTNEY: Okay, perfect. Then you're in the right place already.

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And then just in terms of nanomaterials, thinking about total exposure, it may be going on just in that to mention it but is there collaboration with FDA and other agencies that are looking at the consumer exposure in the nanomaterials? So you know, your workers exposed to materials in their production environment have got a lot of controls but then they every morning are slapping on sunscreens or cosmetics and they're filled with nanoparticles that could be, you know, contributing to exposure, confounding your own attempts to control. So is there a bridge there between the occupational and the nonoccupational sides of nanoexposure?

DR. SCHULTE: There is and then there isn't. There are a whole lot of difference in terms of voluntary exposure versus involuntary exposure versus route of exposure. We have though looked, worked with the Consumer Product Safety Commission for issues as the nanomaterial component of desktop printers, additive printers, and we've done joint collaborations with them. The nanomaterial exposure of spray nanosilver disinfectants for lavatory cleaners, so we—which are also used by consumers. So we've done some, but where there are mutual opportunities we work on them mostly.

That's a good point, to keep alert to those, the opportunities when they exist.

DR. BUNN: Chris.

MS. LASZCZ-DAVIS: Chris Laszcz-Davis. Actually, that prompted a question that you spoke to. I mean, it's clear that NIOSH is thinking about future workplaces and has a whole initiative wrapped around that, and it's very exciting. But you know, when you talk about specific materials, do you guys have any affiliation or communications with the proliferation of materials science degrees and departments that have sprung up around the country? I mean, if we're talking about specific materials, I would think they'd be on the forefront.

DR. SCHULTE: In part. We're trying to get the concept of Prevention Through Design built into all the different professions through the curricula of all the professions that design things, be they materials or buildings. And so we have promoted Prevention Through Design information in engineering textbooks and a variety of other kinds of textbooks. We're also looking at the certification process for people who have come out of these programs. We're working with a lot of different professional groups in terms of advanced materials too. Maybe not to the extent that your question implies but at least we have a working relationship with some of them. And so I think what you're suggesting would help us push that forward.

MS. LASZCZ-DAVIS: Thank you.

DR. BUNN: Other questions.

DR. SCHULTE: I just wanted to get back to Ted's one question. Indeed, understanding the evolution of processes is critical, chemical production processes, and that's one of the areas that we hope our Prevention Through Design program will put more emphasis on.

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- MR. COURTNEY: Great, thank you.
- DR. BUNN: Actually, I have a question myself regarding kind of Ted's, you know, suggestion about FDA as a potential partner because you know, of course they're using a lot of nanoparticles for drug delivery systems right now, and the effects of those potentially developed drugs on physiological—our systems, once people are taking them. So I just wondered if there was any, you know, overlap or any future collaboration with them in mind, to be able to join forces, to be able to look at the effects of some of these.
- DR. SCHULTE: Well, we're aware of the nanomedicine toxicologic literature, but you're looking at a totally different kind of exposure scenario with patients who receive a medication that has nanomaterials in it from workers that are exposed in making or handling or delivering. So the limit, while there might be a commonality of exposure in some cases, the situations are totally different.
- DR. BUNN: Yes. Yes.
- DR. SCHULTE: So we don't get too much into the impact on patients of drugs that have nanomaterials in them. But if there is a worker angle anywhere along that process, we're interested in it.
- MR. COURTNEY: You know, I think what I'm hearing collectively is just that point on force multiplication potential. We'll engage with FDA or other agencies even if it's a little bit peripheral to the core question, still it allows you to expand scale. You know, how value-added the expansion of scale is, I think that's kind of what I'm hearing.
- DR. SCHULTE: We're open to collaboration whenever there's a mutual, mutually beneficial reason to do so. So we've worked in the past with FDA or CPSC and most, many other agencies.
- DR. BUNN: Okay, well, I think we're pretty much right at time now. Thank you very much, Dr. Schulte...
- DR. SCHULTE: Thank you.
- DR. BUNN: For a very, very nice presentation.
- DR. SCHULTE: Thank you.
- DR. BUNN: So I guess we'll take a short break now for ten minutes and we'll get back together at 10:30.
- [Break.]
- DR. BUNN: Okay. Well, Dr. Schulte's presentation was a great lead-in, and a mini introduction to Dr. Lentz' presentation that he's going to be giving us now on Occupation Exposure Banding, and I can see where that will have lots of applications and I'm very interested in hearing about, you know, it was mentioned during the last discussion about possible standardization for this, maybe. And so I'm very happy to have you speak on this topic.

OCCUPATIONAL EXPOSURE BANDING

- DR. LENTZ: Well, thank you, Dr. Bunn, and thank you, especially, to the Board of Scientific Counselors, the NIOSH Associate Director for Science Office, and on behalf of

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the team that I represent here, I'm really excited to talk about the research that led to this guidance. We have a guidance document, as Dr. Schulte mentioned, that's right on the cusp of being published, hopefully, within, certainly, within the month of June, and a companion e-Tool which has been a long time in the works. So we're really excited about this.

I have to mention that, and I'll acknowledge them at the end of this talk, that this has been a huge team effort internally, but also a lot of external subject matter experts, and we all draw a lot of inspiration from one another to perform the research that has resulted in this effort. Another source of personal inspiration for me is quotations from historical figures, and one I'd like to quote is Albert Einstein who said that creativity is intelligence having fun, and I'd like to think that we brought enough of both to this process. But also if we knew what we were doing it wouldn't be called research, would it? So I think, you can look at that a couple ways because we had a similar problem and that is chemical exposures in the workplace, but we looked for a creative approach, a new approach, other than occupational exposure limits.

So with that, what I'd like to do is explain our research and guidance resulting in occupational exposure banding strategy for NIOSH, what it means, how it has evolved over a 10- or 11-year process, why it's important, and what some of the next steps are. And I'll end, as Dr. Schulte did, with some questions for the Board of Scientific Counselors. As Paul indicated earlier, our goal is to create a consistent and documented process which will characterize chemical hazards so that well-informed risk management decisions can be made for chemicals lacking OELs. Hopefully, I can address the question a little bit about the small- and medium-sized enterprises who need guidance for that as well. Also Dr. Stout asked the question about why OEBs can't outright replace occupational exposure limits, and we hope to touch on that, but we do see it more as a starting point to inform risk management decisions using a limited amount of data to do so.

Now, we've heard a little bit about prevention through design. It's an initiative that NIOSH has been engaged in for, at least, 12 years and it encompasses all efforts to anticipate and design out hazards to protect workers and facilities through work methods, operations, new technologies, and the organization of work. Its intent is to design out or minimize hazards or risk.

Yesterday I had the great privilege of hearing Dr. Mike Behm at the NORA Construction Sector Council meeting talk about what this design means, a question that he poses to his classes. And, in this sense, we're looking at design as a new process for addressing chemical exposures. So there are many ways to interpret that, and that's how the occupational exposure banding effort was born of the PTD initiative for NIOSH.

Now, several of you may be familiar with this graphic. I can't take credit for it. This was a publication that several in the room, Chris Laszcz-Davis and Susan Ripple,

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Andy Maier were involved with some of the thought leaders in recognizing the hierarchy of occupational exposure guidelines. And we recognize that at the pinnacle are the quantitative health-based occupational exposure limits using the full breadth of data available to us, human epidemiological or animal studies, mechanism of action data, and with performing a quantitative risk assessment to develop an occupational exposure limit.

Now, at the bottom of this pyramid we see with the fewest data requirements and the least time invested in the process is the hazard banding strategies. This is really an entry point or a way to make just a more rapid assessment given fewer resources and so many chemicals that lack OELs in the workplace. This is really an important recognition in this publication that shows the hierarchy of OELs. As Paul indicated, occupational exposure banding is a mechanism that that we use to quickly and accurately assign chemicals into these five categories in NIOSH occupational exposure banding strategy. A being the least hazardous substances, and we have concentrations for particulate and dust in milligrams per meter cube or gas and vapor in parts per million, all the way down to the most potent chemicals or dusts to E where we would recommend the lowest exposure ranges.

So why do we need occupational exposure bands? I think, it may be a little more obvious to this audience, but I'll go over just for your benefit. We realize that many workers have dangerous jobs where they're exposed to hazardous chemicals and, unfortunately, there isn't always a lot of guidance on the proper use of these chemicals and the types of health effects these chemicals could cause and, more specifically, what concentrations of chemicals might cause negative health effects to the workers. And occupational exposure bands, therefore, are intended to provide the type of guidance needed when a traditional occupational exposure limit is not available.

I think Paul had a better graphic showing this, but we recognize that from the Environmental Protection Agency, Toxic Substances Control Act in the chemical substance inventory, that there are more than 85,000 chemicals in commerce and more being developed and introduced every year. And, in contrast to that, there are only about 1,000 chemicals that have been assigned, at least, one authoritative occupational exposure limit from a government professional or peer-reviewed source. That is a pinnacle of that hierarchy of occupational exposure guidelines.

So therefore, the rate at which new chemicals are being introduced into commerce severely outpaces how fast new OELs are being developed. And there's a tremendous need for more guidance on these thousands of chemicals that don't have quantitative exposure limits.

You've seen this slide previously, but once again, these are the proposed NIOSH occupational exposure bands going from A to E. The highest exposure limits for

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the A and going down to E for the for the most potent chemicals where we recommend the lowest exposure ranges.

Now, there are several potential benefits of occupational exposure banding which this slide is intended to demonstrate. One, it does facilitate more rapid evaluation of health risks. We recognize that it takes a lot of resources, including time to perform a quantitative risk assessment and to do it right, and then to promulgate standards. This occupational exposure banding provides guidance for materials lacking occupational exposure limits, and it also highlights areas where the data are missing or we might guide future research efforts. It also provides a screening tool for the development of recommended exposure limits or if OSHA were to do permissible exposure limits. And then it identifies hazards which could be evaluated for elimination and substitution. For the small- and medium-sized enterprise this could have the greatest benefit with the lowest level of sophistication. They could do a comparative analysis and realize if I have a chemical that's banded in E I might substitute that for one that I band in C. It's also aligned with the Globally Harmonized System for Classification and Labelling of Chemicals for the hazard communication standard promulgated recently by OSHA, and it facilitates the application and extension of prevention to design principles.

Now, we often get asked the question, is occupational exposure banding the same as control banding? And this is where we first started investigating this topic, but our answer is no. Most people would probably be aware of the U.K. Health and Safety Executive, COSHH Essentials, Control of Substances Hazardous to Health. It's a common control banding tool developed in the United Kingdom that helps small- and medium-sized enterprises do risk assessment and provide advice for the processes that may lead to chemical exposures for their workers.

One key difference between control banding and occupational exposure banding is the control banding is a tool that is applied to different processes that are performed and the output is a control approach and advice. And, for us, occupational exposure banding is applied to specific chemicals themselves. The output being a quantitative range of exposure concentrations that can be used as targets for implementing control strategies. The documents shown here on the right was comprehensive risk—or a literature review that NIOSH performed and published in 2009 looking at all the available control banding methodologies and strategies that were available at that time. And there were recommendations within that that included looking at occupational exposure banding as the front end of control banding.

So one more way to look at it is that occupational exposure bands are derived from toxicology and potency information that we know about chemicals. So we assess the hazard potential using the occupational exposure bands, we assign it

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to—the chemical—to a health-based occupational exposure band, and then this is used to inform the risk management strategies and options, engineering controls, and personal protective equipment.

And this is, quite literally, our representation of the occupational hygienists toolbox. You realize that there are a number of things that we bring to bear upon occupational exposure scenarios. The GHS classifications, I mentioned previously; hazard communication standards; exposure monitoring; medical surveillance; engineering controls; PPE. And we see occupational exposure bands as one more supplementary tool that we can add to this approach.

So in informing our occupational exposure banding process we, typically, look at toxicology and potency information for these nine specific toxicological endpoints. Now, one unique thing about the NIOSH banding process is that it is a 3-tiered approach, and it can be performed with different varying levels of expertise with requirements for data sufficiency allowing a variety of stakeholders to use the methodologies in different situations. The most appropriate tier for banding depends on the availability and the quality of the data, how it will be used, and the training and expertise of the user.

Tier 1 requires relatively little information and can be done by a more novice user. And this would be targeted towards the small- and medium-sized enterprise or the people who serve those enterprises. Tier 1 uses the Globally Harmonized GHS hazard codes and categories, and compares them to the NIOSH banding criteria to determine a band for the chemical. And then Tier 2 should be performed by a trained hygienist and requires a full evaluation of recommended secondary data sources that NIOSH illustrates. And this tier is also considered for a minimum level of data sufficiency to ensure we have confidence in the banding result. And then Tier 3 is a much more involved process, closer to a quantitative risk assessment that requires an experienced occupational hygienists or a toxicologist and the use of expert judgment and interpretation of raw data sources to perform the banding process.

Now, completion of a Tier 1 banding process relies solely on the use of GHS hazard codes and categories. And most of you should be familiar with the GHS as a hazard classification system developed by the UN to standardize chemical regulations. It's been adopted by OSHA as part of the hazard communication standard, and there are a number of different sources for these PHS codes and categories that NIOSH recommends for use with our banding process. And this is the primary engine for our occupational banding process for the Tier 1 and these are the criteria. And you'll see here we limit it to C, D, and E because it requires the fewest data. We don't feel confident banding in the highest exposure ranges, A and 'B.' So as a screening process we limit it to C, D, and E. And once you retrieve the GHS classifications from the sources we recommend, you compare them against where they line up within these three columns, C, D, or E for each of

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these nine criteria, and that, then, determines which band would be—a chemical would be assigned to. And I demonstrate this in subsequent slides.

So one of the ways that we use to evaluate the effectiveness and the accuracy of our Tier 1 banding process was to compare it to chemicals that had full shift OELs for over 700 chemicals, and the authoritative OELs we used are shown here on the left column, NIOSH RELs, OSHA PELs, the ACGIH, TLVs, and the others shown here as well. And we found that in greater than 80 percent, in fact, it was closer to 90 percent, the Tier 1 bands were at least as protective as the OEL which is the outcome that we had hoped to have, so that we have confidence that they're going to be protective enough.

And this is an overview of our Tier 2 process. You begin, first, by determining, again, that there's no OEL for a specific chemical research recommended databases, and we're very prescriptive about which databases to search for which health endpoint. And we compare those to NIOSH criteria for each health endpoint and assign a band for each health endpoint based on the criteria we provide. And then select the most protective band from that resulting process. So this slide is a bit outdated now, but we, initially, had a pencil and paper version. We still include this within our draft document which was about 160 pages long. For those who want to fill in a form, we provide the form, but even better is that we've developed a companion occupational exposure banding e-Tool. And this is a free online resource which helps to, once the chemical name or caste number is put in, it's gotten to the automation process where it will pull from the recommended databases and populate if there is information for a specific chemical, the GHS codes and categories, and then indicate the resulting bands. So it's, really, we continue to make that a more powerful tool and to introduce more automation, so that it will have fewer and fewer sources of error and provide consistent results. And this is just an overview of our occupational exposure banding e-Tool.

Incidentally, we published the draft guidance in March of 2017 along with the launch of the draft occupational exposure banding e-Tool. At that time, in 2017, it was a lot less sophisticated. Recently, we've taken down the occupational exposure banding e-Tool to make additional improvements, and we will relaunch that to coincide with the publication of the new document in June. So people will be able to see the advancements that we've made in that.

As I mentioned, there's also within our guidance document, information about how to perform a Tier 3 overview. This is much more limited because the requirements for expertise in toxicology, intensive review, and evaluation of primary data sources, and it's often indicated when there are insufficient data to perform a Tier 2 banding assessment. So I won't go into detail about that today. And, in the interest of time, I'd just like to provide an overview of the Tier 1 process and walk you through an example for that.

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So as I indicated earlier, the NIOSH Tier 1 criteria are based on hazard codes and categories from the GHS, and if a chemical has not been evaluated in the GHS system, essentially, it cannot be banded in Tier 1 and the Tier 2 banding as indicated. Because Tier 1 has, relatively, fewer data requirements, chemicals are only banded into the bands C, D, and E, so that we would be more conservative in those recommendations. Bands A and B, typically, represent the higher exposure ranges, and we don't allow users to band these based only on the limit of GHS information. Chemicals that have the potential to cause severe and irreversible health effects, such as carcinogens, reproductive toxicants, acutely fatal compounds, and corrosive materials are systematically assigned to the most protective bands. And chemicals that cause reversible health effects, such as skin and eye irritants are assigned less protective bands given if the health outcomes are less severe.

In general, though, Tier 1 can be used as a quick screening method, but NIOSH always recommends if you have the time and the data available to go on to the Tier 2 process. And Tier 1 would be likely more useful when banding a large number of chemicals and deciding which one should be prioritized for elimination, substitution, or further evaluation. Once again, you've seen these before and, as I indicated, for the Tier 1 process we don't include the A and B. We'd like to push the users to the more protective bands, C, D, and E.

