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

Lexington, Kentucky
Thursday, November 7, 2024

Hybrid in-person and via videoconference, open to the public

Contents

Summary Proceedings

The Fall 2024 meeting of the National Institute for Occupational Safety and Health (NIOSH) Mine Safety and Health Research Advisory Committee (MSHRAC) was convened at the University of Kentucky, Lexington, Kentucky, and via videoconference, on Thursday, November 7, at 8:30 a.m. EST, Steven Mischler, Chair, presiding. The meeting was also open to the public by video teleconference. A list of MSHRAC members and non-members who participated in presentations or were invited and attended is below, and a list of all attendees is provided in Appendix A.

Members Present In-Person or Virtually

Kristina Behringer, MD, Cheyenne Physician Group

Andrea Brickey, South Dakota School of Mines

Thomas Duffy, United Steelworkers of America (USW)

Marifran Mattson, Brian Lamb School of Communication, Purdue University

Steven Mischler, NIOSH Designated Federal Official (DFO) and Chair

J. Todd Moore, CONSOL Energy

Elizabeth "Libby" Pritchard, National Stone, Sand & Gravel Association (NSSGA)

Steven Schafrik, University of Kentucky

Matthew Stewart, R.T. Vanderbilt Holding Company, Inc.

Ex Officio Members Present (In-Person or Virtually)

Giovanna Biscontin, National Science Foundation (NSF)

Melanie Calhoun, Mine Safety and Health Administration (MSHA)

Danielle Carlin, National Institute of Environmental Health and Sciences, National Institutes of Health (NIH)

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

Barbara Arnold, Chair and Professor of Practice, Mining Engineering, Penn State University

Pauline Benjamin, Committee Management Specialist, NIOSH

Rick Honaker, Professor and Char of Mining Engineering, University of Kentucky

John Howard, NIOSH Director, NIOSH

Pramod Kulkarni, Health Effects Laboratory Division (HELD), NIOSH

Shimin Liu, Professor of Mining Engineering, Penn State University

George Luxbacher, Deputy Associate Director for Mining, NIOSH

Lei Pan, Associate Professor, Michigan Technological University

Sam Petsonk, Attorney, Petsonk PLLC

Robert Randolph, Mining Program Shared Services Director, NIOSH

Wayne Sanderson, Director, University of Kentucky Central Appalachian Regional Education and Research Center (ERC)

Joseph Sottile, Professor, Department of Mining Engineering, University of Kentucky

Christopher Williamson, Assistant Secretary of Labor, MSHA

Siyang Zheng, Professor, Biomedical Engineering and Electrical & Computer Engineering, Carnegie Mellon University

NIOSH Spokane Mining Research Division (SMRD) Staff

Cara Halldin, SMRD Deputy Director

Douglas Johns, SMRD Director

Matt Karwowski, SMRD Miner Health Branch Chief

NIOSH Pittsburgh Mining Research Division (PMRD) Staff

Teresa Barone, General Engineer

Marcia Harris, General Engineer

Zoheir Khademian, Senior Service Fellow

Carin Kosmoski, PMRD Deputy Director

Justin Patts, Mechanical Engineer

Stephen Sawyer, Jr., PMRD Director

Jim Zhou, General Engineer

DFO Introductions, Announcements, Roll Call

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

Chair Mischler, as the DFO for the Committee, called to order the open session of the Fall 2024 meeting of NIOSH MSHRAC at 8:37 am Eastern Standard Time (EST) on Thursday, November 7, at the University of Kentucky in Lexington, Kentucky, and via virtual videoconference. A roll call of all MSHRAC members confirmed that a quorum was present. The roll was also called following each break and lunch, ensuring that 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 videoconference 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 videoconference platform 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 93rd NIOSH meeting of MSHRAC, now in its 54th year. This was the first meeting held at the University of Kentucky. Dr. Mischler thanked Steven Schafrik and the University for hosting the meeting and Alliance Coal for providing the committee a tour of the Riverview mine the previous day. He then reviewed the agenda for the meeting.

Chair Remarks, Approval of Minutes

Dr. Mischler announced that he was serving as Chair for this meeting only, pending approval of a nomination for an incoming Chair. He also announced new members, Dr. Brickey and Dr. Mattson, and noted that Robert Randolph of NIOSH would be taking over as DFO in 2025.

Dr. Mischler then asked for an approval of the minutes from the prior meeting. Mr. Duffy made the motion, seconded by Ms. Calhoun. The floor was opened for discussion and the motion was then approved. Dr. Mischler 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 committee for the opportunity to address them and congratulated the new members. He also thanked the committee for its patience with the lengthy nomination process.

He gave a brief overview of the expected process for the upcoming administration change with the incoming President of the United States. He said that NIOSH was busily preparing transition documents and anticipated important engagements with the new administration's transition team. He stressed that this was an opportunity for NIOSH and the Mining Program to show the value they bring to the nation.

Dr. Howard reviewed the likely leadership changes during the change in administration. He stated that the CDC Director position would likely take extended period to be in place since the HHS Secretary position would probably be addressed first and both involved Senate confirmation. In contrast, Dr. Howard noted, his position as NIOSH Director was a term appointment through 2026.

Dr. Howard then reviewed the current budget status. NIOSH, along with the rest of the federal government, was under a continuing resolution through December 20, 2024, which would need to either be extended or replaced with an approved full-year fiscal year 2025 budget. Despite these uncertainties, he noted that NIOSH and the Mining Program were soldiering on and continuing their valuable work.

Dr. Howard then praised the opioid resource guide recently completed as a collaboration between MSHA and Mining Program staff in Spokane. This guide was launched at a ceremony in Pittsburgh featuring acting Secretary of Labor Julie Su and Assistant Secretary of Labor Christopher Williamson. He thanked Mr. Williamson for his strategic foresight in bringing the agencies together to produce the guide and noted that NIOSH stood ready to assist MSHA whenever it can. Dr. Howard asked the Committee to help evaluate the guide and to contact Spokane staff Douglas Johns, Carol Nixon, or Jerry Poplin if willing to do so.

Dr. Howard finished with an update on the status of the Associate Director for Mining (ADM) position that had been vacant since December 2022. He stated that a candidate had been selected and was undergoing final review and evaluation by CDC, pending a final offer. He expressed optimism that these processes would be completed successfully soon and that the position would be filled before the Committee's next meeting.

In the discussion period after Dr. Howard's remarks, Member Stewart asked whether the administration change would slow approval of the ADM position. Dr. Howard responded that the CDC evaluation committee would be meeting to decide before January 20, 2025, which would provide plenty of time for a decision and an offer before the transition.

Member Schafrik asked whether there was an intention for future MSHRAC meetings to be conducted fully online, as other recent CDC Federal advisory committee meetings had been. Dr. Howard stated that the meeting format was entirely at the discretion of the Committee Chair, the DFO, and the members and that he had no role in the decision. Offering further context, Dr. Luxbacher stated that the Committee briefly went to virtual-only meetings during COVID, but the Committee had later expressed a strong preference for in-person meetings along with field visits. This was followed by general discussion that the Committee still preferred in-person meetings and would not be in favor of changing to online-only.

Comments from the Assistant Secretary of Labor, MSHA

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

Mr. Williamson opened expressing appreciation for Dr. Howard's remarks and for the opportunity to be with him and other NIOSH staff at the recent event in Pittsburgh where the opioid resource guide was launched. He also expressed appreciation for the NIOSH and MSHA collaborators who put together the guide and the event as a demonstration of how effective the agencies can be when they work together.

