
DEEP ENOUGH



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MESSAGE FROM THE CHAIR

MICHAEL FREE

It has been 7 years since we published a department communication. As you might suspect, there have been several changes, including my appointment as department chair in 2019.

Although many of my responsibilities are in the Department of Materials Science and Engineering, my ties with the mining community are strong. My connection with mining began with my maternal grandfather, who worked for many years in the phosphate mines of Idaho, collected rocks, and recycled metals.

Early on in my career, as an undergraduate student, I worked as a lab technician for Newmont. Now, as a metallurgical engineering faculty member, I work on a variety of projects involving phosphates, rare earth elements, gold, silver, and copper.

I'm grateful for the opportunity to be a part of this department, and to get to know and work alongside the excellent members of our faculty, staff and students.

Since our last newsletter, the department has undergone many changes. We gratefully acknowledge Professor Mike Nelson's service and leadership in his role as department chair over the previous eleven years, and appreciate his continued service as a member of the mining engineering faculty.

We have had two retirements of long-time faculty members. Professor Kim McCarter and Professor Felipe Calizaya retired in 2018 and 2020 respectively and we recognize their contributions to our department.



In 2019, we were fortunate to hire Professor Rajive Ganguli as the Malcolm McKinnon Presidential Endowed Chair in Mining Engineering. A year ago, we were able to hire Kitzia Casasola as an Administrative Program Coordinator, to support the department's growth and development. This semester we are excited to have Dr. Karoly (Charles) Kocsis join us as a new faculty member. Our department continues to grow and we are happy to announce that we have begun the search for an additional faculty member.

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I am inspired by the way our students, staff and faculty have faced the difficult circumstances of this year.

2020 has been full of unusual challenges that have affected all of us. I am inspired by the way our students, staff and faculty have faced the difficult circumstances of this year. Despite extreme weather and natural events, political and social unrest, and a worldwide pandemic, we continue to thrive and excel in pursuit of academic excellence.

In March 2020, thanks to the rapid preparation by our faculty and the receptive response of our students, we adapted quickly to on-line teaching and learning. Subsequently, we have continued to improve our hybrid, in-person and on-line teaching.

Despite the pandemic, the department received permission to continue with updates to our facilities, including outfitting our student labs with new computers. Additionally, thanks to a generous donation from Newmont, the main construction for our Newmont Safety Classroom and adjoining Center for Mining Safety and Health Excellence was completed.

We appreciate the great support of the University of Utah, the College of Mines and Earth Sciences and our industry partners who allow us to build an excellent foundation for the future.

Currently, we are in the process of upgrading our curriculum. Inside this edition you'll find information on our new emphases and certificates.

While this is a challenging time for each of us in different ways, it is also a time for unusual opportunities to help others who are struggling from the health and economic impacts of the pandemic. We are fortunate to be in a position to keep the cost of education low for most of our students through scholarships and fellowships because of generous donations from our alumni and friends.

We are privileged to have alumni and friends like you, and we hope you are safe and healthy. Thank you for your contributions of time, talents, influence or donations. Your continued contributions improve our department's capabilities and increase our ability to impact the lives of our students.





DR. MICHAEL K. MCCARTER

Professor Kim McCarter officially retired from his position with the department on January 1, 2018, and now holds the title Professor Emeritus. We have been greatly benefited by his teaching, research and leadership during his 44 years of employment at the University of Utah. His expertise in surveying, surface and underground mining, blasting, rock

mechanics, and mine safety will be missed by students and faculty. A recipient of many professional recognitions during his tenure, most recently as the 2018 John E. Willson Distinguished Alumnus. We thank him for his contributions to the department and to the education and careers of many mining engineers and wish him an excellent retirement.



DR. FELIPE CALIZAYA

Professor Felipe Calizaya retired on July 1, 2020 with the title Professor Emeritus. He joined the Department of Mining Engineering as an associate professor in January of 2002. During his tenure he served on numerous campus and professional committees. His ability to share his knowledge of hydraulics, ventilation, mine finance, mine fire safety, and

operations research over the years resulted in his recognition as CMES Outstanding Faculty teaching awards in 2006 and 2014. His contributions to the department and his service as a faculty member will be missed by students, faculty, and staff. We wish him the very best of success and fulfillment in his retirement.