And so once again, an overview of the Tier 1 process. We start by indicating a chemical has no OEL. We go to the GHS information. We compare those hazard codes and categories to the NIOSH criteria and assigned a band on each relevant health endpoint, and then go through all of those and determine which the most health protective band is, C, D, or E for band 1. Once again, this is our criteria, and you see these are the nine health endpoints that we utilize. And the top two rows show the OEL ranges for particles or vapors, and these are where the hazard categories and codes line up within those bands, and for those nine health endpoints.

We exclude several other GHS codes which are not, specifically, for physical hazards, ecological hazards, and these are ones that we see as not occupationally relevant or not sufficient to affect the result of the banding outcome. So you've seen that one. But the example I'd like to use is a substance called abietic acid. It's an organic compound that occurs naturally in trees, and it's known to be an allergen. There are some qualitative and quantitative data, but no occupational exposure limit exists for this, and that is our starting point for performing the banding and the Tier 1 process.

Our next step is to go to the GHS hazard codes and categories and recommended databases, and for this process we recommend three sources, the Justice Substance database is a German database with roughly 8,000 to 8500 chemicals. And so we see it as a very comprehensive database that has GHS

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hazard codes and categories for the chemicals. So we recognize that as an authoritative source. Also the European chemicals agency, Annex VI database, is another source that we recommend. And, finally, finally safety data sheets as OSHA is now requiring the inclusion of GHS information on the safety data sheets.

So this is just a screenshot of the Justice Substance database for abietic acid, and you see you can put in the caste number or the chemical name and it'll take you to abietic acid in this database. If you go to the regulations section it will show you the GHS classifications here. I brought up to show it has skin irritation and the category and code, high irritation, and a specific target organ toxicity, single exposure.

So this is the paper version where you can fill in the information. We, typically, do this in professional development courses and training for users of this, just to work it through so that they can get a good understanding of how this kind of the mechanism behind the online version. And the user will fill in this information, the hazard code, the hazard category, and the source just for their own resources, and you'll see—compare those hazard codes with the NIOSH criteria and, in this case, the skin corrosion code falls in band C, and so you enter that for skin corrosion at the endpoint band and assign each band for the other health endpoints, and for serious eye damage it's also C, and for the specific target organ toxicity it was not a band that was recognized in our criteria scheme. So based on those two bands we assigned the Tier 1 for the most protective endpoint. And, in this case, the most protective band is C, and that's the result that we get for this example.

As I said, if you have the resources, and not only the data sufficiency, we do recommend going on to Tier 2 because you can perform a more in-depth source going to some of the—beyond just the GHS classifications, you go to some of the original data sources to perform the banding process, and it has the possibility to move it to either a more restrictive or a less restrictive band based on consultation of those original data sources.

As I said, you've seen this previously. We did evaluate this extensively when we find that the overall rate of the Tier 1 bands being at least as protective as the occupational exposure limit, in this case, was almost 92 percent. Our original goal was 80 percent. And so as I said, also we recommend that users go to Tier 2 whenever there's the possibility to use more updated information.

So we see this process as more than just an occupational exposure band, recognizing that the number of chemicals that lack authoritative occupational exposure limits is quite substantial, and risk management for guidance of these documents—or these chemicals is needed. Occupational exposure banding, therefore, is one additional tool that can be used to provide that guidance. An OEB provides more than a range of exposures that is expected to be protective of

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worker health.

Rather, in our thinking, an occupational exposure band can be utilized to identify potential health effects and target organs, specifically, to identify health risks that affect health communication, inform implementation of control interventions and preparedness plans, and inform medical surveillance decisions, providing critical information quickly. The document details the use and application of this process and provides a summary of the efforts taken to evaluate its effectiveness and usability. I didn't go into several chapters that describe the evaluation process using multiple groups and multiple phases of interventions, each time improving the process for consistency of results and understandability for the user.

So some of our next steps are to engage the occupational safety and health community and, especially, those who serve small- and medium-sized businesses. It's been brought up, previously, that these are the ones who could benefit most greatly, probably, from a resource like this. We have stakeholders from multiple organizations, several of whom are shown here, and our feedback has been overwhelmingly positive. The American Industrial Hygiene Association has listed this as one of its top priorities for several years. The Occupational Safety and Health Administration, Dr. David Michaels, former Assistant Secretary of Labor, I used to get excited seeing him when he was in that capacity at conferences because he would come—but excited, but a little embarrassed because he would come up to me and say, "When is the occupational exposure bands...?" And I thought it's good that he knows about it, but it's not fast enough. So we've had lots of confirmation of a need for a banding approach and we presented it, also last week at the American Industrial Hygiene Conference and Exposition, and many people expressed, also a need for this and are excited about the upcoming release of the new publication.

We have had suggestions for improvement, simplicity and training. So that's one of the things that we tried to capitalize on for over the last two years based on the feedback we've gotten from the public and peer review comments. Much of that has been funneled into the development of the occupational exposure banding e-Tool.

We have multiple sources of guidance on this. We have a NIOSH Safety and Health topic page on occupational exposure banding, shown here to the right. We've also developed an occupational exposure banding wiki page, and that drives a lot of traffic to the NIOSH website for information about this project and process. The occupational exposure banding e-Tool, we intend to promote and disseminate as much as we can once we get that tool back online. And then I'd, also like to point out we have a YouTube video. It's about a six-minute video with one of our NIOSH colleagues and team members, Lauralynn Taylor McKernan, describing in six minutes what occupational exposure banding is, probably much more eloquently than I've done today, but she does a really nice job, and it's much

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more engaging, for certain. The e-Tool I've described previously, but this is a previous iteration. We continue to tweak that so that it's more intuitive, and that the output that is received is as clear as the user can use.

Some of the things we focused on, as I indicated, was automating the e-Tool and finalizing the banding guidance document, which is in its, again, final stages. A major goal, again, is the public health challenge of protecting workers from the myriad of chemicals lacking guidance. And two of our major partners have been the American Industrial Hygiene Association and the American Society for Safety Professionals, formerly the ASSE, for initial dissemination and continuing widespread use in the Occupational Safety and Health community.

The AIHA, especially, has been engaged in this, forming a body of knowledge, occupational exposure banding workgroup, to develop a list of the competencies needed for users of the 3-tier bands. And so that's resulted in a publication recently. We presented at the fall conference and also at the last two AIHCes in 2018 and 2019, continued to be active on the AIHA Exposure and Control Banding Committee. And there's been talk about an AIHA occupational exposure banding user workgroup that might band chemicals for comparison and for sharing information among that community and others in the broader safety and health community. We published other articles in *The Synergist*, the professional journal of the AIHA, presented at the IOHA. We have two subsequent manuscripts also coming out in the *Journal of Emergency Management* and the *Journal of Occupational and Environmental Hygiene* on our processes, specifically, for Tier 1 and Tier 2 banding process.

So in summary, we see this as an innovative approach to providing guidance prescriptive enough, hopefully, at some point to be used by small- and medium-sized enterprises or, if not, that audience, specifically, yet, by those who serve that audience, and as a tool for serving them. We, also hope to see this as a process. Once again, we say that this is, specifically, for chemicals without occupational exposure limits. We recognize that many occupational exposure limits are set on data that may be aging, obsolete, or may have newer information. Certainly, it is a voluntary process. And so like other NIOSH recommendations, the users may choose to do that just to see where the band lies compared to existing occupational exposure limits.

And, finally, the accompanying electronic e-Tool once it's launched and related, users will be able to use that tool once you register and you go in to use the tool, your information is kept confidential. NIOSH cannot see it. NIOSH will not share that information, and users are able to save that information, download it for their own use as far as what the output is for specific chemicals that they band using this process.

This is just a small list of the internal folks within the Division of Science Integration and a couple external members as well who have been focused on

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developing this within NIOSH. Paul Schulte showed this. This is the cover of the new document that we will be releasing fairly soon, and we hope that we can get this out, and not only for use by the occupational safety and health community, but also to get the feedback on how we might improve it and how we might further develop research related to this effort.

So as Dr. Schulte did, I'd like to leave you with some additional questions that we could benefit from hearing some answers from the Board of Scientific Counselors. Specifically, what dissemination strategies we should consider for this process. And then, as we have an area on future research needs, we wonder if the Board sees any value in exploring additional applications for banding, for example, with an emergency response or looking at dermal exposures since this is focused on, largely, airborne inhalation exposures. And then are there other groups who could benefit from or assist NIOSH with research efforts focused on occupational exposure banding. So with that, I'll leave you with these questions., and I'll look for answers.

DR. LEMASTERS: Very interesting, T.J. Grace LeMasters. Have you beta tested this with any companies to see what their response has been? Maybe you talked about that and I missed it.

DR. LENTZ: That's a great question, Dr. LeMasters. Yes, we have used—one slide that I will, typically, use, and I used last week at the American Industrial Hygiene Conference, was a five-phase process where we utilized it with focus groups, and in each case we wanted to see how their results lined up for inter-user variability. We wanted to test that, but also to see what their satisfaction with it was. And, also as part of our overall public and peer review process we received significant comments, that it's taken us two years to address, to improve the document as far as usability. And the feedback, it's been positive. I mean, there have been issues that we've had to address. I have to admit, some of the greatest feedback and the improvements that we've made have come from our own internal associate director for Science Office that have looked at it very critically, and provided us some their thoughts on the rigor of the science, the clearness of the message, and the resulting bands that we get from the processes.

DR. LEMASTERS: Well, the reason I ask this, I mean, I really think it should be beta tested in some workplaces because it takes a fair amount of work and sophistication to complete this, and I'm wondering what the motive—how motivated people—well, industry will be to do this, and the only way to tell is to contact someone like Ron Stout and beta test it at P&G or Exxon, or one of these other places to maybe get some folks on board that are willing to help out, and be sort of citizen scientists or professional scientists because, I think, it's not going to be easy.

DR. LENTZ: You make a great point. We do get questions about that, and one of the other places where we have done some testing is in some of the ERCs, some of the more forward-thinking professors have utilized this, and continue to utilize this,

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with their students who are banding chemicals. So we get great feedback from that. Interestingly enough, we also get consultants who are using this for serving their clients, too. And it's a great starting point for indicating, you know, this is a chemical you might want to consider. These are the control options that would be associated with using this chemical versus this chemical, too. So we do get some of that feedback. I think that we'll continue to use that, and that's one of the areas of future research needs that we identify as well.

DR. LEMASTERS: You know, you said that NIOSH doesn't see the work that's done, let's say, by a corporation that wants to do some banding. I think, in a way, that's a shame because it would be a way to validate or show the reliability of when relative advanced lay people do it versus how you would do it in an organization to see if it's a valid—you have to have a gold standard, right? The gold standard would be you all, and then you would compare that to how others in the industry would do it, and is there good meeting with the validity with the gold standard. Have you done that?

DR. LENTZ: We've done the internal testing to make sure it lines up with the occupational exposure limits, so that we have confidence that the bands are, at least, as protective. Your question to the users is one that we've been exploring with the American Industrial Hygiene Association, in particular, and that's where we proposed to them the idea. And, actually, their control and exposure banding workgroup has formed the idea of possibly having a users' workgroup where they would do that and compare internally. So we're still in discussions with them about trying to do that, to see—I'm sorry.

PARTICIPANT: A comment from the IT perspective that you are closer to it in the AIHA than I am.

MS. LASZCZ-DAVIS: I was just going to, you know, really following up on what Grace was saying. And, by the way, TJ, I think this is a great product and great resource. However, I think the reality is unless you're dealing with the Exxons and the P&Gs, you're going to find many companies that don't have internally EH&S people, they just don't. And the truth is, what I've seen business model-wise over the last 15 to 20 years, you've got operations managers who are stewarding EH&S. And so in many cases you're going to have to have—you know, they're, certainly, bright enough, you know, but they're engineering and quality control, and what have you. Those are the people who are going to be applying this if they see a need for it. So to Grace's point, the user group should be more expansive than the health and safety professionals with an ASSP and AIG because they've got a vested interest in doing it, but the real end users where this is going to have significant impact and turnaround is going to be with operations people. And if they can find it useful and additive, it'll just flourish, but there are only so many of us, and in bigger companies we exist; smaller entities, not so much. But I'd support what Grace is saying. It makes it tough. It makes it tough.

DR. LENTZ: No, I appreciate that, and that's a suggestion we'll take to heart, at how to reach

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that audience and to engage them in the use of this, and to solicit that feedback as well.

DR. REDINGER: Yes. Thank you. Charles Redinger. So as many of the things, I think, we talk about or hear about in this Board is the continuum or timeline where different things are. So I think, the agency has demonstrated that it's got its eye on the ball on how well the programs go. So that's what, I think, everyone's head is in the game on. Within AIHA—and, Chris, you may have more information on this than I—is that, at least, from a strategy standpoint within the American Industrial Hygiene Association, is this is one of the top items within. It's what they call their content portfolio. I forget the whole acronym on that. The working group is coming up, but the folks who are into it, and the AIHA, have gone around to all the AIHA committees to begin to ask for input on how now to take this to the next level. So whether it's, say, the science is begun to be pretty well-cooked or formed is now how is it going to be rolled out, and how can we augment it from all these different specialties, at least, within the AIHA community, the safety committee, the risk committee, all the different ones. I know they're collaborating with NIOSH on that. So it'll be interesting to see.

And then if I could just say to follow-up on Ron's comment from earlier. The one graphic that you had—and, Chris, I think, it was in the publication you had in *The Synergist* back in, what, 2014, at some point; it's not that that far back, but the one on the hierarchy of the OELs. It seems, to me, that there might be something there to tease out to—you know, so Ron asked the question about replacing OELs. At least, in my thinking, there's something about—and you touched on this TJ—on what's the application of these, and it seems, at some point, and I hate to say it, some liability may be an issue, at least, from a product standpoint or employer standpoint, is that you better go look to develop either—look at something more than a control band if you've got wide distribution of product or a wide potential liability profile with that. But my sense is, is within this hierarchy of OELs that that's a place to look to, personally, what Ron was asking.

DR. BUNN: Actually, could I ask a couple questions? Just as far as, you know, validation, again, of course, what Grace was saying, have you guys thought of auto populating it for those chemicals that have already been searched; is my first question.

DR. LENTZ: Yes. We have thought about this. We've had a lot of internal discussions about that. And, in fact, during the public and peer review comment we've gotten asked, well, has NIOSH thought about banding a list of top 100 chemicals? And that's a tricky issue. We've put this out as a tool. It's a voluntary tool for the user. So there's some hesitancy to do that. It might be better that some other group would take that on and that's why we're exploring that with the AIHA, rather than putting these out and having them be interpreted. I think, maybe to Charles' issue of the legal interpretation of these. It's a recommendation, but if it comes out as a

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- NIOSH occupational exposure band, we're a little cautious to do that at this point. Maybe we could consider that and discuss that, but it's certainly an issue that's come up previously. It's a great question.
- DR. SCHENKER: Yes. Marc Schenker. There's nothing intuitive about A to E. Is A more toxic or less toxic than E? And I just wonder, it seems like a simple question, but was there any thought to giving either wording association or even color association with the different letters, so that you, you know, immediately recognize that E is, you know, more potent or more toxic? don't know if that had come up in the many discussions or comments, but it's my thought.
- DR. LENTZ: It's surprising how often the discussion of color comes up, and depending on how many people you have on your team what preference is, and we went from red being the most dangerous and maybe some more neutral color being the least hazardous. We hadn't thought of other symbols. I think that's a great question, though, as far as showing the potency from across the range. So I don't know that that's come up. So we'll have to consider that, Dr. Schenker. Thank you.
- DR. LERMAN: So it seems to me that the e-Tool makes at least Tier 1 very easy. And, also a lot of companies that don't have CIHs, they don't have occupational physicians, but a lot of them who don't have those may have occupational health nurses. So to your first question, who else might you reach out to, perhaps, the OHN, AOHN pardon me. And they could either utilize the tool themselves or, at least, become internal advocates for its use.
- DR. LENTZ: Great suggestion. Thank you.
- MS. LASZCZ-DAVIS: Chris Laszcz-Davis again. Can you say a few words about this tool and how it would be used in terms of cumulative exposure, if at all?
- DR. LENTZ: Yes, I could. Unfortunately, right now it's dedicated to what you can perform it for one chemical at a time. Certainly, if there's a mixture that's been characterized as a mixture you can enter the information for that and get the outcome, but otherwise, unfortunately, I think as Dr. Schulte indicated, in the complexity of accumulated risk and aggregate exposures, it's a little bit more tricky than that. But maybe that's an area to go next.
- DR. BUNN: I, actually, have another question. You know, so if something is categorized as a C within C band, do you provide guidance to the companies who are, you know, assessing and identifying which band they belong to, what resources they can use if, you know, if something's identified as a C or a D, or an E, at least, you know, which would be most potent and most potential for toxicity?
- DR. LENTZ: No. At this point—that's a great question, Dr. Bunn, and I think Dr. Schenker brought that up earlier with the previous presentation, is that it's still for small- and medium-sized enterprises. They don't understand exactly what this range means as far as what control strategy is associated with that, and what options are there. As I indicated, you can use it as a comparative process to indicate substitution. It might be better if you get a chemical that's banded in a band with less potency.

