MINUTES

MINE SAFETY AND HEALTH RESEARCH ADVISORY COMMITTEE (MSHRAC) MEETING
MARCH 30-31, 2010
HILTON GARDEN INN PITTSBURGH/SOUTHPOINTE
1000 CORPORATE DRIVE
CANONSBURG, PA

COMMITTEE MEMBERS & ATTENDEES PRESENT

Dr. Jeffery L. Kohler, Executive Secretary to MSHRAC, Associate Director for Mining and Director, Office for Mine Safety and Health Research (OMSHR), NIOSH, called the meeting to order. Because the Committee Chair, Dr. Poulton was unable to attend the meeting, Dr. Kohler chaired the meeting. The following members were present:

Dr. John Daniels (for Dr. Lawrence Bank), Program Director, Geomechanics and Geotechnical Systems, US National Science Foundation
Mr. Brent Chamberlain, Director of Human Resources, Safety, and Health, General Moly, Inc.
Mr. Dennis O'Dell, Administrator for Occupational Health and Safety, United Mine Workers of America
Dr. Jeffery Kravitz, Chief, Special Projects/Mine Emergency Operations, MSHA
Dr. Syd Peng, Director, Longwall Mining and Ground Control Research Center, Department of Mining Engineering, West Virginia University
Mr. Emmett Russell, Director, Department of Safety and Health, International Union of Operating Engineers
Mr. Joseph A. Sbaffoni, Director, Pennsylvania Department of Environmental Protection, Bureau of Mine Safety
Mr. Bruce Watzman, Senior Vice President for Regulatory Affairs, National Mining Association
Mr. Michael Wright, Director of Health, Safety, and Environment, United Steelworkers of America
Dr. Darryl Zeldin, Senior Investigator, National Institute for Environmental Health, NIH

The following attendees were also present:

Karen Busch, NIOSH, Pittsburgh, PA
Floyd Varley, NIOSH, Spokane, WA
Ed Thimons, NIOSH, Pittsburgh, PA
Gerry Finfinger, NIOSH, Pittsburgh, PA
Tom Barczak, NIOSH, Pittsburgh, PA
Joel Haight, NIOSH, Pittsburgh, PA
Marie Chovanec, NIOSH, Pittsburgh, PA
Jeff Welsh, NIOSH, Pittsburgh, PA
Marlene Ackman, NIOSH, Pittsburgh, PA
John Howard, NIOSH, Washington, DC
Chris Mark, NIOSH, Pittsburgh, PA
Tom Novak, NIOSH, Pittsburgh, PA
Michael A Trevits, NIOSH, Pittsburgh, PA

Mike Brnich, NIOSH, Pittsburgh, PA
Güner Gürtunca, NIOSH, Pittsburgh, PA
John Sammarco, NIOSH, Pittsburgh, PA
Les Boord, NIOSH, Pittsburgh, PA
Bob Stein, NIOSH, Pittsburgh, PA
Marcia L. Harris, NIOSH, Pittsburgh, PA
Ken Neely, Sandvik, Brier Hill, PA
William H. Schiffbauer, Frederick Mining Controls, Connellsville, PA

Dr. Kohler explained that some of the MSHRAC members' appointments had expired; however, members can serve for 180 days beyond their expiration dates if they have not been replaced. New nominees were submitted through the approval process about a year ago, but they have not been officially named and approved.

The minutes from the last meeting were read and approved unanimously.

DR. JOHN HOWARD, REPORT FROM THE DIRECTOR, NIOSH

Dr. Howard explained that the MSHRAC appointments have not been singled out. Other NIOSH and CDC committees are also awaiting approval of new members. The issue with the appointments is at the Department of Health and Human Services level. The Department has been inundated with issues related to Health Care Reform. Dr. Howard provided an overview of NIOSH's budget, highlighting that NIOSH received an additional $3 million for a mining test bed. He offered to the Committee members that they should not hesitate to call him if they have further questions about the budget. Dr. Howard explained NIOSH's exemption from CDC's reorganization under the direction of Dr Frieden, the new CDC Director. Dr. Frieden has expressed great support for NIOSH and Mining. The Department of Health and Human Services has been busy with health care reform. NIOSH is putting forward ideas for funding and is involved with the section on protection of health care workers. NIOSH has an active collaboration with MSHA, including the loan of a NIOSH official to serve as the MSHA Deputy Director for Policy. Dr. Howard expressed chagrin that the issues surrounding Lake Lynn Laboratory have not been settled yet. The issues are complicated with government regulations on buildings and facilities, but as an agency, we need to move ahead and decide if the issues can be resolved or do we need to consider other alternatives. Dr. Howard gave an update on the NIOSH diesel study and the procedures that are used to peer review and disseminate the results. Dr. Howard mentioned that NIOSH research on black lung disease was included in a "Parade Magazine" article last week.

