THE UNITED STATES DEPARTMENT OF HEALTH AND HUMAN SERVICES

CENTERS FOR DISEASE CONTROL AND PREVENTION

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH (NIOSH)

MINE SAFETY AND HEALTH RESEARCH ADVISORY COMMITTEE (MSHRAC)

FALL MEETING

NIOSH MINING PROGRAM

BEAVER, WEST VIRGINIA

HYBRID IN-PERSON AND ZOOM, OPEN TO THE PUBLIC

WEDNESDAY, NOVEMBER 15, 2023

Contents

Summary Proceedings

The Fall 2023 meeting of the National Institute for Occupational Safety and Health (NIOSH) Mine Safety and Health Research Advisory Committee (MSHRAC) was convened at the National Mine Health and Safety Academy, Beaver, WV, and via Zoom on Wednesday, November 15, at 8:30 a.m. EST, Kyle Zimmer, Jr., Chair, presiding. The meeting was also open to the public by video teleconference.

Attendees

Members Present In-Person or Via Zoom

Kyle Zimmer, Jr., International Union of Operating Engineers; Chair
Kristina Behringer, M.D.
Ronald Bowersox, United Mine Workers of America
Tom Duffy, United Steelworkers of America
J. Todd Moore, CONSOL Energy
Elizabeth "Libby" Prichard, National Stone, Sand & Gravel Association
Steven Schafrik, University of Kentucky
Matt Stewart, R. T. Vanderbilt Holding Company, Inc.

Ex Officio Members Present

Giovanna Biscontin, National Science Foundation, Ex Officio
Melanie Calhoun, Mine Safety and Health Administration, Ex Officio

Invited Non-Members Present (In-Person or Virtually)

NIOSH Office of the Director (OD)
John Howard, NIOSH Director
George Luxbacher, NIOSH Deputy Associate Director for Mining
Steven Mischler, Designated Federal Official, NIOSH
Pauline Benjamin, NIOSH OD
Robert Randolph, NIOSH OD

NIOSH Spokane Staff
Doug Johns, Director, NIOSH Spokane Mining Research Division Director
Cara Halldin, NIOSH Spokane Mining Research Division Deputy Director

NIOSH Pittsburgh Staff
Steven Sawyer Jr., NIOSH Pittsburgh Mining Research Division Director
Carin Kosmoski, NIOSH Pittsburgh Mining Research Division Deputy Director

Other Invited Guests
Christopher Williamson, Assistant Secretary of Labor, Mine Safety and Health Administration

Members Unable to Attend

Aubrey Miller, National Institutes of Health, Ex Officio

DFO Introductions, Announcements, Roll Call

Dr. Steven Mischler
Senior Research Scientist
National Institute for Occupational Safety and Health
Centers for Disease Control and Prevention

Dr. Mischler, as the Designated Federal Official for the Committee, called to order the open session of the Fall 2023 meeting of NIOSH MSHRAC at 8:31 am Eastern Standard Time (EST) on Wednesday, November 15, at the National Mine Health and Safety Academy, Beaver, WV, and via Zoom. A roll call of all MSHRAC members confirmed that a quorum was present. The roll was also called following each break and lunch to ensure that a quorum was maintained. A quorum was maintained throughout the day.

No conflicts of interest (COIs) were declared. Committee members were instructed that if a COI came up at any time during the meeting, they were to declare that conflict and recuse themselves from any discussion or voting on that matter.

Members of the public on Zoom were notified that they would only be able to listen to the meeting, not comment or ask questions, until the Public Comment period, scheduled at the end of the presentations, although questions could be submitted online via the Zoom chat feature at any time, to be addressed during the Public Comment period.

Dr. Mischler welcomed everyone and briefly reviewed the structure and history of MSHRAC, initially established in 1969. This meeting was the 91st NIOSH meeting of MSHRAC, now in its 53rd year. This was the first meeting held at National Mine Health and Safety Academy, Beaver, WV. Dr. Mischler then introduced himself as the new DFO and thanked Dr. Luxbacher for his work as DFO. He then reviewed the agenda for the meeting and discussed the Mace workgroup.

Chair Remarks, Approval of Minutes

Mr. Zimmer, MSHRAC Chair, welcomed the Committee members. Mr. Zimmer then asked for an approval of the minutes from the prior meeting. Mr. Duffy made the motion, seconded by Mr. Bowersox. The floor was opened for discussion and the motion was then approved. Mr. Zimmer then introduced Dr. Howard for his remarks.