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But as of this point, we haven't linked it to the control strategies, and that will be a next step for us. This was, first, just establishing the scientific rigor behind assignment to the bands, and then the next step will be tying it to the control strategies.

- DR. BUNN: Okay. And then my last question is, have you thought about including immune system effects as one of your additional parameters to use?
- DR. LENTZ: That's a great question. At this point, no, we hadn't, but I could, certainly, take that back to our team and we could consider that in addition to the nine health endpoints that we're considering currently.
- MS. LASZCZ-DAVIS: I'll try one more. Chris Laszcz-Davis. I, generally, bring in the subject matter of global. Is there any uptake by this in Canada or...?
- DR. LENTZ: The only international exposure that we've had so far has been at the International occupational Hygiene Association meeting that was held here in DC, last fall in September 2018. So we have to the extent that there are members on the occupational exposure banding and control banding workgroup, a (BAAHA @ 00:48:54) of which there are several in Canada. We haven't really marketed it outside the US yet.
- MS. LASZCZ-DAVIS: Maybe something to think about in the future.
- DR. LENTZ: That's a good thought. Thank you.
- DR. STOUT: Ron Stout. By holding OELs up as continued gold standard, are we, in effect, advocating for continued animal testing? Let's leave it as a rhetorical question.
- DR. LENTZ: Okay, okay.
- DR. STOUT: But that's background to some of the previous comments that I made.
- PARTICIPANT: TJ, I might be able to just offer maybe just a preliminary response, Ron, to your provocative question. I think it gets to an issue that comes up with the national toxicology program, and in this program—folks may be familiar—that one of the goals of this program is really to develop novel methods, and as that program has unfolded, at least, as far as I can see over the last 10 or 15 years, there has been an increasing emphasis on getting away from animal testing. And there are difficulties and inherencies around that, you know, and not least of which include what's believable, if you conduct testing without having an appropriate verification of animals. And so to your point, I'm not sure that occupational exposure limits, themselves, necessarily drive future requirements for animal testing. I, certainly, believe that NIOSH is interested in, certainly, looking at other methods to get beyond that. I would suggest that, perhaps, other drivers might include regulated communities around toxicology like, say, the Food and Drug Administration or others that would really be more reliant on having animal models as a reference point. I'm not sure that, necessarily, the users of occupational exposure limits from NIOSH, necessarily, have that same constraint. So that would be my own initial impression. That would be my answer for that question.
- DR. REDINGER: Charles Redinger. TJ, it would seem to be two things in the document that—you

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presented a lot of great information in the slide presentation—as you're queuing with the document that's going to be published shortly, two thoughts. One is you may have this, but without having seen a draft of that, is a comment to this point, and I think Dr. LeMasters was touching on this, is the issue of validation. And there's, clearly, levels of validation that this does hit, face validity, content validity, absolutely. You get into predictive validity, that gets a little different. And so but I can see there's value in, one, defining what the different ways validation is done in these sort of endeavors, and explain where it is on that. The second is, possibly, to have a clear statement on whether this is appropriate or not to be mentioned in SDSs with safety data sheets because I could see, you know, does this somehow become a de facto standard in—if folks, you know, a chemical manufacturer goes, "Well, you know, there's no OEL for this, but hmm, here's the NIOSH OEB method," and here we're saying we've run through the calculation for you with our chemical. That it's band whatever. And so is that a possibility that this would start to show up in SDSs? And, if that's the case, do you have a statement, actually, that's appropriate or not in your publication? And I don't know if that's the intent, possibly, to help with safety issues.

DR. LENTZ: That second point, which is the only one I feel compelled to answer, but we frequently meet with the OSHA directorate of standards and guidance and discuss issues such as this, and maybe if we talk with them about their hazard communication standard and the appropriateness of an occupational exposure band and how that would impact OSHA or how they would interpret such an action. I think that would be an interesting discussion to have with them.

DR. REDINGER: In or out. It would seem, to me, there's value saying in or out. You know, that it's either appropriate or not. Sometimes in standards and guidelines this should not be used for this, as general as that sounds. Just a thought.

DR. LENTZ: No, that's great. Thank you.

DR. BUNN: Are there any questions online? Okay. Ted.

MR. COURTNEY: Yes. This is asked, admittedly, having not spent super-intense to all time in this space in a little while because of spending most of my last year in football focus, but you asked about adjacencies, right, additional applications for OE banding? I don't know exactly to what extent it's involved, but there was some buzz about OE banding for physical risks, musculoskeletal hazards, in particular, about a decade ago. So it might be worth trying to tap into what may -- it may have fizzled or it may have, you know progressed, but that could be another space if you're looking for sort of adjacent fruit to apply the strategies. But certainly, in demand, hazard characterization space.

DR. LENTZ: Okay, great. So physical, as in noise or...

MR. COURTNEY: Well, I mean, my thought was musculoskeletal hazards but that's my own base.

DR. LENTZ: Thank you. We'll consider that too.

MR. COURTNEY: But certainly, you know, noise and some of the other suggestions you made in the

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slideshow, it makes sense too, they're a little lower-hanging fruit than musculoskeletal if I think about it.

DR. LENTZ: Okay. Sure. Okay. Thank you.

MS. LASZCZ-DAVIS: And, finally, next year, I'm sure, you're well aware that the World Health and Safety Congress is occurring in Toronto. I think it's a great forum to either launch this, introduce it or reaffirm it.

DR. LENTZ: That's a good idea.

PARTICIPANT: And the call for abstracts, I think, is in September.

DR. LENTZ: Okay. Thank you for that suggestion.

DR. BUNN: Grace, did you have a question?

DR. LEMASTERS: Just a couple of small points. I wasn't sure why, under the criteria respiratory and skin sensitization were put together. I would've put skin with skin corrosion, irritation, and sensitization. Isn't that sort of mixing apples and oranges here?

DR. LENTZ: They are, actually, separated. At that table I combined them for the space purposes on the slide. So but it is misleading.

DR. LEMASTERS: You could put it with the corrosion, skin irritation, corrosion, and skin sensitization.

DR. LENTZ: Right. They are, actually, separated into separate effects. So I think, just for...

DR. LEMASTERS: Oh, all of these are.

DR. LENTZ: Yes, yes.

DR. LEMASTERS: Okay. Well, the simpler an item look, the more likely I am going to do it. So there's something to be said for keeping it simple, sweetie. You know the KISS principle. And how are you going to evaluate this program? I mean, do you have an evaluation process in mind or after it gets launched?

DR. LENTZ: Well, part of that has been it was conducted from 2014 to 2017 in developing the method, and then from 2017—well, during the peer review and public review period, that was some of the evaluation that was intended. We will continue to do so and that will be through user groups, the professional development courses that we plan to use, and then coordination, as I indicated, with some of the ERCs where we might have students—I have one, in particular, who is at the UMass Lowell who's got a thesis project. He's doing some evaluation with some employers in his area. So we're hoping for more opportunistic research validation processes like that, too, and we're open for suggestions and for ideas like that.

DR. BUNN: All right. Thank you very much for an excellent presentation. Alberto has kindly included options for lunch. We have a sheet here in front of you, and we will reconvene at 12:30 p.m.

[Lunch.]

DR. BUNN: We are having a few little computer glitches right now and, hopefully, we'll be back up and running here very soon, but this is our time for public comments. I believe we don't have any that were submitted, but this is the opportunity while we're getting computer up and started for comments from anyone in the room.

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PUBLIC COMMENTS

DR. LEMASTERS: I have a comment. It's really an announcement. The Department of Environmental Health at the UC College of Medicine has an intern chair, Dr. Glenn Talaska, and we are recruiting for a new chair for the department. So I'm putting that out. We haven't formed the committee. We just got the intern director. So I think, a search committee will be on board by this fall, but I would like to give someone who has an interest in occupational health and safety, for once. And, also we are recruiting for a CIH. So if you have any recommendations you can send to me or to Dr. Glenn Talaska. Thank you.

DR. SCHENKER: Marc Schenker. What's the process for setting the agenda for the DSC meetings?

DR. BUNN: Actually, I'll have Dr. Howard answer that question.

DR. HOWARD: We're always happy to take suggestions. It's your meeting.

DR. BUNN: Do you have a suggestion?

DR. HOWARD: When you don't come up with any, then we have to come up with our own.

DR. BUNN: What's your suggestion? Do you have one?

DR. SCHENKER: Well, my own work has evolved more and more to precarious workers and workforce. I think they're, not only the most vulnerable, but the most impacted by all the things we're talking about. So you know, I'm curious to know how NIOSH looks at that and, you know, what they're doing. But that's my own personal interest.

DR. BUNN: Yes. Well, I think we had, also you know, I had made a suggestion, too, maybe for a presentation the next time, you know, for the progression of the contribution analysis. I'm happy to take any suggestions from anyone else in addition to the precarious workers, too, as to other topics that you guys might want to hear about for the next meeting. I think we're limiting it now to about three or four presentations total.

DR. LEMASTERS: I think it's a good idea.

DR. BUNN: Yes, it is a good idea. See if we can send them to you as we think about it. Will that be sent to you, Alberto?

MR. GARCIA: Sure.

DR. BUNN: Are there any other comments, suggestions? Ted.

MR. COURTNEY: Just at one point, I might've imagined this, but I thought at one point, John, you guys were talking about moving or did that all go away?

DR. HOWARD: Well, we're always talking about it.

MR. COURTNEY: But we're still here.

DR. HOWARD: The government does it differently.

MR. COURTNEY: So I thought you had said in September of the year, probably going to be somewhere else by then.

DR. HOWARD: Yes, well, we're not. It would take us the rest of the day to explain why.

DR. BUNN: Okay. All right. So we're up again. So Dr. Felknor will presenting on research integration here at NIOSH.

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RESEARCH INTEGRATION INITIATIVES

DR. FELKNOR: Thank you, and thanks for this opportunity to update you on some evolving initiatives at NIOSH, and I'm going to give an update on where we are with research integration initiatives across NIOSH. I want to start with an acknowledgement of the contributions of Dr. Jessica Streit who's been on detail to the Research Integration Office, and has made many contributions. So the Research Integration Office or the Office of Research Integration was officially established just in January, so it's only a few months old, and, really, follows some of the work that I've been fortunate to lead at NIOSH which has been under the umbrella of research integration and extramural performance for the last eight years, and this represents a bit of a shift to focus on the research integration activities, I think, in a broader sense. And so we've done some work on putting together a mission and purpose, I'd be happy to share that with you. The mission is to bring knowledge and research communities together in innovative ways that will help advance the state of the science through priority research. And by research communities we mean our intramural communities, our extramural communities across divisions, across federal agencies, across councils, program areas. So in its broadest sense when we talk about bringing these communities together to see how we can advance the state of the science. And the purpose is to help promote, what we're calling, strategic alignment and collaboration, particularly, among our intramural and extramural communities, but extramural could also extend to other federal agencies outside NIOSH who are interested in participating in occupational safety and health research. And that alignment we look to support integration of research goals in alignment of future research investment through input on burden and need, and I'll mention the burden and need impact framework a little bit later in my presentation, and I believe I had presented to the DSC before on the BNI framework. And also to collaborate with our stakeholders and subject matter experts to help develop, and recommendations for an expanded focus or framework for occupational safety and health, and that builds on a body of work that many at NIOSH have contributed to and, in particular, the work of Dr. Schulte and colleagues. The core components of the research integration effort at NIOSH is built on a few blocks of past activity which have some maturity to them, and some new efforts. The first being expanding research partnerships, and this builds on a successful conference that we had in Denver in 2017 where we brought intramural and extramural folks together funding limits, the frequency, with which we can have those kinds of meetings. And so it was a great opportunity to have us all together in one space, and we've continued that effort through webinars and other types of virtual gatherings when funding doesn't allow us to come together. Another block of activity within research integration is, what we refer to as, the

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NORA intramural research competition. You may know that NIOSH, annually, competes research projects among its project officers and scientists to address priority goals within the NIOSH strategic plan. And so the intramural research competition is a component of the research integration efforts. And our focus of a new initiative is to develop recommendations for this expanded focus for occupational safety and health that takes a broader view of burden, and also has a look to the future. And I'll talk a little bit more about those in a minute.

So with that background I'd like to give you some updates on what we've been doing this fiscal year. As I mentioned, with the expanding research partnerships, it follows the 2017 conference. We've had a series of annual webinars where we bring intramural and extramural scientists together on common topics or themes, or methods to present their findings, and this has become an increasingly popular opportunity for folks to join. We hold it by Adobe Connect and send invitations out, and we try to disseminate it as widely as we can. So if you ever get one of those notices, please feel free to pass it on. And we try to identify a theme for each year, and for 2019 our theme has been emerging issues, and this fall is the calendar year. The first webinar was on robotics. Researchers from our Center for Occupational Robotics Research presented along with researchers from the University of Utah and UC Davis. We're talking about the use of robots in agriculture, particularly, in hot climates, and I think it was strawberry harvesting that they were talking about. It's really interesting.

June 12th you can join us for a webinar on emerging technologies, and in September we're going to end the series with a webinar discussion of this expanded focus for occupational safety and health. And in August of this year we're going to be able to leverage our flagship extramural centers, our AG construction, ERC, and Total Worker Health Centers who will come together on the University of Cincinnati campus, who's graciously providing the venue for us, and we'll have a day and a half to chat. And we're going to use that as an opportunity to get an extra mural voice into conversations that we often have at NIOSH that are absent the extramural partner. And so following the theme, the mission of research integration, we want to bring those voices into the conversation as we're able. So we're looking forward to that opportunity to engage folks.

As I mentioned, the NORA intramural research competition is an annual competition where we compete about two and a half million dollars in, what we call, small and large projects that go through internal review and are also reviewed by the NIOSH Secondary Review Committee. These projects must identify priority research goals within the NIOSH strategic plan. And research priority is based on an assessment of burden need and potential impact. And this is a framework that NIOSH spent several years developing, testing, revising, getting comments on, and we recently published this in the May issue of the

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Annals of Work Exposures and Health. And well we've talked about, you know, certainly that the concepts of burden, need, and impact aren't new in science, we use them all the time. What's new for us at NIOSH is we've put this into a structured framework which provides a systematic transparent way to build decisions on evidence, and uses the burden, the need to do the work for NIOSH to fund the work, the need for the work at this point in time, and the potential impact the work can have, if successful, as variables that go into making decisions about which projects, not only what research is a priority, but also which products get funded.

With respect to research integration, annually, for the last five years we've reported in the—and the extramural program has published an annual report of their extramural activity, and there's been a section in that report that's looked at, how does extra mural work overlay with the priority goals, and how does it overlay with intramural research. And so we tried our hand at different infographics to try to portray the number of projects that are done or whether there are projects from intramural and extramural communities addressing goals by the different sectors. These icons represent the 10 NORA sectors, and the different boxes and ellipses represent whether there's a project in the intramural or extramural community ongoing.

And I'll say one other thing, I don't think I have it in the next slide. Okay. I'd like to also mention that beginning in FY18, so in this effort to strategically align our research across intramural and extramural, beginning in FY18 the extramural funding opportunities for investigator initiated research, so our RO1s, RO3s, R21s required researchers to identify which strategic and intermediate goals they were trying to address in an effort to try to just get us all on the same page. It doesn't exclude other novel ideas that are totally out of the box. It does make it very clear that funding priority will be given to projects that address—that are somewhere within the ballpark of the strategic framework as expressed in the NIOSH strategic plan.

And just a word about this notion of expanded focus for occupational safety and health. As I mentioned, this is work that Paul Schulte and his colleagues have been working on for a while. And we're trying to get our head around it, and also figure out what the implications are, what the opportunities are for research practice and training, also as we look at training the next generation of occupational safety and health professionals through our ERC and trainee project grant programs; what kinds of skills and competencies do they need as we consider how the future is really going to change work in the workplace, and the workforce is changing. And so where we're taking this opportunity to see how looking at efforts around futuring, looking into the future, trying to do some forecasting can also help us get an idea of is it time for a paradigm shift. And if it is, what does that shift need to be, too.

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We've done some work at futuring at NIOSH. We've conducted some early efforts, which I'll go through after Dr. Howard's presentation about the future of work initiative on futuring at NIOSH, and that work will be an input into the new future work initiative.

So you know, this is not news to anyone here. Certainly, we have a real mosaic right now of new and emerging, and traditional hazards in the workplace, and I think that this is a good time for us to be exploring a transition to a broader view of burden. And I'll stop here.

DR. HOWARD: Well, thank you for allowing me to interrupt your presentation with this commercial message.

DR. BUNN: Anytime, Dr. Howard. I serve at your pleasure, and I'll advance your slot.

DR. HOWARD: Thank you very much. So Sarah has been talking about futuring and forecasting, and foresight, and several other things. And so I wanted to just briefly tell you about what we're doing, and at some point we can go into this in more detail. So you can flip to the next slide.

So you know, the International Labor Organization in Geneva published a document which is called *Work for A Brighter Future*. And they had a commission, the Global Commission on the Future of Work which was co-chaired by the new President of South Africa and the Prime Minister of Sweden to look at the whole gamut of issues that involved the future work from—this was like 100,000-foot level. So investing in people's capabilities, investing in decent and sustainable work, investing in the institution of work. And I remember seeing it and looking at it, and thought, you know, not much of it, frankly.