Mr. Williamson took the opportunity to recap his two-and-a-half-year tenure as a political appointee leading MSHA, which would come to a close with the new administration. He saw his participation in the Committee's meetings as one of the highlights of his tenure. Another highlight was the silica rule and other new protections for miners, and he noted with approval that several presentations on the agenda would be addressing the silica issue.

Mr. Williamson also reviewed the latest mining fatality tallies, which had reached 26 as of the meeting date. While the number was far below 2023's tally through July, several fatalities during August and September closed the gap. Still, the tally remained at nine fewer than at the same point in 2023, giving him hope that it would stay at 26 or rise no higher than 30 by year's end, compared to 40 in all of 2023. He noted that he viewed the lower fatality rate as positive progress and the result of hard work by many that he hoped would continue.

Mr. Williamson brought up polyurethane foam as a cause of mine fires as a potential topic of future investigations by the Committee and its represented organizations. He noted that this had been a topic of interest to him due to its involvement in studying the cause of fires and that there was limited knowledge about whether the polyurethane foam product itself, its application, or how it was used was contributing to the problem. He closed by saying that he planned to continue ongoing work for the remainder of his tenure and felt that MSHA's representation was in good hands with Member Calhoun.

A question period for Mr. Williamson was opened by Member Moore who thanked Mr. Williamson for his hard work and asked about a "silica-type" personal dust monitor or some other device that would offer silica exposure measurements quickly. Mr. Williamson agreed that such a device would be extremely beneficial and that he was aware of significant related technical advances occurring at NIOSH laboratories. Dr. Luxbacher added that the continuous personal dust monitor (CPDM) for coal dust took 30 years to develop and that a similar device for silica might also take many years. Accordingly, NIOSH began extramural funding in 2017 and at least a 10-year development horizon was soon evident. He said that some of the challenges and potential solutions encountered so far would be covered in the presentations occurring later on the agenda.

Continuing his comments, Dr. Luxbacher noted that NIOSH had released a useful rapid quartz analysis system called FAST (Field Analysis of Silica Tool), which offers feedback on exposure

for a full shift, representing a significant step forward in relation to monitoring worker exposure to hazardous respirable crystalline silica. He said that NIOSH would continue pursuing the funding and technology for a more immediate feedback system that could change behavior to the extent that the CPDM did for coal dust.

Member Moore continued the discussion, stating that a real-time silica monitor should receive adequate support and priority, to which Dr. Luxbacher agreed and stated that NIOSH had made it a top priority for MINER Act funding.

The question period continued with Member Schafrik stating that MSHA's ambassador program had been a positive venue for future mining engineers and professionals to become acquainted with MSHA and its experts, to which Member Brickey expressed agreement. Then Member Stewart asked about rollout of the silica rule, to which Mr. Williamson explained that the first step was to prepare training materials for the MSHA inspectors and make them public. The next phase would involve inspector training, followed by a district-by-district implementation.

Comments from the Deputy Associate Director for Mining, NIOSH

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

In the absence of an ADM, Dr. Luxbacher provided brief comments about issues that he deemed worthy of the MSHRAC committee's consideration. These issues included the relationship between NIOSH ERCs and NIOSH Mining and the vital role of representation by MSHA within MSHRAC.

Dr. Luxbacher also summarized topics for upcoming presentations during the session and the rationale behind them, including discussions on respirable dust and dust from nanoparticles. He stressed the deleterious health effects of nanoparticles in the mining environment, noting that a representative from HELD was included as part of the meeting discussion for that reason to outline HELD's role in researching the effects of silica exposure.

Following up on comments by Mr. Williamson about fatalities and fatality rates, Dr. Luxbacher mentioned that he had two upcoming presentations—one to a group of federal agencies and the other as part of the American Exploration & Mining Association annual meeting—during which he would highlight innovations in mining. He noted that one of the most important slides of his presentations would show mining fatality rates in comparison to the Bureau of Labor Statistics General Industry Rate for fatalities, with mining still being over four times higher.

Next, Dr. Luxbacher turned to administrative matters, noting that the MSHRAC Spring meeting in 2025 would have a full forum, with terms for appointed committee members being extended for 180 days. After that Spring meeting, he commented, it might be timely to talk about a reduced committee with three ex officio and three or four appointed members, which might warrant an online rather than in-person meeting. He continued by proposing that future meetings

might also include contractors who could talk about their successes and the challenges and benefits of potential federal funding, including that earmarked for the Desert Research Institute.

Remarks from the Director, University of Kentucky Central Appalachian Regional ERC

Dr. Wayne Sanderson
Professor
College of Agriculture, Food, and the Environment
University of Kentucky

Dr. Sanderson opened his remarks by apologizing that he could not attend the meeting in person and thanking MSHRAC for the opportunity to talk about ERCs, with the ERC at the University of Kentucky dating back to 2012 and including a mining safety and health program. He cited the ERC's regional focus on the five states of the central Appalachian region but stressed that its work encompassed a much broader scale beyond those states. He also stressed that the University of Kentucky ERC was very interdisciplinary-varied, with seven corps along with support from the University's College of Education, which offered a continuing education program. Citing the opioid resource guide mentioned in previous remarks during the meeting, he noted that the ERC had been heavily involved in providing a wide variety of industries with resources to help them deal with this national epidemic.

Dr. Sanderson reported that the ERC had included 200 trainees since its inception, with over 120 of those having since graduated. He noted that he espoused a strong focus on training and that he had worked with NIOSH for 24 years, which ingrained in him an attitude of always striving for better results, total quality management, and constant program evaluation. He also stressed that in working with industries that hired University of Kentucky graduates and through contacts with alumni, he came to understand how teamwork and cross-disciplinary knowledge were very important to success.

Dr. Sanderson continued by describing the University of Kentucky's occupational athletic training program, citing a connection with Toyota Manufacturing which had a large plant in Georgetown just a few miles from campus where students from various disciplines worked as interns. As part of this work, students working on an assembly line learned skills ranging from determining how to work with others effectively to understanding how to recognize early symptoms of problems that could lead to serious injuries if a worker was not pulled from the assembly line when risks were evident. He noted that the ERC had also developed programs to include students actively engaging with members of law enforcement, firefighters, and the military.

In his remarks, Dr. Sanderson stressed the field work component for his students, showing photos of students visiting the Riverview Mine, not far from Henderson, Kentucky, with annual visits there except for 2020 and 2021 during COVID. During these visits, students stood next to miners as they installed roof bolts, operated the continuous mining machine, hauled coal, and transported it to the prep plant, learning about a wide variety of measures to ensure that health and safety hazards were controlled. He noted that, given the commodities of the central

Appalachian region, ERC students also visited with workers in logging and at bourbon distilleries to gain first-hand experience about measures to avoid injuries in these higher-risk occupations.

Dr. Sanderson moved on to remarks about a research study funded by the National Institute of Environmental Health Sciences (NIEHS), which investigated whether living near a coal mine may increase one's risk for particulate exposures and risk for respiratory disease. The NIEHS study was conducted in eastern Kentucky where people tend to live in mining towns, often in small valleys or "hollows", near both surface and underground mines. The study did not find an association with health problems for those living near a mine, per se, but did note that small roadway exhaust particles were entering the homes of residents, impacting the indoor environment. Beyond the association of exhaust particles with roadways, the study findings also determined a potential link between these particles and increased risk of chronic diseases.