NIOSH Director's Remarks

Dr. John Howard, MD
Director
National Institute for Occupational Safety and Health
Centers for Disease Control and Prevention

Dr. Howard thanked the members of the Committee for their service on MSHRAC and expressed his appreciation to both the Committee and the Mining Program leadership and staff. He also welcomed Christopher Williamson and thanked the Academy for hosting the meeting. He then reviewed the Centers for Disease Control and Prevention's Moving Forward Initiative and the major issues emphasized by the new CDC Director, Dr. Mandy Cohen: (1) fall and winter viral respiratory disease initiative; (2) the issue of improving mental health and combating overdose; and (3) positive childhood experiences and strategies involving various school issues. Dr. Howard then discussed the recently passed continuing resolution and progress on the development of the NIOSH Underground Mine Safety and Health Research Laboratory near Mace, WV. He then concluded by discussing the RAND Corporation report on barriers to the commercialization and adoption of new underground coal mining technologies in the United States.

Chair Zimmer thanked Dr. Howard and asked if there were any questions. Mr. Stewart asked for an update on the search for a replacement for the late Dr. Jessica Kogel, the Associate Director for Mining. Dr. Howard responded by saying that although several very qualified internal candidates showed interest, he was hoping to get some external candidates, and the recruitment strategies had been revised for a second opening in late winter/early spring. Chair Zimmer then thanked Dr. Howard and mentioned the memorial for Dr. Kogel, which occurred at the end of July. Chair Zimmer then introduced Mr. Christopher Williamson and emphasized Christopher's concern for the health and safety of U.S. miners.

Comments from the Assistant Secretary Labor; Mine Safety and Health Administration (MSHA)

Christopher J. Williamson
Assistant Secretary of Labor
Mine Safety and Health Administration
U.S. Department of Labor

Mr. Williamson thanked Chair Zimmer for his introduction and began his remarks discussing the two priority areas capturing MSHA's focus. Mr. Williamson remarked on the troubling increase in fatalities that the mining industry had experienced this year, and he reviewed the statistics on these fatalities. He continued by saying the MSHA has some tools to try to reverse this trend, such as enforcement and improved communication, including safety alerts, but asserted that the largest impact would come with everyone working together. He then discussed the second priority area, of miner health, and specifically the silica rulemaking.

Mr. Williamson continued with a discussion on the Department of Labor blog entitled "Speak Up, Save Lives, MSHA Has Your Back." This communication initiative emphasizes not just miners' rights, but miners' rights and responsibilities, and encourages miners to play an active role in their

health and safety with the reassurance that MSHA will protect them against any discrimination or retaliation. Mr. Williamson concluded by saying that the Agency will continue to complete hiring actions and training to get more inspectors into the field and his excitement about NIOSH's new Mace facility. Finally, he thanked the committee for coming to the Academy and for asking him to be part of the committee discussions.

Chair Zimmer than thanked Mr. Williamson and asked if there were any questions. Dr. Schafrik had a comment on two items. He first mentioned that he thought it was remarkable how many committee members have spent time at the Academy and thanked the Academy. Secondly, he mentioned that MSHA has been much more active in professional conferences and sending out speakers to engage with the mining community and how he thought those actions were very important and helpful. Mr. Bowersox thanked Mr. Williamson for his active engagement and for visiting underground mines regularly. Chair Zimmer then thanked both Dr. Howard and Mr. Williamson and introduced Dr. Luxbacher.

Report from the Deputy Associate Director for Mining

Dr. George Luxbacher
Deputy Associate Director for Mining
National Institute for Occupational Safety and Health
Centers for Disease Control and Prevention

With the Associate Director for Mining vacancy, Dr. Luxbacher presented a brief update on the Mining Program budget, the RAND report, and the SME contract that was a follow up to the RAND report. He started with some general background information on MSHRAC, how that the meetings started in 1970 as a response to the 1969 Federal Coal Mine Health and Safety Act and a breakdown of the 91 meetings occurring between 1970 and the present, as well as the purpose of the committee to advise the Secretary of HHS, Director of CDC, and Director of NIOSH, on mine health and safety research. He then mentioned that the Mining Program had a researcher receive the 2023 Charles C. Shepard Science Award for lifetime achievement and that this is only the third time that NIOSH has won this award since it originated. He then discussed the program budget, noting that last year was the first year since 2007 the program had received a budget increase. He continued with discussing the RAND report, which is an independent look at the barriers to commercialization in the mining industry and summarized some conclusions of the report. Dr. Luxbacher mentioned that SME is continuing this work through a BAA project on eliminating barriers for the implementation of automation in the mining industry and is holding workshops to get information from hard-to-reach industry populations including perspectives from the Iron Range, large open pit operators, excavation and tunnelling operators, and a number of other mining populations. He expressed that hopefully a group from MSHRAC can take part in one of these workshops.