And then—the next slide—I was invited to the United Nations on May 1st for the rollout of what they forgot to put in the Global Commission, the document on safety and health at work. This is the document that they produced and showcased at the UN. And then I realized that, actually, the reason I was invited is because I was, actually, doing future of work activities, and Chuck Geracy was also invited, and I realized he was also doing future work activities. So then I began to think well, you know, who else is doing future work activities, so-called, here at NIOSH. You can flip to the next slide.

And, you know, what's really interesting about this whole area, and these are two people that Sarah now knows well since we sent her off to their class at the University of Houston on how to think about the future, and their book, their 2015 second edition, it's really a great book about how to grasp issues related to the future. And they point out that strategic foresight, which is the type of name they call looking at the future, is a way to be proactive as opposed to reactive. You can flip it to the next slide.

So we sort of thought about this, and I looked, you know, in the literature, and not only they're international organizations like the ILO producing these kinds of documents, but nations. Germany gave us the term Industry 4.0, for instance, in a

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white paper that they wrote a couple years ago. They're consultancies, the World Economic Forum, McKinsey. I mean, all you have to do is put future work into Google and you'll get 10 or 12 of these kinds of things that pop out. And so what we did at NIOSH was say, "Look, you know, we need to collect this information and compile what we're doing in the future work, featuring our current research projects, and then where we need to put research in the future." We were very fortunate to have Dr. Sara Tamers, formerly of the Total Worker Health Office, now in the Division of Science Integration, to be our coordinator for our future work initiative. And she just held our first interest group future work call. And so we're off and running. You can flip to the next one.

So we've organized our initiative into sort of three large buckets, and we're not entirely sure if these are the right buckets, but issues that have to do with the workplace, how organizations are designing themselves now, how job arrangements are changing, and then things that have to do with the work itself. As Sarah's mentioned, obviously, robotics, advanced manufacturing, artificial intelligence. A lot of the future work issues are sort of incentivized by technological changes. If you read a lot of future work studies they tend to be focused solely on that as opposed to organizational designs or non-standard work arrangements.

And then the last category is workforce, and here, you know, the old-style demographics, which BLS has done futuring for four decades by saying here's what the workforce is going to look like in 2025, and here's what it's going to look like in 2050, and all that, but there's more to looking at the workforce in terms of the effects that we're seeing in the future. Technological job displacement is an example, occupational polarization, all of these types of sort of changes involve the workforce, but they aren't that old style, you know, representational diversity, demographic stuff. You can go to the next slide. It may be the last.

No, this is just an old slide I stole from Dr. Schulte which, actually, he stole from Hines and Bishop and it sort of shows, you know, what we're trying to do here. And, in my view, we're looking at the near future. We're not like madam Zara, you know, what's going to happen in 2075 to us sitting down with a big crystal ball and stuff. So we're sort of looking at trends that we are already seeing happening in the workplace, and then looking at how we can project them to the future; coming up with various alternatives. Who knows, as this slide, what the actual future is going to be, but it's better to be prepared for a number of future alternatives than not think about it at all. You can go to the next slide.

And that's now your slide. So we're back to Sarah's futuring. And so I just wanted to give you a little brief window into what we're organizing now at NIOSH and, hopefully, at some point we can make a fuller presentation on the future work initiative. Back to our regular scheduled program.

DR. FELKNOR:

Thank you. So Jessica Streit and I've been involved in some of the early efforts to

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help assess the feasibility of establishing a futuring unit or some kind of futuring type of activity at NIOSH. And Dr. Howard mentioned a certificate program that I went to at the University of Houston conducted by Andy Hines and Peter Bishop, and they've been, you know, thought leaders in this field, and it was very useful. So and as I mentioned, this work that we've done will be, I think, useful input into the future work initiative.

We held key informant conversations with a number of intramural stakeholders to try to get some sense of how would we do this, what would it mean, what would be the benefit, what would be the challenge. And we also did an initial scan of both the scientific and grey literature which is, you know, interestingly enough, the grey literature is where you find some really interesting pieces that, I think, have been helpful in getting us to understand the opportunities here.

And we also did a review of our active intramural and extramural research projects to identify those that had some future in component or considered future scenarios; talked about the future of work, and we just have some descriptive results of that effort.

The format conversations we, you know, did a high-level analysis of, you know, trends and themes, and identified some strengths about establishing a future in unit at NIOSH, that it would be a new resource, that it could help improve data accessibility, thinking that someday this could be something that could be externally accessed, also as well as internal, enhances knowledge, puts the—what was the quote, TJ? Intelligence having fun or—that's why I'm not Einstein. That it's future-focused and helps us anticipate rather than respond, and helps, also coordinate some existing resources, as Dr. Howard mentioned, when we first started looking at where people across the institute we're doing work in the future of work. There's now quite a body of effort and a number of players who are engaged in that effort. And, certainly, there will be challenges that we address as we roll this effort out, but it's in its early stages.

We did an initial scanning. As Dr. Howard mentioned, if you Google a future of work, five days later you'll come up for air because it can take you all kinds of places, and we developed some criteria to try to make that a manageable activity, and we've annotated a bibliography that's probably closer down to 100 articles, both from the science and grey—the peer review in grey literature about foresight and futures related to occupational health or the future work.

As I mentioned, we did an inventory of our futures-oriented intramural and extramural research that was active in fiscal year '19. There were over 600 projects in that category of active projects. Sixty of those were related to futures issues, and there were an additional 55 that were surveillance projects, but that had relevant components to the horizon scanning effort within the futuring activities.

And then we, also wanted to get some sense of who else is doing this around the

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world, and we've mapped some of the global future of work players. We did limit the groups that we would include and there's a map on my next slide and in your packet, also. They had to be currently active entities, so not just an individual. It had to be a group or the unit within an agency or institution, university, and there had to be a clear mention of occupational safety and health or related efforts because there are a lot of groups out there. There are think-tanks. There are all kinds of initiatives out there that would come up under future work search. And so here's a list. I think this slide should include someone in—I'm not sure that—I thought there was another group in Germany that didn't make this slide. But anyway, it was only one other additional player. And for those of you who have the slides, these are hyperlinked to those institutions and shows you where they are, and this is just a map of kind of where they're located around the world, and several of those diamonds represent more than one entity. And I think we had—there was a number there. Certainly, more than 10 or a dozen future of work players.

So with respect to the whole research integration effort, the next steps are to work on expanding partnership and research integration efforts to include a futures orientation. We're very interested in developing a future and capacity within NIOSH, and work closely with the Division of Science Integration and the Future of Work initiative on those activities.

And I didn't pose any specific questions for your input, but I'd be happy to take any comments or suggestions as we look to take our next steps to expand our partnership and research integration efforts.

DR. BUNN: Any questions? We have time just for one or two. Okay. Well, actually, I have one. Being a recipient of state-based surveillance, are you including them within extramural research at all?

DR. FELKNOR: Yes. Sure. And, in fact, the state-based surveillance are, probably—I don't know the number offhand, but you see that number that says 55 surveillance projects? That would've included—so the 607 is both intramural and extramural— intramural, extramural anything, project, research center. So anything that was tied to a funding stream somewhere would show up there.

DR. BUNN: Okay. Yes. Thank you. Charles.

DR. REDINGER: Yes, Terry, just a couple of quick ones. Thank you so much. It's really exciting work. One thought on the, I guess, I'd say three buckets that Dr. Howard mentioned on the initiatives of how to break this out of workplace work and workforce than a workplace or design job arrangements. I can't help but think organizational context, and that's kind of a funky way maybe or thing to think about, but I would suggest attention. And, I was, I think, talking with Dr. Howard about this right before lunch of, you know, even with ISO 45001 which was published not long ago, there was attention on that whole process that some people wanted to be a well-being document. So I think, there's a tension here that

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just needs to be upfront or acknowledged of what's the purpose. Obviously, we're focused on people are not hurt, but at what point is work, some people would say, should it be transformational. And that's, I think, something that I would suggest is valuable to have in this conversation.

And the second is a resource that you might want to look into, if you haven't yet, is the work of Otto Scharmer and the Presencing Institute and, certainly, the book *Theory U*. So some of those ideas, I mean, at least, in your team's thinking, I think there would be value in the book *Theory U*, and the ideas there. And, also the predecessor of that which he was involved with, with Peter Senge, and others, a book called *Presencing* (sic). So there's ideas there that, I think, would help with the teams on this.

DR. FELKNOR: Great. Thank you.

DR. BUNN: All right. Thank you. At the end, maybe, we'll have time for more questions. So we're going to have to move on to our next presentation which is an overview of the National Firefighter Registry by Dr. Fent. Thank you very much, Dr. Felknor.

DR. FENT: So thank you for this opportunity to talk to you about this new and exciting program at NIOSH, the National Firefighter Registry. I think it's worth mentioning that we do have some representatives from the fire service here, IFF, and the IPSDI. I'm not sure if there's anybody else. I don't want to put you on the spot, if you wanted to say something you're, you know, more than welcome to, but you don't have to.

DR. MOORE: I will just say we are very, very thankful for this cancer registry, and that is going to be known better as the Firefighter Registry. So this is such an important project to supplement the science that we already know higher risk in firefighters, but having a much larger cohort for comparison and surveillance for, you know, incidents and occurrence is going to be tremendous in our industry. So we're very, very grateful, and we're very grateful for the new team that has been put together at NIOSH.

DR. FENT: Thank you. So that's Lori more from IPSDI.

DR. MOORE: Data Institute. Yes.

DR. FENT: Got it. Okay. So my name is Kenny Fent. I'm a research industrial hygienist at NIOSH. I've been there for 11 years, and much of my work there has been on firefighter health and safety. So I want to start out, first, by, you know, just talking about the members of our registry team. I am the team lead, but we also have a lead Epidemiologist, Dr. Siegel, who's over there. She and I are going to tag-team a little bit on this presentation. We also have Alex Mayer who's a health scientist assigned to the registry. And then we have three vacancies that we're currently trying to fill, a health scientist vacancy which we have identified a great person for that position. We're going to be bringing her on soon. And then currently looking for a health communication specialist. So if anybody knows of anyone recently graduated with a master's degree, please talk to me. And then, also a statistician. And then I'd be remiss if I didn't mention other key personnel, also here with us.

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Beth Weiland who's our branch chief, the field research branch now, not IWSB because of the reorg. And then Joe Rodebaugh who's our IT team lead. And then Terri Schnorr also who's our division director.

So why is the registry being created? So this all stems from the Firefighter Cancer Registry Act of 2018. So that was signed by the president back in July. And, really, the motivation behind the registry is that, you know, while we know that—or there's evidence to suggest that firefighters have an increased risk of a variety of different cancers. There are still a number of questions that remain. So most of the studies that have been done to date had small numbers of women and minorities too small, really, to draw any conclusions on those particular groups of firefighters. And then they, generally, have lacked any information on volunteer firefighters. And so volunteer firefighters, actually, make up about 70 percent of the firefighter workforce.

So the ultimate goal of the registry is to track firefighters cancer risk over time so we can better understand the link between their exposures, and they are unique exposures. I can't really think of any other occupation where you had the potential to be exposed to so many different compounds and particular carcinogens. So we want to better understand those exposures and their link to cancer.

So I kind of already talked about this, but we're certainly interested in learning more about how cancer risk varies between different groups of firefighters, but we also want to know what does the cancer risk look like today. So many of the studies that have been done on firefighters were done among workers from many decades ago, firefighters from decades ago. And so you can imagine like personal protective equipment has changed over the last few decades, but exposures are also different today. And part of the reason for that is that there's a lot more synthetic materials in our homes and structures, and vehicles than there were 20 or 30 years ago. We also want to better understand how do the control interventions that are being implemented affect the cancer risk. Is it making things better? So many of the more progressive fire departments are implementing new policies and procedures, requiring more consistent use of SCDA, not just during the attack of the fire, but also during overhaul which is when the fire has been suppressed and they're walking through the structure. Also there's a lot of departments that have implemented decontamination measures, routine laundering of turnout gear, hood exchange programs, and so on.

We, also want to be able to explore how cancer risk varies geographically. So between an urban department and the rural department, a department that serves a more industrial center versus one that's more agricultural. So you can imagine that exposures would vary geographically. And then, ultimately, anytime you do a cancer cohort study you want to try to capture exposure, so you can look at dose response relationships.

So who will be included in the registry? So it's absolutely critical that we convey

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the message that the registry is for all firefighters, and not just those with cancer. So there's a lot of misunderstanding in the fire service, and even among academia, that you have to have cancer to be in the registry, and that's not what this is. And, in fact, it wouldn't provide enough information to really be able to answer the questions that were outlined in the Act. So this is open to all firefighters. We're, especially, interested in the three groups that I already mentioned, but we're also interested in subspecialties of the fire service, like instructors and wildland firefighters, and arson investigators. And our goal, right now, is to try to enroll 200,000 firefighters. So this is an ambitious goal, but we also think it's achievable. And that would be roughly about 20 percent of the firefighter workforce, and we think would provide sufficient numbers of those subgroups that we can, actually, explore cancer risk among those groups.

So how will the registry data be collected and used? So we're not going to ask firefighters for their cancer diagnosis. We want to match firefighters who register with state cancer registries because that's going to provide the most reliable information about the development of cancer. We also want to collect information on possible confounders and other variables of interest, and we'll likely do that through an initial survey during the registration process. I should mention that the registry is a voluntary registry, so we will have to obtain informed consent during the registration process.

We're also interested in collecting work history and exposure records from the fire departments. That would allow us to look at those dose-response relationships. The exposure records that we would look at, at least, initially, would be the incident records that fire departments are required to collect. I'll talk a little bit more about that in the ensuing slides. And then we, ultimately, want to disseminate the information via scientific publications, communications to the public, and then we want to get the information out there to the fire service. That's our ultimate goal. And then, also we're required to make the data available to external researchers while maintaining privacy. So we'll talk a little bit more about that, too.

We just recently posted a request for information that, actually, closed, I think, yesterday or two days ago, but it was open for two months for public comment. And it, actually, outlined three different enrollment approaches that we're considering. It's likely that we'll include possibly all three sampling approaches. But the first approach would be an open enrollment through a web portal. So this would, actually, allow any firefighter in the in the country to enroll themselves in the registry. The problem with open enrollment is that it may not be representative of the firefighter population. So for example, firefighters who already have cancer may be more likely to enroll themselves.

We're also considering organization levels sampling. So this would be working

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through the various professional organizations like IAFF which is the career firefighters union, the National Volunteer Firefighter Council, other groups that represent female firefighters or women firefighters. And that would allow us to reach various groups of firefighters, but they would, likely, still enroll through the web portal.

And then the third approach would be working directly with fire departments. So this is certainly the most time intensive approach, but it's also the most scientifically valid because we can select a representative population to draw from, and it also gives us access to fire department records.

So we think the registry will help address many of the knowledge gaps that exist, currently, by being open to all firefighters regardless of their health status, you know, having a representative population of the fire service, but also being inclusive of many of the understudied groups of firefighters. We want to capture those work history records, so we can estimate the exposures and look at those response relationships. Of course, we want to collect information on other cancer risk factors, so lifestyle style factors, for example. Many firefighters have second jobs, so we would try to capture information on those other jobs that they have.

And then, ultimately, linking to those state cancer registries and the National Death Index to look at both incidents and mortality over time.

Some of the activities that that are in progress. We have been funded. We have, I guess you would call it, startup funding for FY19 of \$1 million, and then we have authorized 2.5 million per year for the next four years, but it's no guarantee that you're going to get what's been authorized each year. We are in the process of hiring the registry team, as I mentioned at the beginning. We are currently meeting with a variety of the stakeholders. We've had a lot of face-to-face meetings with various professional organizations and groups, and fire departments including some of the wildland groups. I mentioned that we posted the request for information on the Federal Register, and that's now closed. So we're going through all those comments now and determining the best way to address those comments and consider them in our design.

So this is just an outline of—or, I guess, our timeline for the registry. So we are in Year 1 right now. This is this is the planning stages. We're obtaining input on the registry design, that's why I'm here today, to get your input. We'll identify the best sampling methods to move forward and design the registry using those sampling methods. We hope to start recruiting firefighters and consenting them within the next year or so. So that takes us to Year 2 through 4. Once we have firefighters registered we'll begin matching with state cancer records which will take some time, and Dr. Siegel will talk about that process here in just a minute. And then we'll determine the cancer incidence. You'll see that there's a feedback loop there that we also want to update the registry as necessary. So that may be opening up for more enrollment of firefighters as well as periodically updating against the

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state cancer records and the National Death Index. And then, ultimately, at the end of this initial five-year period, we want to disseminate our findings to the fire service. And you can see at the bottom that we're going to seek stakeholder input throughout the whole process. So that's very important to us at NIOSH that we're getting that input from stakeholders.