FACULTY RECOGNITIONS

Professor Jessica Wempen was honored with a Celebrate U Research Award for “Remote Sensing for Mine and Environmental Monitoring.” Dr. Wempen was nominated by Dean Butt and selected as an honoree for her overall research work in 2019. **Professor Mike Nelson** was recognized as a Society for Mining, Metallurgy, and Exploration (SME) Fellow and Distinguished Member in 2020. Recognition as an SME fellow is awarded to members of 15 years or more who have made significant and sustained contributions to the minerals industry and to SME. He is also the 2020 recipient of the General Patrick E. Connor Award, which is awarded annually by the Utah Mining Association (UMA) to an individual who has made significant contributions to Utah's mining industry. **Professor Michael Free** is the recipient of the 2020 TMS (The Minerals, Metals & Materials Society) Distinguished Service Award. This award recognizes an individual whose service to TMS has “clearly facilitated the Society’s capability to serve its members and their supporting organizations.”

DR. RAJIVE GANGULI

Professor Ganguli is currently involved in three projects; two analytics projects, and one mine training project. The members of his group include Dr. Rambabu Pothina, post-doctoral fellow, and graduate students Narmandakh Sarantsatsral and Lewis Oduro.

In the first analytics project, his ai.sys group is working with the National Institute for Occupational Safety and Health (NIOSH) to detect leading indicators for hazards from safety data at mine and other industrial sites.

The data may be in the form of description of conditions and/or behaviors observed at work sites. Natural language processing based machine learning algorithms are being developed to detect problem conditions and behavior.

In one instance, an industrial site that is a customer of a Utah-based safety app (an early partner in the project) was given actionable intelligence to address hazards. Tools are currently being developed to analyze the Mine Safety and Health Administration's (MSHA) national database to detect leading indicators on a larger scale.

In the other analytics project, his group is assisting University of Utah colleagues in Atmospheric Sciences and School of Medicine to understand the impacts of COVID-19.

In the mine training project, he is leading a \$1.2M cooperative agreement with the U.S. Department of State, Bureau of Energy Resources (ENR) to assist the Greenland School of Minerals and Petroleum (KTIR) in developing its mining engineering related curriculum. The 3-year agreement is part of an ENR initiative to help Greenland build capacity to address their growing mineral sector. Activities will focus on assisting KTIR to develop its underground mine training facility, create a search and rescue program, offer various topical courses, and familiarize KTIR and Greenland government stakeholders with major elements of a modern mining sector.

The team, which includes Professor Mike Nelson, and the Mining and Petroleum Training Service of the University of Alaska Fairbanks has significant experience in mining research and workforce development in the Arctic and other remote regions such as Mongolia. The agreement leverages the University of Utah's award-winning student mine rescue team, and its relationships with state agencies, mines and professional associations in Utah and Alaska.

Raw Data	MSHA Description
	•after changing a deck screen, the miner was crawling out from between the screen deck and misplaced their footing causing them to dislodge the board placed as a safeguard over an opening. the miner fell through the opening and struck their head.
Extracted Info	Accident
	•Accident: fell, through, opening
Extracted Info	Causes
	•changing, deck, screen, crawling, out, misplaced, footing, causing, dislodge, board, placed
Extracted Info	Other Details
	•struck, head

An example of information extracted from text. Patterns in extracted fields can serve as early warning indicators.

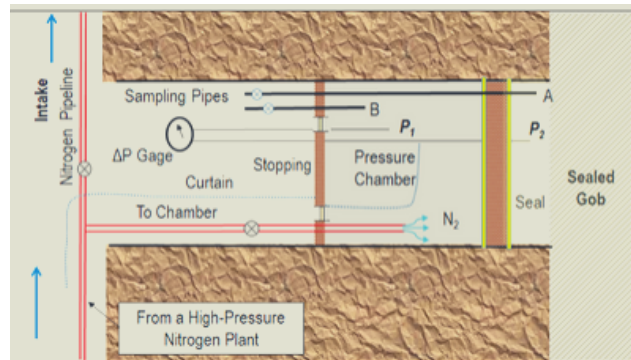


KTIR Råstofskolen - Greenland School of Minerals & Petroleum

DR. FELIPE CALIZAYA AND DR. JEFF JOHNSON

Spontaneous combustion is called sponcom in the mining industry and is a health and safety hazard in underground coal mines. It accounts for approximately 20% of the total number of underground coal mine fires recorded in the U.S. since 1990.