Next, Dr. Luxbacher gave an update on the NIOSH Underground Mine Safety and Health Research Laboratory near Mace, WV, and summarized the Mining Program exhibits for national conferences such as SME and MINExpo, including the ROHMAC Mule and smart cabs. He concluded with a discussion on the possible establishment of a NIOSH Center for Critical Minerals Mining Health and Safety and the importance of critical minerals. At the conclusion of his presentation, Dr. Luxbacher asked if there were any questions. Ms. Calhoun asked about the possibility of NIOSH

and MSHA coordinating recruiting efforts. Dr. Luxbacher replied by agreeing that recruiting and retention is difficult within the federal government and agreed that more discussion would be helpful. Dr. Johns added that NIOSH has hired an outreach coordinator to help with these efforts and cast a broader net and Dr. Sawyer added that there are other federal programs to help with hiring. Ms. Pritchard wondered how NIOSH and MSHA could collaborate with NSSGA on workforce development and Mr. Stewart continued by asking how the general population could be educated to see that mining is a good place to work. Ms. Pritchard replied discussing how NSSGA is starting in middle and high schools, promoting the industry, and changing the narrative. Ms. Calhoun added that MSHA created a recruitment video and Dr. Luxbacher mentioned that the video was very impressive. Dr. Luxbacher noted that the committee could spend some time in future meetings to discuss hiring and retention issues and introduced Christina Spring.

Report from Associate Director, Communications and Research to Practice Office

Christina Spring, M.A.
Associate Director
NIOSH Office of Communication and Research to Practice
Centers for Disease Control and Prevention

Christina Spring, from the NIOSH Office of Communication and Research to Practice, presented on the communication campaign developed for the Healthcare Worker Wellbeing Initiative. She provided an overview of the burden of mental health issues among healthcare workers and the need for addressing this within the workplace setting. She also provided a brief highlight of the NIOSH Miner Health Program. Later in her presentation she provided a deeper look into how the campaign was developed to address the healthcare worker audience. Chair Zimmer thanked Ms. Spring and mentioned his interest in seeing material related to the Toral Worker Health space and asked if there were any questions. Ms. Calhoun asked if there are any peer-to-peer toolkits. Ms. Spring replied that toolkits are available for leaders but there is still a need for more looking to meet additional needs. Chair Zimmer mentioned that the operating engineers have a robust peer-to-peer program that have interacted with the NIOSH Total Worker Health group. Ms. Spring concluded by outlining the timeline for the toolkit launch. Chair Zimmer then introduced Dr. Sawyer.

PMRD Directors Report

Dr. Stephen G. Sawyer, Jr.
Director for Pittsburgh Mining Research Division (PMRD)
National Institute for Occupational Safety and Health
Centers for Disease Control and Prevention

Dr. Sawyer began by thanking Assistant Secretary Williamson for hosting the MSHRAC Committee meeting at the MSHA Mine Health and Safety Academy. Dr. Sawyer continued his presentation recounting his brief history on the number of times he had addressed the committee and what he had learned from the feedback received from those presentations. Dr. Sawyer said he understood the MSHRC Committee liked to see how the projects matured over the course of their tenure. He also mentioned that the committee liked to hear a business case presentation format for

these projects, which encompasses the health and safety issue, how PMRD is addressing that issue through research, and how PMRD plans on implementing those results of that research into the industry. Dr. Sawyer stated that five researchers from PMRD were in attendance and were going to present the business case for their projects that had just began in October of the current year.

Dr. Sawyer then presented the five-year trend of the budget ceiling for PMRD, where it had fallen each year, and the fact that it currently sits at $21.49 million. He followed up these financial numbers with current FTE levels of just under 120 for PMRD. He pointed out that just two years prior this number had been over 150, but due to budgetary constraints, these higher FTE levels could not be sustained. Dr. Sawyer also mentioned that PMRD historically carried 24 to 28 active research projects; however, with the budget constraints, this number was projected to be 17 in fiscal year 2024. Dr. Sawyer then introduced Mr. Paul Schmidt to present on his new project entitled "Information Dissemination during Mine Emergencies."

