H.R. 3734, TO AMEND THE SURFACE MINING CONTROL AND RECLAMATION ACT OF 1977 TO PROVIDE SUPPORT TO MINING SCHOOLS, AND FOR OTHER PURPOSES, "MINING SCHOOLS ENHANCEMENT ACT"

LEGISLATIVE FIELD HEARING

BEFORE THE

SUBCOMMITTEE ON ENERGY AND MINERAL RESOURCES

OF THE

COMMITTEE ON NATURAL RESOURCES
U.S. HOUSE OF REPRESENTATIVES

ONE HUNDRED FOURTEENTH CONGRESS

FIRST SESSION

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CONTENTS

LEGISLATIVE FIELD HEARING ON H.R. 3734, TO AMEND THE SURFACE MINING CONTROL AND RECLAMATION ACT OF 1977 TO PROVIDE SUPPORT TO MINING SCHOOLS, AND FOR OTHER PURPOSES, "MINING SCHOOLS ENHANCEMENT ACT"

Monday, December 14, 2015

U.S. House of Representatives

Subcommittee on Energy and Mineral Resources

Committee on Natural Resources

Idaho Springs, Colorado

The subcommittee met, pursuant to call, at 10:15 a.m., in the Underground Classroom of the Edgar Mine, Colorado School of Mines Experimental Mine, 365 8th Avenue, Idaho Springs, Colorado, Hon. Doug Lamborn [Chairman of the Subcommittee] presiding.

Present: Representatives Lamborn, Bishop, and Hardy.

Also Present: Representative Perlmutter.

Mr. LAMBORN. The Subcommittee on Energy and Mineral Resources will come to order.

Before we get started with our committee hearing, I would like to first recognize Matt Schreiner, the Mine Manager here at the Edgar Mine, for a safety briefing.

Mr. SCHREINER. Thank you. Welcome all to the Edgar Mine. I am glad that we can do this here today.

I will take a few minutes. Throughout your time underground today, I need everyone to please keep your hard hats on at all times. As you travel throughout the facility, please be mindful of your footing. You want to avoid slips, trips, and falls. You will see equipment, valves, disconnects, and switches. We ask that you do not touch any of that.

Please stay together as a group; and if you have any questions about the mine, mine operations, or safety, please contact myself or some of the other workers that are identified by cap lamps on their hard hats. Thank you.

Mr. LAMBORN. All right, thank you.

The subcommittee is meeting today to hear testimony on a bill introduced by Representative Cresent Hardy, who is with us here today, H.R. 3734, a bill to amend the Surface Mining Control and Reclamation Act of 1977, to provide support to mining schools, and for other purposes. It is the "Mining Schools Enhancement Act."

By way of introduction, I am Doug Lamborn, the Chairman of the Subcommittee on Energy and Mineral Resources. I also represent the 5th District of Colorado, which is south and east of here.

Also with us today is Congressman Rob Bishop from Utah, the Chairman of the House Natural Resources Committee, and Congressman Cresent Hardy of Nevada.

We also have the pleasure of having with us today Ed Perlmutter of Colorado, a friend and colleague of many years who represents the Colorado School of Mines campus.

Since Mr. Perlmutter does not serve on the committee, I ask unanimous consent that he be allowed to sit with the committee and participate in today's hearing.

Hearing no objection, so ordered.

I now recognize myself for an opening statement.

STATEMENT OF THE HON. DOUG LAMBORN, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF COLORADO

Mr. LAMBORN. Today the subcommittee is meeting to discuss H.R. 3734, the "Mining Schools Enhancement Act," that was introduced on Friday, October 9 by Mr. Hardy and Mr. Perlmutter. Thank you again for joining us today.

I am excited to be chairing what is, to my understanding, a historical first for Congress, the first congressional hearing held underground in a mine. What better place to gather and discuss the need for future mining engineering experts, a need felt by industry, states, and the Federal workforce, as well as nonprofits.

This bill is the final in a three-pronged response to the EPA's Gold King and Standard Mine spills that occurred here in Colorado in August and September of this year. These three bills provide a path forward to tackle the problem of abandoned mines that need remediation.

My legislation, H.R. 3843, includes a Good Samaritan title, which provides limited liability relief for existing conditions at abandoned mine land (AML) sites for the Clean Water Act and the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), to encourage volunteer cleanup of both coal and non-coal AML sites.

H.R. 3844, sponsored by Congressman Jody Hice of Georgia, provides a way for concerned individuals and organizations, like environmental groups that have been so vocal on this issue, to raise money to help fund the cleanups through the private sector.

This bill, while receiving seed money from claim maintenance fees, provides a mechanism for unlimited funding through the non-governmental sector.

In the committee's investigation of the Gold King Mine spill, we discovered that out of 15,326 employees that the EPA has, there is not a single mining engineer—out of 15,326 employees. They only have 68 geologists, only two of which are assigned to Region 8, where these unfortunate spills occurred. In contrast, out of 8,790 employees, the Bureau of Land Management (BLM), does have 36 mining engineers and 170 geologists.

The U.S. Bureau of Reclamation, in the Department of the Interior's recent *Technical Evaluation of the Gold King Mine Incident Report*, found that in abandoned mine guidelines and manuals, there is significant emphasis on environmental issues—"with little appreciation for the engineering complexity of some

abandoned mine projects that often require, but do not receive, a significant level of expertise."

This brings us to why we are here today. The Mining Schools Enhancement Act, sponsored by Congressman Hardy, provides support to the mining schools around our Nation which produce the mining engineers of the future. In part, this is to ensure that the Nation has the technical expertise to competently perform cleanup of AML sites.

I am excited to hear from our witnesses today. Leigh Freeman, a professional talent recruiter for the mining industry, will be speaking on behalf of the National Academies of Science on a recent report from the Academies. This report on the emerging workforce trends in the U.S. energy and mining industries was instrumental in the development of this legislation.

I would also like to welcome Dr. Hugh Miller, a Professor of Mining Engineering at CSM, the Colorado School of Mines; and Nancy Nuttbrock, who was with the Wyoming Department of Environmental Quality until 2014, where she was Deputy Director.

I want to thank all the witnesses for being here, and I look forward to hearing from them today.

[The prepared statement of Mr. Lamborn follows:]

PREPARED STATEMENT OF THE HON. DOUG LAMBORN, CHAIRMAN, SUBCOMMITTEE ON ENERGY AND MINERAL RESOURCES

Today, the subcommittee is meeting to discuss H.R. 3734, the "Mining Schools Enhancement Act" that was introduced on Friday, October 9 by Mr. Hardy and Mr. Perlmutter. Thank you for joining us today.

I'm excited to be chairing what is, to my understanding, a historical first for Congress. The first congressional hearing held underground in a mine. What better place to gather and discuss the need for future mining engineering experts, a need felt by industry, states and Federal workforces, and nonprofits alike.

This bill is the final of a three-pronged response to the EPA's Gold King and the Standard Mine spills that occurred in my state, Colorado, in August and September of this year. These three bills provide a path forward to tackle the problem of abandoned mines that need remediation.

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The U.S. Bureau of Reclamation, in the Department of the Interior's recent *Technical Evaluation of the Gold King Mine Incident Report*, found that in "abandoned mine guidelines and manuals" there is significant emphasis on environmental issues—"with little appreciation for the engineering complexity of some abandoned mine projects that often require, but do not receive, a significant level of expertise." [1]

This brings us to why we are here today. The "Mining Schools Enhancement Act" sponsored by Congressman Hardy provides support to the mining schools around our Nation which produce the mining engineers of the future. In part, this is to ensure that the Nation has the technical expertise to *competently* perform cleanup of AML sites.

[1] http://www.usbr.gov/docs/goldkingminereport.pdf (page 2).

I'm excited to hear from our witnesses today. Leigh Freeman, a professional talent recruiter for the mining industry, will be speaking on behalf of the National Academies of Science on a recent report from the Academies. This report on emerging workforce trends in the U.S. Energy and Mining Industries was instrumental in the development of this legislation.

I'd also like to welcome, Dr. Hugh Miller, a professor of mining engineering at CSM; and Nancy Nuttbrock, who was at the Wyoming Department of Environmental Quality until 2014 where she was Deputy Director.

I want to thank all the witnesses for being here and look forward to hearing from them today.

Mr. LAMBORN. I would now like to recognize the author of H.R. 3734, Representative Hardy, for a statement on his bill.

STATEMENT OF THE HON. CRESENT HARDY, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF NEVADA

Mr. HARDY. I would like to thank the Chairman, and also Chairman Bishop for holding this hearing today. And thank you, Congressman Perlmutter, for going on and serving as an important asset to help get this bill through.

I would also like to extend a special thank you to the Colorado School of Mines for hosting this today. I appreciate you for that.

As a fifth-generation son of farmers and ranchers, and a former general engineering contractor, I am all about hard work and getting my hands dirty. The Edgar Experimental Mine here in Idaho Springs is my kind of environment. It is truly a privilege to get out of Washington and see what the next generation of scientists and engineers will learn in their craft.

There is not a single sector of the economy that is not touched by mining, whether it be minerals to power our industrial companies, metals that allow our consumer electronics and our military to function, or the materials I relied on as a contractor to build roads, bridges, and dams. America's economy, energy, and national security all depend on a capable mining and engineering workforce. Yet, despite the vital importance of these highly skilled and technical experts in the mining disciplines to private industry, academic institutions, and government agencies, we have witnessed a dangerous decline in the number of accredited mine schools and the graduates that they produce.

This generated a vicious cycle that has a devastating impact across the board. We are at a generational crossroads as the demographics of the U.S. workforce continue to change. With Baby Boomers retiring in large numbers, experts in the mine disciplines are needed now more than ever. Private sector mining companies are in a constant search for STEM graduates with the capabilities to understand and employ advanced technologies, even in entry-level positions.