Next, Dr. Sanderson further emphasized regional partnerships in the Southeastern U.S., with a strong relationship between ERC and those universities with a health and safety program, with ERC providing continuing education, support for symposiums and conferences, and pilot grant funding. He noted that these activities had also led to ERC becoming a national leader in vector-borne diseases, with links established between such things as tick bites with those who work in the logging and farming industries, representing an occupational risk factor that he deemed worthy of continued study.

In concluding his remarks, Dr. Sanderson noted that the subsequent speaker and colleague, Dr. Sottile, would discuss mining students in more detail, but that he wanted to close by emphasizing the administration of an annual survey of employers who hired University of Kentucky students, with the results indicating that employers wanted students to receive more training on how to be good communicators with both workers and managers.

Remarks from Professor of Mining Engineering, University of Kentucky Central Appalachian Regional ERC

Dr. Joseph Sottile
Professor
Department of Mining Engineering
University of Kentucky

Dr. Sottile framed his opening remarks in relation to the ERC mining health and safety corps, stressing the objective of giving ERC graduates a thorough education in mine health and safety that could be applied to ventilation, dust control, explosives and blasting, and electrical system safety. He noted that emerging areas such as autonomous mining were also available for study. Dr. Sotille reiterated his colleague Dr. Sanderson's earlier remarks during the meeting that a multidisciplinary approach was key to the program's success, with students therefore studying in areas outside of the Department of Mining Engineering.

Dr. Sottile continued by saying that the ERC program was typically able to pair students up with funded projects on relevant research topics and that many students gained practical experience through mining-specific internships. In addition, the ERC budget allowed for students to travel to

2-3 conferences per year to present their research findings and network with other presenters. He highlighted a recent trainee project involving methane ignition blast suppression methods—an active suppression method where the ignition was detected and the suppressant was released to mitigate the ignition from propagating. He summarized work by a PhD student predicting fracture extension around a borehole to determine the radius of the blast damage, work by a student to develop an application for a novel ventilation simplification algorithm that could be applied to ventilation network analysis software, and work by a student who developed an approach for predicting airflow characteristics at the continuous miner phase. The airflow project involved particle imaging velocimetry and the student was able to take some measurements at the experimental mine in nearby Georgetown, Kentucky.

Dr. Sottile also discussed other student projects on subjects including strain energy analysis related to strata failure in caving operations, rock mechanics work on a lab-based numerical investigation of strength in irregularly shaped pillars, an autonomous mining experiment with the goal of having a coal mine shuttle car dock with the continuous miner, and development of an in-mine underground collision avoidance information system.

Dr. Sottile's final remarks extended to achievements by several students who had graduated in recent years. Liz Gaunce had been promoted to Health and Safety Coordinator for the U.S. offices of the Aldea consulting firm. Caitlin Strong and Caroline Gerwig worked at MSHA as a mine safety and health specialist and in the roof control division, respectively. Lastly, John Meuth had worked as an explosives safety engineer at one of the National Centers for Explosives Training and Research at the Bureau of Alcohol, Tobacco, Firearms and Explosives.

Chair Mischler invited follow-up questions for Drs. Sanderson and Sottile. Member Stewart asked about the difficulty of attracting students to the ERC program, which Dr. Sottile noted was a challenge, especially regarding students from outside of mining, and Member Schafrik commented that students with the right aptitude for the program were sometimes recruited individually. Member Calhoun asked what the MSHRAC group could do to help with recruitment efforts, to which Dr. Sottile replied that supporting areas of interest to students, such as autonomous mining, was key.

Dr. Luxbacher pointed out that the research areas being discussed were being funded, including the active ignition suppression technology, and that from an accreditation standpoint, it was important that mining engineering programs such as that offered at the University of Kentucky had health and safety criteria written into the program, which could also affect recruitment.

PMRD Director's Report

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

Dr. Sawyer began his remarks by thanking MSHRAC for the opportunity to present and by thanking Member Schafrik and the University of Kentucky for hosting the meeting as well as a tour of the Riverside mine the previous day, which had followed a tour of CONSOL's longwall

mine at the May meeting, allowing participants to gain a perspective of two different mining techniques that both involved large volumes of coal extraction. He summarized that the CONSOL facility extracted the coal using longwall mining methods, then brought it to the surface and put it on a railcar, while the Riverside mine used room-and-pillar multiple-level mining, then transported the coal over a land conveyor to a barge. Dr. Swayer noted how these two different techniques, both extracting the same material, shared important and illuminating commonalities that transferred across all mining sectors.

Dr. Sawyer continued by saying that numerous researchers from PMRD had accompanied him on the long trip from Pittsburgh to help describe new startup research projects as part of this MSHRAC meeting, with plans for updates on those projects at future meetings. He shared a chart representing funding constraints along with a profile of employment trends at PMRD, pointing out that more stability was emerging at PMRD than he had described in previous meetings in relation to staff turnover. He noted that his view was that PMRD was in a stable position in relation to new projects and strategic planning that aligned with the needs of the mining industry.

Next, Dr. Sawyer turned over the presentation to Zoheir Khademian, the principal investigator (PI) for a new startup project, to discuss seismic forecasting. Dr. Khademian began by presenting a graphic to show how a seismic event, also known as an earthquake, affected an area of an underground coal mine just a few feet from a pillar right next to an entry. He stressed that these kinds of events could affect an underground area as close as a few feet from mine workers, with potentially fatal results. Therefore, he continued, coal mines needed a practical way to forecast these possibilities so that the mining engineers could develop mitigation techniques.

Dr. Khademian described a pilot project at PMRD from the previous year to develop a methodology to forecast seismic events, with that methodology applied to a mine in Virginia. Researchers modeled the surface of the mine as well as deep beneath the surface to develop a seismic potential map, which he described as being basically a heat map with certain colors showing higher potential for an earthquake underground. Based on an event that occurred at the mine in 2016, he demonstrated how the map might have been used to help forecast that event.

Dr. Khademian continued by describing the goals of the new four-year project, including improvements to the methodology and strategic placement of instrumentation underground at one mine site in the eastern U.S. and one site in the western U.S. He described how a remote sensing tool called LiDAR along with fiber optics technology were being used for the first time in coal mines to understand underground deformation and seismic events. He also summarized how the project would use traditional methods of data collection involving drilling a borehole in the roof underground and running a camera up into the roof to collect data for interpretation by geologists. He presented a final example of the project's research methodologies through the example of studying the vibrations emitted from a roof bolting machine to aid in data interpretation of the roof's characteristics.

Next, PI Marcia Harris presented material about a new four-year project on panel design optimization and mine ventilation considerations around gas wells. She showed a map of

Pennsylvania detailing the locations of both conventional and unconventional gas wells, with the map identifying limestone and dolomite deposits and locations where these deposits overlapped. She described how shale gas wells were mining through limestone deposits and the need to understand the issues associated with that process. She pointed out that results from this project could be of interest to mines not just in Pennsylvania, but also to those in West Virginia, Ohio, Maryland, and potentially even Kentucky.

Ms. Harris continued by detailing the research aims for the project. One aim was to evaluate the effects of massive collapse and blasting on the shale gas wells and underground stone mines, which could help to answer the questions of the effects of mining in multiple seams, consequences to ventilation, and appropriate locations for monitoring methane. Another aim she described was to undertake experimental research on gas wall deformations of existing wells along with numerical simulations involving both ground control and ventilation to answer questions about appropriate setback distances, permeability changes due to massive collapses or blasting, and likely migration paths for methane. She ended her presentation by stressing the ultimate goal of providing scientific evidence and considerations for pillar layout, gas well construction and setback distances, permeability changes in the ground strata, likelihood of a gas well breach, and suggested monitoring points.