Mr. Paul Schmidt provided a briefing on the "Information Dissemination during Mine Emergencies" project. He discussed examples of mine emergency response information dissemination concerns, possible improvements, and the project's target audience within the incident response community. Mr. Schmidt outlined the four-year project schedule and deliverables, including an eLearning module that can be worked into various organizations' training curriculums. Mr. Schmidt concluded with an overview of two of the project team's desired outcomes: (1) to get potential response leaders who weren't spending any time training on incident response to start with just an hour or two of training on that topic, and (2) to get these trainees to start to incorporate what they learn by simply asking questions about their mine's incident response. Mr. Kyle Zimmer added a comment that he hoped that this research would be able to help other emergency response services outside of mining and Mr. Schmidt responded that there would be likely crossover points for this work. Mr. Schmidt then introduced Dr. Liming Yuan to present his project.

Dr. Yuan presented a summary on the project entitled "Characterizing the Generation and Mitigation of Hazardous Gases during Lithium-ion Battery Failure Events," discussing how thermal runaway of lithium-ion (Li-ion) batteries can be caused by abnormal conditions such as overcharging, external heating, internal short circuits, and mechanical impact. Dr. Yuan stated that much research has been done in the scientific community to understand the mechanisms of thermal runaway and develop control measures to reduce Li-ion battery fire hazard. For the mining industry, the hazardous gases released during a Li-ion battery failure can be a severe health hazard in the confined space of underground mines. He pointed out that there is little data on gas generation rate and duration. For mining applications, there are no effective mitigation strategies for hazardous gases generated in underground mines. Four major tasks were planned in Dr. Yuan's new project to address those research gaps: (1) Li-ion battery gas emissions at different stages; (2) parameters affecting gas generation during Li-ion battery failure events; (3) understanding and mitigating gas generation hazards; (4) ventilation control modeling to prevent gas spread in underground mines. Dr. Yuan expects the research results from his project to be used by U.S. mines to help develop a proper battery fire emergency management and response plan. The experimental results on hazardous gas generation rates and durations can be helpful in selecting appropriate PPE for mineworkers and first responders. His team will collaborate with mines to develop ventilation control measures for preventing the spread of hazardous gases underground

during a battery fire emergency. The findings from his project will be shared with state and federal mine safety and health regulatory agencies to better assess Li-ion battery safety hazards in mines. Dr. Yuan then turned over the presentation to Ms. Lydia Kocher.

Ms. Kocher presented a summary of her project entitled "Using Exoskeletons to Reduce Overexertion Injures." During the presentation, she described the need for reducing overexertion injuries in the mining industry. Overexertion was the second leading cause of injury in the mining industry from 2017-2021 based on accident type, and these injuries placed a large burden on the industry across all sectors and locations. With appropriate evaluation research and adoption strategies, exoskeleton use could potentially reduce this burden. An exoskeleton is a device worn on the body that assists with physical activity or motion. Ms. Kocher described the use of exoskeletons to reduce overexertion in the context of a two-year project (fiscal year 2024-2025) which evaluates exoskeleton use and user experience during mining tasks that lead to overexertion injuries. She detailed a three-pronged approach for evaluation: formative, empirical, and field. First, miners and researchers will identify mining tasks associated with overexertion injuries. Next, a laboratory examination will quantitatively measure the physical demands of the task with and without wearing an exoskeleton. Lastly, a field evaluation will measure exoskeleton efficacy and acceptance by miners while performing the task. This project is not specific to commodity, task, or exoskeleton but is dependent on areas of concern identified by interested parties and observable risks. It is essential to connect with interested mining partners for this research. Overall, these results can be used by mines to make internal decisions about exoskeleton use and reducing overexertion injuries. Mr. Matt Stewart asked Ms. Kocher if PMRD was looking for volunteers and if there was a geographic limitation for where data would be collected. Ms. Kocher responded that PMRD would be willing to work with any volunteer from any commodity. Following the conclusion of her presentation, Ms. Kocher introduced Ms. Jennica Bellanca.