MSHRAC members held an extensive discussion of Lake Lynn Laboratory and the critical need for it.

DR. JEFFERY L. KOHLER, REPORT FROM THE ASSOCIATE DIRECTOR FOR MINING SAFETY AND HEALTH, NIOSH

Dr. Kohler provided an overview of the meeting and the goals for the Committee. The meeting will include information updates and responses to inquires from the last meeting, detailed informational updates on specific topics and a request for feedback, and Committee deliberations

and recommendations on NIOSH research to address gaps identified in the deep cover retreat mine study and research opportunities to inform future decisions on escape and rescue.

Overall, the NIOSH Mining Program continues to be well aligned with the most compelling program needs, and unification of the program in Pittsburgh and Spokane has been completed. Research-to-practice activities remain strong. Progress has been made on addressing National Academy of Sciences recommendation, and exciting post-MINER Act initiatives are underway. NIOSH continues to push Communications and Tracking advancements in functionality and survivability through Mining's intramural and extramural programs. A new major research project is being initiated to enable the next generation of refuge alternatives. The next-generation SCSR effort expands beyond the dockable to a full-face style. NIOSH continues to address and solve issues related to training, self-escape, rescue, and mine practices.

The Mining Program is now reassessing the program and redefining the future direction. A major revision of the strategic plan is underway. Researchers are defining a new and expanded vision for training. The research program is focusing on a systems level approach to oxygen supply including caches, refuge, and self-escape planning, equipping, and training. The tube bundle system that was discussed at the last meeting is going in at a mine site.

Dr. Kohler provided an overview of the budget and staffing of the NIOSH program. While budget is adequate to address the most important mining safety and health needs, staffing remains a challenge. Staff attrition continues to erode core competencies and adversely impact staffing of projects. Despite a continuing global advertising effort, success in recruiting has been very limited. Facility issues, including those at Lake Lynn and the Pittsburgh campus, are having a negative impact on the program.

Dr. Kohler ended with comments on the relevance and impact of the NIOSH program and highlighted the question that he often asks staff, "What have you done for mineworkers today?"

DR. CHRISTOPHER MARK AND DR. THOMAS BARCZAK, OFFICE OF MINE SAFETY & HEALTH RESEARCH, NIOSH

Dr. Mark updated the Committee on the progress that has been made with the NIOSH deep cover pillar recovery project. The project was undertaken in response to a request by Congress in the FY2008 appropriation and is being conducted in collaboration with the University of Utah and West Virginia University (WVU). Approximately 12 room and pillar mines in the US recover pillars at depths exceeding 1500 ft, most of them located in Harlan County, KY, and Wise County, VA. Another 30 mines in the central Appalachian coalfields are extracting pillars at depths greater than 1000 ft. The report has been completed and is currently undergoing HHS review. Dr. Mark presented the key findings and recommendations from the research. These included recommendations for conducting burst hazard assessments, minimizing the risk of coal bursts, improving pillar design, and protecting miners from roof falls. To follow up on the research, NIOSH OMSHR is undertaking the following actions:

1. Make enhanced versions of ARMPS and LaModel software available to the industry.

2. Conduct a pillar design training initiative, with hands-on computer training, in seven coalfield locations (Harlan, Hazard, and Pikeville, KY; Norton, VA; Charleston and Mullins, WV; and Grand Junction, CO).
3. Investigate the development of a retreat mining handbook.
4. Conduct research to better identify "red zones."
5. Define a research effort to reduce the rib fall hazard.
6. Develop and encourage seismic monitoring research in deep cover longwall mines.

