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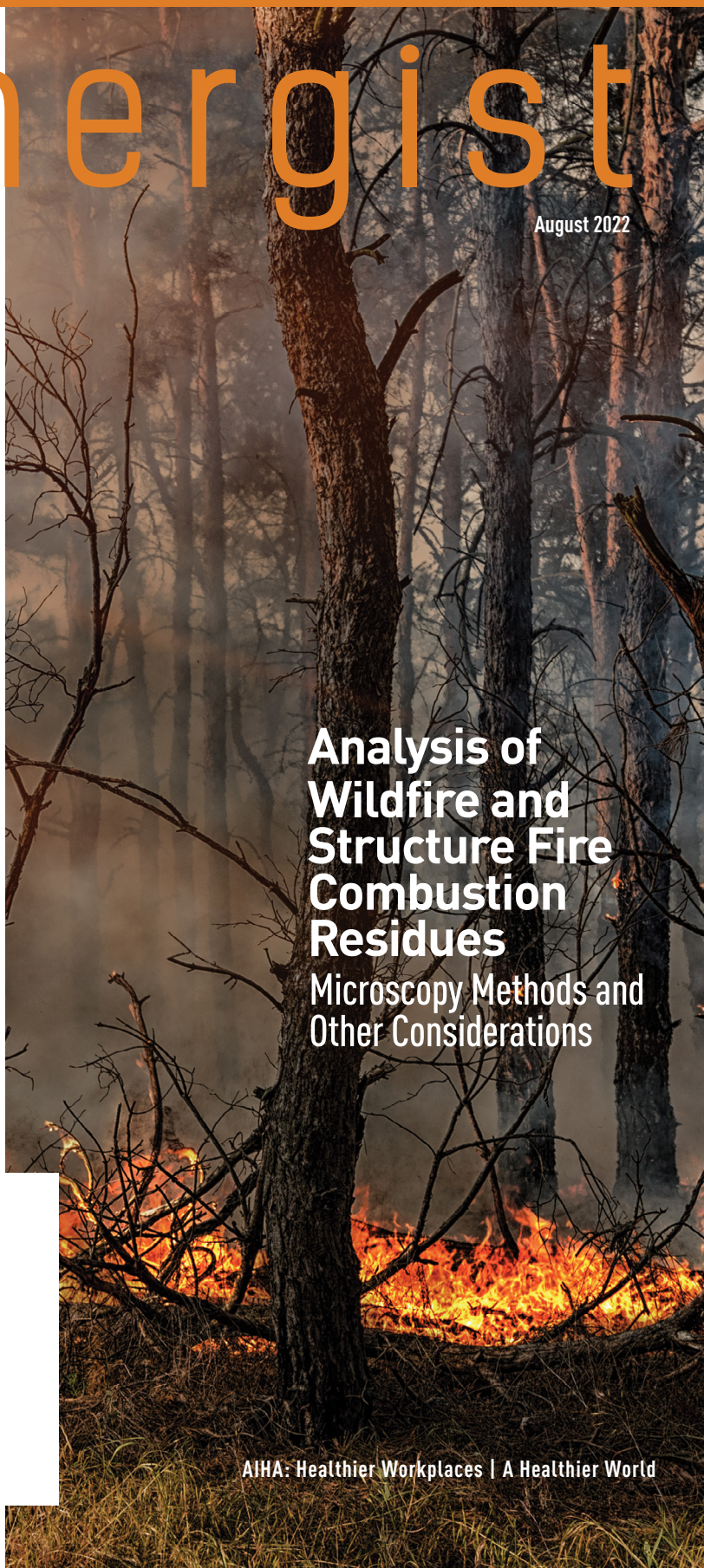
August 2022



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Millennials as OEHS Leaders | Emerging Workforce Issues for Students and Early-Career Professionals | Professional Judgment and Its Pitfalls for Young IHs

The Synergist's mission is to provide AIHA members with news and information about the occupational and environmental health and safety fields and the industrial hygiene profession. *The Synergist* focuses on industry trends and news, government and regulatory activities, key issues facing the profession, appropriate technical information, and news on association events and activities.