Ms. Bellanca introduced the project entitled "Evaluation of VR Mine Rescue Training Platform," which is proposed research building on years of developmental work into the virtual reality mine rescue environment. Ms. Bellanca discussed the challenges mine rescue teams faced in training, from limited access to training facilities to limited realism. She stated that VR mine rescue training can help enhance a mine rescue teams readiness by improving the team's procedural, collaborative, and problem-solving skills for an underground response. Ms. Bellanca then presented the three modes of the training environment, which include scenario editor, simulations, and debriefing. She discussed the series of evaluations that will be performed over the life of the new project along with projected timelines. Ms. Bellanca concluded her presentation with several ways that researchers anticipate how this VR environment could be utilized and implemented into industry training and mine rescue preparation. Mr. Bowersox provided a comment that he knows many teams who had the opportunity to experience the VR environment and they all thought it was fantastic. Assistant Secretary Williamson provided a comment that he felt this tool had a lot of applications and was a big fan of it. Mr. Moore made a comment of how his team had a chance to use the VR mine rescue training and they spoke very highly of it. Mr. Moore also mentioned he felt there were a lot more uses for this technology as well. Ms. Prichard commented on how she felt this could be a good tool for workforce development by exposing younger generations to this technology so they could shed the idea that the mining industry is antiquated. Ms. Bellanca then yielded the floor to Mr. Dave Yantek to continue with the presentation.

Mr. Yantek delivered an introduction to a new four-year project entitled "Environmental Susceptibility of Mine Utility Vehicle and Rubber-tired Mantrip Lithium-ion Batteries." He provided information on the motivation for this project including adoption of lithium-ion batteries (LIBs) by mine utility vehicle and rubber-tired manufacturers and concerns with respect to the harsh mining environment's effect on LIBs. Mr. Yantek also briefly discussed LIB thermal runaway and the effects of mechanical shock, vibration, and moisture on LIBs. Next, he provided an overview of the new project. Mr. Yantek discussed the three research areas of the project: field data collection, test procedure development and laboratory testing, and LIB installation method design. He concluded by summarizing interaction with stakeholders and how the project will benefit mine utility vehicle and rubber-tired mantrip manufacturers, battery suppliers, and the mining industry. Mr. Yantek turned the presentation back over to Dr. Sawyer.

Dr. Sawyer thanked the five PMRD researchers for making the trip to the Academy to participate in the presentation. He then continued to highlight several past research projects that had applicable results to the industry. First, Dr. Sawyer mentioned the gas well project and the strong collaborations it had with MSHA, Pennsylvania DEP, and the mining/gas industry. The research yielded engineering considerations that operators could use in MSHA's risk matrix while planning mine development and potential gas well interactions.

Next, Dr. Sawyer highlighted the massive stone mine collapse project that used various technologies, such as LiDAR (Light Detection and Ranging) to help collect data. He mentioned how this project was another collaborative effort between several outside entities, including Pennsylvania DEP, MSHA, and stone mine operators. Dr. Sawyer relayed a story where stone mine operators were changing their development practices and monitoring techniques based directly on the work from this project.

Dr. Sawyer concluded his presentation discussing a third project he wanted to highlight, which was the self-escape research from several years ago. He mentioned how one organization who participated in the research took to heart the results, which indicated that the miners at their operations weren't as knowledgeable or comfortable with self-escape aspects as they had thought. They increased their training program and after several years, a reassessment was made of the miner's competencies, which increased in almost every category. This company then decided to invest in developing a state-of-the-art training facility to continue to address these deficiencies.

Dr. Sawyer then asked if there were any questions. Mr. Matt Stewart asked Dr. Sawyer about the status of EMP (elongate mineral particle) research. Dr. Sawyer stated there were research challenges in continuing that work and Dr. Luxbacher followed up with how EMP research is a very complex subject that has much broader issues. Mr. Todd Moore then made a comment stating that it was his company that was creating the state-of-the-art training facility that was mentioned earlier in the presentation and thanked NIOSH for making him and his company aware of some of the deficiencies their miners had in their confidence in self-escape. Dr. Sawyer thanked the MSHRAC Committee for the opportunity to present to them.

Chair Zimmer then released the committee for a short break.