Usually, sponcom in underground coal mines starts with the self-heating of coal in mined-out areas of the mine called the gob. Depending on the coal characteristics, the mining method, and the ventilation system used, self-heating of coal can start at temperatures as low as 35°C. If the heat and oxidation is not removed it will increase the coal temperature, leading to ignition and fire. Sponcom has been the cause of an abundant number of fatalities as well as the temporary or permanent closure of mining operations.

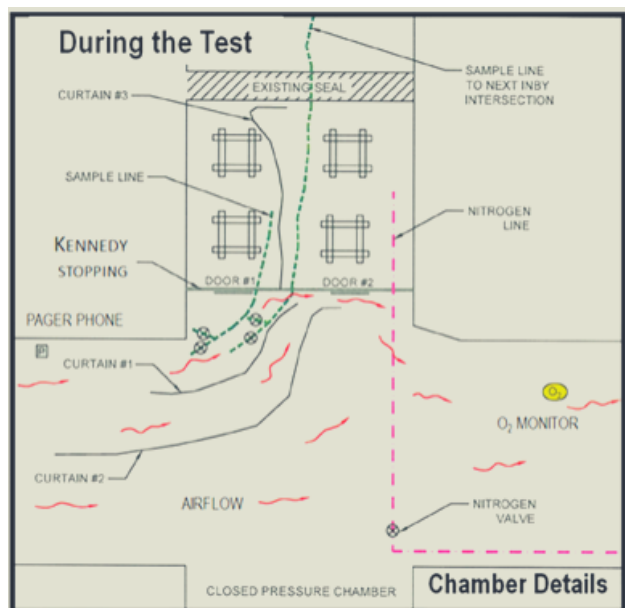


A conceptual design of an active pressure chamber, in which nitrogen gas is used to pressurize the chamber and eliminate the flow of air to the gob.

The main objective of this research work is to test the principles of pressure balancing technology in preventing the development of sponcom in a coal mine. The proposed research includes the construction and operation of two pressure chambers near the caved area (gob) of an operating mine.

The chambers will be equipped with a set of monitors to determine pressure differences around the chambers, and a nitrogen injection system to reduce the leakage of air to the gob when pressure imbalance signals are recorded. Using these chambers, several pressure balancing tests will be conducted for different gob ventilation scenarios.

If the results from these experiments prove useful, then these pressure chambers can be installed to reduce or eliminate the problem of sponcom.



An MSHA approved drawing for one of the chambers. Notice that, in this drawing, all sampling points, oxygen sensors, and nitrogen control valves are located upwind of an isolation (Kennedy) stopping.

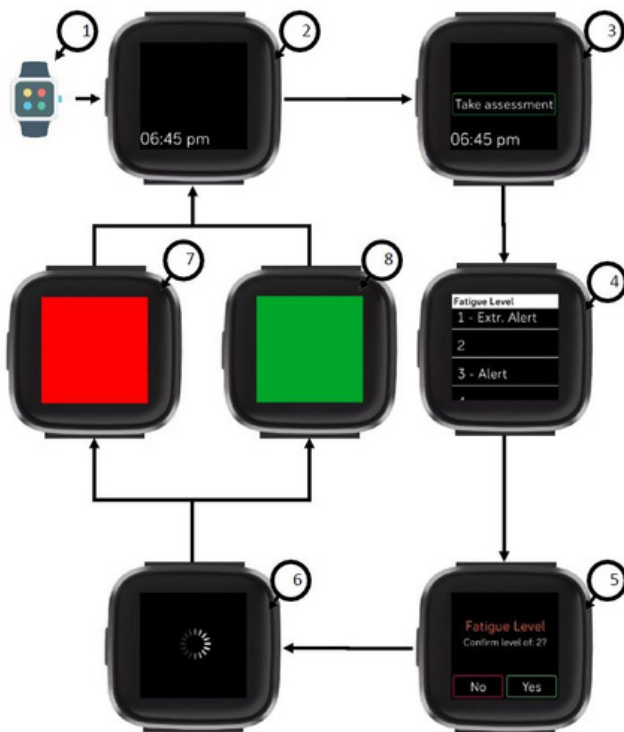
DR. PRATT ROGERS

During 2020, Dr. Roger's Mining Operational Data Excellence Lab (UMODEL) team has been advancing multiple projects. In late 2019, they started a project with NIOSH. In this project, they have been investigating the workforce fatigue in haul truck operators.