Next, PI Justin Patts presented on a new project to expand monitoring of plant-level respirable dust levels, arguing that continuous use of monitoring systems had value to operations in relation to identifying hot spots, assessing control performance, and identifying possible exposure hazards in specific areas of the plant where exposure may not be anticipated. Mr. Patts framed his argument by summarizing the serious health hazards associated with exposure to respirable crystalline silica (RCS) and the importance of continued work to help coal and metal/nonmetal operations meet the requirements of existing and new regulations that aimed to protect workers from RCS exposure. He described how the project would leverage the use of particulate matter sensors in mining environments, following up on laboratory experiments where reference measures had been established by exposing nine sensors to common dusts such as ground silica, sand, and limestone as well as a test aerosol Arizona road dust.

Mr. Patts continued by detailing how project researchers were engaged with four mining companies to assess the correlation of the particulate matter sensors to filters over long time spans, on the order of months and even up to a year, in order to produce data that would be reliable and meaningful to the companies. Mr. Patts summarized how inter-unit variability was assessed by distributing the sensors across various plant locations, which also aided the companies in understanding dust concentrations in the context of production variations, production volume, and housekeeping practices. He ended by stressing that the project goals were to quantify risks, visualize data interactively with mines, and collaborate with mines to design effective engineering controls. As mine-specific examples of those goals already beginning to be realized due to a related successful previous five-year project, Mr. Patts noted that U.S. Silica had installed cameras at its plant to add further context to the dust network data being collected, that R.T. Vanderbilt had asked for assistance in setting up a dust sensing network

to help justify the expense of newer automated technologies there, and that the Covia mine had recently installed five sensors in its Cleveland plant.

Next, Jim Zhou from PMRD introduced himself as the team leader for the Mining Technologies team in Pittsburgh, noting that he was presenting on behalf of PI Alan Zhang, to discuss a project on assessing wireless technologies to support underground mine safety systems. Dr. Zhou summarized that applications of wireless technologies in mines were voice communication and data communication, commonly used to transmit sensor data, and tracking, used to track both personnel and equipment. He discussed well-known wireless technologies such as Wi-Fi and emerging wireless technologies such as 4G/5G networks and global positioning systems (GPS), with GPS not used in underground mining due to physical constraints of the environment, but with some companies exploring ways to generate GPS signals underground for tracking purposes.

Dr. Zhou continued to describe how the project's goals were to better understand the performance of wireless technologies in underground mining environments and to assess critical properties, challenges, and limitations of radio frequency (RF) uplinks through a combination of theoretical study, simulation, and field experiments. He cited the lack of a commercially available modeling tool that the mining industry could use to simulate the RF signal underground, with the project aiming to develop models that might be integrated into an existing software tool for use by the mining industry. Dr. Zhou posed the question of what level of accuracy and reliability was needed from existing tracking technologies in the underground environment and the challenge of improving those technologies. He closed by summarizing the project's ultimate goal of developing engineering considerations that could help the mining industry to deploy wireless technologies underground and to speed up adoption of new technologies that could be used to support mining safety systems.

Next, PI Teresa Barone presented on a new pilot project for continuous monitoring of RCS. Dr. Barone noted that the need for a real-time RCS monitor was recommended by MSHRAC in 2017, with important dialogue continuing ever since, and that the new project was a response to that recommendation. She noted how useful a real-time monitor would be, in particular in the mining environment, citing a recent example from a sandstone quarry where 20 exposure samples were collected, with the percentage of quartz in the exposure samples ranging from 24 percent to 70 percent—a very wide range that occurred within one week. Dr. Barone summarized the two parts of the research project, which were to continue research on a promising method for real-time infrared analysis and to complete an in-depth review of emerging technologies on continuous monitoring.

Continuing, Dr. Barone said that infrared analysis had been chosen because it would allow researchers to sort out interferences from other minerals which were not crystalline silica and that the type of sampler chosen was an impactor because it could collect samples at very high flow rates of up to 20 liters per minute and be accurately calibrated by comparison to a traditionally used personal sampler. She cited the challenge of making the impactor, which is a conventional aerosol sampling tool, transparent to the infrared beam—a challenge that was met through a previous pilot project where respirable dust was deposited onto an infrared transparent

window and thus accumulated so that the infrared spectrometer could continuously measure that accumulation inside the impactor. Dr. Barone ended her presentation by stating the long-term goal of the project, which was to shift from a small, portable Fourier-transform infrared spectrometer (FTIR) over to an even smaller infrared source, the quantum cascade laser, so that the monitor would be more convenient for field use. To meet that goal, she said, researchers would be collaborating with the small company Aerosolworks, located in Madison, Wisconsin.

With the PMRD project presentations concluded, Dr. Sawyer thanked the speakers and invited discussion, which prompted a lengthy question and answer period. In response to a question from Member Calhoun on behalf of MSHA, Ms. Harris confirmed that there were no suggested setback distances for stone mines, with those decisions based on practices in coal mines, and Member Calhoun and Member Schafrik expressed a high interest on MSHA's part in the related project work to guide decisions by their district managers. In response to a question from Member Stewart about partnerships with equipment manufacturers related to the wireless technologies project, Dr. Zhou noted PMRD's desire to talk with companies with expertise in 5G networks, such as Nokia, and Member Stewart pointed out the importance of considering the cost of sensing technologies for small and medium-sized companies in particular. In response to a question from Member Moore about percentages of silica as presented on a slide about monitoring respirable dust levels, Mr. Patts clarified how he had derived the percentages from MSHA's public access database, with those percentages applying only across metal/nonmetal mines and not to coal mines.

With the question-and-answer period concluded, Dr. Luxbacher followed with extensive comments related to the PMRD projects, noting that moving forward with automation in mines would require advances in communication between pieces of equipment as they interacted, pointing out distinctions between European and U.S. regulations and the types of plant environments in European and U.S. mines, and inquiring about the readiness of the RCS monitoring technology. He ended his comments by discussing future funding opportunities provided by way of NIOSH Broad Agency Announcements (BAAs).

SMRD Director's Report

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

Dr. Johns began his remarks by thanking SMRD staff and MSHRAC along with thanking Alliance Coal for the tour of the Riverview mine prior to the MSHRAC meeting. He noted that SMRD was going through an organizational health exercise and program assessment to identify programs with potentially decreasing resources and increasing costs in order to assess and prioritize the research being done. He stressed the importance of SMRD's continuing focus on mining health and safety in the Western U.S., including work with partner mines such at one in the Upper Peninsula in Michigan and the administration of the national Miner Health Program with support from SMRD's Miner Health Branch. He also discussed staffing changes, including hiring Jerry Poplin as SMRD's Associate Director for Science, taking over for Todd Ruff, who

now served as a Senior Scientist; Matt Karwowski, to lead the Miner Health Branch; and Brianna Eiter, who had been with Mining for many years and had recently accepted a position as Team Lead for the Scientific Quality Team in the NIOSH Office of the Director. In response to an impromptu question from Dr. Sawyer, he noted that the vacated positions at SMRD were still funded, with searches pending.