DR. JOHN SAMMARCO, OFFICE OF MINE SAFETY & HEALTH RESEARCH, NIOSH

Illumination plays a critical role in coal and metal/nonmetal mines because miners depend most heavily on visual cues to detect potential hazards associated with falls of ground, slips/trips/falls (STFs), and powered haulage. There are many human factor issues and illumination technology issues to consider. First, it is difficult to detect hazards because of the low illumination levels, and the hazards are typically of low contrast and reflectivity. Glare is another factor to consider, as it can impede miners' ability to identify hazards and perform their jobs safely. There are additional challenges for older workers given that visual performance degrades as a person ages. Age is important given an aging mining workforce that averages about 44 years. NIOSH research is addressing these issues by investigating if the color and light distribution from light-emitting diode (LED) technology can be used to improve miner safety. NIOSH has developed three prototype lighting systems: 1) LED cap lamp; 2) machine-mounted visual warning system (VWS); 3) machine-mounted LED area light. Human subject test results are very promising. The NIOSH LED cap lamp, with a light color having more of the short wavelengths, enabled these improvements: 24% better trip hazard detection, 15% better peripheral motion detection that is needed to detect machine pinning/striking hazards, and 45% reduction in disability glare. The VWS is intended to reduce pinning/striking hazards by visually giving a warning of impending machine movements and by indicating the type and direction of movement. Human subject tests indicate up to a 72% improvement in detecting machine movement. The LED area lighting is intended to reduce STF accidents in the vicinity of a mining machine. Human subject tests indicate up to a 20% improvement in detecting trip hazards. Formal research agreements are in place with the intent of commercializing the three NIOSH lighting systems.

MR. EDWARD THIMONS, OFFICE OF MINE SAFETY & HEALTH RESEARCH, NIOSH

Mr. Thimons provided an overview of the key elements of NIOSH's current research program for monitoring and control of diesel emissions in mines. He discussed an upcoming workshop "Advanced Diesel Engine and Exhaust After-treatment Technologies for Underground Coal and Metal/Nonmetal Mining Applications" to be held in Pittsburgh, PA, on April 14, 2010. This workshop will provide a forum for NIOSH mining stakeholders and diesel engine manufacturers to discuss the application of new Tier 4i and Tier 4 engines in underground mines. He then discussed preliminary diesel characterization research findings to date in terms of the physical and chemical characteristics of diesel emissions as a function of engine type, operating mode, fuel formulations, and after-treatment devices, along with preliminary findings in terms of toxicological characterizations of these emissions. Two new technologies for monitoring diesel particulate matter (DPM) in real-time in mines were presented. These included a NIOSH developed real-time elemental carbon monitor, which works on a laser absorption technology basis. This will be commercially available in late summer of 2010. The second instrument is a

variation on the current personal dust monitor technology and is now being both laboratory and field evaluated. It shows significant promise for providing real-time total DPM mass measurements. In addition to current efforts to develop DPM mass measurement instrumentation, NIOSH is also looking into other measurement technologies which will be able to provide new metrics for measuring and characterizing diesel emissions. These measurement metrics will address diesel emission characteristics such as particle counts, surface areas, and concentrations of nano and ultrafine particles. Lastly, the presentation covered current efforts to assist the industry in controlling DPM emissions in underground mines. Several field evaluations of the effectiveness of new DPM and NO_x control technologies are being evaluated in underground mines. These include field evaluations of filter types and recirculation systems for cabs as well as a variety of new diesel particulate filter technologies. A comprehensive best practices guide entitled "Diesel Particulate Matter and Gases in Underground Mines – Best Practices Guide to Exposure Assessment and Control" will be published in late 2010. This publication release will be followed by best practices workshops which will be held for both coal and metal/non-metal mines around the country.

MR. FLOYD VARLEY, OFFICE OF MINE SAFETY & HEALTH RESEARCH, NIOSH

Mr. Floyd Varley discussed current and planned research in Escape and Rescue from underground coal mines. The research path is directed to address the overarching goals of: understanding and communicating the "state-of-the-art" in escape and rescue, identifying opportunities to improve the self-escape capability of US mineworkers, improving the ability of rescue teams to conduct rescue operations more safely and at the same time more efficiently, and facilitating diffusion and adoption of improved escape & rescue methods through the use partnerships and other consensus building activities. The research direction was based on an extensive investigation including US and international experts and stakeholder input. The primary research areas will be in self escape, safe-rescue operations, incident command, and training. Emphasis will be on standardization and development of a systems approach to emergency response planning and training. The desired outcome of the research will be implementation of standardized procedures, training, and methods utilizing advances in technology in a systematic response to mine emergencies. Discussions after the presentation centered on the desire to move these concepts into practice in a consultative manner. Concern for improper application of incident command structures used outside of mining was expressed. It was agreed formation of a partnership of NIOSH, MSHA, industry, labor and state agency stakeholders was necessary for oversight of the development of standardized systems, and that this partnership include metal/non-metal interests. Committee members expressed interest in seeing well-executed and documented research drive decisions on changes to current practices.