Two mine companies have partnered and have provided researchers access to their operators and key data. The UMODEL team has conducted focus groups and surveyed over 300 operators at four different mine sites.

These surveys have provided information on the qualitative factors of fatigue. Along with the qualitative measures, the team is also exploring predictive models of fatigue. They are using advanced computational intelligence and standard operations technology to statistically determine conditions that lead to fatigue events.

The team has also developed smart watch apps to expand the data collection gap of fatigue common to many mine operations. With these tools the team hopes



Smart watch application to track response time and fatigue level



PhD student Aaron Young collecting data for the stockpile modeling project (Australia, 2020)

to provide mine sites better resources for managing fatigue. Proper fatigue management will reduce risk in mining operations and help advance the worthy goal of zero harm in the mining industry.

Another project started in 2020 by UMODEL is a project developing block models for ore stockpiles. Stockpiles are a difficult mine to mill optimization barrier for many mines. UMODEL is hoping to improve the data handling and remove this barrier.

The team is using standard operational technology, unmanned aerial vehicles (UAV) photogrammetry, and open source geostatistical tools to develop the data management process and block model. With this tool and future iterations, operations will have tighter control of the ore control of stockpiles and downstream processing.

Professor Rogers is grateful for the excellent work of his graduate students. Mentoring and learning from them is one of the more enjoyable aspects of his job. Current students and recent graduates include: Hiago Amado, M.S., James Newman, Ph.D., Aaron Young, Elaheh Talebi, Joao Marques, Shantae Lee, and Patrick Guild.



DR. JESSICA WEMPEN

Dr. Wempen is interested in research applying advanced remote sensing technologies, including satellite imaging and Unmanned Aerial Vehicle (UAV) technology, for mine ground control, mineral exploration, and environmental monitoring. She is also interested in innovative seismic monitoring and analysis to improve mine ground control safety.

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Education is one of Dr. Wempen's fundamental research objectives...

Dr. Wempen's research has focused on applying satellite based imaging to measure surface deformation, and on imaging spectrometry, using a UAV, to characterize Earth materials.

Through extensive field-based projects, the loading conditions of a mine structure were evaluated using seismic analysis. This research has improved our understanding of how mine structures respond to stresses.

Improved seismic monitoring has identified significant induced seismicity in western mining regions; better monitoring and analysis has potential to lead to improvements in ground control safety through a better

understanding of sources and characteristics of mining induced seismicity.

Dr. Wempen has received research funding from NIOSH and SME, as well as funding from industry, and gratefully acknowledges the contributions of these organizations. Additionally, Keith Koper, Professor of Geology & Geophysics, and Kim McCarter and Bill Pariseau, Emeritus Professors of Mining Engineering, have meaningfully contributed to Dr. Wempen's research.

Education is one of Dr. Wempen's fundamental research objectives, and she has the opportunity to work with exceptional graduate students: Daniel Amoakoh, Dallan Coons, Bilguunkhavar Erdenekhuyag, Josie Kinzie, Belinda Kyeremeh, Bailey Simmons, and Doug Weyher.

Without the motivation and interest of these students, Dr. Wempen's research would not be possible. She hopes that students she has collaborated with will continue to contribute to the safe and sustainable development of mineral and energy resources, in the state of Utah, and globally.

DR. MICHAEL FREE

Professor Free's research group has recently been working on the extraction and recovery of rare earth elements and critical metals from coal waste as well as the recovery of copper, gold, and silver from electronic waste.