Continuing, Dr. Johns described the organizational and team structure of SMRD and collaborations with PMRD in certain areas, such as a project on automation and emerging technology. He discussed current ongoing projects at SMRD, including a study on the impact of heat strain on cognitive function in miners and work to inform the development of a real-time or near-real-time silica monitor, noting that task timelines and project lengths had been extended for these projects due to COVID and delays in Institutional Review Board (IRB) approval. Other projects he discussed included research on highwall safety, coexistence and safety of wireless systems in mining, machine situational awareness, and exposure assessment in metal/nonmetal mining. Dr. Johns summarized other newer projects related to surveillance, integrated approaches for mine worker well-being, opioid awareness among workers, and hazards unique to women in mining. He stressed that some of these had begun as pilots and then were funded fully for 3-5 years as follow-on projects based on their success, and he noted again the importance of collaborations with PMRD researchers in certain cases based on the need for shared expertise.

Offering specific examples from project research, Dr. Johns presented slides with photos of researchers and their work. These photos included Casey Stazick, studying corroded wire mesh to determine the impact of that corrosion on mesh strength; Tyler Emery, at one of SMRD's partner mines, using a thermocouple to assess the strength of backfill without destroying it; Steve Murray and Greg Fagan, pouring cemented paste backfill into forms for curing and testing; and Paul Jansen and Tyler Emery at a partner mine, taking a core sample of cemented rock fill for subsequent testing. He presented slides with photos that emphasized partnerships as well, including researchers from Jeonbuk University, South Korea, who traveled to SMRD to participate in dynamic shear testing, with that collaboration informing SMRD's modeling efforts, and work with the National Institute of Standards and Technology on developing guidance and recommendations related to the wireless coexistence in mining project.

Turning from the safety component to health-related projects. Dr. Johns repeated how important the heat stress project and the opioid awareness project had become for SMRD, beginning as pilot efforts and maturing to fully funded work, and he thanked Kristin Yeoman and Carol Nixon for their dedication to these areas, in particular for the opioid project, which they had both worked on along with MSHA to publish a resource guide for the mining industry. He noted that the heat stress project, with Kristin Yeoman as the PI, involved recruiting human subjects who agreed to being tested within an environmental chamber, and that this was a delicate matter in determining the correct payment amount for the human subjects given the potential risks involved combined with the logistics related to a federal contracting law. Dr. John's ended this summary by noting that the process had become easier as of October 3rd, 2024, with the approval of a U.S. Treasury debit card and digital pay program. With this change, the IRB had approved a

reimbursement rate of $35 an hour for participants in the study, clearing the way for human subjects testing to begin.

Lastly, Dr. Johns described some field work between SMRD and the Department of Energy (DOE) Nevada National Security Site in August of 2024, initiated based on a memorandum of understanding (MOU) between SMRD and DOE. As part of this MOU, the DOE was interested in ensuring it was effectively protecting the health and safety of workers in the DOE's subterranean facilities, with SMRD interested in conducting research in those facilities as well. Therefore, SMRD researchers visited the Yucca Mountain Waste Repository, and during that visit it was determined that SMRD would be giving future presentations to a newly established subterranean safety committee, to meet quarterly.

Dr. Johns turned over the presentation to Matt Karwowski, who discussed his varied professional background with the CDC and his recent appointment as Branch Chief of SMRD's Miner Health Branch Chief. First, he noted that like many physicians who ended up going into public health or occupational medicine, his was a nontraditional career path, but that even in his entrance essay for medical school admission he cited his desire to study the interrelationship between human health and environmental exposure, which he referred to as a guiding light throughout his career. Secondly, Dr. Karwowski noted that through different training experiences in Wisconsin, Massachusetts, and Atlanta, he learned that research targeting real-world problems and priorities was a powerful tool—a lesson he had applied in working for the National Center for Environmental Health (NCEH) and the Agency for Toxic Substances and Disease Registry, and as the chief medical officer for one of the divisions in the NCEH. He ended by noting that this career path had helped lead him to SMRD, where he saw an opportunity to combine all of the skills he had accrued during his long career trajectory and apply them to one topic area to help address the complex health problems faced by miners.

Chair Mischler invited questions, and Member Stewart asked about the surveillance project at SMRD and how it related to a national survey done about mining in 2017, with Dr. Johns clarifying that the project did not involve a survey but was looking at existing data sources and potentially partnering with other groups that might have data that could be analyzed related to miner health.

Remarks from Associate Professor of Chemical Engineering, Michigan Technological University

Dr. Lei Pan
Associate Professor
Michigan Technological University

Dr. Lei Pan from Michigan Technological University was the next presenter, joining the MSHRAC meeting virtually, noting that Michigan Tech was in the upper peninsula of Michigan with a copper mine and a metal mine located nearby. He summarized a research project that had begun in 2018, initiated after a recommendation by the National Academy of Sciences about occupational exposure to respirable coal mine dust (RCMD), with the goals being to evaluate the broad use of the fixed-site monitoring device and to better understand characteristics of

respirable coal mine (RCM) particles. He indicated that in order to address the variability in the RCM particle composition, more comprehensive sampling was necessary to understand how mining activity and ventilation impacted RCMD characteristics. Dr. Pan also stressed that new sampling protocols were needed that would allow for both spatial and temporal mapping of RCMD.

Continuing, Dr. Pan said that the research had developed both a short-period sampling protocol, taking multiple samples in one shift at different mines, and a long-period sampling protocol, which involved sampling over several shifts, with both protocols resulting in accumulated amounts of dust on filters for subsequent analysis. He noted that the follow-up analysis involved images generated by a scanning electron microscope (SEM), which allowed researchers to characterize each particle and look for trends in the composition of the particles captured. Dr. Pan cited quartz as being the dominant particle at a particular site, measuring about 2.5 to 3 microns, and he pointed out the clear trend that coal particles captured were much finer compared to the other minerals present, probably due to coal's comparative softness and high likelihood of being pulverized. With SEM analysis allowing particles to be scanned layer by layer, he said, researchers could determine how particles changed over time.

Dr. Pen next discussed another technology called micro x-ray fluorescence (XRF), which was used to determine the elemental composition for entire samples. Micro-XRF allowed researchers to determine the chemical composition of the RCM particles on the collected samples, with one example he presented representing the silica content on a particular sample being about 1.88 percent and the sulfur content being 0.2 percent, and with these elements, along with aluminum, being of high interest from a health standpoint.

Dr. Pan ended his discussion by summarizing that these sampling and analysis techniques led researchers to better understand and characterize both the dust concentrations and the presence of submicron particles over time as mining activities took place. He cited specific examples from the Bronco mine in Utah and the Francisco mine in Indiana. He also described other methods being applied more recently to meet the research goals as well, including field-flow fractionation technology to analyze nano-sized fractions, and inductively coupled plasma mass spectrometry (ICP-MS), with ICP-MS allowing researchers to determine the content of each element by separating ions.

Next, Chair Mischler invited questions, and Member Stewart asked if the nano-sized particles pictured in one of the slides might be just diesel particles, to which Dr. Pan replied that diesel particles were evident and significant at the beginning of the shifts sampled, but at the ends of shifts there were other particles clearly present in the nano-sized fractions. More technical questions followed about particulars of the micro-XRF sampling technology, with Dr. Pan highlighting how that technology allowed researchers to change the acceleration voltage as well as the inclination angles, which in turn allowed them to control the sampling depths.

Dr. Luxbacher closed out the session with a few comments underscoring how previous contracts awarded by NIOSH had also been devoted to studying this issue, in particular because some researchers had questioned the existence of nanoparticles in mines—at least in coal mines. He

also cited past questions that had arisen about diesel nanoparticles in relation to MSHA's regulatory requirements and the need for more emphasis on small, low-mass particles with high potential for negative health effects. As confirmed by Member Moore, some companies were collecting dozens of samples per shift on CPDM filters that were discarded after use and not studied, and Dr. Luxbacher pointed out that with more collaboration and the application of Dr. Pan's research, those samples could be analyzed for nanoparticles. Dr. Luxbacher ended his comments by emphasizing the opportunities represented by such collaborations, citing that upcoming presentations by Penn State and Carnegie Mellon researchers would also be devoted to this research area of interest.