At our regulatory agencies, the situation is equally serious. According to Richard Perry, the Administrator of the Nevada Division of Minerals, agencies have had to hire graduates that do not have the technical skills required to manage and evaluate mine-related projects, mine reclamation and closure, or to evaluate environmental risk associated with orphan mines. This is due to the absence of available graduates with degrees in mining and

mineral engineering and may lead to more environmental disasters like the Gold King Mine water disaster and spill.

As schools that produce the very mining engineering graduates that are shrinking in supply lack access to Federal funding for research, it has tripled the pipeline for new faculty and made mining education programs less and less sustainable.

So, what can we do about it? To start, we can amend SMCRA by directing the Office of Surface Mining Reclamation and Enforcement to distribute 70 percent of the funding made available for applied science transfer programs and accredited mining schools. This will enhance and support those educational programs and involve more undergraduate and graduate students in critical research.

The Mining School Enhancement Act is a common-sense bipartisan bill that would do just that. By supporting and training mineral engineers and scientists in the field of mining minerals resources and technology, my bill helps to restore the original intent of the Office of Surface Mining under SMCRA and will attack the shortage of mining engineers in this country head-on.

To sum it all up, the Nation needs more mining engineers. To ensure that more mining engineers are produced, our mining schools must be sustained; and to sustain our mining schools, they need a strong faculty; to ensure that strong faculty, new professors need to make it through the tenure process; to make it through the tenure process, new professors need to conduct research; to conduct research, professors need to have Federal funding. We need to provide more funding to support mining schools, and the Mining Enhancement Act will help accomplish this.

Again, I would like to thank my colleagues, the Colorado School of Mines, and the witnesses for being here today. I look forward to hearing the testimony.

Mr. LAMBORN. Thank you.

I now recognize the original co-sponsor of this legislation, Representative Perlmutter, for his opening remarks.

STATEMENT OF THE HON. ED PERLMUTTER, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF COLORADO

Mr. PERLMUTTER. Thank you. I want to thank Congressman Lamborn and Congressman Bishop for letting me participate in this underground hearing today.

[Laughter.]

Mr. PERLMUTTER. It is really actually very exciting. I also want to thank Congressman Hardy for sponsoring this bill to help train and educate our mining engineers and scientists of the future. This is badly needed both in terms of developing and maintaining the extraction of our natural resources in a solid way, and also dealing with assets that were closed a long time ago where it needs help. It needs real science and real engineering to do it right.

I would like to thank the committee for showcasing the Colorado School of Mines, which is one of the premiere engineering and research institutions in the world, and has students from all over the world that participate in it. I want to thank the School of Mines for hosting our hearing today. Thank you.

Mr. LAMBORN. Thank you.

I now recognize the Chairman of the Full Committee, the gentleman from Utah, Mr. Bishop, for a statement.

STATEMENT OF THE HON. ROB BISHOP, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF UTAH

Mr. BISHOP. I want to thank everyone who is here as well, especially the Colorado School of Mines for hosting this event. This is weird.

[Laughter.]

Mr. BISHOP. It is great to be here. I appreciate Doug, Cresent, and Ed for joining us here. Thank you for coming down, for putting all of this together.

We are here to hear testimony, specifically about H.R. 3734, from our three witnesses. That is part of a larger package that we have put together that deals with the Gold King Mine in the omnibus bill that should have been prevented and could have easily been prevented.

These three bills that deal with the Good Samaritan Act, that deal with getting more engineers, more experts—however you want to define that—into the field, as well as involving the private sector and private money coming in with the Hice bill, they all are complementary, to be proactive in finding a solution so that none of this happens again.

Secretary Jewell finally appeared before our committee last week, and there was something a little bit troubling about the report that the Interior Department, the Bureau of Reclamation specifically, gave to us. It did show what I think is a lack of transparency. There was unclear objectivity. It was a very narrowly focused investigation. But, it also showed that the government, specifically EPA in this situation, was blatantly mishandling the spill, both before and afterwards, and that we need to do something different.

We have 400,000 abandoned mines still here in the country, and it brought into question the ability of the Federal Government to adequately manage those other mines and to clean them up, whether they can handle it or not.

So, as Doug said, it is frustrating to us that EPA, with their 15,000-plus employees, has no mining engineers. Our committee, by serendipity, actually has more mining engineers than EPA does.

[Laughter.]

Mr. BISHOP. That is why Cresent's and Ed's bills are so significant, because obviously there has been a reduction of the students that we are putting out into that sector, and there has to be some kind of assistance to make it happen.

We have an aging workforce, all sorts of good jobs that are out there, and potential. Americans need to have those jobs, and we need to start training Americans to take those jobs and expand and make better an industry that still has a lot to give to this country. That is very important to us.

So, I am looking forward to that. I am happy to be here with my colleagues. I appreciate the witnesses who are here. I am looking forward to this hearing.

This is something that I hope we are taking lots of pictures of, because nobody, nobody is going to believe this back in Washington.

[Laughter.]

Mr. BISHOP. One last thing I would like to ask of our staff. I appreciate the hard work they put in to make this happen.

How many of these do you think I can pack today?

[Laughter.]

Mr. BISHOP. There is no bathroom here, so this will be——

[Laughter.]

Mr. BISHOP. I will apologize in advance, but we do have a plane to catch back to Washington. So between the plane ride and these three bottles, we may make a quick exit.

[Laughter.]

Mr. BISHOP. Thank you all for being here. I appreciate being a part of this.

[The prepared statement of Mr. Bishop follows:]

PREPARED STATEMENT OF THE HON. ROB BISHOP, CHAIRMAN, COMMITTEE ON NATURAL RESOURCES

First, I would like to thank the Colorado School of Mines for hosting us for this field hearing to discuss H.R. 3734, the "Mining Schools Enhancement Act," introduced by our colleague, Mr. Hardy.

H.R. 3734 is part of a larger mining development and reclamation bipartisan reform package that also includes two other bills:

— H.R. 3844, the "Energy and Minerals Reclamation Foundation Establishment Act," introduced by Rep. Jody Hice of Georgia, which provides a private sector funding mechanism for Abandoned Mine Land (AML) cleanup, seeded by Federal mineral lease fees, and

— H.R. 3843, the "Locatable Minerals Claim Location and Maintenance Fees Act," introduced by Mr. Lamborn, which provides liability relief for Good Samaritan individuals or entities who wish to come in and restore AML sites.

These three bills work in a complementary fashion to address the range of complex technical, legal, education and funding related challenges facing mining development and reclamation.

While all three reforms offer a proactive and positive set of solutions that are long past due, they are now even more critical, in light of the EPA-caused Animas River spill, which occurred last August some 325 miles from here at the Gold King Mine, not far from Silverton.

After months of failing to provide clear answers, last week Interior Secretary Jewell finally appeared before the committee to testify about her Department's role in the spill, before, during, and after. The hearing underscored the deeply troubling response by this Administration to the spill, including a complete lack of transparency and objectivity and a too narrowly-focused investigation of the Federal agencies' blatant mishandling of the spill and its aftermath.

As a result of this disaster, the Obama administration's credibility in managing abandoned mines is at an all-time low, which is why the legislation we are here today to discuss is so important.

Today there may be as many as 400,000 abandoned mines across the western states, some of which pose serious health and safety hazards, and environmental risks as exemplified by the Gold King Mine spill.

Although we still don't know why the EPA started urgently digging at the Gold King Mine, resulting in the Animas River spill, the event did help draw a spotlight to broader mining reclamation challenges.

It also further made clear that the Federal Government cannot handle the job. The EPA doesn't even have the mining engineering expertise to do so. There are more mining experts on our own committee staff than even on EPA's team. This is completely unacceptable.

Mr. Hardy's common-sense bill—H.R. 3734—encourages and provides support to America's mining schools that produce and help train the experts needed on the technical side to do this work in the future.

I appreciate being here today with my colleagues, Subcommittee Chairman Lamborn, and Congressman Hardy, to discuss their bills; and I welcome Congressman Perlmutter and thank him for joining us today for this hearing. And I look forward to hearing from our witnesses.

Mr. LAMBORN. OK, thank you.

We will now hear from our panel of witnesses. Each witness' written testimony will appear in full in the hearing record, so I ask that witnesses keep their oral statements to 5 minutes as outlined in our invitation letter to you and under Committee Rule 4(a).

I also want to explain how our timing lights work. When you begin to speak, our clerk will start the timer and a green light will appear. After 4 minutes, a yellow light will appear, and at that time you should speed up. At 5 minutes, the red light will come on, and we ask that you finish your statement at that time.

Before we hear from our witnesses, I also want to take a moment to urge the audience to submit written comments that will be included in the hearing record. We want to include as many comments as possible into the hearing record. There are comment forms at the room entrance, and you can also submit comments at our Web site, which is www.naturalresources.house.gov, under "Contact Us."

We want to hear from you. If you have any questions about how to do this, please see one of our staff members.

I will now introduce the witnesses.

We have Mr. Leigh Freeman, Principal of Leigh Freeman Consultancy; Dr. Hugh Miller, Associate Professor of Mining Engineering at the Colorado School of Mines; and Ms. Nancy Nuttbrock, Associate and Texas Regional Leader of Brierley Associates.

The Chair now recognizes Mr. Freeman for his statement.

STATEMENT OF LEIGH FREEMAN, PRINCIPAL, LEIGH FREEMAN CONSULTANCY, DENVER, COLORADO

Mr. FREEMAN. Chairman Lamborn, Mr. Perlmutter, and members of the committee, I would like to thank you for the invitation to address you on the subject of education, training, and workforce issues related to the U.S. mining industry. My name is Leigh Freeman, and I am the Principal at Leigh Freeman Consultancy. I have more than 40 years of experience in the private sector of the mining industry.

Relevant to these proceedings, I served as a member of the Committee on Emerging Workforce Trends in the U.S. Energy and Mining Industries of the National Academies of Sciences, Engineering, and Medicine. The National Academy of Sciences was chartered by Congress in 1863 to advise the government on matters of science and technology.