In collaboration with researchers at Virginia Tech, his group led a project to demonstrate methods to economically extract, recover, and upgrade the REE contents from coal waste. The content of rare earth elements in the coal waste is low (usually less than 300 ppm), but the high commodity price of some of the elements can contribute enough value to make them economically viable to process using low cost technologies. The low-cost processing approach begins by taking coal waste and recovering pyrite from it. The pyrite is fed to a bioreactor where it is bio-oxidized to produce acid. The acid is then used to extract the rare earth and critical metal elements from the coal waste. The resulting solution is then processed by a combination of selective

precipitation and solvent extraction to produce a concentrated product that contains more than 37% rare earth elements. This approach has the added benefit of using the pyrite to generate acid needed for extraction, while simultaneously eliminating it as a source of future acid mine drainage. His group is continuing some of this work as part of a large pilot-scale project led by the University of Kentucky.

His group also has an electronic waste (e-waste) project that addresses key techno-economic barriers to e-waste recycling. The project involved the use of shredded e-waste that is subjected to a biooxidation leaching solution that generates the oxidant needed to leach the copper out of the e-waste. The leaching solution is sent to solvent extraction to recover and concentrate the copper in solution and return the iron to the biooxidation reactor to regenerate the ferric ions needed for copper leaching. The concentrated copper solution is then sent to electrowinning for recovery as high purity copper. The residual e-waste is then leached using thiosulfate solution to extract gold and silver that are subsequently concentrated and recovered by electrowinning. This processing approach is more energy and environmentally efficient than conventional processing.

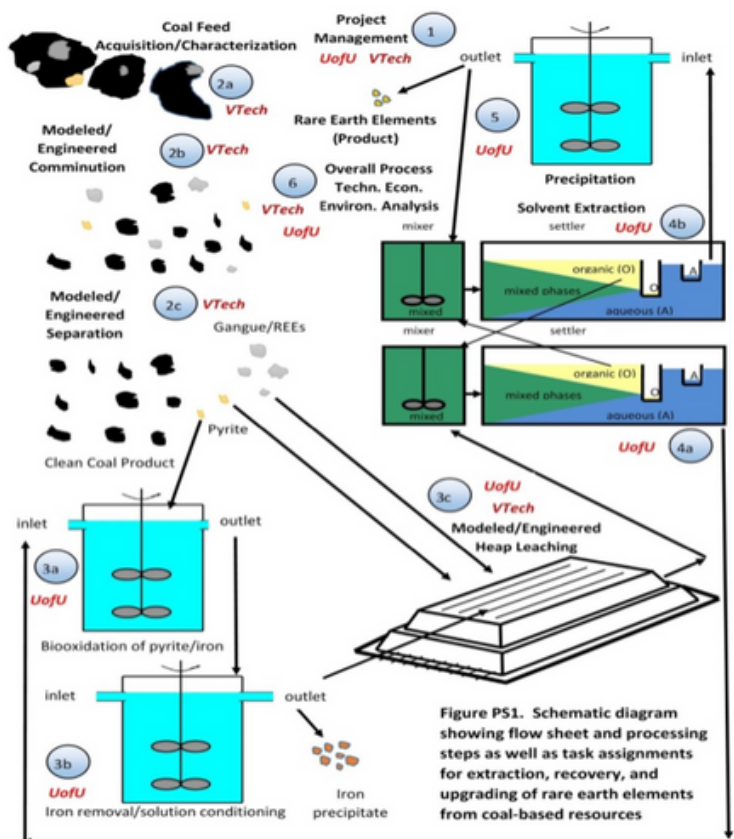


Figure P51. Schematic diagram showing flow sheet and processing steps as well as task assignments for extraction, recovery, and upgrading of rare earth elements from coal-based resources



DR. CHARLES KOCSIS

Professor Kocsis is our newest professor. He is a licensed Professional Engineer (P.Eng.) in the province of Ontario, Canada. He has over 24 years of experience in the mining industry, including work for consulting firms and a large research organization. He also has nine years of academic experience as a faculty member in the Mining and Metallurgical Engineering Department at the University of Nevada, Reno, where he conducted projects funded by NIOSH, The Alpha Foundation, Newmont Gold Corporation, and Freeport McMoRan.



1) ASSESSING, MODELING, AND COOLING UNDERGROUND WORKINGS IN DEEP AND HOT MINES

The key objectives of this 5-year and \$1.25M research study were: (1) Quantify the heat load at underground metal mines in Nevada, (2) Develop ventilation-thermal-humidity (V-T-H) models to evaluate transient heat transport processes, (3) Quantify the “thermal flywheel effect” and demonstrate its importance when predicting work conditions in future underground mines, and (4) Develop efficient mine cooling systems which can be used in deep and hot mines in the USA and world-wide.