The Synergist's objective is to present information that is newsworthy and of general interest in industrial hygiene. Opinions, claims, conclusions, and positions expressed in this publication are the authors' or persons' quoted and do not necessarily reflect the opinions of the editors, AIHA, or *The Synergist*.

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HEALTHIER WORKPLACES | A HEALTHIER WORLD

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Progress on Heat Hazards

BY DONNA S. HEIDEL, AIHA PRESIDENT

What a pleasure it was to attend AIHce EXP 2022 in Nashville this past May! After more than two years of virtual-only meetings, our members came out in full force for the first face-to-face AIHce since the 2019 conference in Minneapolis. I'm looking forward to seeing how this energy translates into new resources for protecting workers and helps AIHA move closer to fulfilling our mission.

One area of OEHS practice that has a lot of momentum is heat stress.

BUILDING MOMENTUM

One area of OEHS practice that has a lot of momentum is heat stress. Just last month, *The Synergist* published an article on preventing heat-related illness (**bit.ly/syn2206heat**) and discussed ways to lessen heat burden from personal protective equipment. AIHA has commented on proposed heat stress standards in Virginia and Maryland, and has followed legislation addressing heat-related illnesses in several states. The AIHce program included a professional development course and other sessions on heat stress, and the Upton Sinclair Memorial Lecture was delivered by Kristen Lombardi, a journalist who contributed to a series of articles about OSHA investigations of heat exposures.

For its part, OSHA recently launched a national emphasis program on heat stress (**bit.ly/osha220412**) and initiated the rulemaking process for a standard that would protect workers from heat hazards in both outdoor and indoor work settings (**bit.ly/frheatanprm**). At the AIHce closing session, Jim Frederick, the deputy assistant secretary of labor for OSHA, spent part of his address talking about the agency's efforts. "We know there are heat hazards in many different workplaces," Frederick said. "Heat is a problem that many workers—both indoors and outdoors—face."

Frederick acknowledged that heat is a complex challenge and that assessing heat hazards requires knowledge of personal risk factors and Wet Bulb Globe Temperature (WBGT). He also stated that OSHA's standard will need to account for the widely varying capabilities of workplaces across the United States, some of which will not have the expertise to monitor WBGT. Understandably, Frederick couldn't say when the agency's heat standard would be completed, and he reminded attendees that "issuing an OSHA standard takes, on average, seven and a half years." That time is necessary to ensure that the agency produces a defendable standard, Frederick said.

A NEW VOLUNTEER EFFORT

But we don't have to wait that long to make a difference. Earlier this year, AIHA formed a Thermal Stress Working Group (TSWG) that has already identified ways AIHA can help.

As just one example, TSWG members are launching a research project intended to determine current attitudes, behaviors, and knowledge about heat stress across several industries. The project would involve a survey that will help TSWG and AIHA understand what resources employers need.

Conducting the survey, analyzing the results, and developing resources to address identified needs would probably take at least a year, so the TSWG is also considering creating guidance that could help employers in the shorter term. Such guidance could follow the model of Back to Work Safely, the AIHA initiative that quickly produced dozens of short, practical guidance documents for various types of businesses that were reopening after COVID-19 lockdowns were lifted in 2020.

TSWG members are also involved in discussions with NIOSH and OSHA related to possible updates to the agencies' jointly developed heat safety app. The app currently relies on heat index to identify heat risk levels. A potential upgrade to the app would base its risk determinations on WBGT, which, unlike the heat index, accounts for radiant energy from sources of heat. Upgrading the app would be a resource-intensive undertaking for both agencies, and for this reason, no timeline has been identified to date for completing it.

HOW TO HELP

Like Back to Work Safely, the TSWG is demonstrating how much a dedicated group of volunteers can accomplish in a short amount of time. If you would like to contribute, please consider joining TSWG. More information is available at **bit.ly/aihatswg**.

Responses to "Ethics and ESG Ratings"

Editor's note: The case study in this article is fictitious and is intended to highlight ethical issues in the practice of industrial hygiene. Any resemblance to real people or organizations is coincidental. The opinions expressed are those of the authors and do not necessarily reflect the opinions of AIHA, *The Synergist*, the Joint Industrial Hygiene Ethics Education Committee, or its members.