In 2013, the Academies' committee published a consensus report sponsored by the Department of Energy's National Energy Technology Laboratory. Specifically, the report analyzed the need for and availability of workers for the hardrock and coal mining, oil and gas, geothermal, nuclear, solar, and wind energy industries.

Two factors impact the workforce across all mining and energy sectors. The first is demographic. Approximately one-third of the

U.S. workforce comprises Baby Boomers, who are poised to retire in great numbers by the end of this decade.

Mr. LAMBORN. Mr. Freeman, can I ask you to speak just a little bit louder for our recording equipment? Thank you.

Mr. FREEMAN. Moreover, there are too few workers currently available and prepared to replace them.

The second major crosscutting factor impacting the workforce is competencies. Specifically, the application of STEM principles in the workplace has increased the skill and competency requirements of the mining and energy workers.

In its recommendations, the committee highlighted the importance of collaborative efforts among government, industry, and educational institutions to create multiple pathways in higher education. To ensure that there are enough faculty now and in the pipeline who qualify to work and teach at the cutting edge of technology, the committee also recommended that the government and industry consider public-private partnerships to provide joint support for mining and energy research programs at U.S. universities.

The balance of my remarks will focus on the mining component of the report.

The study committee identified a critical role for U.S. universities to develop graduate research programs in mining, with the goal of establishing global technological leadership. Although the need for sustaining highly qualified university faculty and graduates in mining engineering and mineral processing is evident, the capacity of U.S. universities to meet this need is severely challenged. Data illustrate the nature of these challenges.

First, the number of accredited mining and mineral engineering programs has declined from 25 in 1982 to 14 in 2007. The number of faculty has also declined, from approximately 120 in 1984 to a mere 70 in 2007.

Over the last 10 years, U.S. universities have produced fewer than 200 mining engineers per year for employment across the full spectrum of metals, coal, industrial minerals, and building materials in support of Federal positions.

Observations from my own professional experiences complement work done by the Academies' committee. In 2002, the industry and the academic community, acting through an industry-supported professional organization, the Society of Mining Metallurgy and Exploration (SME), recognized the pending crisis of talent in the U.S. mining industry. These efforts of SME supported the Energy Policy Act of 2005, as well as the Academies' report presented here.

Consistent with the recommendations of the Academies, industry formed and funded the SME Education Sustainability Committee. This year, actionable items facilitated by this committee included two initiatives: one, the development of 4-year graduate fellowships for qualified Ph.D. students, who are committed to pursuing careers in academia; and two, the awarding of career grants to assist new faculty in establishing research and publication records necessary to achieve tenure and promotion. This program is chaired by Dr. Hugh Miller, Colorado School of Mines, who will be speaking next.

The Academies' report recommended industry-funded programs, such as ESC, as a short-term solution to a longer-term, stable

solution realized by public-private funding. In summary, the Academies' report suggested expansion of research programs at universities, with matching funds from industry, could be directed toward advancing technology to drive innovation, and developing university faculty.

I would like to thank the committee for its time and interest in this subject, and I look forward to questions.

[The prepared statement of Mr. Freeman follows:]

PREPARED STATEMENT OF LEIGH FREEMAN, PRINCIPAL, LEIGH FREEMAN CONSULTANCY; AND MEMBER, COMMITTEE ON EMERGING WORKFORCE TRENDS IN THE ENERGY AND MINING INDUSTRIES, BOARD ON EARTH SCIENCES AND RESOURCES, DIVISION ON EARTH AND LIFE STUDIES; AND BOARD ON HIGHER EDUCATION AND WORKFORCE, POLICY AND GLOBAL AFFAIRS, THE NATIONAL ACADEMIES OF SCIENCES, ENGINEERING, AND MEDICINE

Chairman Lamborn, Ranking Member Lowenthal, and members of the committee, I would like to thank you for the invitation to address you on the subject of education, training, and workforce issues related to the U.S. mining industry. My name is Leigh Freeman and I am the Principal at Leigh Freeman Consultancy. I have more than 40 years of experience in the private sector of the mining industry. I am a Geological Engineering graduate of the University of Montana at Montana Tech. I am deeply involved in minerals education and talent development. To this end, I currently serve on industry advisory boards for the geological engineering department of the University of Montana at Montana Tech, the Profession Land & Resource Management program for the Western State University here in Colorado, and the mining engineering advisory boards for the South Dakota School of Mines and the University of Arizona. For much of my professional career I have been active on committees for the Society of Mining, Metallurgy & Exploration (SME), particularly those committees involving minerals education and sustainability. Relevant to this proceeding, I served as a member of the Committee on Emerging Workforce Trends in the U.S. Energy and Mining Industries of the National Academies of Sciences, Engineering, and Medicine. The National Academy of Sciences was chartered by Congress in 1863 to advise the government on matters of science and technology and later expanded to include the National Academies of Engineering and Medicine.

In 2013, the Academies' committee of which I was a member published a consensus report titled "Emerging Workforce Trends in the U.S. Energy and Mining Industries: A Call to Action," which was sponsored by the Department of Energy's National Energy Technology Laboratory. The report examined the U.S. mining and energy workforce, and proposed approaches to address crucial, emerging needs to meet the Nation's requirements for skilled workers in most mining and energy sectors, spanning the workforce in private industry, at universities, and in the Federal Government. The report task originated as a congressional mandate in the Energy Policy Act of 2005.

Specifically, the report analyzed the need for and availability of workers for the hardrock and coal mining, and oil and gas, geothermal, nuclear, solar, and wind energy industries. In each of these sectors, the committee examined the availability of skilled labor at both entry and senior levels; the historical and current trends in the size, growth, and demographics of the workforce; labor market characteristics; future demand for and supply of workers; job health and safety impacts of potential labor shortages; and, particularly relevant to today's discussion, the availability and need for education and training programs for workers in these sectors. The report recognized that creation of a skilled workforce begins early, that the Nation will depend on these workers to be capable in science, technology, engineering, and mathematics (STEM) disciplines, and that this STEM prerequisite creates a parallel requirement for an educational system that can effectively teach these subjects.

I will focus my remarks primarily on those aspects of the Academies report that are relevant for mining and the topic of today's hearing. However, the broader scope of the report provides useful context to the mining information and I will share some of the overarching recommendations from the report. I will also add some personal observations from my own professional experience about what has taken place in academia and industry to address mining education at the university level over the last 15 years.

Two major factors impact the workforce across all mining and energy sectors. The first is Demographic. Approximately one-third of the U.S. workforce comprises Baby

Boomers—the generation born between 1946 and 1964—and they are poised to retire in great numbers by the end of this decade. Moreover, there are too few younger workers currently available and prepared to replace them. The second major cross-cutting factor impacting the workforce is Competencies. Specifically, the application of STEM principles in the workplace has increased the skill and competency requirements of the mining and energy workers. A strong foundation in STEM skills is therefore needed for many mining and energy jobs, and the need is growing at all levels as innovation and new technologies are increasingly applied in the workplace. The current pipeline of STEM-capable students and workers is inadequate to meet these workforce needs. The report outlined seven recommendations to address the shortfalls of the current education pipeline and I will review those briefly.

In its recommendations to address challenges presented by Demographics and Competencies, the committee highlighted the importance of collaborative efforts among government, industry, and educational institutions to create and support new approaches to develop multiple pathways in higher education that can lead to a range of mining and energy jobs. To ensure that there are enough faculty now and in the pipeline who qualify to work and teach at the cutting edge of technology, the committee also recommended that the government and industry consider public-private partnerships to provide joint support for mining and energy research programs at U.S. universities, with the goal of attracting and better preparing students and faculty, promoting innovation, and helping to insure the relevance of university programs. Recognizing that industry's ability to financially support these critical efforts is subject to market price cyclicity in the commodity sectors underscored the importance of government-industry partnerships in providing consistent financial support for mining and energy education.

The availability of current, accurate mining and energy information was also highlighted by the committee as being important. The report stressed the need for industry and educational institutions to provide timely and accurate information about career opportunities in mining and energy fields, and educational and career navigation resources targeted toward students, educators, and policymakers. In a related way, the report called upon the Federal Government to work with industry to develop more agile and responsive workforce data that reflect the fast-paced change of jobs and occupations and allow students, educators, and employers to understand and take advantage of changing job opportunities.

Finally, the report found a critical, pending shortage of Federal employees involved in mineral and energy fields due to high, ongoing retirement rates in the Federal Government sector. These Federal employees play an important role in data gathering and advising, as well as in oversight of mining and energy activities for an increasingly involved and concerned citizenry. The committee recommended several approaches for the agencies to attract and retain qualified workers to meet current and future needs in mineral and energy policy, permitting, extraction methods, production oversight, reclamation, and research and data provision. The committee noted the challenges faced by the Federal sector in hiring qualified employees both because of the high retirement rates and competition from the higher compensation offered by industry.

The balance of my remarks will focus on the mining component of the report. Mineral and energy resources are essential for the Nation's fundamental functions, its economy, and its security and are essential for the existence and operation of products that are used by people every day. The committee defined mining to include metals such as copper and iron—basic materials for all industrial nations—as well as rare earths and other metals necessary for high tech, national defense, and energy applications; industrial minerals such as potash used for fertilizer and sodium carbonate (trona) for glass production; coal for energy; and building materials including sand, gravel and crushed rock for infrastructure including houses, highways, and airport construction. In addition to the convenience and security offered by these kinds of products, minerals also support the economic standard of living in the United States. The USGS estimated that the overall value added to the U.S. gross domestic product (GDP) in 2014 by major industries that consumed processed nonfuel mineral materials was $2.5 trillion. This contribution represented about 14.4 percent of the total U.S. GDP of $17.4 trillion in 2014.