Ventilation and climatic monitoring units were installed at the Turquoise Ridge mine, operated by Barrick, and at the Leeville Mine, operated by Newmont, to quantify the heat load generated from sources such as: strata, auto-compression, mining equipment, and blasting. A new method was developed to assess and rank proposed heat stress indices at underground mines based on an advanced thermal comfort model. Mathematical models assessed the sweat rate, skin wetness, and work duration limits for miners as a function of their personal characteristics (e.g. age, gender, body mass index), metabolic rate, clothing, and climatic conditions in the work area were developed and designed. Ventilation and climatic data at the participating mines was collected to quantify the thermal flywheel effect and validate the V-T-H models. As part of this project, twelve students graduated with advanced degrees (four Ph.D. and eight M.S.).

2) SUSTAINABLE INTELLIGENT MINING SYSTEMS (SIMS), (2016 - 2019)

During his sabbatical leave from the University of Nevada, Reno, Professor Kocsis worked with faculty from the University of Lulea (Sweden) and system engineers from Epiroc, Agnico Eagle, LKAB and Ericsson on the Sustainable Intelligent Mining Systems (SIMS) project. This project focused on the introduction of battery-powered mining equipment in underground mines and development of fully autonomous mining systems. Another important objective of this collaborative research project was to test, evaluate, and demonstrate an advanced material handling system developed by Epiroc (Sweden) for underground mines.

Emerging new technologies have the ability to remove diesel particulate matter (DPM) and toxic gases from the production stops and educe noise while reducing the mines' energy consumption through the use of battery-powered mining equipment and advanced material handling systems. Equipment testing, process demonstration, and battery design work was also performed at Epiroc's underground new testing facility in Orebro (Sweden) and at the Kittila Mine (Finland) operated by Agnico Eagle. The knowledge and experience Professor Kocsis gained through this collaborative research project can be transferred to the underground mines in Utah, Nevada, and across the USA to improve productivity, safety and health, and lower carbon emissions.

DR. MIKE NELSON

In 2016 a team under the direction of Professor Nelson began a project to evaluate the intervention effectiveness of safety and health managements systems (SHMSs) in U.S. mines.

By January 2020, the project team had made 22 visits to a group of 14 mines. Three mines were visited three times, two mines twice, and nine mines once. The team administered more than 4,000 surveys, generating almost 230,000 data points for analysis.

The team also analyzed the SHMS in each of the 22 visits, rating each site's effectiveness in four of the components of an SHMS. The study reached the following conclusions:

1. The implementation of SHMSs varies widely. In a given company, the implementation varies from one mine to another; at a given mine, it varies from one year to the next. **2.** A SHMS can contribute significantly to standards and performance at any mine, but such a system alone does not guarantee a safe and healthy workplace. **3.** Longitudinal effects at a given mine are very difficult to identify and quantify, because a single, uncontrollable variable, such as a new mine manager, can markedly change the workplace climate and culture in a short time. **4.** The most important components of any SHMS are leadership, workplace culture, and workplace climate. The study produced a large database, which continues to be analyzed by members of the project team.

Three students worked with Dr. Nelson on this project: Ashley Hodgson completed an M.S. degree and now works at Sandia National Laboratory; Amy Richins also completed an M.S. degree and is now analyzing the data further for use in her Ph.D. research; Hayley Wallin participated in mine visits to Alaska, Indiana, and Mississippi, and has just finished her B.S. degree.

Professor Nelson is currently finalizing the solicited proposal for a research project in which he and his students will be monitoring the air quality at the intake and exhaust entries of coal mines in Utah and Colorado. This work will be similar to a project that Dr. Nelson completed for the BLM in 2010 and 2011.



Amy Richins, Ph.D. student, surveying workers at a mine site.

KITZIA CASASOLA

We also are extremely happy to have added a staff member in our office. Kitzia Casasola started with us in January 2020 as our administrative program coordinator. She is a graduate of Jönköping International Business School with a bachelor's degree in Business and Economics, and is bilingual in English and Spanish.