So some important considerations. I've already mentioned this, but I don't think it's wrong to hamper on it a little bit. The Registry is for all firefighters, not just those with cancer. So we are working closely with our stakeholders like, for example, IFF on really getting the message out there, that this is for all firefighters. Once we are ready to start enrolling firefighters we'll have a strategic rollout communications plan. We've already got the backbone of that in place. We are in the process of developing an open enrollment web portal, and we're exploring other groups at CDC that have had registered, you know, have done cancer registries or other types of registries. And one of those is ATSDR ALS Registry. So we're looking at them as a model. And then we want to make the process as simple as possible for the firefighters. So right now what we're using is our guiding principle is that we want the whole process to take, hopefully, less than 10 minutes, 10 minutes or less, you know, have a very short initial questionnaire. Again, we're not going to ask firefighters for their cancer diagnosis. We're going to be able to get that directly from the cancer registries. We will need to enroll fire departments directly. That's really important to be able to access those employment records, but some considerations with that is are the departments using electronic records or are they still using paper records. Believe it or not, there are still many departments out there that are on paper records. Those that are using electronic systems it's uncertain how long they've been doing that. And so that'll, certainly, play a role in what's required from us to be able to get those incident records. And then how do we re-contact participants to update the registry? What's the best way to do that? And then how can we most efficiently link to the various state cancer registries?

Some potential opportunities with respect to the exposure data. So there is this new system called the National Fire Operations Reporting System, and they have an exposure reporting module that has been developed. Lori Moore, who you heard from earlier today, is in charge of that program. This is an exciting program because it collects self-reported exposure data directly from the firefighters. They have a mobile platform. They have a couple different apps that are available—or they have an app available on Apple and Android. It links with computer-aided dispatch. And what it does is it provides a much more robust response activity records compared to incident records. And so there's a lot of potential they are moving forward that we might be able to tap into that wealth of data and use it to do dose-response analyses. That would really go above and beyond what we can do with incident records.

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So I will turn this over real quick to Dr. Siegel, and she'll talk about cancer registries.

DR. SIEGEL:

So I'm Miriam Siegel. I'm the lead epidemiologist on the firefighter registry, and I'm just going to jump up here to stretch my legs, but also just very briefly talk about this topic because I've been coordinating a lot of the conversations we've been having with our contacts related to this opportunity.

So as some of you might know right now researchers that want cancer data from multiple state cancer registries need to approach every single state separately and individually, and send study participant identifiers such as name, date of birth, and Social Security number to get the cancer status of those participants and link with their data, but each state cancer registry has different requirements in terms of application processes, IRB protocols, data use agreements, and fees. And so it can become pretty burdensome for researchers to meet all of those different requirements. And this table pictured here, you don't need to be able to read the text, but it's a screenshot taken from the CDC's website that, briefly, lays out the 12 or more domains of requirements needed to match with state cancer registries for just three states pictured there. So you can imagine how large this table is and how time and labor-intensive this process can be. There was a recent cohort study, for example, that took about a year and a half to match with just 38 states, and that was a national effort. So that just gives you an idea of how long it can take, which is why the Virtual Pooled Registry Cancer Linkage System is being developed by the North American Association of Cancer Registries with funding by the National Cancer Institute. And this is an opportunity for individual state cancer registries to voluntarily participate in a pooled data portal, if you will, and that allows for uniform and standardized procedures for state registries to approve and deliver data to researchers conducting cancer research. Now the VPR comes in two different phases. Phase 1 is already active, and that gives aggregate case counts to researchers that submit their participants' identifiers to let them know how many cases of cancer are in the various states participating in the VPR, and that's really good for researchers to prioritize which states they want to invest their resources in pursuing data, especially, if they have to do it outside of this VPR, the original pooled registry system. Ultimately, for our purposes, it won't be especially useful down the road because our scope is the whole country, but in its infancy we might be able to use Phase 1 to prioritize our resources while we have a smaller sample size. Right now there's about 45 state cancer registries participating in Phase 1 which encompasses 87 percent of the US population.

Now, Phase 2 is what we're more interested in, and they're estimating that Phase 2 is going to be rolled out later this year, and that involves a central IRP and standardized linkages for all state cancer registries that want to participate in terms of one application process and one central area where researchers can retrieve the data. An early survey indicated that there were 14 early adopters that

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would be committed to participating in Phase 2, and 8t registries that said maybe, but it's anticipated that that number will probably grow in light of changes to the IRB common rule and also as time goes on, and researchers and registries alike we'll see that it makes the whole process of universal cancer research easier and more efficient.

And so there's multiple levels of participation. So registries that don't want to or can't participate in Phase 2—and I do what I mentioned that those registries that may have less financial or personnel resources are offered incentives either financial incentives or the VPR will have staff to offer as roving linkers to go to these registries and help with uploading data and whatever other resources are involved in participating. But those that still aren't able to or don't want to participate in Phase 2 can adopt the standardized templates for IRB and data use agreement and application requirements that the VPR offers, that they can still have researchers fill out, and then they'll just, individually, work with the researchers to give them that data. But all in all, the VPR has several options to make the process easier for researchers and registries, and I think it's going to be a really great and efficient tool for us as the National Firefighter Registry to be used down the road.

DR. FENT:

All right. Thank you, Dr. Siegel. And so another requirement of the registry is to make data available to outside researchers. So we are exploring options for doing that. The utmost importance is that we protect the data, we maintain privacy, and then we also want to make sure that we're providing data to researchers who are going to use it in the appropriate way. So we definitely need a mechanism in place to do that.

Some important milestones just through the second year. For those of you who are familiar with project management, we've developed a project charter and scope and Gantt charts, and critical path and we have our milestones, our timeline. and budget. I mean, we've done a lot of the legwork to know where we need to be at, and at what time. We're in the process of developing our protocol informed consent survey. We have a list of variables for the survey, and then we'll have to obtain IRB approval which, of course, takes time. We also need to get OMB clearance for the survey which takes time. So we're aware of these time requirements. And then developing the web portal for the enrollment it's going to be a big undertaking. Again, we're going to have to make sure that we're protecting the data to the to the highest level. We'll also need a secure database. I mentioned the rollout communications plan which needs to be released right as we're going live. And then we're hoping, again, through Year 2 to begin registering firefighters, identifying representative fire departments for enrollment. We are working with IFF. They have a list of fire departments they call their gold list which is representative of the US Fire Service, at least, career firefighters. We'll have to do something similar for volunteer firefighters. And then once we have identified

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those fire departments will have to have a whole process in place to be able to get their employment and incident records. There's a lot to do.

So we do have more information out there on our website. We're, actually, in the process of developing a dedicated website just for the registry. We have a specific email address and we've been getting a lot of emails from that. I mentioned the RFI which is now closed, but we're working on that as well. My contact information is listed they're. I'm happy to answer any questions that you guys have. I do have a list of discussion topics which we can get to here in just a minute. And I just wanted to show this is some of the promotional materials that we've developed. This was presented at FDIC which is the largest fire department. It's the Fire Department Instructors Conference. It's the largest firefighter conference in the world. And so this was at the general session. So we're starting to get the word out there that this is coming and to stay tuned. So thank you for your attention and, like I said, we do have some discussion topics. I think it'd be great to kind of go through them one by one, but I think I first want to open it up for any questions.

DR. BUNN: Thank you very much for a great presentation. Yes, yes. Looks like you've, actually, accomplished quite a bit in just this first year. So kudos.

DR. FENT: Thank you.

DR. BUNN: Do we have any questions? Yes, Ted.

MR. COURTNEY: Having just come off of running, not the same scale, but a smaller scale cohort program for football players, I'm just wondering how are you guys going to do or you don't think it's going to be issue, validating the authenticity of your occupational classification that is, I'm going to self-report. I'm a firefighter. Am I a firefighter or not? How do you validate that?

DR. FENT: That is a very good question. I think we were hoping that we would receive—it would be on the honor code, but certainly, you know, and it might be something we can talk with IFF and IPSDI about. There may be a way to look at—because there's certain state certifications and things like that that we could explore.

DR. SIEGEL: (Inaudible @ 01:00:47). Yes.

DR. FENT: Validating.

DR. SIEGEL: There are those kinds of information. We can validate by certification at the state level, but also linking them to an incident response. So they may be in a classification of a firefighter, but they've never responded to anything. That's very different than a firefighter who's on a list that is, actually, responding. So we have some ways to link them to their departments, and then actual incidents, for response.

DR. BUNN: Other questions? Yes. Marc.

DR. SCHENKER: Marc Schenker. I don't know how much time you have. I'm putting on my epidemiologist hat. I have a lot of questions that come up. One is, the covering of the entire country instead of selected areas where you could have both more

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efficiency and more complete ascertainment, and I don't know if that's in the legislation or exactly why, but it's going to be a nightmare for you if you're trying to cover the entire country. And I'll just throw out a bunch of things. In terms of the population approach, I would definitely go for the organizational level or fire department sampling, or firefighter organization sampling, or something where you have a database and you know what you're getting as opposed to just the website where you're never going to be able to answer those questions of representativeness, and...

DR. FENT: Yes, and we're aware of those limitations. So it is required by the legislation that it's open for all firefighters. So the open enrollment is to meet that letter of the law, but then what you're talking about with respect to working through fire departments to be able to draw conclusions, statistical conclusions, we're right there with you in that. I think that's going to be the primary—in terms of doing real epidemiology it's going to be done at the fire department level, and we'll have to select specific departments. But again, the scope is the whole country. So we're still going to have the challenge of, like Dr. Siegel said, I mean, how do you get all the different states to—getting all the cancer registries from the states, and it is a big undertaking and challenge.

DR. SCHENKER: One big question is your reference population, and you need to really think about that. There's, certainly, non-firefighter population, whether it's from state registry or state demographic data, but then there's always the healthy worker effect and all these complications of who becomes a firefighter. And the second way is having some measure of dose to look at, and that gets me to the question about your exposure assessment core or group. I didn't remember from the list of people working on it, but I would hope that there would be a lot of effort, you know, exposures, half the equations. And you really need to, hopefully, have some useful data and some ability to do dose-response.

Another comment has to do with looking at other outcomes besides cancer, and I don't know if that's possible, but I mean, it's useful for a lot of reasons; understanding the population, looking at other risks, etc. And I suspect this may be the legislation again, but you might think about that because of its value.

PARTICIPANT: Yes, particularly, cardiovascular, musculoskeletal. That was what I was thinking about as well. They need to do follow-up studies in that cohort once you...

DR. FENT: Right. And so the focus—I mean, if you read the Act, the focus is cancer, but now we are certainly open to exploring other health outcome. One option would be follow-on questionnaires, for example, because it probably would have to be self-reported. I don't know if we'd be able to get medical—you know, there's all sorts of complexities associated with that, but certainly through a survey-based kind of system we might be able to gather some additional health effects information.

DR. SCHENKER: Well, you're going to spend all this money to create the population cohort, and with that investment it seems a shame if you don't have the ability to look at any

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anything you could think of now or that might come up, you know, a question about musculoskeletal or traumatic injury, or what have you. You might as well create that platform where you would be able to look at other things with the population since so much money to go into creating the population.

DR. FENT:

Right. Yes. That's good advice.

DR. LEMASTERS:

Well, this is a topic near and dear to my heart. I was glad to hear that you're doing your research at the fire department level. I just quickly wrote down, probably, I would do a proportional cluster sampling procedure based upon certain criteria. For example, if you want to get a lot of African-American firefighters, you're not going to go to the state of Utah, Wyoming, and Montana, maybe. So maybe you set stratum for—you get all the information you can from the International Firefighters and other firefighters association. How many African-American firefighters they have, how many women, how many Caucasians, and then you do this cluster, this stratum sampling within that by the numbers. You, certainly, don't have to do all the fire departments, but you have to systematically, and I'm sure Miriam knows all this, but some systematic sampling procedure, and that's what I would nail down really soon by trying to gather all the demographic information you can from the states or I would assume they would have that firefighter department.

I, also was wondering if you were going to think of any eligibility criteria for your firefighter. So the question that came to my mind, if I'd only been a firefighter a year it's probably going to take me 20 years before you're going to see anything, but you could set the bar at, at least, 5 years of firefighter training or something. There's advantages and disadvantages for both approaches. Also I, personally, if I was doing it, I probably wouldn't roll out volunteer firefighters in the first phase because their exposures are much more sporadic and undefined than your traditional full-time firefighters. And you think 200,000 is a lot, it's not really. Once you break it down in all these subgroups, African-Americans, women, you know, etc., old, young, you know, what kind of firefighters. So you want to really optimize that sample size of 200,000 which isn't that—it's large, but it may not even be large enough to do all the various groups you're thinking of looking at, but you could think of it in Phase 1 and Phase 2. I wasn't sure why you were going to ask the firefighters if they have cancer. I mean, if I was a firefighter and I knew this study was about cancer and firefighters, I'd say, "Why wouldn't you ask me if I had cancer or not?" Now, you may want to validate it with the cancer registry, but certainly, all cancers may not be as well—what is the word?

PARTICIPANT:

Surveilled or diagnosed.

DR. LEMASTERS:

Surveil. They may not all be—there may a lot of differences in registries and how well those registry collect skin cancers, for example or prostate cancers or testicular cancer, uterine, ovary. Probably all is not level here, playing field, for cancer. So I would definitely ask firefighters. They would definitely want you to, at

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least, in all the firefighters I've talked to, and they would appreciate the question. And sometimes they'll have two or three cancers that they're dealing with, and you might just get one registered in that surveillance program, or cardiovascular disease. I'm like Marc, with all this—hopefully, you get all the money you're promise because you're going to need every dime of that \$10 million for sure, and I'm not even sure if that's enough, but you might as well—you know, with a few more questions you could broaden the bang for your buck, and I hope you get it all, and more.

DR. FENT: That's great input. I think we don't want to—I guess, we didn't want it to be like a requirement that they report their cancers because they may be hard to re-contact because during the initial registration if they have cancer, that's one thing, but if they develop cancer five years from now or ten years from now, we didn't want to put the onus on them to report it.

DR. LEMASTERS: But you're going to be updating this, right?

DR. FENT: Right. So well, yes, but then at the same time...

DR. LEMASTERS: Surveillance means continuous, ongoing, right? That's how I see it.

DR. FENT: Well, the follow-on—this is part of why we're meeting here, is because we want to get input. We need input from the stakeholders, too, because, I mean, we're talking about budget. Like if we have to re-contact every single firefighter again, you have to have an authorization process in place. I mean, Joe can talk more about that. It gets really expensive when you do those, you know, re-contacting and updating...

DR. LEMASTERS: Well, get email addresses, right? You could just send everybody—I mean, I'm just putting in some details, but...

DR. FENT: Response rate. I mean, there's all these factors.

DR. LEMASTERS: Firefighters are very responsive, I can tell you that. I think

DR. FENT: I think there's some that might disagree.

DR. LEMASTERS: I have found they're calling me, you know. Really, I think they're a great group to really care—they really care about this topic and what's been going on to their buddies in the fire department. I mean, they're a very concerned group. I think it's great what you're doing, and it's going to be worth every agony you're going to go through. There will be some.

DR. LASZCZ-DAVIS: Chris Laszcz-Davis. I think this is very timely for all kinds of reasons, but boy, in listening to you I think the biggest challenge is going to be your exposure assessment. You're talking all parts of the country. So you've got differences in foliage, you've got differences in terrain, manufacturing practices, materials that have been used, new advanced materials. So to the extent you can gather information on the environment, that's the only way that the information is going to be useful to you in the longer term. So I don't know what part of your project through really deals with assessing the environment beyond the sampling.

DR. FENT: This has come up. We've had some conversations with Matt Donne, who was the

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industrial hygienist on a three-city cancer study, the NIOSH study. And he mentioned to us like you really need to look at it—you need to find out where the departments are in relation to—not just departments, firehouses, in relation to the community because there's going to be industrial areas or agriculture. I kind of mentioned this. So there is the potential we could get to that level of detail and, potentially, look at those different—again, it gets to this whole idea you're starting to really cut up your sample size. We'll have to make sure we have the power to do those kinds of...

DR. LEMASTERS: I just think that if you're talking disclosure assessment you need to have that piece of information.

DR. LERMAN: Two things. One, you mentioned, especially, with the Internet-based enrollment, the concern about the validity of your sample and, specifically, about people who may already have cancer, and that's why they're entering. I think that's going to be an issue with all three of your approaches to strategies. And I think the simplest way to address that is to make it a prospective study. Just only look at cancers that occur after the date that you enroll, not before the date that you enroll, and then if that doesn't address it completely, that for someone who had one cancer, maybe more like they have a second cancer later, that certainly will address it to a large degree.

The other thought I had as you were talking, I assume when you talked about volunteer firefighters you were thinking about community volunteer firefighters.

DR. FENT: Yes.

DR. LERMAN: Every refinery and chemical plant I know has volunteer firefighters who are employees at the plant, but when there's a fire they become firefighters all of a sudden, and that is a unique exposure because now I'm talking about a fire within a refinery or a chemical plant, but I think that could be an interesting subgroup to recruit.

DR. FENT: Yes. Thank you.

DR. BUNN: We have a question online. Karla.