Although the committee's recommendations were applied across the broad array of mining and energy sectors, the study committee noted a particularly acute situation regarding age demographics in the workforce and an accompanying shortage of STEM-capable, younger people to fill upcoming and current openings in mining and mining engineering. The USGS has monitored import reliance for decades and these data have shown an increase in the number of minerals for which the United States depends primarily or completely on foreign suppliers of the raw material. Whether or not the minerals used every day in the United States are mined domestically or

abroad, the capacity to conduct research and foster technological innovation are important. Without them, the committee suggested, the Nation may not be able to anticipate and react to potential restrictions in the mineral markets. A talent crisis for professionals and workers is pending, and already exists for faculty in mining and mining engineering, driven by an aging workforce and international competition for talent. Both will precipitate fundamental changes in the cost of talent at all skill and education levels, but particularly for those positions requiring the most highly trained or educated practitioners.

Mining disciplines in higher education were broadly defined in the committee's report to include fields such as mining exploration, mineral extraction and processing, metallurgy, extractive metallurgy, economic geology, exploration geophysics, and geochemistry, among others. The committee underscored the advantages of disciplinary diversity whereby students could be trained and educated across disciplinary lines to increase innovation and educate people with a breadth of skills to address career challenges in a cyclical commodity business.

Although the need for sustaining highly qualified university faculty and graduates in mining and mining engineering is evident, the capacity of U.S. universities to meet this need is severely challenged. Some of the data available from the committee's report—and updated, where possible, for this testimony—illustrate the nature of these challenges. First, the number of accredited mining and mineral engineering programs has declined from 25 in 1982 to 14 in 2007. The number of faculty has also declined, from approximately 120 in 1984 to 70 in 2007. This translates into an average of 5 faculty at each of the 14 programs, each awarding 9 B.S. degrees per year per school. Over the last 10 years, U.S. universities have produced fewer than 200 mining engineers per year for employment across the full range of metals, coal, industrial minerals, and building materials sectors, and in academia and Federal and state agencies. Relative to other engineering disciplines, these mining and mineral engineering programs are small and may be more vulnerable to financial pressures experienced by universities. Furthermore, the major proportion of the current technological leadership in U.S. institutions of higher education is approaching retirement without an obvious source of qualified replacements. The study committee identified a critical role for U.S. universities to develop graduate research programs in mining with a goal of establishing global technological leadership.

One approach to reasserting U.S. leadership in mining fields suggested by the committee was the establishment of several interdisciplinary graduate Centers of Excellence in Earth Resources Engineering at leading U.S. research universities. These kinds of centers could help focus attention on the science and engineering challenges presented by the mining industries and develop the professional expertise that will be needed. These Centers could efficiently coordinate the work of faculty and research facilities at multiple universities and would complement the more classical programs of the U.S. schools of mines. In addition, Centers of Excellence could create an education system that responds to changes in the economy more quickly and produces a more flexible, STEM-competent workforce. The immediate goal in addressing the shortfalls of the current education pipeline would be to re-establish the pipeline of talent and particularly of qualified faculty in the 14 remaining mining schools in the disciplines deemed to be 'professions at risk': mining, extractive metallurgy/mineral processing, and economic geology. The outcome from such an approach was envisioned by the committee to develop students equipped with multiple skills, who are prepared to adjust quickly to industry requirements and job availability.

In my own professional experience, I have participated in a consistent industry-academic initiative since 2002 to try to develop more robust mining education programs and I'd like to briefly discuss a few of these here as complements to the work done by the Academies committee. In 2002, industry and the academic community recognized the pending talent crisis in the U.S. mining sector. This realization led to the formation of an Education Sustainability Task Force, where I served as co-chairman under the auspices of the SME. At subsequent workshops and symposia, leaders from industry and the academic community, with participation from Federal agencies, established plans to stabilize and advance minerals education at U.S. universities with a special focus on funding to re-establish the 'the pipeline for qualified faculty.' These efforts continued in support of the aforementioned congressional mandate in the Energy Policy Act of 2005 as well as the Academies report presented here. Consistent with recommendations in the Academies report to "provide financial and leadership support to sustain critical teaching capacity until medium- and long-term solutions can be developed and implemented," the effort led to the formation and subsequent funding by industry of the SME Education Sustainability Committee (ESC).

Since its inception in fall 2013, the ESC has sought to develop actionable items to address the long-term challenges to the sustainability of U.S. degree granting programs in Mining Engineering and Mineral Processing/Extractive Metallurgy. Given its mission and the implications of faculty shortages on the future viability of these academic programs, the ESC has focused its efforts on ways of rebuilding the faculty pipeline in order to address the growing absence of viable tenure-track candidates to replace the aging workforce of existing faculty at U.S. universities. The actionable items facilitated by the ESC culminated in two complimentary initiatives: (1) the development of 4-year graduate fellowships for qualified Ph.D. students who are committed to pursuing careers in academia; and (2) the awarding of Career Grants to assist new faculty in establishing research and publication records necessary to achieve tenure and promotion. Thus far, 3 Ph.D. Fellowships and 2 Career Development Grants have been distributed and the solicitation for 2016 has been recently released. When full participation of the Grant Program is reached in 2018, the total financial commitment will be $1.477 million annually. This program, chaired by Dr. Hugh Miller of the Colorado School of Mines, will be discussed by others at this proceeding. The Academies report recommended industry-funded programs, such as ESC, as a short-term solution to a longer-term, stable solution realized by private-public funding.

In summary, with a direct alignment to industry education and skill requirements, the Academies report suggested that the success of mining education programs can be measured by attainment of employment and advancement opportunities in the mining industries. Expansion of research programs at universities, with matching funding from industry, could be directed toward specific outcomes such as: (1) advancing technology or business processes to drive innovation and enrich graduate and undergraduate education; and (2) developing university faculty who work on the cutting edge of research to enhance the quality of higher education. For mining and mining engineering, where the supply of STEM-capable younger workers is inadequate to replace or sustain requirements for workers in the private sector, in academia, and in the Federal Government, establishing Centers of Excellence in Earth Resources Engineering or similar technology- and innovation-focused research and education programs could help re-establish a U.S. leadership role in mining.

I would like to thank the committee for its time and interest in this subject and I look forward to questions.

Mr. LAMBORN. Thank you.

The Chair now recognizes Dr. Miller to testify.

STATEMENT OF HUGH MILLER, ASSOCIATE PROFESSOR OF MINING ENGINEERING, COLORADO SCHOOL OF MINES, GOLDEN, COLORADO

Dr. MILLER. Great. Thank you. Chairman Lamborn, Mr. Perlmutter, and members of the committee. I would like to extend my sincere thanks for the opportunity to address the challenges associated with the U.S. academic programs in mining engineering. My name is Hugh Miller, and I am an Associate Professor in the Mining Engineering Department at the Colorado School of Mines. I have nearly 30 years of combined professional experience in both industry and academia. I also serve as the Chair of the Education Sustainability Committee for the Society for Mining, Metallurgy, and Exploration.

As Mr. Freeman has addressed, one of the most ominous threats facing the industry is the steady decline in the number of accredited U.S. mining engineering programs over the last 30 years. Since these programs are largely responsible for educating the next generation of mining professionals who will assume technical and leadership positions in all sectors of the industry and government, the loss of these mining programs will have and have had a profound and long-lasting impact. The crisis in talent has prompted action within the industry, including groups like SME and the

National Academies, which have sought to quantify the reasons for the loss of these academic programs, to find ways for the remaining programs to remain stable, and to effectively increase the number of graduates being produced.

Paramount among these challenges identified are shortages in qualified candidates to replace retiring faculty and the limited number of sources available to support academic research. While seemingly independent, the issues associated with faculty scarcity, research funding, the production of graduates, and program instability are all inter-related.

Of significant concern is the absence of a viable means to address the current number of faculty vacancies, as well as the looming labor deficiencies associated with retirements over the next decade, when more than half of the existing tenure and tenure track faculty will be eligible for retirement within 5 years.

To put this in context, the average nationwide graduation rate for mining Ph.D.s has historically been less than 15 annually, where the vast majority of these candidates who are graduates are international students. Even if 25 percent of these individuals had the interest of pursuing a career in academia and possessed the skill sets necessary to be successful as a tenure track faculty, we would fall far short in the number of faculty needed to sustain the current programs.

Furthermore, the overall success rate in developing faculty from graduate school through tenure is extremely poor, with some estimates as low as 25 percent. While this low success rate is consistent with the belief of the national average associated with other engineering disciplines, the limited size of the candidate pool in mining compounds the current difficulties in attracting a critical mass of faculty that are needed for these programs.

SME is focusing its efforts on rebuilding what is often referred to as the faculty pipeline, the mechanism through which individuals acquire the experience, skill sets, and qualifications necessary for employment at a university and then to subsequently achieve tenure. These efforts include the development of graduate fellowships for qualified Ph.D. students who are committed to pursuing careers in academia, and career development grants to assist new faculty in achieving tenure and promotion.

The importance of research funding in higher education is not well understood outside of academia. While research is primarily used as a criteria for assessing faculty performance and is intimately tied to promotion and tenure, it is also the driver that enables programs to recruit and retain graduate students, acquire and maintain laboratory equipment and facilities for both education and research, and to publish.

In addition, with the significant reductions in state funding over the last 10 years, most public universities have become increasingly dependent upon research overhead to offset the costs associated with operations and support staff. With the exception of CDC NIOSH, which is solely focused on occupational safety and health, there are very limited opportunities available for Federal funding for mining research at levels comparable to other science and engineering disciplines.

In summary, mining education is at risk. The continued loss of programs and the talent they generate will have a profound impact on the Nation's economy and security. Without significant near-term investment, academic programs in mineral engineering will not have the capacity to produce the graduates necessary to sustain industry demand.

There are opportunities, however, where the Federal Government can make a substantive difference by investing in meaningful research initiatives that encourage industry, university, and government collaboration. Efforts to amend SMCRA in order to provide support to mining schools is a monumental step in the right direction and will have significant long-term benefits.