MR. LES BOORD and MR. BOB STEIN, NATIONAL PERSONAL PROTECTIVE TECHNOLOGY LABORATORY, NIOSH

Mr. Les Boord updated the Committee on mine escape respirator topics and mine rescue team ensembles. Self-contained self rescuer (SCSR) training modules have been developed in collaboration with MSHA. A training module consists of video, computer training, instructor's guide, and sticker. A project is underway to evaluate the effectiveness of the training modules. NPPTL is conducting a Long Term Field Evaluation (LTFE) Program of SCSRs. The LTFE Program tests and evaluates mine-deployed escape respirators. In 2007, NIOSH redesigned the

program to change the focus from a research program to a respirator certification audit program. The program's protocol incorporates random based sampling, evaluation criteria, documented test protocol, and follow-through actions. Random collection from MSHA SCSR registration listing started in May 2009. The program has collected 259 respirators and tested 173. Collection logistics have presented difficulties, but the collection goal currently remains at 400 SCSRs. One SCSR exhibited critical test failure, and the Certified Protocol Investigation is in process. NPPTL is developing a new standard for certification test and evaluation of Closed Circuit Escape Respirators (CCER) and is awaiting the SBA Economic Analysis. NPPTL is working through a competitive contract to develop both a dockable and hybrid person-wearable self-contained self-rescuer. They are also developing appropriate design and performance requirements for Mine Rescue Ensembles (MRE).

DR. JOEL HAIGHT, OFFICE OF MINE SAFETY & HEALTH RESEARCH, NIOSH

Dr. Joel Haight shared highlights of NIOSH's Human Factors Research. The team is developing a knee pad prototype (kneel assist device) in collaboration with the Rooster Group to reduce knee injuries in mining. Dr. Haight described an ergonomic audit project to define and develop tools to measure the exposure of workers to ergonomic risk. The tools will be designed for use by non-ergonomists to measure and control exposures to musculoskeletal disorders (MSDs) and slips, trips, and falls. Dr. Haight updated MSHRAC on the development of a Virtual Reality Mine Environment for Training. He also provided an update on the Safety Culture Assessment project. Dr. Haight discussed refuge chamber training research and the training product that have been developed, and he discussed improvements to mine escape training.

MS. MARCIA HARRIS, OFFICE OF MINE SAFETY & HEALTH RESEARCH, NIOSH

Ms. Marcia Harris presented the results from recent coal dust particle size surveys and the implications for mine explosions. She explained that dust explosibility is strongly dependent on the size distribution of the coal particles in a coal and rock dust mixture. Underground coal mining technology has changed significantly since the 1920s when the size surveys for the current regulations was conducted. The present coal size study indicates that the coal dust in intake airways of U.S. mines is significantly finer than that measured in the 1920s. Based on the inerting data from the Bruceton and Lake Lynn Experimental Mines (LLEM), due to finer coal particles, intake airways require more incombustible content to render the particles inert than the 65% Total Incombustible Content (TIC) specified in current regulations. For return airways, the current requirement of 80% TIC is still sufficient. LLEM inerting experiments demonstrated that at least 76.4% TIC is required to prevent explosion propagation for the finer dust found in modern intake areas. LLEM experiments have also shown that the TIC required to prevent flame propagation becomes much less dependent on coal particle size as the TIC approaches and exceeds 80%. Therefore, unless the determination of the coal particle size is required as part of the explosibility assessment for each sample, NIOSH recommends an 80% TIC requirement for both intake and return airways.