MS. ARMENTI: Yes. Karla Armenti. That perfect question that I don't know who just asked it, it's a different—or a subpopulation to look at. I did want to just clarify, and you might've it and I missed it. You talk about fire departments. Are these, again, just like municipal fire department type things, you know, that are eligible? What I'm getting at is firefighters on military bases, is another kind of special population that may be exposed to a variety of other chemicals, and it seems like you are collecting that sort of information. So could firefighters at chemical plants or military bases, are they eligible to participate?

DR. FENT: So I'll answer that initially, and then I'll turn to Dr. Howard, if he wants to say anything, but I think, at least, initially, the focus is going to be on municipal firefighters, fire departments, and then, also wildlands. So some of the state wildland agencies, potentially, federal wildlife agencies. The problem is with some

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- of these other groups it becomes a budget issue, right? So in terms of doing targeted enrollment, that's going to be one of the most expensive parts of this whole project. So firefighters that our military firefighters or industrial firefighters could, certainly, still self-enroll through the web portal, but in terms of targeted enrollment, at least, initially, it's going to be those municipal community departments or, like I said, some of the wildland agencies were interested as well. But Dr. Howard, did you want to say anything else?
- DR. HOWARD: No, I think you said it. We're always happy to talk to DoD. My understanding is they have a few dollars.
- DR. FENT: It really is a budget issue and a personnel issue doing the targeted enrollment.
- MS. ARMENTI: So I can just follow-up. So if they do self-enroll, do you then exclude them, and how do you determine—I mean, you must have to ask a very specific question about where they were firefighting.
- DR. FENT: Right. Exactly. So we would want questions about where they're employed and what they do. That'll be part of the questionnaire. We have to identify what are the core set of questions that we want to ask. They would not be excluded, although, it may be more exploratory analyses because the more statistically valid approach is working through the departments, but they would still be able to enroll. It's just the target enrollment becomes a problem.
- MS. ARMENTI: So you'll collect their data and maybe just park it for future reference?
- DR. FENT: Well, we would do explore—I mean, we definitely want to do exploratory analyses. So looking at the different types of cancers. For the self-enrollees there are a lot of exploratory kinds of analyses that could be done. It's just drawing conclusions, statistical conclusions, would be, potentially, problematic, although, maybe having a more perspective approach would address some of those limitations.
- DR. MCKENZIE: Judith McKenzie. So from listening to you it sounds like it's going to be a fixed cohort where you'll follow these people over time without adding more?
- DR. FENT: I think we would have—again, open to advice and input. We're thinking we would do re-enrollment periods. So you'd have an initial enrollment period, and then we would open it up every so often to re-enroll because you're going to have, you know, firefighters is an ever evolving, you know, they get new folks all the time. So I think it's important to do that.
- DR. MCKENZIE: I was going to say because if it's, more or less, fixed then I think—so initially, we get prevalence data, that incidents over time. And depending on how large your re-enrollments sample would be, the initial cohort, the sampling would be even more important, so that you have what's as representative as you can get of the firefighters.
- DR. FENT: Right. That's a good point.
- MR. COURTNEY: I would just like to toss out for later down the road when you get around to these follow-up studies that we've recommended, one of the things that's hard to figure until you get to that point, the retrospective is how engage the cohort until you get

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to the follow-up because if you don't then the response rate plummets. So if you enroll, and then you go quiet for a year or two, people think, okay, that's a done deal. We'll never hear from them again. So the next time they get your email they're like, oh, wonder what they're doing today. Got to move on to my next thing. So just think about your communication strategy being a way to keep that cohort engaged, you know, positively motivated so that when you do go back for follow-up there's a population ready to follow-up with you.

DR. MCKENZIE: Although, from what you're saying, it seems as if you link the state registries you'll be able to still update your cohort without actually asking anything because you have that link.

DR. FENT: That's true. Right. For cancer, at least, but for other health effects we would want follow-on questionnaires. And then we're also thinking about if we have a cohort at 200,000 firefighters or more, that it would be a missed opportunity if we also don't try to deliver information regarding the best practices and control interventions, and things like that. Wo we're hoping to also do that with this cohort.

DR. BUNN: Actually, I have a question myself. And, I guess, this gets to, actually, the whole premise of the study for the system, you know, what is the ultimate goal here?

DR. FENT: Right. So I would say the ultimate goal is to better understand the risk of cancer in the entire fire service. So we know a lot about career firefighters, not so much about a lot of the other groups. But secondarily, the NIOSH mission is to prevent worker illness and injuries. So we would also want to try to deliver some of the great workplace solutions documents and stuff that we develop as well as other research that's being done out there. We would want to try to convey some of that information as well.

DR. BUNN: Okay. So it sounds like the intent of the legislation is really to—I mean, they're terming it a registry, but it almost sounds like the intent is to develop surveillance system.

PARTICIPANT: Just to study cancer characteristics?

DR. FENT: Right.

DR. BUNN: Right. Well, cancer surveillance system among firefighters. So in that regard then you would want to—I would agree with your strategies for sampling that you want to get every single firefighter that you can in the system, and really having all three of those are important to try to get as many as you want, but then, also as it's been mentioned here, you want ongoing enrollment, ongoing follow-up, ongoing linkage with the various data sources. And then just a couple of other questions. You were mentioning what data system. We and U.K. have really switched over to the use of REDCap because it's a great software platform where you cannot easily enter the data in the web portal, and it's also easier on the back end of it to be able to use for analysis of the data, too. So that might be one web-based platform to consider.

You also had a question on underrepresented groups. I mean, we have a lot—

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- well, in Kentucky, anyway, that it's combined EMS fire. So you may have some that, actually, identify as EMS when they, actually, do a lot of firefighter duties as well. So I was just wondering how you plan to include them or did you plan to include them in the study? I would recommend including them in the study.
- DR. FENT: So I think they would be included. I mean, we're wanting to get—that's one of the big questions we have for our stakeholders, and we have a conference—I didn't mention this, but not next week but the following week there's a conference in Miami where a lot of the different stakeholders are going to be present and we have three hours devoted just to the registry. So we're hoping to get a lot of that input from the stakeholders, but that is one of the key question, is how do you define a firefighter for the registry? And so we want to hear from them on what that's going to look like.
- DR. BUNN: So my last comment, again, is on, you know, I realize the ultimate goal is to surveil or identify cancer, but there are a lot of comorbid conditions that might be associated with that. So I don't know. So you know, if you have this opportunity, if you're developing this huge system anyway to really, you know, try to identify, at least, some of the major chronic diseases.
- DR. LERMAN: Steve Lerman, again. One more comment which, actually, it goes to that as well. I think if you're using cancer registries as your comparison, I think you almost are forced to put aside non-melanoma skin cancers because I don't believe cancer registries collect those. A lot of the discussion which I agree with the principle of, well, let's get cardiovascular, let's get respiratory, let's get musculoskeletal conditions in there. Like I said, in principle I think that's great, but there is no musculoskeletal registry to compare themselves to.
- MS. LASZCZ-DAVIS: Chris Laszcz-Davis. Just a final comment. I do know that when the fires are huge they'll bring in convicts, ex-cons and convicts. So I don't know whether or not that's a group to consider.
- DR. FENT: Dr. Howard mentioned, also tribes—tribal communities. I mean, we're, certainly, open to it. It presents some complexities in terms of IRB approval, but they are part of the firefighter workforce. And so you know, we would, certainly, be open to it.
- DR. BUNN: Any other questions or comments? All right. Thank you very much.
- DR. FENT: Great. Well, thank you. Yes, thank you for the input. Thank you.
- DR. BUNN: I, actually, would like to thank all of our speakers today. I mean, excellent presentations and, you know, I think there's been all around, on both sides, a lot of food for thought here in the room today.
- So I think it's been a great meeting. So I guess, as far as future agenda items go, I mean, we started a little bit of that discussion. Are there any suggestions that anyone, you know, these last couple of presentations? Yes, Michael.
- DR. BEHM: I think I brought this up a couple of meetings ago, but workplace violence, bullying, harassment. When I first joined this Board that was on the suggested

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topics of the previous meeting. And so I still think that's—if there's anything more in mind.

DR. BUNN: No, very good idea.

PARTICIPANT: To dive into one of the pieces from Dr. Schulte's presentation. The document on occupational risk assessment. So the draft came out in June of 2018. I think it would be interesting and valuable, possibly, to have a session just on that, if there's interest in that. And the other, it might be too soon for it given that it was talked about today, but this topic of the future of the workforce. So whether that deserves a whole block of an hour—45 minutes or an hour. It seems valuable. And, again, maybe, also from a brainstorming perspective it could be interesting.

DR. BUNN: And, Marc, actually, I forgot you had a question on the research integration presentation that we weren't able to get to at the time.

DR. SCHENKER: Yes. I liked the discussion about the workplace of the future, and I think a major goal of NIOSH should be to get health into the discussion, and I suspect that a lot of those references that you look at don't address health. They're all dancing around health and this is the National Institute of Occupational Safety and Health, and getting that as part of the discussion as people are looking at the changing workforce in automation and AI, etc., etc., would be a major important goal.

DR. BUNN: I agree. Any other comments, questions? Okay. All right. So next on the agenda is, I guess, thinking about future meeting dates. Are we thinking, probably, another meeting this fiscal year in September or...?

PARTICIPANT: The fall.

DR. BUNN: Okay. Not a lot of discussions there, huh? Okay.

PARTICIPANT: No date yet.

PARTICIPANT: Alberto, we usually try to have one more before the end of the fiscal year. So that would be the first of October.

MR. GARCIA: Yes, some time in September. October, yes, September. The big meetings are in September.

MR. COURTNEY: I mean, that's what's happened, at least, in my time on this. It's usually in September.

DR. LEMASTERS: It's a good time.

DR. BUNN: Are there any special days or weeks that kind of like right off the bat are off for current participants or current board members?

MS. LASZCZ-DAVIS: For me, the latter half is more problematic than the front half.

DR. BUNN: Okay. All right. So it sounds like more towards the beginning.

PARTICIPANT: Yes, the beginning for me would be the third week.

DR. BUNN: Yes, third week for me is not good either. Okay, great. As far as closing remarks or whatever, like I said, I mean, I, particularly, enjoyed all of the presentations today and learned a lot of myself. I was just, actually, blown away especially by the first presentation on the risk management and risk characterization, and compilation, and integration of all the information that NIOSH has produced that,

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you know, I look at, you know, in kind of silo. Well, they're doing this, they're doing that, but geez, when you put it all together it's very impressive. As well as the other presentations, too, on the banding, the integration initiatives, like I said, and the establishment of a new firefighter registry. So again, thank you all for great presentations.

Any other comments for the closing or are there any comments online?

MS. LASZCZ-DAVIS: Chris Laszcz-Davis. I'm always impressed by the vision that's apparent, and the associated discussion that goes along with the vision that NIOSH has in the work product. So and I have sought to...

DR. BUNN: All right. Thank you, everyone, then. Meeting's adjourned.

[END MEETING]

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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
COSH	Conference and Exhibition on Occupational Safety and Health
CPSC	Consumer Product Safety Commission
CRA	Cumulative Risk Assessment
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
FDA	Food and Drug Administration
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
TWE	Total Worker Exposure

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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: Seventy-second 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/>

Thursday – May 30, 2019

Time	Topic	Presenter
8:30 am	Welcome and Introduction Meeting Logistics	Mr. Alberto Garcia DFO, NIOSH
8:40 am	Agenda, Announcements, and Approval of Minutes	Dr. Terry Bunn Chair, NIOSH BSC
8:50 am	Director's Opening Remarks	Dr. John Howard Director, NIOSH
9:20 am	NIOSH Chemical Risk Management	Dr. Paul Schulte EID Director, NIOSH
10:20 am	Break	
10:30	Occupational Exposure Banding	Dr. Thomas J. Lentz, Branch Chief, DDB, EID
11:30 am	Lunch	See Lunch Suggestions on Folder
12:30 am	Public Comments	Mr. Alberto Garcia DFO, NIOSH
12:40 pm	Research Integration Initiatives	Dr. Sarah Felknor, Associate Director for Research Integration, NIOSH
1:00 pm	Overview of the National Fire Fighter Registry	Dr. Kenny Fent Team Leader, DSHEFS, NIOSH
2:00 pm	Summary & Wrap-up, Future Agenda Items, Meeting Dates, Closing Remarks	Dr. Terry Bunn Chair, NIOSH BSC
2:30 pm	Adjourn	

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Appendix B

**Board of Scientific Counselors
NIOSH Headquarters
Washington, D.C.
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Budget

On Wednesday, 8 May 2019, the Appropriations Committee of the House of Representatives conducted a “mark-up” of the fiscal year (FY) 2020 appropriations bill for the Departments of Labor, Health and Human Services, and Education.

The House Appropriations Committee provided a total budget for NIOSH of \$346.3 million. This amount is \$10.0 million dollars above our FY 2019 funding level of \$336.3 million and \$156.3 million above the President’s proposed budget request of \$190 million.

Included in the House bill is an additional \$2 million for Education and Research Centers as a group, \$2M for the Agriculture, Forestry and Fishing Program as a whole (which includes the 10 Agriculture Safety and Health Centers); and \$2M for the Total Worker Health Centers as a group. Additionally, there is an increase of \$600K to support the Firefighter Cancer Registry, an increase of \$400K for the National Mesothelioma Registry and Tissue Bank and \$3 million for Other Occupational Safety and Health Research.

You can find the text of the House Appropriations Committee mark-up at https://appropriations.house.gov/sites/democrats.appropriations.house.gov/files/FY2020%20LH_HS_Report.pdf.

Senate has yet to do a mark-up of the Labor, Health and Human Services, and Education appropriations bill.

Organizational and Personnel Announcements

NIOSH Reshaping Initiative

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NIOSH established the first phase of the NIOSH Reshaping Initiative led by Dr. Margaret Kitt. The first phase will be stood up on May 28, 2019 and includes:

- Establishing The Division of Science Integration (DSI) and the Division of Field Studies and Engineering (DFSE)
- The Cincinnati Chemical and Biological Monitoring Branch in the Health Effects Laboratory Division (HELD)
- The Office of the Deputy Director for Management (ODDM)

Staff

- **Dori B. Reissman, M.D.**, Associate Administrator for the World Trade Center (WTC) Health Program (<https://www.cdc.gov/wtc/>), has been promoted to Rear Admiral and Assistant Surgeon General in the Commissioned Corps of the U.S. Public Health Service.
- **Grady Calhoun** has been selected as the new DCAS Director.
- **Nicholas (Nick) Gipson** has been selected as the Associate Director for Facilities Management at NIOSH.

Retirements

- **Rear Admiral Margaret Kitt** retired from the Commissioned Corps on 1 December 2018 after 30 years and 5 months on Active Duty (14 years in the Air Force and 16 years in the Public Health Service). Dr Kitt has rejoined NIOSH and continues to serve as Deputy Director for Program.
- **Denzil Slaughter**, NIOSH's former Associate Director for Facilities Management since 2013, retired on March 29, 2019.

New Programs and Initiatives

Future of Work

NIOSH has launched a Future of Work Initiative to address issues affecting the future of workplace safety and health such as new work arrangements, differences in organizational design, technological advances, and changes in demographics. These transformations offer many

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opportunities, such as new job creation, sustainable practices, and clean technologies, but they also bring challenges that impact the workforce, such as skill and job loss, job displacement, emerging occupational hazards and risks, and worker exclusion. A NIOSH work group, headed by Dr. Sara Tamers and hosted by the Division of Science Integration's Risk Evaluation Branch, will address the future of work innovations, opportunities, and challenges through intramural and extramural collaborative activities aimed at improving the quality of working lives. More on this during Dr. Felknor's presentation.

Artificial Intelligence

NIOSH has launched an AI Interest Group which brings together those scientists across the Institute that are using AI methods to see new relationships in occupational safety and health data. A new webpage is being developed to showcase that work.

Faces of Work-related COPD

Faces of Work-related COPD is an impact video series that is part of a NORA Respiratory Health Cross-Sector Council initiative. The series of four short videos includes a physician explaining the disease and interviews with patients diagnosed with work-related COPD. The patients discuss work exposures, their quality of life living with the disease, and ways to minimize the risks of getting the disease.

<https://www.cdc.gov/nora/councils/resp/FacesCOPD.html>.

Office of the Director (OD)

International Conferences

NIOSH, the World Health Organization, and the Vietnam National Institute of Occupational and Environmental Health co-sponsored the 5th International Scientific Conference on Occupational and Environmental Health held September 10-12, 2018 in Hanoi, Vietnam. The theme of the conference was "Occupational Health and Environment: Challenges and Opportunities in Sustainable Development." Four NIOSH staff participated in the conference which hosted about 300 participants from 16 countries.

The XXII World Congress on Safety and Health at Work will be held October 4-7, 2020 in Toronto. Our Canadian colleagues have put together an exciting program with the theme of *Prevention in the Connected Age*. The first Program Announcement has been published and the

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call for abstracts will be out in September 2019. The preliminary program can be found at <https://www.safety2020canada.com/>.