Remarks from Professor of Mining Engineering, Penn State University

Dr. Shimin Liu
Professor
Penn State University

Dr. Liu opened his remarks about a research project on the characterization of nanoparticles by pointing out that since a landmark 1995 study, an increasing amount of attention was being paid to progressive massive fibrosis (PMF) and coal workers' pneumoconiosis (CWP), also known as "black lung." He cited a 2018 report from the National Academies of Sciences, Engineering, and Medicine (NASEM), which provided recommendations to the mining industry to better understand the types and nature of particles released during the mining process. Comparing regulations from countries including South Africa, China, Australia, and the U.S., Dr. Liu pointed out that all of these regulations were based on particle mass rather than how the particles were released and interacted with the mine environment. He summarized collaborations with MSHA and researchers from other universities about the results from seven different mines where the chemical and elemental compositions of the nanoparticles were being studied, in particular looking at data representing both carbon and oxygen—the two major components of coal mine dust—as an indication of toxicity.

Dr. Liu ended his presentation by summarizing the importance of moisture content in mines based on mining practices and the ability of nanoparticles to absorb moisture, citing both modeling data and field data with the aim of understanding the specific gravity of coal and its impact on nanoparticles, along with the engineering goal of dust suppression techniques through the use of surfactants. Continued study in these areas, he noted, was important to addressing the ongoing issues of PMF and CWP in miners as recommended by the NASEM report.

Next, Chair Mischler invited discussion, with Dr. Lui answering a question from Member Moore about how the hardness of coal influenced the moisture uptake, and noting that some surfactants could effectively change the surface properties of coal to influence how moisture was transported through particles. Dr. Lui also answered questions about the types of filters provided by MSHA, how continuous mining machines had changed over time in relation to horsepower and weight, and changes to mining drill bit design—all of which had potential implications for understanding how particles were released during the mining process. He closed his responses to questions by noting that analysis of exactly what caused health problems from coal dust was complex due to all of its components, and that not all coal dust could be classified as having a singular toxicity.

Remarks from Professor of Biomedical Engineering and Electrical & Computer Engineering, Carnegie Mellon University

Dr. Siyang Zheng
Professor
Carnegie Mellon University

Dr. Zheng began his remarks by connecting his research to that of the previous presentation by Dr. Liu, with the commonality being an interest in surveying the health effects of coal dust particles small enough to penetrate into the alveoli region of the lungs, but with different methodology to his research. He pointed out that the lungs were fundamentally a weak part of the body that allowed such penetration, made up of just two layers of cells and a thin layer of basement membrane. He summarized the common ways of studying this issue: by culturing lung epithelial cells in a Petri dish; by using a Transwell membrane with two chambers and culturing cells on both sides of the membrane; and by using in vivo animal models in the field—often mouse models. With all of these models having their limitations, Dr. Zheng moved on to describe a more recent engineering model his team had developed, which was to create a computer chip to which a membrane could be integrated, serving as a three-dimensional (3D) model of the alveoli region of the lungs.

Continuing, Dr. Zheng described how micro-nanofabrication had been added to the membrane, giving it the clinical advantages of being biodegradable, highly porous, and allowing for the growth of both epithelial cells and endothelial cells. Further, he said, the model incorporated stretching of the cells by way of a deformable membrane lid, which mimicked the breathing motion of the lungs and allowed researchers to create an air-liquid interface. He presented slides to demonstrate where both the epithelial and endothelial cells began to die with exposure to coal dust; where multiple cytokines were released after coal dust exposure, causing an inflammatory response; and whether this kind of coal dust exposure could trigger DNA damage, with DNA damage being a potential cause of lung cancer. Lastly, Dr. Zheng described how the model allowed researchers to compare the effects of both acute and chronic exposure—important because coal dust exposure did not necessarily affect lung health only, but could also lead to large-scale inflammation, cardiovascular disease, stroke, and even neurodegenerative disease as recorded in the literature. Knowing this, he said, allowed researchers to mimic potential treatments by testing the impact on the cells when antioxidants such as vitamin C and E as well as anti-inflammatory over-the-counter drugs such as ibuprofen were incorporated into the model, with the goal being to minimize system inflammation.

To summarize his study, Dr. Zheng noted that the new 3D chip recalculated key physiological features of lung alveoli and could serve as a miniature system for mechanistic study, ultimately leading to realization of the goal of potential therapeutic intervention. He stressed that a funded integrated program of biomedical and mining engineering collaboration would be needed for more advanced iterations of this type of nanoscale coal dust lung disease work, which could lead to more technological developments such as the important incorporation of immune cells in the fibroblasts.

Next, Chair Mischler opened the floor for discussion, followed by extensive questions and comments from Member Schafrik and Dr. Luxbacher. In response to Member Schafrik's questions, Dr. Zheng clarified how researchers were using a conventional nebulizer device to introduce liquid and saline that would be mixed with the coal dust, and that related experiments had also been performed on burned dust and rubber burn particles, which could also cause significant cell death, as comparatives. Dr. Luxbacher pointed out that it would be interesting to look at critical minerals in the cell structure, such as nickel dust, to see if further data could be generated on minerals related to the underground or surface mining aspects of the dust, to which Dr. Zheng agreed. Member Stewart echoed the value of studying nanoscale particles such as talc, titanium, or whatever researchers would detect given the many cytokine interactions that could be taking place, to which Dr, Zheng agreed and noted that it would be especially valuable to incorporate more immune samples into the study because of the potential uptake of the minerals into the bones.

Remarks from Professor of Practice in Mining Engineering, Penn State University

Dr. Barbara Arnold
Professor
Department of Energy and Mineral Engineering
Penn State University

Dr. Barbara Arnold from Penn State University was the next presenter, joining the MSHRAC meeting virtually, and opening by commenting on the connections between her presentation and the previous ones by Drs. Liu and Zheng, citing their common scientific interests in studying hydroxyl radical concentrations as a measure of coal mine dust toxicity. She noted that her research examined different grades of coal and obtaining quartz samples from them as well as different reagents proposed in the literature to reduce toxicity. The goal, she said, was to attempt to shut off the reactive oxygen species that caused the toxicity by testing carboxymethyl cellulose (CMC) along with some commercial dust suppressants.

Continuing, Dr. Arnold outlined different test methods including X-ray diffraction (XRD), Fourier-transform infrared spectroscopy, and X-ray photoelectron spectroscopy, followed by the use of a spectrofluorometer to measure the hydroxyl radicals. She described various findings based on testing differently aged samples of different types and with different additives in distilled water over a range of pH, with the results triplicated to achieve a good confidence interval. Dr. Arnold noted that the CMC samples produced the best results among all of the additives tested, with the CMC coating the surface in a way that reduced the hydroxyl radical content on the surface for certain coal types. By contrast, she pointed out, the freshly generated quartz particles had the highest levels of hydroxyl radicals when compared to results for coal and pyrite. These successful test methods, Dr. Arnold finished, had led to a new research grant as a follow-up, to further study CMS as a dust suppressant as reported in the literature.