SMRD Overview

Dr. Doug Johns
Director, Spokane Mining Research Division (SMRD)
National Institute for Occupational Safety and Health
Centers for Disease Control and Prevention

Dr. Johns introduced himself as the Director of the Spokane Mining Research Division, and he expressed appreciation for the work of MSHRAC. He noted that he would leave the majority of his time for SMRD researchers to go into some detail on projects initiated in fiscal year 2024, and he thanked Robert Randolph for putting together the booklet with the slides and project information for MSHRAC members. Dr. Johns provided an overview of the structure of the Division, along with an update on recent changes to the leadership team within SMRD, noting that the Division was undergoing a restructuring of its administrative unit to increase efficiency. Dr. Johns referenced a comment from earlier in the meeting by Dr. Howard regarding an increase in funding through the fiscal year 2023 Omnibus Appropriations bill, and he noted that the intent of this increase was to increase staffing within SMRD to enable an expansion of research to prevent mining-related injury, illness, and death in the western U.S. He described the Division's efforts to fill high-priority vacancies, noting that even given difficulties with recruitment and retention, SMRD has been successful in filling vacancies with high-quality staff over the past four years. Dr. Johns then presented several slides listing current Division projects and turned his time over to Michael McNinch, Brianna Eiter, Casey Stazick, and Jerry Poplin to describe the Division's four new research projects.

Michael McNinch presented the new project entitled "Machine Situation Awareness (MSA)—Framework and Algorithms for Assured Autonomy in Mining." After expressing gratitude to the project's team members, he explained the background for MSA: the past project entitled "Evaluating and Developing Emerging Technologies to Improve Conveyor System Safety" and the past pilot project entitled "Assured Autonomy Supervisory Intervention System Technology (AASIST)" and how these illustrated a need for autonomous machines to take a more active role in ensuring safety. He continued by defining MSA and explaining its basis in human situational awareness. Mr. McNinch outlined the project's approach to delivering a standardized framework for industry that includes the MSA architecture, hardware requirements, and supporting methods. He presented a high-level chart of MSA's functions and illustrated the preliminary lab work, which included skeletonization and sensor testing. Mr. McNinch concluded by outlining outputs and the first year's tasks, which will include evaluation of equipment processes, detailing of safety requirements, algorithm testing, and supporting data collection.

Dr. Eiter introduced herself as the Team Lead for the Health, Surveillance, Assessment, and Intervention (HSAI) Team that is housed within the Miner Health Branch of SMRD. She is also the PI for the pilot project entitled "Exploring Integrated Approaches for Mineworker Well-being," which is scheduled to run from October 1, 2023 through March 31, 2025. Max Barham, Tim Bauerle, Zoe Dugdale, and Carol Nixon are researchers on the pilot project. Dr. Eiter provided a brief overview of the current understanding of traditionally investigated mining hazards and occupational exposures and acknowledged that a complete understanding of mine worker health and well-being is still not known. Dr. Eiter discussed previous HSAI team research (e.g., fatigue,

opioid use and misuse, and hazard recognition) focused on concepts individually and indicated that the objective of the current pilot project is to develop a testable integrated research model to address associated mine worker health topics related to the physical environment, work organization, and psychosocial environment at a systems level. Thus, the aim of this pilot project is to more broadly examine concepts such as fatigue, substance use and misuse, mental health, risk mitigation, well-being, and health hazard recognition and relationships among these concepts to understand how these concepts intersect. Dr. Eiter concluded that this pilot project will integrate concepts and methods for reducing psychosocial risk factors of work and improving mine worker health and well-being, and it will also establish a coalition of mining companies and mine sites through partnerships and MOUs (memorandums of understanding) to carry out the work.

Casey Stazick introduced herself as the co-PI of the project entitled "Developing a Framework to Identify and Address Hazards Unique to Women in Mining." Ms. Stazick stated that this is a new project that emerged from the diversity, equity, and inclusion committee at SMRD, and that it had recently been awarded funding through the NIOSH CORE Health and Equity Science and Solutions Strategy competition. She explained that this project is composed of a cross-functional team that includes staff from both the Miner Safety and Health branches at SMRD as well as researchers from PMRD. Ms. Stazick then provided an overview of the current number of women in the mining industry and outlined that most mining research and equipment has been centered around the experience of male workers. She described the current issues the industry is facing with retirements and the need for new and more diverse ideas to address newer and more complex mining problems. She summarized issues that have been expressed in the industry affecting and limiting the number of women and related this back to the two specific aims of this project. This includes an aim to develop a framework for mine operators and health and safety professionals that can be used as a resource for them to design and redesign work systems to equitably address needs of their diverse workers. The other aim relates to taking existing NIOSH safety messages and expanding them to be more inclusive of women and people of various body types and taking this process and expanding that to new infographics. She finished by sharing the article SMRD researchers published in the Journal of Women's Health called "Occupational Safety and Health of Women in Mining," and that it was also condensed into a NIOSH blog. She stated that people can reach out to her or Brianna Eiter with any questions.