I would like to thank the committee for the time and interest in this very important topic, and it is a pleasure to answer any questions you might have. Thank you.

[The prepared statement of Dr. Miller follows:]

PREPARED STATEMENT OF HUGH B. MILLER, ASSOCIATE PROFESSOR, MINING ENGINEERING DEPARTMENT, COLORADO SCHOOL OF MINES

Chairman Lamborn, Ranking Member Lowenthal, and members of the committee, I would like to extend my sincere thanks for the opportunity to address you regarding the long-term challenges that threaten the sustainability of U.S. Mining and Extractive Metallurgy/ Mineral Processing degree granting programs. My name is Hugh Miller and I am an Associate Professor in the Mining Engineering Department at the Colorado School of Mines (CSM). I have nearly 30 years of combined professional experience in both industry and academia. I also have the pleasure of serving as the Chair of the Education Sustainability Committee (ESC) for the Society for Mining, Metallurgy, and Exploration (SME). The ESC is a committee comprised of academicians and experts in higher education that was formed with the expressed mission to develop specific actionable recommendations to address the daunting challenges facing these academic programs.

I would also like to welcome you to the CSM Edgar Experimental Mine: a unique laboratory focal to the development of undergraduate and graduate students and cutting edge research in a wide variety of mineral and earth related disciplines including Mining, Metallurgical, and Geological Engineering, as well as Economic Geology, Underground Construction and Tunneling, Explosives Engineering, Environmental Engineering/Science, and Petroleum Engineering.

This morning you will hear testimony from several experts on the importance of domestic mineral production as it pertains to our economy, standard of living, and national security, and the dire implications of disruptions to the production of these raw materials as a consequence of future shortages in skilled labor and professional talent. Contrary to public perception, and what's often portrayed on television and in the media, mining and mineral exploration in the developed World is pushing the limits in terms of technology and innovation that extends from equipment and operating systems to processes and environmental controls. Furthermore, due to the economic pressures associated with declining ore value, increasing operating and capital costs, and growing regulatory oversight, companies are heavily dependent upon continuous improvement and the use of technology to remain viable. This is particularly true in the mining of unit value commodities, where U.S. operations are often at a competitive disadvantage relative to foreign producers. As such, the future viability of the U.S. Mining Industry and the domestic production of raw minerals is directly dependent upon the availability of a skilled workforce which must possess technical capabilities and competencies that far exceed those needed a mere decade ago. This supposition is supported by a workforce study produced by the National Academies in 2013 titled, "Emerging Workforce Trends in the U.S. Energy and Mining Industries: A Call to Action." Mr. Leigh Freeman served on the Committee responsible for this critical study and will provide testimony later this morning.

This study, and several others, identified significant threats to the stability of this skilled workforce. The aging demographics of the Mining Industry has long been a major source of concern that impacts both hourly and salaried labor, where there are simply too few workers available to adequately replace those that are retiring. In addition, the increasing technical sophistication of job assignments and the

requisite competencies these younger workers must have represents another challenge. The current labor pool does not have the skills and education necessary to adequately meet these workforce needs now, or in the future.

With regards to professional talent, one of the most ominous threats facing the industry is the steady decline in the number of accredited U.S. Mining Engineering programs over the last 30 years. In 1982, there were 25 degree granting programs in Mining Engineering. Today, there are 14 accredited departments, of which only half can be considered healthy. Of these, only 12 of these remaining programs offer Ph.D. graduate degrees. Since these programs are largely responsible for educating the next generation of professionals who will assume technical and leadership positions in all sectors of the industry, the loss of these engineering programs will have immediate and long-lasting impacts. Beginning with the rise in commodity prices in the early 2000s, industry began to experience significant labor shortages in technical and supervisory positions. With regards to entry level engineers, there was insufficient capacity within the remaining mining programs to provide the new talent that these companies desperately needed. Driven by their constituencies, this "talent crisis" prompted action within professional organizations, such as the Society for Mining, Metallurgy, and Exploration (SME), to quantify the causation factors responsible for the deterioration and loss of these academic programs and find ways for the remaining programs to become stable, and effectively increase the number of graduates being produced. A great deal of work was conducted by many throughout the decade to collect and analyze the data and to formulate strategic plans intended to stabilize and advance U.S. minerals education. These activities facilitated a unique collaboration between industry, academia, and government that resulted in numerous committees and task forces, workshops, symposiums, and related research activities. The consequence of these efforts led to formalized studies produced by the National Academies and SME, papers written by distinguished members of the academic mining community, and proposals regarding the promulgation of potential legislation.

Building upon the contributions derived from these numerous sources, SME leadership created the ESC in fall 2013 with the expressed mandate to formulate meaningful, actionable recommendations to mitigate the prevailing challenges that threaten the survival and long-term viability of U.S. academic programs in Mining Engineering and Mineral Processing/Extractive Metallurgy. The primary intent of the Committee wasn't to rectify all the threats and challenges facing these programs, but to focus on addressing those critical factors where interventions could have a direct and substitutive impact. The first step was to quantify the underlying factors jeopardizing the short-term and long-term sustainability of the current programs. This was performed by analyzing data and information previously collected through SME and other sources, where potential deficiencies were assessed. Additional information was then collected as deemed necessary. The Committee attempted to develop causation factors that correlated with the trends seen in the data. While the threats to specific academic programs vary by university, there were commonalities inherent to each of these degree programs. It's important to note that these challenges are complex and interrelated, where many of the underlying threats identified are symptomatic of larger changes that have occurred in higher education and are difficult for an individual department or an external entity (e.g., professional organization or a company) to remedy or facilitate meaningful change. These issues are often driven by state mandated university policies and institutional economics, where student enrollment, the physical footprint, and cost per student associated with mineral engineering programs greatly contribute to their vulnerability. That said, the Committee was able to identify several common, underlying factors that significantly contributed to the current dilemma facing these mining programs. Paramount among these challenges includes faculty scarcity and insufficient sources of support for faculty research. While seemingly independent, these two issues are intimately related.

FACULTY SCARCITY

As discussed previously, the labor shortages endemic to the Mining Industry also extend to academia. Of immediate concern is the absence of a viable means to address the current number of faculty vacancies as well as the looming future labor deficiencies associated with retirements over the next decade. Two fundamental studies conducted by McCarter (2007) and Poulton (2012) analyzed the demographics of U.S. mining engineering faculty and provided quantitative evidence of

the pending crisis.[1, 2] The results of these studies showed that of the 74 tenured track faculty reported in the 2009/2010 academic year, 100 percent of the senior faculty in the United States (39 mining professors) will be eligible for retirement by 2020. Compounding this situation is that few qualified professionals are entering academia as new faculty, where only 13.5 percent were 40 years of age or younger. These factors have resulted in 14 open faculty positions being reported by 12 of the 14 U.S. Mining Department Heads in the 2009/2010 academic year (Poulton, 2012). This study went on to estimate that an additional 18 faculty positions would be needed in 2015 and 21 more openings would occur by 2020. These ominous predictions were largely substantiated at the 2013 SME Annual Meeting in Denver, where a survey of the 14 mining departments indicated that there were 18 faculty positions either currently open or planned in the immediate future, including 5 department head positions.[3] To put this in context, the average nationwide graduation rate for Mining Ph.D.s has historically been less than 15 annually, where a vast majority of these graduates are international students. In the event that even 25 percent of these individuals had an interest in pursuing a career in academia and possessed the skill sets necessary to be successful as tenure-track faculty, it would fall far short of the number of faculty needed to sustain the current programs.

The situation facing the six remaining U.S. Extractive Metallurgy/Mineral Processing Departments appears to be even dire as a consequence of the limited number of key faculty keeping these programs stable. An examination of these programs reveals a population of approximately 22 tenured or tenure-track faculty, where 10 of these professors will be eligible for retirement within the next 8 years.[4]

The problem associated with faculty scarcity is cumulative and extends from recruiting appropriate candidates with a desire for pursuing a career in academia and the ability to successfully complete a Ph.D. degree, through the tenuous process of achieving tenure at a given academic program. The overall success rate of developing faculty from graduate school to tenure is extremely poor, with estimates as low as 20 percent. While this low success rate is probably consistent with the national average of other engineering disciplines, the very limited candidate pool of potential faculty only compounds the current difficulties associated with mineral engineering departments maintaining a critical mass of faculty because of the low Ph.D. graduation rates and the lack of qualified candidates.

To address this challenge in a meaningful way, the ESC recommended to SME leadership, and its industry constituencies, that the organization focus its efforts on several complimentary actions related to rebuilding what is often referred to as the faculty pipeline. The pipeline represents the mechanism through which individuals have traditionally acquired the experience, skill sets, and qualifications necessary for employment as tenured-track faculty at an accredited university and then to go on to successfully earn tenure. As part of these efforts, the ESC recommended the following actions: (1) the development of a 4-year graduate fellowship for qualified Ph.D. students who are committed to pursuing careers in academia; and (2) the awarding of Career Grants intended to assist new faculty in establishing research and publication records necessary to achieve tenure and promotion. Both of these initiatives were strongly endorsed by the SME and SME Foundation Boards. The structure, guidelines, and budgets of these academic grants were formalized in 2014 and fundraising efforts began shortly thereafter. The success of these activities, and the necessary industry buy-in to financially support them, led to the formal solicitation of applications in March 2015, and the awarding of 3 Ph.D. Fellowships and 2 Career Development Grants in August 2015. The 2016 solicitation for these grant programs was released by SME in November. When full participation of the combined grant programs is reached in 2018, the total annual financial commitment will be $1.48 million and will be entirely supported from donations derived by SME members and industry partners.