DR. JEFFERY KOHLER and DR. THOMAS NOVAK, OFFICE OF MINE SAFETY & HEALTH RESEARCH, NIOSH

At the last MSHRAC meeting, a question was raised about how NIOSH decides to look at promising technologies with the concern that new emergency communication technologies may not be getting sufficient attention by NIOSH. Dr. Kohler's presentation explained the process that NIOSH follows. When an inquiry about a new technology is made, NIOSH will identify an appropriate contact person who is familiar with the underlying technology. The person will contact the vendor/manufacturer to gather information for a preliminary assessment and to arrange for a meeting. If the NIOSH contact finds that the product or concept does not contain novel technology, only provides an incremental improvement over existing products, or is not applicable to mine safety or health, NIOSH will not participate further. If the NIOSH contact determines that the product may demonstrate new technology or provide a significant improvement over existing products, the contact will request detailed information including test data, technical information, and an on-site demonstration, if appropriate. The vendor must be willing to share proprietary information if it is necessary to evaluate the product's principle of operation or its effectiveness. If the NIOSH researchers verify that the product demonstrates new technology and provides significant improvement over existing technology, the contact person will facilitate discussions with appropriate stakeholders to help the vendor find a path forward for industry implementation. If funding is requested for further product development, the contact person will inform the vendor to submit a white paper to the OMSHR's Broad Agency Announcement. NIOSH makes evidence-based decisions as supported by test data, in-mine tests, etc. Gaps in the needs/functionality hierarchy help to establish funding priorities.

DR. THOMAS NOVAK, OFFICE OF MINE SAFETY & HEALTH RESEARCH, NIOSH

An update of proximity detection systems used in underground coal mines was presented. The presentation described the magnetic-field, zone-based technique that is presently being used by manufacturers. The problems associated with applying this technology to remote-controlled continuous miners were also explained. NIOSH research, which uses a different approach, was discussed. The NIOSH approach uses vector analysis (triangulation) from multiple field generators to identify the exact location of the operator and other mine workers in the vicinity of the continuous miner. By knowing the exact location(s), the system can disable only the machine-movement functions that present a potential hazard.

MR. MICHAEL TREVITS, OFFICE OF MINE SAFETY & HEALTH RESEARCH, NIOSH

Mr. Trevits presented an update of work on the construction and testing of the prototype mine escape vehicle (MEV). This presentation was a follow-up to the NIOSH sponsored conceptual MEV design that was recently completed by Raytheon UTD. Mr. Trevits began by presenting a brief review of the Raytheon UTD conceptual design. He then described the formation of a MEV team that was charged to create a roadmap for development of the MEV including elements of the Scope of Work for a follow-up NIOSH contract. The team was challenged by NIOSH management to use current technology and to follow a layered approach where improved levels of technology could be added as they were developed or refined. This approach would guarantee delivery of the MEV in a reasonable timeframe and would not be delayed by the lengthy research and development process. Mr. Trevits outlined the MEV subsystems which included the vehicle platform, life support, communications, vision, and navigation. The current

approach to the MEV is centered upon retrofitting an existing mine personnel carrier chassis with available, mine-worthy equipment that meets the MEV requirements. He then described the components of each subsystem and their associated functionality. Mr. Trevits then provided the sequence of events for the MEV which includes acquisition, integration, and testing of the major MEV subsystems (12 months), MSHA and local state approvals and certifications (4 months), in-house tests (1 month), surface or simulated underground mine tests (1 month), and underground field test (6-months). Mr. Trevits concluded the presentation by describing the progress and timeline for awarding the contract to construct and test the MEV.

DR. GERRY FINFINGER, OFFICE OF MINE SAFETY & HEALTH RESEARCH, NIOSH

Dr. Gerry Finfinger gave a presentation of the development of a robot for assisting mine rescue teams. The robot is being developed by Sandia Lab on a platform that was originally developed for mobility over difficult terrain including rubble piles, standing water, and mud. The platform is designed as a scout concept to be able to move ahead of mine rescue teams and provide information to the team and command center on the conditions of the mine. The information gathered by the robot includes temperature and gas levels of methane, oxygen, and carbon monoxide. The robot has color video and IR capabilities, uses two different independent light sources, and has two-way voice transmission. The robot is designed for both wireless (line-of-sight) and fiber optic tethered control and data transmission. The robot was designed to meet MSHA approval and final delivery of the robot for extensive testing and evaluation studies is schedule for May 2010.

The presentations to update MSHRAC on Broad Agency Announcements for new technology and for mine ventilation were postponed due to time constraints. Dr. Finfinger will send copies of Contract Final Reports to the Committee members.