Dr. Poplin began his presentation indicating that he would cover the last two topics of the session first on the continuing research efforts focused on better understanding the health of mine workers by multiple analytical methods. In addition, Dr. Poplin would lead a discussion on distinguishing survey and surveillance research, in general, highlighting select data surveillance efforts that have been undertaken by the NIOSH Mining Program. To begin, Dr. Poplin presented a new research project led by Ms. Tashina Robinson, an epidemiologist with SMRD. This project is an evolution of a completed and successful five-year research project, led by Dr. Aaron Sussell, that helped establish an analytical framework for assessing the viability of data sources that can assess various aspects of worker health outcomes, behavior, and exposure to hazards. Ms. Robinson proposed three new research aims that will begin to systematize analytical methods for select data sources, continue to evaluate new and ongoing data for continued relevance in describing mine worker health, and introduce new data visualization strategies that will improve the Mining Program's ability to communicate this highly technical research in a more accessible manner. With input

from Dr. Sussell and PMRD's epidemiologist, John Heberger, Dr. Poplin then introduced a general discussion comparing and contrasting health surveillance strategies to complex survey designs methods and analyses, including their limitations. Dr. Poplin highlighted select examples of surveillance and survey design that NIOSH has led related to the injury and fatalities, coal worker respiratory health, demographics, etc. With these ongoing efforts and the health-related surveillance previous discussed, Dr. Poplin emphasized the need for coordination and systematic approaches to any surveillance system in order to evaluate efficacy and ensure reliable interpretation of data analyses. Dr. Poplin responded to a question on results from a 2018 demographics survey and contributed to a group discussion about potential future surveys.

Extramural Research Overview

Dr. George Luxbacher
Deputy Associate Director for Mining
National Institute for Occupational Safety and Health
Centers for Disease Control and Prevention

Dr. Luxbacher started his presentation with a summary of the three major grants funded by NIOSH: "Western Mining Safety and Health Training," "Underground Mine Evacuation Technologies and Human Factors Research," and "Robotic and Intelligent Mining Technology and Workplace Safety Research." He continued by saying that NIOSH has executed 151 contracts since the MINER Act of 2006 and received proposals from 210 companies and 40 universities. He gave details on specific contracts executed in fiscal year 2023, breaking them down into categories of automation and emerging technologies, geotechnical, mine rescue, and respirable dust. Dr. Luxbacher discussed Broad Agency Announcements and the work they support on PAPRs (powered air-purifying respirators), infrared technologies, and nanosheet technologies for silica measurement. He concluded by summarizing the success of the Mining Program's capacity-building contracts and provided an extended discussion on breathing air supply systems and different contracts and collaborators supporting this work. Mr. Moore mentioned that a big issue with breathing air supplies is communication, and Dr. Schafrik and Mr. Bowersox added to this discussion concerning the ability to text using the current breathing air supply technology. Dr. Luxbacher ended by asking the committee to think about how NIOSH research should move forward on this topic. Chair Zimmer than asked Dr. Schafrik for an update on the Mace workgroup.

Update on the NIOSH Underground Mine Safety and Health Research Laboratory near Mace, WV, subcommittee meeting

Dr. Steven Schafrik
Associate Professor, Mining Engineering
University of Kentucky

Dr. Schafrik gave a brief overview of the Mace subcommittee meeting on November 14, 2023. He thanked all of subcommittee members and the presenters for their input. He discussed the completion of a detailed list of references and a report outline. He concluded by saying that the subcommittee will continue to work on this report over the next few months and hope to circulate it

to the entire subcommittee in January. At this point the meeting entered the Public Comment period.

Public Comment Period

Chair Zimmer asked if any member of the public attending via Zoom wished to address the Committee; there were no such requests, and the Public Comment period was closed.

Spring Meeting Planning

Dr. George Luxbacher
Deputy Associate Director for Mining
National Institute for Occupational Safety and Health
Centers for Disease Control and Prevention

The Committee discussed the dates, location, and format for the next meeting. It was decided that potential dates would be circulated for input. The meeting will include time for a report from the Mace subcommittee as well as a Mining Program update. The National Mine Health and Safety Approval and Certification Center in Tridelphia, WV, was suggested for the site of that meeting.