Next, Chair Mischler opened the floor for discussion, with Dr. Luxbacher pointing out that Dr. Arnold's research transcended issues of compliance and extended to the use of surfactants, and

that she was already working with a mining company interested in using surfactants to reduce toxicity.

Remarks from Branch Chief, Health Effects Laboratory Division

Dr. Pramod Kulkarni
Branch Chief, Chemical and Biological Monitoring Branch
Health Effects Laboratory Division
National Institute for Occupational Safety and Health
Centers for Disease Control and Prevention

Dr. Pramod Kulkarni from HELD was the next presenter, joining the MSHRAC meeting virtually, opening by presenting a lengthy overview of the research projects at HELD, in particular related to silica measurements and assessment, often for non-mining applications but with implications for mining as well. He noted that the branch he oversaw at HELD focused on practices including analytical methods for exposure assessment, testing of instruments used in inhalation studies, and developing newer portable or near-real-time instrumentation to take automated or semicontinuous measurements of aerosols in the field. Most of these projects, he emphasized, were designed to address some of the strategic goals within NIOSH's National Occupational Research Agenda, and those laboratory and analytical methods related to silica were motivated by the desire to help companies address the newer permissible exposure limit set by the Occupational Safety and Health Administration.

Continuing, Dr. Kulkarni shared slides representing how the presence of polymer residue in silica samples created an undesirable artifact by clumping the particles together, which then interfered with analysis of the particle by standard XRD methods. He described the size-dependent nature of the XRD signal and ways that researchers were attempting to account for that to achieve better results. He presented plots showing that the silica content of a reference material dropped significantly at particle sizes below 1 micron, and that his project team's current investigations were to determine if this was a mere effect of using gravimetric mass for calibration or an artifact in the XRD measurement itself. Therefore, he concluded, researchers were looking at a newer method based on Raman spectroscopy—an optical method which radiated the sample with a laser beam to measure inelastic light scattered from the particles—to quantify silica content.

Dr. Kulkarni also described recently developed on-site direct reading methods, with one example being the use of a commercially available wearable sampler that served as an optical monitor with a built-in filter cassette that collected aerosols during a full shift, followed by the use of a handheld Raman spectrometer to perform subsequent measurements on site or in the lab, depending on the application. A second example he discussed was the use of a portable aerosol mobility spectrometer that allowed for on-site size distribution measurement, followed by real-time or near-real-time semicontinuous measurement of metals in the field. These and other newly developed methods, he ended, compared favorably to XRD methods and were complementary to XRD in relation to detection limits.

Next, Chair Mischler opened the floor for discussion, with a debate ensuing about whether HEPA filters being used in mining applications in cabs removed nanoparticles, with the consensus reached after discussion that more research was needed to answer that question, perhaps by the NIOSH Nanotechnology Research Center.

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 opened his extensive overview by noting that his extramural report would very non-technical, but he felt that it was important to give an annual update in this area, which included grants, contracts, and interagency agreements (IAAs). He thoroughly described ongoing research challenges and accomplishments related to extramural funding over several years, including a mine rescue robot being developed with NASA's Jet Propulsion Laboratory (JPL), which Mining was working to move through to MSHA certification and permissibility approval; underground mine evacuation technologies with New Mexico Tech; and the latest effort in developing robotic and intelligent mining technology with the Missouri University of Science and Technology. He also noted that since 1997 NIOSH was working with partners such as the University of Arizona (U of A) as part of the western states training. He cited that U of A had trained around 11,000 people in the previous year within the grant cycle, also making their products available to trainers outside of the University.

Dr. Luxbacher continued by describing meetings and collaborations with other grant recipients such as the Colorado School of Mines (CSM) and subcontractors, including the University of Kentucky and University of Arizona. He explained that this funded research was devoted to areas such as coal dust explosions, refuge alternatives (RAs), and liners for ball mills to reduce the risk of dust explosions. He noted that 2024 had been an interesting contract year for the Mining Program, with 17 new solicitations and 29 contracts under management, and with 11 ongoing contracts extended into 2025 due to challenges with getting contracts completed on time due to COVID. Dr. Luxbacher summarized contracts on automation and emerging technologies, lithium-ion battery fire detection, wireless ventilation monitors, and an autonomous shuttle car—with a demonstration underground of the shuttle car forthcoming. Collaborations on these and other contracts, he summed up, involved Virginia Tech, MX3 Diagnostics, Penn State, the University of Utah, Innovative Wireless Technologies (IWT), and Draeger.

Dr. Luxbacher also discussed matters related to extramural research including a final report about eliminating barriers for the implementation of automation in the mining industry, which had been referenced in a presentation at the annual meeting of the Society for Mining, Metallurgy & Exploration, arguing that the barrier to automation in mines was not regulation, but constraints within the mining industry itself.

Continuing, Dr. Luxbacher also touched on capacity-building contracts, which were to help build the capacity of university programs and their graduate students and faculty in the areas of mine

ventilation and ground control. Notably, he summarized why a recent transition had occurred to the names of these contracts, funded since 2009, from capacity-building to university research contracts, based on input from NIOSH contracting specialists in Atlanta. He ended by citing that $50 million had been invested into this contracts program over time, which he assessed to have played a significant role in graduate students' successes, advancement and tenure of PIs, and building laboratory facilities. With funding provided through this program for 149 master's and 131 PhD students, he stressed the importance of continued funding for this successful program to keep moving forward.

Finally, Dr. Luxbacher briefly mentioned continued progress under IAAs, including the NASA JPL contract and a new IAA on advanced sensors and robotic deployment platforms, with the ultimate goal of moving the technology through MSHA approval and certification. He described particulars of the technology that had been demonstrated at MINExpo, with planned modifications including the use of caterpillar tracks instead of wheels to improve their mobility, explosion-proof capabilities through additive manufacturing of honeycombed material to reduce the weight of the battery enclosure, improvements to autonomous mobility, and an tether backup function so that if the attached tether were to break the robot would be able to turn around and return to its point of origin.

Next, Chair Mischler invited questions, which were extensive and wide-ranging, including the points of contact at universities such as U of A and CSM, specifics on collaborations with Wesco and Boston Dynamics, and air purging practices in RAs. These questions and related clarifications came from Members Moore and Schafrik, including follow-up questions about the status of the BAA program schedule for the upcoming year, with Dr. Luxbacher hoping that the BAA schedule would get back on track in relation to its calendar with the pending hiring of the new ADM.

NIOSH Underground Mine Safety & Health Research Laboratory Working Group Report

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

Dr. Luxbacher introduced the next speaker as Dr. Steven Schafrik, chair of the workgroup for the NIOSH Mining Health and Safety Research Laboratory at Mace, West Virginia. Dr. Schafrik noted that the workgroup's progress was slow in relation to a new underground safety research facility in Mace that would allow full-scale mine experiments and research that would accurately simulate an underground mine. Reasons cited for the slow progress ranged from the challenges of building a road adequate for drill rigs to requirements for the size of surface buildings to the environmental impacts of disturbing two endangered species of plants located on the site. Drs. Luxbacher and Schafrik summarized how a report was being prepared for MSHRAC review and approval, with subsequent review by Dr. Howard to include recommendations about how the work might move forward, and with the new ADM ultimately being responsible for implementation.