Beyond the Academic Grant programs, the ESC also outlined a full agenda of activities and recommendations intended to address challenges related to the availability of research funding, the recruiting of qualified industry professionals into both M.S. and Ph.D. degree programs, activities designed to mentor new faculty on

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[1] McCarter, M. (2007), "Mining faculty in the United States: current status and sustainability," Mining Engineering, SME Publication, September, pp. 28–33.

[2] Poulton, M. (2012), "Analysis of the Mining Engineering Faculty Pipeline," 2012 SME Annual Meeting, Conference Proceedings, February, pp. 1–9.

[3] Department Survey, Mineral School Department Heads Meeting, 2013 SME Annual Meeting, Denver, CO, February 24, 2013.

[4] "*Federal Support for U.S. Mining Schools*," Society for Mining, Metallurgy & Exploration, Position Paper, 2014.

topics critical to tenure (e.g., teaching, research, publication, and service), and the development of a campaign to educate industry on the realities and threats facing higher education. These activities are active and on-going.

RESEARCH SUPPORT

The importance of research funding to the health and welfare of an academic program is often not well understood outside of academia, even among a department's industry advisors and constituencies. While research is usually a primary criterion used to assess faculty performance and is intimately tied to promotion and tenure, it is also the driver that enables programs to recruit and retain graduate students, acquire and maintain laboratory equipment and facilities used for both education and research, and generate peer-reviewed publications. In addition, with the significant declines in state funding, most public universities have become increasingly dependent on research overheads to offset the costs associated with department operations and support staff. While others have documented the increasing reliance of universities on tuition and in-direct financial support derived from research, I wanted to focus on the importance of research as it pertains to the challenges facing faculty scarcity, the redevelopment of the talent pipeline, and the overall health of academic departments. With the exception of the large, multi-national "majors", most mining companies want to employ our graduates but see little value in supporting funded research despite their dependence on technology. Research, student enrollment, and the number and productivity of faculty, however, are all interdependent. Put succinctly, without research academic programs in minerals engineering will simply cease to exit. Departments are generally evaluated by university administrators relative to their performance as measured by criteria such as research volume, scholarly work (publications), student credit hours, and the number of Ph.D. students that are produced. University resources (financial, space, and personnel) are subsequently distributed to individual departments on the basis of these criteria. By their very nature, mineral engineering departments are generally small, high cost programs with a significant footprint as a consequence of laboratories. These characteristics make them highly vulnerable. As such, research provides the catalyst for promoting stability and growth by creating the means to attract students, construct and operate labs, and justify the hiring and retention of faculty. The pipeline that recruits and funds graduate students, provides opportunities to hire new faculty and enables them to achieve tenure, and hence, teach and mentor undergraduate students, is all facilitated by research.

With the closure of the U.S. Bureau of Mines in 1996, it's become increasingly difficult for faculty to find Federal sources to support mining related research. With the exception of CDC NIOSH, which is solely focused on occupational safety and health, there are very limited opportunities available to fund mining research at levels comparable to other science and engineering disciplines. Furthermore, access to government and industry sponsored research is often tied to faculty expertise and program facilities, which make it very difficult for new faculty or departments that are under financial stress or below critical mass in terms of faculty. As such, the development of new Federal sources of research funding is critical to the well-being of current and future academic programs in Mining and Extractive Metallurgy/Mineral Processing.

In summary, mineral education is at risk. The continued loss of these programs, and the talent they generate, will have a profound impact on the Nation's economy and security. Without immediate intervention and significant near-term investment, academic programs in mineral engineering will not have the capacity to produce the graduates necessary to sustain industry demand. Issues related to faculty shortages and limited availability of Federal research support are interrelated and among the most significant threats facing these programs. There are opportunities, however, where the Federal Government can make a substantive difference by investing in meaningful research initiatives that encourage industry/university collaborations and provide needed support for graduate students and promote faculty development and tenure. Efforts to amend the Surface Mining Control and Reclamation Act of 1977 (H.R. 3734) in order to provide support to mining schools is a monumental step in the right direction and will undoubtedly have significant, long-term impacts that will benefit the Nation. I would like to thank the committee for its time and interest in this important topic and it would be a pleasure to answer any questions you might have. Thank you.

Mr. LAMBORN. OK. Thank you.
The Chair now recognizes Ms. Nuttbrock to testify.

STATEMENT OF NANCY NUTTBROCK, PE, ASSOCIATE/TEXAS REGIONAL LEADER, BRIERLEY ASSOCIATES, HOUSTON, TEXAS

Ms. NUTTBROCK. Chairman Lamborn and members of the committee, thank you for the opportunity to offer my testimony in support of your bill today.

Please indulge me for just a minute while I tell you a little bit about my background. It will tie into my remarks. I graduated with a Bachelor's degree in Geological Engineering from South Dakota School of Mines back in 1996. While in college, I worked as an intern for two summers for Phelps Dodge in Morenci, Arizona, which at that time was one of the world's largest copper mines. After graduating, I worked for Pacificorp at their surface coal mine in Centralia, Washington. Then, I worked for Halliburton in Wyoming, and then relocated to Denver to pursue my Master's degree in Mining Engineering here at the Colorado School of Mines.

While pursuing my degree, I focused on tunnel design and was introduced to Brierley Associates, an engineering firm offering all varieties of tunnel and shaft design, and heavy civil underground construction. I worked with Brierley on tunnel projects across the United States and internationally for the next 5 years. Then, I left my friends at Brierley and headed back to Wyoming. For the next 6 years, I served as the Deputy Director for the Wyoming School Facilities Commission, which proved to be a unique and beneficial tangent to my training in the earth sciences. Following this, for the next 3 years I served as the Administrator, and then the Deputy Director, for Wyoming's Department of Environmental Quality.

This position really took me back to my mining engineering roots. I ran a program there that regulated all the mining activity across the state. That included coal, trona, bentonite, uranium, sand and gravel, just to name a few. Then, about a year ago, I left Wyoming to rejoin my friends again at Brierley and to open our office in Houston, Texas.

This bill is important for a lot of reasons, but from my perspective, it is particularly important to states like Wyoming with a robust mining economy. The regulatory program for Wyoming's DEQ is charged with not only permitting the mining operation and ensuring that reclamation is successful, but everything in between. Mining operators are required to submit detailed mine plans to incorporate into their permits, which involve all aspects of a mine's operation. With that, now also consider that Wyoming's program is charged with regulating all forms of mining, each dramatically different.

Consider a traditional open pit mine, where you would see the largest coal mines in the Powder River Basin, to the rare elements mines, to large and small sand and gravel operations. Now also consider underground mining, much like we are in today, the largest trona mines in the country, and underground coal gasification. Also consider in situ uranium mining. These are all dramatically different mining techniques, and some of Wyoming's operations are the biggest in the world.

Wyoming's program employed about 45 Earth Science professionals—geologists, range scientists, vegetation and reclamation experts, soil scientists, hydrologists, and engineers. These professionals are extremely capable and well-respected in their fields of expertise.

In order to regulate the wide spectrum of mine types that I just described, each of those professionals must learn the technicalities of each operation assigned to them. For example, a soil scientist might be required to regulate an in situ uranium mine. To do that, each person learns from their peers, to a large degree they are self-taught, and they learn from the mine operators they are entrusted to regulate.

Wyoming is very fortunate, and perhaps even a little rare, in that the mining industries and the regulatory entities honestly collaborate toward a balance between environmentally sound techniques and profitable operations.

So, while it is true that Federal funding is needed to conduct research at mining schools, and new professors need to conduct research for tenure, the cycle still lacks a source of students. Simply stated, when contemplating the age-old question, "What do you want to be when you grow up?", very few high school students will answer "a mining engineer." If there was not a mining engineer in your family or if your dad was not one, the odds are you are not going to know what a mining engineer is.

Recently, the president of Brierley Associates asked me, "Nancy, when you were 8 years old, what did you want to be?" He chuckled at my response. I told him I wanted to be a truck driver, because that is the way I thought I could see the world and travel.

I will leave you with this friendly recommendation from a person who had no idea what a mining engineer was. Include a mechanism to engage high school students, and especially those students who would not otherwise be exposed to mining engineering as an exciting career choice.

Thank you for your efforts to bolster professionals in our industry and for listening to me today.

[The prepared statement of Ms. Nuttbrock follows:]

PREPARED STATEMENT OF NANCY NUTTBROCK, ASSOCIATE & TEXAS REGIONAL LEADER, BRIERLEY ASSOCIATES

INTRODUCTION

Thank you for the opportunity to offer my testimony in support of H.R. 3734. My name is Nancy Nuttbrock.

BACKGROUND

I graduated with a B.S. in Geological Engineering from South Dakota School of Mines and Technology in 1996. While in college, I worked as an intern for two summers for Phelps Dodge in Morenci, AZ, at that time, one of the world's largest copper mines. After graduating, I worked for Pacificorp at their surface coal mine in Centralia, WA. Then, I worked for Halliburton in Wyoming. I relocated to Denver to pursue my M.S. in Mining Engineering here at the Colorado School of Mines. While pursing my Masters in Mining Engineering-Earth Systems Technologies, (aka: tunnel design), I was introduced to Brierley Associates, an engineering firm focusing on all varieties of tunnel and shaft design, and heavy civil underground construction. I worked with Brierley on tunnel projects across the United States and internationally for 5 years. Then, I left my friends at Brierley and headed back to Wyoming. For the next 6 years, I served as the Deputy Director for the Wyoming School Facilities Commission, which proved to be a unique and beneficial tangent

to my training in the earth sciences. Following this, for the next 3 years, I served as the Administrator, and then the Deputy Director, for Wyoming's Department of Environmental Quality. This position took me back to my geology and mining engineering roots—I administered Wyoming's program that regulated all mining activities across the state, including coal, trona, bentonite, uranium, and sand and gravel, to name a few. The program employed approximately 45 earth science professionals: geologists, range and reclamation scientists, hydrologists, and engineers. Then, about a year ago, I left Wyoming to rejoin my friends at Brierley Associates, and open our office in Houston, TX.