Division of Applied Research and Technology (DART)

American Chemical Society Local Section Honor

Dr. Pramod Kulkarni has been selected the 2019 Chemist of the Year by the Cincinnati Local Section of the American Chemical Society (ACS). He was honored at an ACS meeting on March 28 at Miami University's Shriver Center, Oxford, OH. The award recognizes Dr. Kulkarni's work to develop portable aerosol instrumentation and other efforts to improve health and safety in the workplace. At the meeting, Dr. Kulkarni gave a presentation titled "Taking the laboratory to the field: Developing the next generation of real-time instrumentation for mobile aerosol measurement in workplace atmospheres."

International Conference on Occupational Stress and Health

NIOSH, the American Psychological Association, and the Society for Occupational Health Psychology are currently organizing the 13th International Conference on Occupational Stress and Health, "Work, Stress and Health 2019: What Does the Future Hold?" The conference will be held on November 6-9, 2019 in Philadelphia, PA. The 2019 conference will give special attention to the workplace of the future. Just what does the future hold for employers and for workers? As the world copes with growing economic, political, environmental and social changes, what can organizations do to sustain the health and productivity of their workers? More information can be found at: <https://www.apa.org/wsh>.

NIOSH will be sponsoring a discussion forum, "Working Hours, Sleep & Fatigue: Meeting the Needs of American Workers & Employers", on September 13-14, 2019 in Coeur D'Alene, Idaho. Taking place after the 24th International Shift Work and Working Time Symposium, the forum will present and encourage discussion of research gaps/needs and effective countermeasures related to working hours, sleep, and fatigue among U.S. workers and employers. Everyone interested in worker safety including researchers, academicians, safety professionals, labor union representatives, industry leaders, policy makers, government representatives are invited to attend, listen and share their views on this important topic. More information can be found at: <https://www.cdc.gov/niosh/topics/workschedules/fatigue2019.html>.

Division of Safety Research (DSR)

Center for Occupational Robotics Research (CORR)

NIOSH has joined Advanced Robotics for Manufacturing (ARM), the nation's leading collaborative in robotics and workforce innovation; NIOSH joins more than 170 member organizations representing industry, academia, non-profits, and government.

High-Profile Report on Suicide Rates

NIOSH and the National Center for Injury Prevention and Control co-authored a report in the November 2018 *Morbidity and Mortality Weekly Report (MMWR)* on suicide rates by major occupational group. Data from the National Violent Death Reporting System for 2012 and 2015 indicated that suicide rates by occupational group differed by gender, with the highest rates in both data years for males in 'Construction and Extraction' and the highest rates for females in 'Arts, Design, Entertainment, Sports and Media.' The report has been viewed almost 35,000 times, was mentioned in 53 news stories from 45 news outlets and in 189 tweets from 165 users; the Altmetric score is 524 which is in the top 5% of all research outputs.

Drug Overdose Deaths at Work

NIOSH authored a brief report in *Injury Prevention*, published online in April 2019, showing that drug overdose fatalities in the workplace rose significantly between 2011 and 2016. Although the overall rate was low, these data from the Census of Fatal Occupational Injuries showed a 24% annual increase, with the highest rates in the transportation and mining industries. One-third of workplace overdose fatalities occurred in workplaces with fewer than 10 employees. Heroin was the single drug most frequently documented.

Slip-Resistant Footwear

NIOSH authored an evaluation of an intervention to determine the [effectiveness of a program to provide slip-resistant footwear](#) (at no cost to workers) in preventing workers' compensation injury claims from slipping on wet or greasy floors. Participating were food service workers in 226 school districts. The study showed the probability of a slipping injury was reduced significantly in the group that received the intervention; no change was observed in the control group.

Aerial Lift Simulator

The [NIOSH Aerial Lift Hazard Recognition Simulator](#) is a free downloadable tool that provides the opportunity for workers who operate aerial lifts (various types of mobile platforms utilized to elevate workers to different heights in industries such as construction) to practice navigating these lifts in a simulated workplace environment. The simulator can be used by experienced operators to refresh their skills and by new operators to become familiar with typical hazards they may encounter on the job. In March 2019, the existing ‘scissor lift’ scenario was expanded to include a different type of aerial lift called a ‘boom lift.’

Division of Surveillance, Hazard Evaluations, and Field Studies (DSHEFS)

Health Hazard Evaluation Program

The 2018 Health Hazard Evaluation (HHE) Annual Report is available at <https://www.cdc.gov/niosh/hhe/annualreports.html>. The HHE Annual Report includes summaries of interesting projects and other highlights of the HHE Program year. The Annual Report provides examples of how the HHE Program makes a difference for workers’ health and safety.

An HHE was performed to evaluate possible exposure to secondhand cannabis smoke among police officers conducting enforcement activities during a campus event (<https://www.cdc.gov/niosh/hhe/reports/pdfs/2017-0174-3335.pdf>). Among the activities performed for the evaluation were collection of personal and area air samples for tetrahydrocannabinol (THC), the active substance in cannabis, and collection of pre- and post-concert urine and blood samples. There are no occupational exposure limits for THC, but urine testing is commonly used as a measure of exposure to cannabis. THC was found in personal and area air samples. Although THC-COOH (a metabolite and chemical marker of THC exposure) concentrations were observed in urine samples, they were below concentrations considered positive in a routine urine drug screening test.

The Behavioral Risk Factor Surveillance System (BRFSS) is the nation’s system of health-related telephone surveys that collect state data about U.S. residents regarding their health-related risk behaviors, chronic health conditions, and use of preventive services. Thirty states added the occupation and industry module to the BRFSS – the largest number of states to participate in the NIOSH sponsored module. Approximately 100,000 employed adult respondents, provided data

on their current occupation and industry. In 2018, publications and reports authored by NIOSH and state partners explored a wide spectrum of health related topic by industry an occupation, including health insurance coverage in adults; marijuana use; long work hours, leisure time, physical activity and obesity; adverse health outcomes and Tdap vaccination among healthcare workers.

Health Insurance Coverage

NIOSH authored papers using data from the Behavioral Risk Factor Surveillance System and the National Health Interview Survey (NHIS) to examine health insurance coverage among U.S workers. One article was published in *MMWR* (DOI: <http://dx.doi.org/10.15585/mmwr.mm6721a1External>) while the other was published in the *American Journal of Preventive Medicine* (<https://doi.org/10.1016/j.amepre.2018.12.010>). Both papers found a decline in the prevalence of being uninsured before and after 2014. The study using the BRFSS data found the decline varied by occupational group. The study using NHIS data found health insurance coverage varied by work arrangement, with workers in nonstandard work arrangements having the highest percentage without coverage.

A recent publication in the *American Journal of Health Promotion* analyzed national data from the 2015 National Health Interview Survey NHIS-OHS on the availability and participation in workplace health promotion programs (WHPPs). It was observed that 46.6% of employees had WHPP programs available to them; and of those that had them available, 57.8% participated in at least one program. Results showed that adults who worked ≤ 20 h/week, worked regular night shifts, were paid by the hour, or worked for temporary agencies were less likely to participate in WHPPs. <https://doi.org/10.1177/0890117119844478>

Workers' Compensation and Opioids

NIOSH will host a meeting, “Advancing Workers' Compensation Opioids Research” on Wednesday, July 10 in Cincinnati, OH. The purpose of this meeting is to bring together workers' compensation (WC) and public health organizations to discuss specific ways to use WC data (and other data sources such as prescription drug monitoring programs, PDMP) to address research gaps related to the prevention and reduction of opioid use/misuse and workplace exposures.

Education and Information Division (EID)

Draft Occupational Exposure Banding

The *NIOSH Occupational Exposure Banding Process for Chemical Risk Management* and associated electronic tool (e-Tool) are being finalized for publication. This document and e-Tool provide employers and the safety and health community with a documented and validated scientific process to assess the hazards of chemicals that have no established exposure limits. Employers can use the banding process to compare chemicals with similar uses to identify which chemicals are the least toxic. These tools target occupational safety and health professionals who serve small and medium-sized establishments.

Draft Risk Assessment

The draft document, *NIOSH Current Intelligence Bulletin: NIOSH Practices in Occupational Risk Assessment* was revised following input from public, stakeholder, and peer reviews. When published, the document will make accessible the methods used by NIOSH researchers conducting high quality, scientifically sound assessments of the health risks associated with workplace hazards.

NIOSH risk assessors are assisting EPA risk assessors in meeting the provisions of the Lautenberg Chemical Safety for the 21st Century Act, which updates the Toxic Substances Control Act (TSCA), through review of the scoping documents, risk assessment plans and chemical risk assessments developed for the EPA priority chemicals. In addition, NIOSH is consulting directly with EPA risk assessors to provide assistance in understanding and dealing with the unique issues that arise in occupational risk assessment.

Draft Silver Nanomaterials Document

A public meeting was held on October 30, 2018, to discuss and obtain public comments on the draft *NIOSH Current Intelligence Bulletin: Health Effects of Occupational Exposure to Silver Nanomaterials*. NIOSH is revising the document in response to public, stakeholder, and peer review comments.

Safe-Skilled-Ready Workforce Program

The NIOSH Safe-Skilled-Ready Workforce (SSRW) Program is assisting with the design, coordination, and dissemination of a 5-week, social media campaign in April/May, 2019, #MySafeSummerJob. The campaign is coordinated by the Occupational Safety and Health

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Administration (OSHA) Young Worker Alliance, which also includes CareerSafe, American Society of Safety Professionals, Center for Construction Research and Training, American Industrial Hygiene Association, Board of Certified Safety Professionals, and the National Safety Council. The goal is to reach partners, teachers and young workers directly, in advance of the summer jobs season, with OSH messages and content through various social media channels. The campaign content is mainly drawn from the NIOSH *Talking Safety* curriculum.

SSRW researchers recently published (with one in press) new peer-reviewed articles in *Prevention Science* and the *Journal of School Health*. The papers present results from the small FY15 Small NORA Project conducted in the Miami-Dade Public School System and the FY17 Small NORA Project conducted in the Oklahoma City Public Schools related to the implementation of the NIOSH *Talking Safety* curriculum.

Nanotechnology and Emerging Technologies

The Nano and Emerging Technologies program funded 10 FY2019 Pilot Studies. The funding demonstrates the diversity of emerging technologies and proposed to: evaluate drones in construction; evaluate contact avoidance in robots; expand respirator performance and evaluation studies; evaluate exposures and potential respiratory effects from additive manufacturing of pharmaceuticals; demonstrate new techniques to measure nanomaterials; and conduct preliminary toxicological testing of emerging nanomaterials.

Nanotechnology Research Center scientists attended and spoke at several meetings including the 2nd Quantifying Exposure to Engineered Nanomaterials from Manufactured Products (QEEN II) Workshop; 2018 U.S.-EU: Bridging NanoEHS Research Efforts joint workshop; International Labor Organization (ILO), Global Dialogue Forum on Challenges for Decent and Productive Work arising from Digitalization in the Chemical and Pharmaceutical Industries; Society for Risk Analysis (SRA); the National Science Foundation (NSF) Nanoscale Science and Engineering Grantees Conference; 2019 Indiana Health and Safety Conference; the Materials Research Laboratory at the University of Illinois; and Fostering EU/US Cooperation in nanosafety, Bilat USA. A series of webinars on Additive Manufacturing and Potential Occupational Hazards were presented to the DoE and to America Makes.

Emergency Preparedness and Response Office (EPRO)

Disaster Related Exposure Assessment and Monitoring (DREAM) Course

NIOSH, along with the Agency for Toxic Substances and Disease Registry (ATSDR), is working to implement the Disaster Related Exposure Assessment and Monitoring (DREAM) Course at

the FEMA Center for Domestic Preparedness in Aniston, Alabama. The course will provide training for public health professionals at the local, state, and federal level on NIOSH's Emergency Responder Health Monitoring and Surveillance™ (ERHMS™) framework and ERHMS Info Manager™ and ATSDR's Assessment of Chemical Exposure and Epi Case Assessment Symptom and Exposure tools. We expect FEMA to offer the first 4-day pilot course in fall 2019.

Transmission Mitigation

NIOSH is leading the Transmission Mitigation Workgroup as part of the CDC Anthrax Coordination Unit (ACU). The ACU is a dedicated group formed in the fall of 2018 to coordinate anthrax preparedness activities across the agency. The Transmission Mitigation Workgroup is working to improve coordination with EPA and other federal and state agencies that work with environmental samples across all phases of an anthrax response. In April, NIOSH hosted a meeting with CDC and EPA to identify critical activities where the agencies can focus on increasing preparedness over the next year.

Health Effects Laboratory Division (HELD)

Peracetic Acid

Peracetic acid (PAA) is a disinfectant used in hospitals, the food industry and pharmaceutical manufacturing. It is formed when acetic acid and hydrogen peroxide are mixed and exists in equilibrium with these compounds in the mixture. HELD has designed and built an exposure/plethysmograph system that allows for assessment of sensory irritation (respiratory rate) in unrestrained mice during both exposure and recovery. Studies will be conducted to add additional lower dose points to get a more accurate point of departure to better estimate threshold. The unrestrained animal system will allow for longer exposure times and longer times to monitor recovery back to base line.

National Personal Protective Technology Laboratory (NPPTL)

Reusable Elastomeric Respirators in Health Care

At the request of NPPTL and CDC's National Center for Immunization and Respiratory Diseases, the National Academies of Sciences, Engineering, and Medicine conducted a study on the use of half-facepiece reusable elastomeric respirators in health care. The study report (Reusable Elastomeric Respirators in Health Care: Considerations for Routine and Surge Use)

was published on December 6, 2018 (National Academies of Sciences, Engineering, and Medicine. 2019. Reusable elastomeric respirators in health care: Considerations for routine and surge use. Washington, DC: The National Academies Press. doi: <https://doi.org/10.17226/25275>.) The report focused on economic, policy, and implementation challenges and opportunities. The report provided the following three recommendations: (1) Expand Research to Improve Respiratory Protection, (2) Ensure Robust Respiratory Protection Programs and Training, and (3) Harmonize Standards and Clarify Guidelines and Responsibilities. NPPTL is in the process of developing a strategy to implement these recommendations.

Mine Escape Respirators

Coal mine operators in the United States are required to make self-contained self-rescuer (SCSR) units available to each underground coal miner. No functional assessment of damage can be made prior to actual use since the units are sealed. NIOSH, in cooperation with the Mine Safety and Health Administration (MSHA), conducts an ongoing, long-term field evaluation (LTFE) of SCSR units deployed in underground coal mines to assess their reliability and performance with regard to both physical damage and the effects of aging. The current LTFE sampling strategy involves testing randomly selected SCSRs from all 11 MSHA mining districts to identify a statistically valid sample to improve the significance of test results. The report for sample period of February 2013 to December 2014 was published in March 2019 (“Personal Protective Equipment Conformity Assessment Studies and Evaluations Point-of-Use Assessment for Self-Contained Self-Rescuers Randomly Sampled from Mining Districts: Third Phase”, <https://www.cdc.gov/niosh/npptl/ppcase/pdfs/PPE-CASE-P2019-0101-508.pdf>).

NIOSH is revising its LTFE strategy to target specific mines and smaller samples to expedite disseminating meaningful results to stakeholders. The strategy will focus on mines that have deployed models approved based on oxygen capacity. This will allow NIOSH to compare post-market these devices sampled at the point of use to NIOSH’s pre-market approval requirements and the performance characteristics of post-market capacity- and duration-approved SCSRs sampled at the point of use to explore the impact of deployment location and deployment time on protection.

CBRN Air-Purifying Canisters

NIOSH, Department of Defense (DoD), and the Department of Homeland Security (DHS) recently conducted a CBRN hazard assessment of new/emerging chemical and radiological threats. This was done to ensure NIOSH’s Chemical Families and 11 Test Representative Agents

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(TRAs) selected during the initial 2001 CBRN hazard assessment are still representative of today's CBRN threats. DHS and DoD identified 236 priority chemical threats (190 chemicals, 46 radiologicals, and 14 classified chemicals). A selection process was developed to systematically compare these new/emerging threats to NIOSH's current TRAs used for approval of CBRN canisters. The process included (1) collecting chemical and physical properties for all identified agents, including anticipated filtration behavior in the canister carbon bed, (2) categorizing each agent into NIOSH's current Chemical Families, and (3) identifying agents where empirical testing data is needed to inform its appropriate NIOSH Chemical Family and the need for the agent to replace a current TRA. In summary, no change to NIOSH TRAs, Chemical Families, or to NIOSH's CBRN APR standard is necessary at this time. Of the chemicals/radiologicals evaluated, six were identified as requiring further study. These six chemicals are being tested but are not anticipated to replace a current TRA.

The 19th ISRP International Conference

Recognizing the benefits of a collaborative partnership to improve respiratory health and safety in the workplace, the National Institute for Occupational Safety and Health (NIOSH) and the International Society for Respiratory Protection (ISRP) completed a Memorandum of Understanding in 2017. NPPTL supported the planning and execution of the biennial 19th ISRP International Conference in Denver, CO, September 16-20, 2018. NIOSH Director, Dr. John Howard, delivered the opening Key Note Address, Perspectives on American Innovation.