The article "Ethics and ESG Ratings" in the April 2022 issue (**bit.ly/syn2204ethics**) presents a fictional case study about the ethical issues related to environmental, social, and governance (ESG) rankings. A summary of the case study appears below, followed by responses from *Synergist* readers.

"This article raises quite a relevant problem: the credibility of ratings, labels, certifications, and so on. When they are only used to improve the company's image, they may induce pernicious effects."

SUMMARY

Global General Appliances (GGA), an American multinational manufacturer and marketer of home appliances, has a new CEO who is enthusiastic about getting the company listed on ESG scorecards. He proposes to turn the EHS department into an ESG affairs department. GGA publishes a short corporate responsibility report each year, but the CEO understands that to get listed on important scorecards, he needs a much more robust set of initiatives and metrics and a longer annual publication. EHS staff feel pressured to give the CEO the numbers he wants.

Judith, a certified industrial hygienist who works at GGA, has proposed several new leading indicator metrics for environmental and safety issues. While GGA informally tracks many of these measures, Judith finds that the company misrepresents them as half-truths. She reports the shortcomings to her boss, who tells her it's going to be an uphill slog getting senior executives and the board of directors to commit resources to improving the quality of these metrics.

What are Judith's options? How hard should she push back against the chain of command? How does she show the worth and positive impact of ethical ESG metrics? Should she quit her position at GGA due to the risk that pushing for better ESG performance might set back her career?

READER RESPONSES

I think Judith needs to get some company leaders interested in fixing things that have been reported but not resolved. They have to understand they are at risk if inspectors come out, see the list of reported problems, and want an update on what the company has done to resolve them, or if someone gets hurt and inspectors come calling to understand how. ESG issues are important, but they are too far removed in this scenario for leadership to relate to them. Judith should first push harder to get leadership on board with fixing problems. Once she's done that, she can relate the problems to ESG.

At the same time, Judith should report the ESG metrics honestly. I understand the leadership can pick and choose what they want to present to the board, but if those metrics start changing over time, the board probably will pick up on it and want to know why. Before she reports the metrics, she should show them to the leadership teams so she doesn't make enemies. She should be respectful and work with them if they have issues with what is reported. They have probably earned and expect that courtesy.

A digital Synergist *reader*

This article raises quite a relevant problem: the credibility of ratings, labels, certifications, and so on. When they are only used to improve the company's image, they may induce pernicious effects, as illustrated in this example. The core issue is the company culture, which the CEO must explain, promote, and develop. Because the CEO does not appear to be effective at this, Judith and other managers and directors will have less influence. If Judith is sure to find another job in a better environment, she should quit her position at GGA.

Michel Guillemin

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Technical Frameworks: Resources on Core OEHS Knowledge

BY SPENCER PIZZANI AND STEVEN D. JAHN

AIHA University has published 11 technical frameworks on critical subjects and areas of practice in occupational and environmental health and safety as part of the association's commitment to serve OEHS professionals and protect workers' health worldwide. Technical frameworks are intended to provide practitioners and stakeholders with baselines of knowledge on the components of OEHS subject areas. A technical framework may include guidance on what to consider when addressing a topic or seeking professional development within a domain.

Each technical framework is authorized by the Content Portfolio Advisory Group, created by a team of subject matter experts and qualified OEHS professionals, and vetted by AIHA members to ensure that the content is validated under the current standard of care. The review stage provides consensus on the current state of practice and establishes credibility when building coalitions with other allied professionals in roles such as human resources, occupational health, and risk management.

Technical frameworks are intended to provide practitioners and stakeholders with baselines of knowledge on the components of OEHS subject areas.

TECHNICAL FRAMEWORKS

A central focus of each technical framework is the identification of professional roles or tiers of competency that are necessary to responsibly complete work in each OEHS subject area. Technical frameworks may include specific knowledge, skills, and abilities (KSAs) for each role or tier of competency as well as supporting experience or skills that help practitioners properly fulfill identified roles. Technical frameworks are not intended to establish practitioner criteria or requirements but to guide professionals on important considerations for their work and professional development. They can also answer important questions on each OEHS topic, such as:

- How is this subject viewed by the OEHS community?
- What are the key terms in this subject area?
- What KSAs should practitioners in this area have or consider obtaining?
- What topics or components of work should be considered?