Her contributions have been extremely helpful as part of our effort to grow both our graduate and undergraduate programs. Our new website reflects work she has already done to improve our communication with our stakeholders like you. Take a look at mining.utah.edu



SME ALUMNI EVENT

We will be hosting a virtual alumni event during the SME annual conference. Please watch your inbox for more information about joining us on March 2nd, 2021 at 5:30 PM.

If you are not on our e-mail list, please contact us at mining-info@lists.utah.edu for more information.



SUBMIT A STORY

Storytelling is one of humanity's most basic and effective forms of communication. We all have stories to tell and when a group of people read the same story, it connects them.

We hope you'll share your story with us. Whether it's an amazing life accomplishment, a personal milestone, an inspirational account, or a great professional move—we want to know!

Additionally, we invite you to send us pictures, videos, stories, or memorabilia from your time spent as a mining engineering student.

Visit the [Alumni & Friends](#) section of the new Mining Engineering website to submit a story.



NEWMONT SAFETY CLASSROOM

We are excited to announce the completion of the Newmont Safety Classroom renovation in the William Browning Building. The Newmont Safety Classroom and adjacent space housing the Center for Mining Safety & Health Excellence, opened for use at the beginning of Fall 2020.

This educational space highlights Newmont's ongoing commitment to safety and will be used to continuously reinforce a culture of safety that eliminates all workplace injuries and illness through a focus on behaviors, leadership, and risk management.

Through this renovation and future equipment installations, we will be able to access new teaching technologies to allow better course delivery and provide a modern space for professional development, student education and community outreach. This was all made possible through Newmont's generous \$500,000 contribution to the project. Thank you Newmont!

EMPHASES & CERTIFICATES

The department underwent an extensive review of its curriculum that involved benchmarking all major mining engineering programs in the U.S., extensive faculty discussions, Industry Advisory Board evaluation and input, and a student survey. Based on this information, we revised our curriculum to include five areas of emphasis as part of the B.S. degree program: Aggregates and Mineral Processing, Geomechanics and Spatial Analytics, Mine Safety and Health, Mine Operations Management, and Sustainable Resource Development. These areas of emphasis will allow students to focus on and receive training in specialized areas of industry.

Each of the new areas of emphasis will also be offered as a certificate. In addition, general mining and pre-mining engineering certificates are being developed. These certificates are designed to be used in conjunction with other degrees or as a standalone professional development tool.

Certificates in [Pre-Mining Engineering](#), [Mine Operations Management](#), and [Sustainable Resource Development](#) should be available by the end of the year. We are awaiting the final approval for our new areas of emphases and remaining certificates. We look forward to the new opportunities these programs will provide to our students and industry partners.

INDUSTRY ADVISORY BOARD

The Industry Advisory Board (IAB) provides support and guidance to the University of Utah's Department of Mining Engineering from the perspective of industry leaders. Our current board, headed by Denee Hayes, is made up of 12 members who have broad experience working within the mining industry.

The main responsibility of the IAB is to collaborate with the Department to ensure that the program is delivering education that is relevant to current industry practices.

This past fall the IAB hosted two networking events for our students. The events were well attended and provided important perspectives from industry leaders. We are happy to have been able to interact with them during 2020 thanks to the ever-popular Zoom meetings and look forward to the continuing contributions of the IAB to our program.



IAB MEMBERS

AMANDA SMITH

General Manager, Borates & Lithium Operations at Rio Tinto

ANDREW CAREY

Principal Engineer - Studies at Rio Tinto

BART HYITA

President, HyitaTech Consulting LLC

BILL HALL

VP Technical Services, Peabody

DENEЕ HAYES

Principal - Bijih Resource Consulting

FRANK MCALLISTER

Formerly, President/CEO, Stillwater Mining Co.

GEORGE KARPAKIS

Formerly, President, BHP Billiton Marketing

JOHN BYARS

General Manager, Wolverine Fuels, SUFCO Mine

MATT TOBEY

General Manager, Rio Tinto Kennecott

MONICA DODD

Senior Director Mine Engineering, Newmont Mining Corp.