FROM MY PERSPECTIVE

This bill is important for many reasons, but based on my background, it is particularly important to states like Wyoming with a robust mining economy. The regulatory program for Wyoming DEQ is charged with not only *permitting* the mining operation, and ensuring that *reclamation* is successful, but *also everything in between*. Mining operators are required to submit detailed mine plans to incorporate into their permits, which involve all aspects of a mine's operation. With that, now also consider that the Wyoming's program is charged with regulating all forms of mining that differ dramatically:

- traditional surface mines (ranging from the world's largest coal mines in the Powder River Basin to rare elements to small sand and gravel operations);
- underground mines (including underground coal mines, underground coal gasification, and large trona mines); and
- in situ uranium mining.

Some of these mines are the largest of their kind in the world.

The geologists, the reclamation and vegetation experts, the hydrologists and the engineers employed to run Wyoming's program are *extremely* capable professionals in their respective fields of expertise. In order to regulate a wide spectrum of mine types, each professional must learn the technicalities of each operation assigned to them. To do so, each person learns from their peers, are self-taught, and/or learns from the mine operators and mine personnel they are entrusted to regulate. Wyoming is fortunate, and perhaps even rare, in that the mining industries and regulatory entities collaborate honestly toward a balance between environmentally sound techniques and profitable operations.

RECOMMENDATION

While it is true that Federal funding is needed to conduct research at mining schools, and new professors need to conduct research for the tenure process so they can educate the next generation of mining and mineral experts, this cycle still lacks the source of students.

Simply stated, *very few* high school students contemplating the age-old question "What do you want to be when you grow up?" will answer 'a Mining Engineer'. The President of Brierley Associates recently asked me: "When you were 8 years old, what did you want to be?" He chuckled at my response: I wanted to be a truck driver, because I thought that was the only way I could travel and see the country.

Please consider this: include a mechanism to engage high school students and especially those students who would not otherwise be exposed to mining engineering as an exciting career choice.

CONCLUSION

Thank you for your efforts to bolster professionals in our industry, and for listening to me today.

Mr. LAMBORN. Thank you.

I also thank all the panel members for their testimony.

I would like to remind Members that Committee Rule 3(d) imposes a 5-minute limit on questions.

I will now recognize Members for any questions they may wish to ask the witnesses. We will start with subcommittee members, then full committee members, then Members of the Congress who are not on the committee.

The first question is to anyone who wants to weigh in. In your opinion, do you believe that the Gold King Mine spill might have been prevented if EPA had had a qualified mining engineer on the site who was involved with the remediation process?

Mr. FREEMAN. I strongly believe all problems are solved with talent, and I think the more talent you can have and can bring to bear, both in terms of the discipline expertise that people have, as well as just pure talent, it certainly could have benefited from that.

With respect to people that would be employed by the Federal agencies, I think there is a real challenge there, because the Federal agencies have the same demographic challenges as the industry has, and probably even more so. They also typically have pay compensation levels that are substantially below the industry. So, I think increasing the talent in all those agencies, including the talent that could be brought by mining engineers, would have been very important.

Mr. LAMBORN. Dr. Miller or Ms. Nuttbrock?

Dr. MILLER. Yes, I totally agree. The issues are technical, and to have an appreciation of the underground environment, understanding geo-mechanics, rock mechanics, soil mechanics, that is what mining engineers do. The protocols that are in place, there are best industry practices that are associated with that which were not followed.

I am a huge advocate for eliminating some of these issues, to integrate technology that is being used in the industry currently, and to collaborate with government agencies.

Ms. NUTTBROCK. Sure. I will just comment by saying in Wyoming there was a lot of effort put toward that collaborative nature. It is the mining operators working with the regulatory community, and a lot of times the mine operators themselves are telling the regulators how this is supposed to work, how this approach is supposed to work, in the technicalities of a particular mine.

Like I said, an in situ uranium mine is dramatically different than a surface coal mine. In a lot of instances in Wyoming, for example, we had to regulate a mine's operation, and you needed everybody from a soil scientist, to the vegetation experts, to the hydrologists, and the geologists—you needed that entire spectrum. But it would have been very helpful to have someone on staff, mining engineers on staff, who understood the full cradle-to-grave operation of a mine.

Dr. MILLER. It is also about risk assessment. If you do not understand the dynamics of how those mines were built and designed, it is hard to figure out what the risks are.

Mr. LAMBORN. Dr. Miller, it has been suggested that maybe the bill should be expanded to include not only mining and metallurgy engineering but also metallurgy. Can you tell me what goes on in the Colorado School of Mines and how that might make the bill a better bill?

Dr. MILLER. Within SME, we actually incorporated mining engineering and efforts with mineral processing and extracting metallurgy, and the reason for that is the programs associated with extracting metallurgy are even in more dire shape than the mining programs.

There currently are six departments across the country employing some 22 faculty. Of those 22 faculty, 10 are eligible for retirement within 2 years. So, if you look at the dynamics of those programs, we will lose them if there is not some sort of interventions that are taking place.

Mr. LAMBORN. Mr. Freeman, a minute ago you touched on the need for better representation in the Federal workforce by trained mining engineers. Could you elaborate on that just a little bit more? I had asked you in the context of the Gold King Mine, but just in general, what would be your advice?

Mr. FREEMAN. The advice is first just to have a very strong cadre of talent within those Federal agencies. The Academies' report recommended improving those methods within the Federal agencies for recruitment, development, and retention of talent.

The other thing I would add personally, is I am very involved in working with communities in the mining industry, and increasingly the citizenry is concerned about that interface between natural resource recovery and reclamation. There are going to be increasing pressures on the Federal talent who stand at that interface. I think we need to try to make sure we have a strong cadre of talent there.

Mr. LAMBORN. OK. Thank you.

I will now recognize Representative Hardy for his questions.

Mr. HARDY. Thank you.

Mr. Freeman, in your testimony you talked about the steady decline in the number of U.S. mining engineers over the last 30 years. What role, if any, have the universities played in this effect?

Mr. FREEMAN. I would have nightmares if I was trying to manage state institutions in the context of the access they have to dollars. It is a really difficult problem, and one of the challenges there is that the metrics for a lot of the universities are research dollars and numbers of Ph.D.s that are granted. All 14 of the mining programs are state-funded programs; so, there is a lot of pressure on trying to manage the university-level budget.

In that, when we graduate a very small number of mining engineers, we do not need a huge number. In total, in the United States in the last 40 years, we have graduated 12,000. If you spread that over 40 years, that is 300 a year. That is not a lot to amortize the cost of the minerals education in engineering at the university level. It is one of the most expensive education programs on these campuses.

One of the important and critical components of the erosion of that broad support that we had is it is just a very expensive program to have. So, the bill that you are contemplating here and in support of is to put the research behind that so the universities can justify this effort. As a result, we have about half the programs that we started with 20 years ago.

Mr. HARDY. Thank you.

Ms. Nuttbrock, has the lack of mining engineers played a role over the years in the process of getting permitting done for mining projects on Federal lands? Has that been a cause and effect? And if so, can you elaborate a little bit.

Ms. NUTTBROCK. Oh, certainly. I do believe that there is a cause and effect relationship there. Take, for example, underground coal gasification. New technology in Wyoming, just a year ago when I

left the DEQ, they had just approved a permit for underground coal gasification. There are constantly bright minds thinking about better ways to extract the resource and less environmentally damaging ways of extracting the resource. If we had people working on the regulatory side of things who were up to speed with those up and coming technologies and the research that is going on in the universities, that would absolutely put state programs up to par and able to react and review documents more quickly and process permits more quickly.

Mr. HARDY. Another question for you. The regulators you discussed that are basically relying on the operators themselves for the technology and an understanding of what their job is supposed to be, do we sometimes at the Federal level forget what our obligations are and who we are working with, that we are partners?

Ms. NUTTBROCK. I would like to comment on that first, if I could. And again, Wyoming is a wonderful place. The mining environment, the political environment, and the people who are working in Wyoming in the mining industries are very much engaged with the regulatory community as well; and I mentioned that that might be a little bit rare. In working with my former colleagues out in the Eastern region, it is definitely a little rare because maybe that was not the case. We are working in lockstep with the people who are regulating and mining.

But it is true, yes. For rare elements resources and, again, the new technologies, we are learning together and we are learning from the operators.

Mr. HARDY. I have a quick question to Dr. Miller.

Dr. Miller, the shortage of mining engineers, can you put in perspective what the potential crisis could be over the coming years to our economy, to the country at large?

Dr. MILLER. It is huge, and it is kind of a vicious circle. If you do not have the faculty to teach and those faculty are not capable of getting the research required to get tenure, then the academic programs themselves suffer. They do not have the financial or the manpower, the talent to produce undergraduates. Put straightforward, a major talent crisis that occurred for undergraduates in the early 2000s, there was just nobody to hire. These operations are going to experience tremendous challenges associated with that. They are going to go abroad, or they are going to bring international people here. There is no other solution to it. And it is a huge security issue.

Mr. HARDY. Thank you. My time has expired.

Mr. LAMBORN. Chairman Bishop.

Mr. BISHOP. Thank you.

Dr. Miller, let me start with you. I am an old teacher, Liberal Arts though. People always talk about how it is important to have people working on the ground in the business world. But if I understand what you are telling me, there are few people who are graduating as mining Ph.D.s, few of those want to become teachers, and few of those who actually want to become teachers can get through the tenure process; and that becomes like a death spiral.

Dr. MILLER. That is exactly right.

Mr. BISHOP. So, what we are talking about is we need as a government to try to increase people to go into the industry, to go

into the Federal workforce, but also who can become teachers. So, the lessons that are taught in the classroom, that becomes extremely significant.