Overall concerns were expressed among committee members that the proposed facility would not meet a similar fate as the Lake Lynn Experimental Mine in Pennsylvania, which had been closed in 2013, with members agreeing that lessons learned from Lake Lynn needed to be incorporated into the design of the new facility. More specifically, concerns were expressed about radio frequencies and communications in the proposed facility, which were planned to be addressed through a meeting with the Asset Management Group from the Office of Safety and Security Administration Management, which could provide NIOSH with surface communications. Drs. Luxbacher and Schafrik closed the discussion by acknowledging the challenges of understanding the geologic data at the proposed site, including the limestone bedding, and the related issues of performing repeated explosions to gather experimental results and their effect on the bedding. Nevertheless, despite all of the challenges outlined, they expressed optimism that the work would continue meaningful progress due to its importance to West Virginia and the mining industry.

Public Comment Period

With the presentations finished, Chair Mischler announced the public comment period, noting there was one pre-registered commenter: Mr. Sam Petsonk. Mr. Pentsok introduced himself as a coal mine health and safety lawyer representing workers in safety grievances and negotiating dust exposure challenges for workers at the face in coal mines—primarily workers from the central Appalachian coal base. In his comments, he expressed the strong appetite in the mining industry for continuous dust monitoring for silica as soon as possible and commented on whether a new Request for Information (RFI) about silica was needed in reference to the 2014 respirable dust rule. Dr. Luxbacher thanked him for his concerns and replied that these comments, in particular related to the RFI, might best be addressed as part of MSHA's quarterly call with stakeholders, with Mr. Williamson from MSHA echoing that response and noting that the next quarterly call would be scheduled soon. Chair Mischler invited further public comments from the room, and no further requests were received.

Committee Discussion

Dr. Luxbacher opened the committee discussion period by reflecting on the logistics of the present meeting—which included three contractors from universities—and future meetings, suggesting that they might include company representatives such as those from IWT, to discuss how BAA funding had impacted the products developed by IWT. He also led a discussion on the value of in-person versus virtual attendance at meetings, in particular as it affected the question and answer period following presentations, and the value of mine site visits being integrated into the time frame of the MSHRAC meetings, with a special interest in copper and salt mines. Member Moore also noted that he would like future meetings to include information on such things as built-in-place shelters.

The committee discussion period closed with comments about the historical value of workshops provided by NIOSH, followed by publication of proceedings from the workshops, in particular when they were designed to help companies achieve compliance with specific regulations, and that such workshops might be worth reviving. The discussion also noted the desirability of offering health services to miners, such as pulmonary function testing, along with building

capacity in sampling and medical care provisions. Committee members cited the effectiveness of so-called “black lung clinics,” which received federal funding and had been serving populations for decades. Member Stewart ended the discussion by suggesting that a workshop about effective methods for air sampling could be of value to the industry, with the necessity of including industrial hygienists, and Chair Mischler noted that future joint workshops might be provided by NIOSH and MSHA to help companies comply with the new silica rule.

With the discussion period ended, Chair Mischler made a motion that NIOSH and MSHA work together to create a series of workshops by September 2025 to help mines comply with the new silica rule. The motion was seconded and approved by a vote.

Dr. Luxbacher noted that a full committee would be available until June 23rd, 2025, based on the current MSHRAC terms. Therefore—with Member Calhoun stressing that the next meeting should include Kyle Zimmer, Jr., from the International Union of Operating Engineers, and Ronald Bowersox, from the United Mine Workers of America—the committee agreed that a meeting should be scheduled for the Spring of 2025.

Closing Remarks and Adjournment

Chair Mischler closed the meeting by thanking Alliance Coal for the mine tour the previous day and thanking the University of Kentucky for hosting, and the meeting was adjourned.at 4:44 p.m.

Appendix A: Attendees

Name	Affiliation
Zach Agioutantis	University of Kentucky
Barbara Arnold	Penn State (Member)
Davood Bahrami	NIOSH-PMRD
Teresa Barone	NIOSH-PMRD
Tim Bauerle	NIOSH-SMRD
Tim Beck	NIOSH-PMRD
Kristina Behringer	WYHealth Optum (Ex Officio Member)
Pauline Benjamin	NIOSH-OD
Giovanna Biscontin	National Science Foundation
Robert Bissonette	NIOSH-SMRD
Leslie Boord	Dräger
Ronald Bowersox	United Mine Workers of America
Kathleen Braunegg	NIOSH-PMRD
Andrea Brickey	South Dakota School of Mines (Member)
Melanie Calhoun	MSHA (Ex Officio Member)
Danielle Carlin	National Institute of Environmental Health Sciences (Member)
Jacob Carr	NIOSH-PMRD
Thomas Dubaniewicz	NIOSH-PMRD
Thomas Duffy	The United Steelworkers (Member)
Zoe Dugdale	NIOSH-SMRD
Kelley Durst	NIOSH-OD
Tyler Emery	NIOSH-SMRD
Cara Halldin	NIOSH-SMRD
Marcia Harris	NIOSH-PMRD
Rick Honaker	University of Kentucky
John Howard	NIOSH-OD
Jon Hrica	NIOSH-PMRD
Ronald Jacksha	National Institute for Occupational Safety and Health
Douglas Johns	NIOSH-SMRD
Matt Karwowski	NIOSH-SMRD
Zoheir Khademain	NIOSH-PMRD
Carin Kosmoski	NIOSH-PMRD
Pramod Kulkarni	NIOSH-HELD
A. Scott Laney	NIOSH-RHD
Shimin Liu	Penn State University
George Luxbacher	NIOSH-OD
Alyssa Lypson	NIOSH-PMRD
Launa Mallett	NIOSH-PMRD
Marifran Mattson	Purdue University (Member)
Berni Metzger	NIOSH-OD
Steven Mischler	NIOSH-PMRD (DFO, Acting Chair)
Khaled Mohamed	NIOSH-PMRD

Name	Affiliation
J. Todd Moore	CONSOL Energy (Member)
Mike Morris	Neal R. Gross and Co.
Michael Murphy	NIOSH-PMRD
Mahiyar Nasarwanji	NIOSH-PMRD
Carol Nixon	NIOSH-SMRD
James Nowicki	Booz Allen Hamilton
Lei Pan	Michigan Technological University
Justin Patts	NIOSH-PMRD
Eranda Perera	NIOSH-PMRD
Sam Petsonk	Petsonk Law Offices
Gerald Poplin	NIOSH-SMRD
Elizabeth (Libby) Pritchard	NSSGA (Member)
Robert Randolph	NIOSH-OD
Randy Reed	NIOSH-OD
Miguel Reyes	NIOSH-PMRD
James Rowland	NIOSH-PMRD
Wayne Sanderson	UK Central Appalachian Regional ERC
Stephen Sawyer	NIOSH-PMRD
Steven Schafrik	University of Kentucky (Member)
Brent Slaker	NIOSH-PMRD
Anthony Spearing	NIOSH-SMRD
Matthew Stewart	R. T. Vanderbilt Holding (Member)
Wen Su	NIOSH-PMRD
Aaron Sussell	NIOSH-SMRD
David Weissman	NIOSH-RHD
Jeffrey Welsh	
Christopher Williamson	MSHA
Dana Willmer	NIOSH-PMRD
Samantha Wilson	NIOSH-SMRD
Allegra Yeley	NIOSH-SMRD
Liming Yuan	NIOSH-PMRD
Siyang Zheng	Carnegie Mellon University
Jim Zhou	NIOSH-PMRD
Lihong Zhou	NIOSH-PMRD
Kyle Zimmer	IUOE Local 478

I hereby certify that, to the best of my knowledge, the minutes of the November 7, 2024 meeting of the Mine Safety and Health Research Advisory Committee (MSHRAC) are accurate and complete.

Chair, Mine Safety and Health Research Advisory Committee