Committee Discussion

At the conclusion of the planning for the spring meeting, the Committee discussed the format of the MSHRAC meetings and decided to continue to have program updates from the directors of the Pittsburgh and Spokane Mining Research Divisions. They also agreed to send emails on future topics of interest. Dr. Luxbacher asked if the committee finds project summaries in the briefing books to be valuable and the committee members unanimously agreed that they do. The committee then discussed holding an SME meeting on barriers to implementation of technology in the mining industry. Chair Zimmer noted that labor has yet to be included in these discussions, and Dr. Luxbacher mentioned that input from MSHA would also be valuable, so the committee agreed to include an SME workshop during the Spring meeting.

Adjourn

At the conclusion of the meeting, a motion was made to adjourn, was seconded, and was unanimously approved.

Appendix A: Attendees

Name	Affiliation
Amanda Azman	NIOSH-PMRD
Denise Baker	NIOSH-PMRD
Timothy Beck	NIOSH-PMRD
Jennica Bellanca	NIOSH-PMRD
Pauline Benjamin	NIOSH-OD
Ron Bowersox	UMWA – Committee Member
Andrea Brickey	South Dakota Mines – Committee Member
Kendra Broadwater	NIOSH-SMRD
Aleksander Bugarski	NIOSH-PMRD
Melanie Calhoun	MSHA – Ex Officio Member
Linda Chasko	NIOSH-PMRD
Thomas Dubaniewicz	NIOSH-PMRD
Tom Duffy	United Steelworkers of America
Zoe Dugdale	NIOSH-SMRD
Kelley Durst	NIOSH-OD
Brianna Eiter	NIOSH-SMRD
Kelsey Flowers	MSHA
Matthew Girman	NIOSH-PMRD
Kristen Glovier	NIOSH-PMRD
Sydonia Grogan	MSHA
Marcia Harris	NIOSH-PMRD
John Heberger	NIOSH-PMRD
Cassandra Hoebbel	NIOSH-PMRD
John Howard	NIOSH-OD
Ronald Jacksha	NIOSH-SMRD
Doug Johns	NIOSH-SMRD
Lydia Kocher	NIOSH-PMRD
Carin Kosmoski	NIOSH-PMRD
Scott Laney	NIOSH-RHD
Mark Larson	NIOSH-SMRD
Heather Lawson	NIOSH-PMRD
George Luxbacher	NIOSH-OD Mining
Alyssa Lypson	NIOSH-PMRD
Launa Mallett	NIOSH-PMRD
Jacek Mazurek	NIOSH-RHD
Mark Mazzella	NIOSH-PMRD
Michael McNinch	NIOSH-SMRD
M. Berni Metzger	NIOSH-OD Mining
Hugh Miller	Colorado School of Mines
Khaled Mohamed	NIOSH-PMRD
Todd Moore	CONSOL Energy – Committee Member Pending
Michael Murphy	NIOSH-PMRD
Carol Nixon	NIOSH-SMRD

Name	Affiliation
Timothy Orr	NIOSH-PMRD
Eranda Perera	NIOSH-PMRD
Gerald Poplin	NIOSH-SMRD
Elizabeth Pritchard	NSSGA – Committee Member
Vaibhav Raj	NIOSH-SMRD
Robert Randolph	NIOSH-OD Mining
Miguel Reyes	NIOSH-PMRD
Laura Reynolds	NIOSH-RHD
Stephen Sawyer	NIOSH-PMRD
Samir Sbai	NIOSH-SMRD
Steven Schafrik	University of Kentucky – Committee Member
Steve Schatzel	NIOSH-PMRD
Paul Schmidt	NIOSH-PMRD
Brent Slaker	NIOSH-PMRD
Christina Spring	NIOSH-OD
Justin Srednicki	NIOSH-PMRD
Casey Stazick	NIOSH-SMRD
Matthew Steward	R.T. Vanderbilt – Committee Member
Aaron Sussell	NIOSH-SMRD
Wei Tang	NIOSH-PMRD
Jack Trackemas	NIOSH-PMRD
Jeffrey Welsh	Public – Retired, NIOSH
Christopher Williamson	MSHA
Dana Willmer	NIOSH-PMRD
Samantha Wilson	NIOSH-SMRD
Yuting Xue	NIOSH-PMRD
Dave Yantek	NIOSH-PMRD
Liming Yuan	NIOSH-PMRD
Alan Zhang	NIOSH-PMRD
Chenming Zhou	NIOSH-PMRD
Kyle Zimmer	IUOE – Committee Member (Chair)

I hereby certify that, to the best of my knowledge, the minutes of the November 15, 2023 meeting of the Mine Safety and Health Research Advisory Committee (MSHRAC) are accurate and complete.

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Chair, Mine Safety and Health Research
Advisory Committee