OPEN COMMENT PERIOD

Dr. Güner Gürtunca discussed NIOSH's celebration of the 100th Year Anniversary of Mining Health & Safety Research in the United States. Members are encouraged to participate in the events. He also distributed a timeline of significant mine health and safety events during the last 100 years.

There were no other comments from the public.

FINDINGS AND RECOMMENDATIONS BY MSHRAC MEMBERS

There was general discussion of the issues among the members following each of the presentations. Specific findings, recommendations, comments, and requests include:

- The Committee agreed to develop a motion related to Lake Lynn Laboratory, as the work at the Laboratory is critical.

- Three weeks ago, the National Mining Association introduced a new safety web site for sharing best practices (safetyshare.org). The site is open to everyone. NIOSH stepped forward to provide current, fresh, and timely information for the site.

- A member brought up a concern that the concept of risk assessment was not on the agenda. An extensive discussion followed on the research and workshops already conducted by NIOSH, as well as the overall value and use of risk assessment to augment enforcement activities. NIOSH should further consider if and how to accomplish responsible implementation.

- Members were pleased with the research on mine illumination. This technology will offer a tremendous advantage and help in an area where they never anticipated there could be an improvement.

- A member commented that much of the escape and rescue research in response to the MINER Act has been in underground coal. He asks that NIOSH not ignore the metal/non-metal industry. Research in response to the MINER Act can often be tweaked to make it applicable to metal/non-metal.

- To move forward in escape and rescue research, NIOSH needs to examine practices and experiences in a consensus type forum. It should pull from state, MSHA, labor, and company experiences for improvements to emergency response systems including incident command structures, mine rescue procedures, technology development, and training.

- A member suggested that NIOSH contact MSHA to get a copy of their "Mine Rescue - Job Task Analysis" and to discuss what MSHA has already done with non-verbal signals.

- Given the Mining research budget and technical challenges that the mining application presents, NIOSH is finding that it is too high of a risk to continue developing robots. The focus now will be on developing a research protocol on how the existing robots should be used. Dr. Kohler will provide an update on the next steps at a future MSHRAC meeting.

- A member recommended that NIOSH expand work on Human Factors Research. Work at some properties is safer than others while working under the same regulations and available technologies. A "safety culture" may help explain this. We should learn from mines that do well and transport that to other companies.

- Concern was expressed that the LTFE program has not been able to collect 400 SCSR's. Members were also troubled that NIOSH has information on an SCSR problem and has not released that information to the workers or industry. Dr. Kohler agrees to work with NIOSH leadership to resolve and then report back to the Committee.

- Members expressed interest and are looking forward to better dust sampling technology. They believe PDM is going to work, but the cost is not cheap. Members ask that NIOSH keep the door open to new technology that can provide real-time technology.

- MSHRAC members were unanimously complimentary of NIOSH's Mining Program. Specific comments from members included:
    - Appreciate the work that NIOSH is doing to spur new technology.
    - The portfolio is focused to the mission and is well on target. Work is having an impact.
    - This is the best FACA that I have served on – the quality of the people on it and their dedication to mine safety are unique. Disagreements are substantive and not ideological based. It is really a pleasure to come and hear what is being done. I learn a lot that can be applied beyond mining.
    - The mining industry is fortunate to have the leadership and the employees of the Mining Program, who have been able to creatively manage limited resources and always respond to the most pressing needs.
    - All of the presentations were excellent.
    - Thank you and your departments for great work. It is valuable and will save lives of mineworkers. I appreciate and commend companies and industry members who have a commitment and work towards a safe work place.
    - Thank you for the important work.
    - I am impressed with how much you get done.
    - Great job.

The Committee discussed possible topics for the next meeting. Members suggested holding the meeting with other coal/mining events and that there would be value to holding the meeting in a place that would also allow for a visit to NIOSH laboratories to observe work being done. Possible topics included:

- Presentation on the University of Arizon contract report addressing Severe Injury Surveillance program and methodology
- Progress that is being made on metal/non-metal issues
- Report on the MINER Act Interagency Working Group
- Update on health issues, surveillance, and respiratory issues
- Programmatic update
- Portfolio update; how the current program compares to the strategic plan
- Brief look on all the research being conducted to better see the whole picture
- Update on human factors
- Mine preparedness
- Silica

The meeting was adjourned.

I herby confirm these Summary Minutes are accurate to the best of my knowledge.

Jeffery L, Kohler, PhD, MSHRAC Chair

July 21, 2010

Date