NPPTL and the NIOSH Personal Protective Technology Core and Specialty Program leveraged the conference to foster platform presentations and discussions on timely issues including: Respiratory Innovations for Healthcare and Emergency Response and Respiratory Protection Use by Wildland Firefighters and Impacted Community Members. In celebration of one hundred years of respiratory protection in the United States, a session explored the Historical Perspectives and Future Possibilities for Respiratory Protection. Other technical sessions focused on innovations in assessing respirator fit, discussions about translating occupational respiratory protection knowledge to public use recommendations, respiratory protection by the Public Safety Sector and international respiratory standards development. NPPTL's Dr. Ziqing Zhuang received the ISRP 2018 Edwin C. Hyatt Award for outstanding scientific contributions in the field of respiratory protection and Dr. Bingbing Wu received the ISRP Americas Section 2018 Arthur Johnson Young Researcher Award. NPPTL ISRP leaders and members are planning to host the next annual technical meeting of the ISRP Americas Section at the NIOSH Pittsburgh Facility on October 30, 2019. The meeting will focus on factors that impact effective use of respirators - e.g. program elements, workplace culture, intuitive design, sensor and other new technologies.

2018 NPPTL/Respirator Manufacturers' Meeting

On October 17, 2018, NPPTL hosted an annual Respirator Manufacturers Meeting at the NIOSH Pittsburgh facility. Topics included Respirator Approval Program Updates and Metrics, an update from the Edgewood Chemical and Biological Center about live agent testing to achieve chemical, biological, radiological and nuclear (CBRN) protections, the combined Food and Drug Administration and NIOSH process for NIOSH approval of N95 filtering facepiece respirators for use in healthcare settings, and regulatory and voluntary consensus standard updates. Based on an Action Plan developed in 2017-2018, manufacturers were also introduced to new approaches for labeling and quality system requirements, and an updated communication strategy, including notices about facial hair and respirator use and implementation of the anthropometric test panel developed by NIOSH/NPPTL researchers. The next meeting is scheduled for October 29, 2019, at the NIOSH Pittsburgh Facility.

Viral Penetration through Protective Clothing

NPPTL researchers' groundbreaking research shows that liquid (visual) and viral penetration occur at nearly the same time in protective clothing. This paper presented a quantitative approach to evaluate a fabrics' resistance to liquid and viral penetration. To our knowledge, it is the first paper to compare the time of liquid penetration to viral penetration. Testing determined that the difference between liquid and viral penetration was 0.29 minutes for this fabric. Further evidence of the 'viral compatibility' between the liquid and viral test for this fabric may allow the manufacturer to substitute an inexpensive quick screening technique for a costly viral test.

Citation: Li M, Furlong JL, Yorio PL, Portnoff L (2019) A new approach to measure the resistance of fabric to liquid and viral penetration. PLoS ONE 14(2):e0211827.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0211827>

100 Years of Respiratory Protection

September 3-6, 2019, NIOSH will celebrate 100 Years of Respiratory Protection approvals in the U.S. with a web-based observance. This is an event to recognize this milestone and utilize it as an opportunity to disseminate a century's worth of experience in preventing disease, injury, and death for the millions of working men and women relying this equipment. NPPTL will work with partner organizations to provide educational materials and resources for stakeholders to emphasize proper respiratory protection practices. Educational materials will be disseminated using social media, the website, webinars, and avenues available through partner participation. The event will occur during Respiratory Protection week, an observance that has expanded out of the established N95 Day event.

Respiratory Health Division (RHD)

Indoor Environmental Quality

NIOSH released The Dampness and Mold Assessment Tool for both general buildings and schools to help employers identify and assess areas of dampness and mold in buildings. These Tools provide an inexpensive mechanism to investigate, record, and compare conditions over time. The tool has been disseminated by the National Safety Council, Association of Occupational and Environmental Clinics, American Industrial Hygiene Association, and the Navy and Marine Corps Public Health Center.

<https://www.cdc.gov/niosh/docs/2019-115/pdfs/2019-115.pdf>

<https://www.cdc.gov/niosh/docs/2019-114/pdfs/2019-114-508.pdf?id=10.26616/NIOSH PUB2019114>

Additive Manufacturing Research

Since 2014, RHD has been actively engaged in Additive Manufacturing (3-D printing) research. Researchers in the Division have been evaluating emissions from various types of 3-D printers in a test chamber and in several workplaces, and collaborating with toxicologists to understand implications of exposure. Laboratory emissions testing studies have identified several factors related to printer design and the feedstock material that influence emission of ultrafine particles and organic vapors. Researchers have visited three workplaces in South Africa and six workplaces in the USA. The workplaces span small businesses using desktop-scale 3-D printers that extrude plastic to multi-national companies that use plastics, metals, and liquid resins to build objects. One company that was visited eight times is engaged in Big Area Additive Manufacturing and owns two of the largest plastic 3-D printers in the world. NIOSH is working with this company to understand ultrafine particle and organic vapor emissions and develop engineering controls (in collaboration with colleagues from NIOSH DART). In collaboration with university and NIOSH colleagues, researchers have generated exposures from 3-D printers using plastics for toxicology studies and demonstrated that brief exposures lead to acute hypertension in rats and cytotoxicity, generation of reactive oxygen species, and apoptosis in lung cells in vitro. Results of these studies have been disseminated in the form of 8 peer-reviewed publications and one NIOSH Health Hazard Evaluation report.

Ultraviolet (UV) Cured-in-Place Pipe (CIPP) Installation

Researchers in the Respiratory Health Division recently completed a health hazard evaluation and described workplace exposures to styrene during ultraviolet (UV) cured-in-place pipe (CIPP) installation. The CIPP process involves inserting a resin-impregnated liner into a length of existing pipe in need of repair and using UV to cure the resin. CIPP is advantageous because excavation of existing pipes in need of repair is not required. The investigation found that UV-cured CIPP liners emit styrene, an IARC-classified probable carcinogen and known respiratory irritant, and identified tasks that could result in increased occupational exposures to styrene. The researchers made recommendations to protect respiratory health by reducing occupational exposures to styrene.

Electronic Health Records

Work has a profound influence on health, both as a fundamental social determinant of health, and as a set of specific challenges and opportunities for prevention and management of illness and injury. This pertains to illnesses and injuries not considered to be caused by work as well as occupational conditions. At the present time, information about work is recorded, if at all, in electronic health records in unstructured ways that preclude effective use of the information at the time of care, in evaluating populations, or for public health purposes.

Health Level Seven International® (HL7) is an ANSI-approved standards development organization (SDO) that generates consensus interoperability standards for formatting and sharing health and healthcare data. HL7 also produces Implementation Guides (IG) and Profiles that are specific to a particular task a health information system is to perform (e.g., sharing a patient record). All IG's and Profiles are built from an interoperability standard.

NIOSH has developed an information model, Occupational Data for Health (ODH) that provides the data elements and associated value sets needed to provide structured (coded) data for collection, management, and use of work information in electronic health record systems. The model includes Employment Status, Present (or Past) Job, Usual Work, Retirement Date, and work in Military Combat Zones.

HL7 published the *Work and Health Functional Profile* of the EHR-System Functional Model in April 2019. A Functional Profile is a set of specific directions for software developers to use, in this case, for the collection, management, and use of Occupational Data for Health (ODH) in electronic health record systems. Vendors use HL7 products to develop software for EHR and

health information systems. A summary of the Work and Health Functional Profile is available at http://www.hl7.org/implement/standards/product_brief.cfm?product_id=49 . The full document will be available for public download on July 10, 2019.

Lung Function Monitoring

The Defense Health Agency (DHA) approved the use of the NIOSH Spirometry Longitudinal Data Analysis (SPIROLA) software on the Navy Network and highly recommended its use for all Navy occupational health clinics. SPIROLA is an integrated visual and quantitative tool intended aid in monitoring and interpreting computerized longitudinal lung function in individuals and groups. It is available to download for free from the NIOSH web site. A web-based platform is currently under development and expected to be posted to the NIOSH web site fall 2019.

<https://www.cdc.gov/niosh/topics/spirometry/spirola-software.html> .

Mesothelioma

As part of response to a Congressional directive to assess the feasibility of a national mesothelioma registry, on March 26, 2019 the Respiratory Health Division partnered to assist the Mesothelioma Applied Research Foundation in holding a symposium on potential approaches to establishing a registry and develop tools for rapid identification of patients and linking them to clinical resources. The symposium was held in Bethesda, MD. NIOSH presented “Malignant Mesothelioma Mortality in the United States—1999-2017.” A Request for Information (RFI) was posted in the federal register on April 8, 2019 and a docket is open for receiving comments until July 8, 2019. Federal Register

Notice: <https://www.cdc.gov/niosh/docket/review/docket327/pdfs/2019-06784-4-8-19.pdf> or see <https://www.regulations.gov/document?D=CDC-2019-0029-0001> .

Silicosis

On May 14, 2019, the NORA Respiratory Health Cross-Sector Council will host a free webinar for employers on controlling worker exposure to silica dust during engineered stone countertop manufacturing, finishing, and installation. Speakers from NIOSH, OSHA, the California Department of Public Health’s Occupational Health Branch, CalOSHA, and the Natural Stone Institute will describe the dangers of silica exposure, employer requirements to comply with OSHA’s Respirable Crystalline Silica Rule, and methods employers can use to protect workers. This webinar was prompted by the identification of one case of silicosis in Washington State, one fatality in California with two additional cases under investigation, and a recent cluster of 12

silicosis cases in Texas (currently under investigation). The first case of silicosis associated with engineered stone in the U.S. was identified in Texas in 2014 and reported in 2015 <https://www.cdc.gov/mmwr/preview/mmwrhtml/mm6405a5.htm>. To date, 17 silicosis cases associated with engineered stone manufacturing, finishing, or installation have been confirmed or are under investigation in the U.S.

In January 2019, “[Silicosis prevalence and incidence among Medicare beneficiaries](#)” was published in the *American Journal of Industrial Medicine* doi: 10.1002/ajim.22944. Epub 2019 Jan 18. This work analyzed health insurance claims from nearly 50 million Medicare beneficiaries aged 65+. The authors found that the highest prevalence of silicosis was found among North American Natives (87.2-213.6 per 100 000) and those in New Mexico (83.9-203.4 per 100 000). This analysis concluded that morbidity data from health insurance claims can provide a more complete picture of silicosis burden. Additional analysis using Medicare claims is currently underway.

Total Worker Health® (TWH)

Opioids Coordination Efforts

By using Total Worker Health® principles, NIOSH is developing solutions to help workers and employers face the opioid epidemic in their communities. Resources are available on a new webpage, <https://www.cdc.gov/niosh/topics/opioids/default.html>, or just google “NIOSH opioids” to find the homepage.

Examples of resources include:

- Using Naloxone to Reverse Overdose (Fact Sheet for Workplaces)
- Medication Assisted Treatment (or Med-Based Tx) Workplace Solutions Document. <https://www.cdc.gov/niosh/docs/wp-solutions/2019-133/default.html>
- Research, data, and surveillance
- Field Studies
- Recommendations for First Responders

Workforce Development

NIOSH is exploring development of a peer-reviewed Journal of TWH and formation of a new professional society for TWH professionals. Currently degree, certificate programs and continuing education are being offered or developed at 10 academic partners.

Total Worker Health Book

- Brings together the state-of-the-science knowledge on integrative prevention strategies that safeguard and ensure the health and well-being of workers.
- Includes contributions from over 60 researchers and practitioners at the forefront of the Total Worker Health[®] field
- Summarizes the seminal theory and research that underpins the case for integrative workplace prevention strategies addressing the interplay of occupational risk factors and risks beyond the workplace
- Discusses applications of organizational approaches for integrated interventions and evidence of their effectiveness in various occupational and industry contexts
- Describes the design of Total Worker Health[®] programs targeting specific health and safety risks of central concern in occupational and public health today, such as chronic diseases, aging, fatigue and sleep, and work-life conflict

TWH Affiliates Program

- Totals 44 with 8 new Affiliates since last summer. Six organizations have been Affiliates since the program's inception in 2014, plus one which became a Center of Excellence (Colorado). We are planning a 3rd meeting of the Affiliates this summer.
- We are exploring the development of international TWH Affiliates given increasing global demand.

Western States Division (WSD)

Oil and Gas

Industrial Hygienists from WSD completed an assessment of potential hydrocarbon gas and vapor exposures to inspectors from the Department of the Interior's Bureau of Safety and Environmental Enforcement (BSEE). BSEE personnel inspect off-shore oil and gas platforms as

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part of their duties in the Gulf of Mexico. Results from the personal air sampling did not reveal personal breathing zone exposures to individual chemicals that exceeded occupational exposure levels. However, high concentrations of gases such as methane emitted during certain valve tests into the area did result in multi-gas meter readings up to 100% of the lower explosive limit, presenting a hazard. Results of the assessment will be used by the Department of the Interior and BSEE for improvements in how they approach health and safety practices for their inspectors.

Center for Maritime Safety and Health Studies

Seafood processors, a vulnerable worker population, are at high risk for injuries and illnesses. NIOSH recently published two epidemiologic studies identifying hazards and elevated injury/illness risks in Alaska's seafood processing industry. These studies involved analyzing injuries reported to the US Coast Guard among offshore seafood processors, and analyzing workers' compensation claims data for the onshore industry. A qualitative study, which involved interviewing managers about their safety and health programs in Alaska, is currently under review for publication. Following presentations on our research at the 5th International Fishing Industry Safety and Health conference (IFISH5), NIOSH researchers contributed to a position paper on bioaerosol exposures among seafood processors. This international collaboration aims to help industry members and other stakeholders translate research to practice.

To engage with stakeholders and share our research findings in the United States, NIOSH researchers have presented at other conferences and workshops. Currently, NIOSH is developing relationships with stakeholders in the Gulf of Mexico and East Coast. NIOSH also plans to expand research to investigate (a) ergonomic risk factors and solutions, (b) fatigue risk management for long shifts (e.g., 12 to 18+ hours per day), and (c) health equity issues affecting the many immigrant workers in this industry, who arrive to the US from across the globe and have non-English primary languages.

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Social Presence Statistics

NIOSH continues to expand its presence on social networks.

Social Media and Public Outreach	April 2018	April 2019
Facebook likes	134,113	138,438
Twitter followers	@NIOSH account: 324,539*	@NIOSH account: 30,6054
Instagram	1,518 followers, 1148 posts	2,720 followers, 1,432 posts
YouTube	212 videos, 57,7749 views	249 videos, 78,8601 views
LinkedIn Members	696	777
Website Views	1,400,657	1,364,954
eNews Subscribers	70,633	75,155
TWH Newsletter Subscribers	77,357	83,152
Research Rounds Newsletter Subscribers	68,093	72,051
Science Blog: Cumulative Total since inception	Total blog entries: 477 Total comments: 7,624 Blog site views: 36,180	Total blog entries: 532 Total comments: 8,286 Blog site views: 33,807

*Twitter deleted all inactive accounts in July 2018

NIOSH Publications

October 2018

[Officer Road Code Toolkit](#)

[Understanding Small Enterprises: Proceedings from the 2017 Conference](#)

[Spirometry Training Program](#)

[Become a NIOSH-Certified B Reader](#)

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[Enhanced Coal Workers' Health Surveillance Program](#)

[Using Naloxone to Reverse Opioid Overdose in the Workplace: Information for Employers and Workers](#)

November 2018

[PPOP: Immune, Infectious and Dermal Disease Prevention Program](#)

[PPOP: Oil and Gas Extraction Program](#)

[Using Total Worker Health® Concepts to Reduce Fatigue among Retail Workers](#)

December 2018

[PPOP: Agriculture, Forestry, and Fishing Program](#)

[Dampness and Mold Assessment Tool – General Buildings](#)

[Dampness and Mold Assessment Tool – School Buildings](#)

January 2019

[Continuing to Protect the Nanotechnology Workforce: NIOSH Nanotechnology Research Plan for 2018 - 2025](#)

[NIOSH Skin Notation Profiles: Sodium Fluoroacetate](#)

[NIOSH Skin Notation Profiles: Pentachlorophenol \(PCP\)](#)

[NIOSH Skin Notation Profiles: Chlorinated Camphere](#)

[NIOSH Skin Notation Profiles: Catechol](#)

[NIOSH Skin Notation Profiles: Atrazine](#)

March 2019

[Illicit Drugs, Including Fentanyl: Preventing Occupational Exposure to Emergency Responders](#)

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April 2019

[Responding to a Suspected Opioid Overdose](#)

[Prevent Construction Falls from Roofs, Ladders, and Scaffolds](#)

[NIOSH Coal Workers' Health Surveillance Program](#)

[Bibliography of Communication and Research Products 2018](#)

Certification Statement

I hereby certify that, to the best of my knowledge and ability, the foregoing minutes of the May 30, 2019, meeting of the NIOSH Board of Scientific Counselors, CDC are accurate and complete.

7/16/19
Date

Terry L. Bunn, Ph.D.
Chair, NIOSH Board of Scientific Counselors