RICK HOGGAN

President, Millcreek Engineering

WALDEMAR (WALLIE) RASMUSSEN

Formerly, Lawyer, ExxonMobil

STUDENT GROUPS

The student groups Women in Mining (WIM), SME, and the Mine Rescue Team are important contributors to positive student experience in our department. We support and commend them for their inclusive efforts to offer opportunities for all students to be involved, have a meaningful experience at the University, and develop their professional networks.

The WIM student chapter just started its 6th year! Even though 2020 stopped in-person activities, WIM was able to continue two of their traditional events. In October they passed out crystal creation kits and candy to their fellow students. In November WIM's virtual fund

drive raised over \$750 for the Utah Food Bank! Their most recent field trip pre-Covid was to Morton Salt in Grantsville, Utah, where they saw the mining and processing plant operations. They are looking forward to starting up field trip opportunities soon.



The SME student chapter was creative in fundraising 2019 and hosted its first ever skeet shoot. The event was well supported and was so successful the student chapter was able to support



30 students at the 2020 SME Annual Conference in Phoenix at no expense to the students! While in Arizona, a group of students toured Freeport McMoRan's Morenci mine site. Events have been restricted, but the chapter officers continue to plan for the future. They are looking forward to another skeet shoot and more fields trips.



MINE RESCUE TAKES FIRST PLACE

The University of Utah's first-ever mine rescue team won big at the 2020 SME annual conference in late February. The team led in the first aid and breathing apparatus categories, and won the overall competition.

Because Utah's Mine Rescue Team had never competed before, the team's overwhelming win took the competition by surprise. For the competitors, the victory was the result of lots of hard work and tenacity. The winners were, from left to right: Amy Richins, Stephen Hall, Travis Brammer, Paige Estep, Rebecca Ray, Victor Harrell, Jack Peterson, and Billy Riley. Many thanks to team trainer Victor Harrell, Faculty Advisor Michael Nelson and graduate student Amy Richins for their efforts in the team's success.

DEPARTMENT SCHOLARSHIPS

The Department of Mining Engineering offers two excellent scholarships to our enrolled students: the Explore More Scholarship and the Browning Scholarship. Applications are available online by visiting mining.utah.edu/scholarships

THE BROWNING SCHOLARSHIP

Browning Scholarships are available to current students, resident and nonresident, entering freshmen, and transfer students who are interested in pursuing a degree in Mining Engineering. Students returning to the University and nontraditional students are encouraged to apply. Recipients are awarded up to \$7,500 per year.

THE EXPLORE MORE SCHOLARSHIP

The Explore More Scholarship is available to new incoming freshman, resident and nonresident, and transfer students who are starting their first semester at the University of Utah. Recipients are awarded \$10,000. The Explore More scholarship is a one-time award that does not renew. However, after one year, continuing students are invited to apply for the Browning Scholarship.

SME PHD FELLOWSHIPS

SME has implemented the Ph.D. Fellowship Program to address the long-term challenges that threaten the sustainability of U.S. mining and mineral processing/extractive metallurgy academic degree granting programs.

The program focuses on providing financial support to qualified candidates with industry experience and a desire to pursue an academic career. University of Utah students have claimed more SME Ph.D. Fellowships than any other school.

RECIPIENTS

AMY RICHINS - 2019 Shoemaker Ph.D. Fellowship Grant

Culture, Climate, and their Roles in Health and Safety Management

AARON YOUNG - 2018 Stantec/McIntosh Ph.D. Fellowship Grant

A Data-Driven Approach for Increasing Run-of-Mine Stockpile Understanding

DOUG WEYHER - 2018 Robert S. Shoemaker Ph.D. Fellowship Grant

Material Failure in a Longwall Yield Pillar: A Primer on Using Seismology as a Tool for Ground Control.

PHILANTHROPIC SUPPORT

Philanthropic support from our alumni and friends greatly benefits our students and faculty. Thank you for all that you do!

For online contributions please visit: ugive.app.utah.edu/designation/421

We also accept contributions made by check.

Please make checks payable to the University of Utah and indicate Mining Engineering on the memo line. Checks can be mailed to:

College of Mines and Earth Sciences
Department of Mining Engineering
ATTN: TJ McMullin, Development Dir.
115 South 1460 East, Room 205
Salt Lake City, UT 84112



THE UNIVERSITY OF UTAH

**DEPARTMENT OF
MINING ENGINEERING**