Dr. MILLER. Without question, and you have hit it right on the head. It is a spiral. It comes with research dollars, and it comes through the education; and the working degree in the mining industry is typically still the undergraduate degree. So, to bring qualified people into the graduate programs is a struggle, particularly with the salaries that are being made in industry.

Mr. BISHOP. OK. So a lot of the needs we are going to have in future research with you will be in mine reclamation.

Dr. MILLER. Yes.

Mr. BISHOP. And that has to be done in the classroom? So how is what happens in the classroom so significant not only for the Federal workforce but also for the industry workforce?

Dr. MILLER. One of the great things about mining is we do a lot in environments at actual mines or in laboratory facilities. We have a unique collaboration with industry in that we do an awful lot of our teaching at industrial facilities. The concept is we reinforce engineering principles and fundamentals at sites, and that is where that collaboration between government, industry, and academia will work effectively. Federal grants, we do that work at industry sites, and the promulgation of the knowledge base comes back to government as well.

Mr. BISHOP. Mr. Freeman, let me ask you a quick question. We had another hearing down in New Orleans, at that time a program at LSU. We talked about how fewer people are going into the engineering process, but a lot more are going into the regulatory stream, to become regulators. It would be my intention, though, that if you are talking about regulators on the Federal side dealing with mine safety, that this kind of background would be essential.

Do you also think it would be profitable for somebody who is going to become a regulator to have some practical experience, like you did, in the industry before they become a regulator?

Mr. FREEMAN. A real good example, and we in the industry talk about this, the idea of having a mine inspector who does not have industry experience would be really frightening. You really need that foundation of industry experience to be able to go forward.

Mr. BISHOP. But they have to have the academic background before they get that. There are several steps you have to go through.

Mr. FREEMAN. It is just like with any stepping of careers. You would like ideally 10 years' worth of really good practical experience in the field and then be able to employ that in the regulatory environment.

Mr. BISHOP. So, for both of you, the tenure process is really dependent upon grants to fund research. That says something negative about the tenure process, but it is the reality which we face.

Let me ask you, Ms. Nuttbrock, obviously to get somebody in the Ph.D. program, you have to have an undergraduate program. To get somebody there, you have to have somebody in public schools, high school and K-12, who is excited about it. Oftentimes, people going into engineering, there has to be something that is really exciting or a chance to succeed and do something really cool, and we find that in other engineering areas.

How do we get kids in K-12 to become excited about starting this process?

Mr. FREEMAN. You bring them in.

Ms. NUTTBROCK. Thank you for asking that, because I think that is the missing link in this whole cycle. We still need to get kids interested in this industry. From talking with a number of you today, I know that the outreach program here at the Edgar Mine is much larger than I thought it was. But that is the fact, and I wonder if there is a mechanism in your bill that you could write in to say that with the Federal funding, it would require some collaboration with high schools and bringing them underground. Or in my industry, what kid would not like riding on the back of a TBM?

Mr. BISHOP. That may not be the vehicle to accomplish that, but it is something we need to look at.

I only have 10 seconds left, but sometime you have to tell me what tunnel design actually means. I don't have enough time to get into it.

Mr. LAMBORN. If the Chairman will wait——

Mr. BISHOP. Do you put some carpeting down——

[Laughter.]

Mr. LAMBORN. You can answer that question.

Ms. NUTTBROCK. Sure. My background is geological engineering. We put tunnels in for highways, railroads. You drove through some tunnels coming up here. Water conveyance tunnels, I do a lot of those, and they are becoming huge in diameter. In Dallas right now, there is due next week a 40-foot-diameter flood control tunnel structure, 40-foot diameter for 5 miles long. So, flood control, a lot of different utilities, and our aging infrastructure in our cities is a huge market.

Tunnel design is looking at the geology, looking at the groundwater, looking at the type of tunnel, looking at the excavation methodology, what you are going to do with the muck, how you are going to support that opening, how you are going to tie it in to the rest of the utilities.

You would not believe what is under the city in terms of the utilities. It is just phenomenal, and that is the beauty of our industry. It is underground, out of sight, and out of mind; and that is kind of the way we like it. It is a fascinating industry, and it ties into mining engineering hand-in-hand.

Mr. BISHOP. Thank you.

Mr. LAMBORN. Thank you.

Representative Perlmutter.

Mr. PERLMUTTER. Thank you. The other Members of this hearing have asked all the right questions. I am not sure I have any for the panelists. Thank you very much.

Obviously, here in Colorado, and it also applies to the Rocky Mountain West—Wyoming, Utah, Nevada—we love our outdoors. That is why we are here. We enjoy such an abundance of natural resources that are so necessary to everything we do in commerce, whether it is construction, energy, or technology, the rare earth minerals in my phone, all these kinds of things; but we always like to be outside climbing, skiing, fishing, whatever it might be.

What I see, and the importance of this bill that Congressman Hardy has proposed, is we have to have the best and the brightest

to continue to be able to build these tunnels, to extract the minerals that we need for commerce, and to do it in a way that over time is environmentally sound, as you said, so that we can continue to enjoy our outdoors.

Mr. Freeman, let me start with you. In terms of this bill, you had language, "the importance of collaborative efforts among government, industry, and educational institutions to create and support new approaches in higher education that can lead to a range of mining and energy jobs." Do you think this bill helps us get that done?

Mr. FREEMAN. Absolutely.

Mr. PERLMUTTER. How?

Mr. FREEMAN. Well, it builds a foundation for research that will support the universities, the education, and will support the tenure track of faculty members. I think all of us, going to college, were inspired by our ability to make a difference with the educations we have had and those professors that we learned under as mentors. I think they become a real critical component to that; and any damaging of that pipeline for those people, damages the entire U.S. economy in the end.

Mr. PERLMUTTER. Absolutely. The collaborative piece of this, which you talked about in your testimony—let's go back to the Gold King Mine disaster that we talked about a few minutes ago. Obviously, water was involved, the design of the several different mines out there. I mean, this is very complicated stuff, and I see a place both for the university to come in as kind of a consultant, but you want to have people who have the right qualifications to deal with the different tangents of the thing.

Ms. Nuttbrock, could you comment on that?

Ms. NUTTBROCK. I can. It is almost as if, in order to regulate to the extent that we would like to, you have to have an infinite understanding of the history of that mine, how it was built over the course of many decades. The retention systems and the water control systems are often aging, perhaps, and they need to be replaced. It is almost as if, in order to regulate, you need to know the history of the mine and how it has been operating. It has probably changed hands from one operator to the next over the course of its life, and they may have taken different design approaches. It is complex, and it is not as simple, I don't think, as having more mining engineers on the regulatory side. It is that collaborative piece.

You have a mining engineer on the regulatory side working with the mining engineer on the operator side, and they know that mine inside and out. When one of them says there is a potential for that toe to fail, they know what they are talking about, and they can go back and look at the design records and the as-builts for those structures and understand if that is, in fact, a failure point.

But, it is that collaborative piece, without question.

Mr. PERLMUTTER. A couple more seconds.

Dr. Miller, we are in the Edgar Mine. As a professor, do you bring students here? Do they benefit by actually being here? Is this something that this legislation might be able to provide some resources to you to continue to develop a program?

Dr. MILLER. That would be fantastic. The unique element of the Edgar Mine—and it is just not solely limited to mining engineer-

ing. We teach, I think, parts of 19 courses in 6 different academic majors that are done here. One of the reasons this facility is great, is it allows you to apply engineering fundamentals on a project-oriented type of class. The students can actually see the dynamics of what they are doing, and it is a unique venue.

But the biggest part of this is, it is about solving open-ended problems. It is about safety ethic. It is about the dynamics of what it takes to be a good, competent engineer; and you can only learn that in a unique environment like this. It is a great place.

Mr. PERLMUTTER. Thank you, Mr. Chair. I yield back.

One last question for Dr. Miller. Do any of the 13 other mining schools in the country have a mine like this as part of their classroom experience?

Dr. MILLER. Yes. Out of the 14, there are 4 universities that have school mines, the University of Arizona, Montana Tech, and the University of Missouri at Rolla, which is now Missouri Science and Technology.

Mr. PERLMUTTER. Excellent.

Mr. LAMBORN. I thank the witnesses for their valuable testimony, and the Members for their questions. The members of the committee may have some additional questions for the witnesses, and we ask that you respond to these in writing. Under Committee Rule 4(h), the hearing record will be held open for 10 business days for these responses.

I, and the other Members, want to thank the Colorado School of Mines for opening up this facility and for their work in making this available today. I want to thank the committee staff for all of their work so that we could take advantage of this unique venue.

Before I conclude, I would ask unanimous consent that we enter into the record the letters of support for this legislation from the following schools: the University of Alaska at Fairbanks, Colorado School of Mines, Missouri University of Science and Technology, Montana Tech, University of Nevada at Reno, New Mexico Tech, Penn State, Southern Illinois University at Carbondale, South Dakota School of Mines, and West Virginia University, as well as the Nevada Division of Minerals.

If there is no objection, so ordered.

If there is no further business, without objection, the committee stands adjourned.

[Applause.]

[Whereupon, at 11:13 a.m., the committee was adjourned.]

[LIST OF DOCUMENTS SUBMITTED FOR THE RECORD RETAINED IN THE COMMITTEE'S OFFICIAL FILES]

Comment left at Hearing in Support from Eddie Kochman of Northglenn, Colorado

Letters in Support:

- Benjamin M. Statler College of Engineering and Mineral Resources, West Virginia University
- Colorado School of Mines
- Illinois Association of Aggregate Producers
- Illinois Coal Association
- Illinois Mining Institute
- Mackay School of Earth Sciences and Engineering, University of Nevada, Reno
- Missouri University of Science and Technology
- Montana Tech
- New Mexico Tech
- Penn State College of Earth and Mineral Sciences
- South Dakota School of Mines & Technology
- Southern Illinois University
- State of Nevada Commission on Mineral Resources
- University of Alaska Fairbanks College of Engineering & Mines