Following are descriptions of the topics covered by the existing 11 technical frameworks, plus another that is currently in development.

"Guidance on Use of Direct Reading Instruments." This technical framework outlines steps for conscientious use of all types of direct reading instruments, using a model that places trust in the users of these instruments. Four tiers of competency are established based on progressive and verifiable KSAs that inform instrument use, management, selection, and qualification. A detailed guidance section shares lessons from the authors, with the aim of helping to prevent potentially disastrous misapplications, and reinforces the importance of using systemic evaluation to establish instruments as fit for purpose.

"Legionella." Partnerships among professionals in healthcare, property management, and water systems are critical to ensuring proper management of risks posed by *Legionella* bacteria and effective outbreak response. This technical framework identifies three key roles for *Legionella* control in building water systems: a competent technician who executes monitoring plans and conducts risk assessments, a responder professional who leads outbreak investigations and mitigations, and a program professional who develops and manages water management programs to minimize risks of illness related to *Legionella*.

"Big Data." One of the greatest challenges facing modern OEHS is adapting to the advent of Big Data. This technical framework establishes three industrial hygiene roles important to the use of Big Data: IH technicians for standardized data collection and basic analysis, advanced IH professionals for developing and implementing data management plans, and IH data experts for leading projects and aligning technology-enabled solutions. Each tier of KSAs outlined in this technical framework emphasizes the execution of high-quality data collection, communication, and privacy protection. This technical framework is essential for OEHS professionals tasked with commissioning continuous real-time detection systems.

"A One-of-a-Kind Resource for All IAQ/IEQ Practitioners." Jointly approved by AIHA and the Indoor Air Quality Association, the indoor air quality and indoor environmental quality technical framework establishes a diverse set of 94 KSAs across eight domains of competence for assessing and mitigating contaminants and stressors in the built environment and building envelope. Almost all OEHS professionals can find a KSA in this technical framework that they can improve upon in their own careers to benefit their professional capabilities.

"Occupational Exposure Banding Process." Occupational exposure bands offer essential guidance in situations where occupational exposure limits have not been established. The OEB technical framework provides KSAs for IHs, chemical risk assessors, and toxicologists who are responsible for interpreting complex and sometimes disparate sources of technical information and literature data to establish a range of tolerable exposures among potentially significant uncertainty.

"A Resource for Respiratory Protection Programs." This technical framework establishes KSAs necessary to implement effective respiratory protection programs (RPPs) for four critical stakeholders: employers or users, fit testers, supervisors, and RPP administrators. The technical framework also addresses the following 12 program elements: RPP requirements; medical evaluations; training; respirator fit testing; hazard determination; respirator selection; respirator maintenance, care, and storage; proper use of respirators; breathing air quality and use with respirators; regulatory framework; documentation; and program evaluation. This technical framework provides a robust basis for establishing the roles, responsibilities, accountabilities, and authorities for successful RPPs.

"The Keys to Effective Presentation of Your Business Case." Established by AIHA's Leadership and Management Committee, this technical framework provides OEHS practitioners with an easy-to-follow, seven-step process for establishing a business value proposition. The text outlines the application of the hierarchy of controls in a cost/benefit regimen tied to operational management. Establishing a business value proposition allows practitioners to assign financial and other tangible benefits and costs to risk management decisions as well as present defensible risk control options in terms that the corporate suite can understand.

"The Road Map for OSH Professionals." This technical framework integrates hazard recognition and evaluation with risk assessment and the resulting implementation of controls to support business case development and communication with stakeholders. It formed the basis of the OEHS profession's addition of the "confirmation" step to the former "anticipate, recognize, evaluate, and control" convention for assessing exposures. This technical framework establishes validating controls as a resource-demanding but critical tenet of effectively implementing exposure risk assessment and management logic.

"Role of the OEHS Professional in Emergency Planning." Modeled after the planning process used by the Federal Emergency Management Agency (FEMA), this technical framework focuses on the collaborative effort necessary to represent the health and safety interests of all stakeholders that may work together in planning emergency responses. Using the "Plan, Do, Study, Act" cycle, the technical framework identifies critical resources needed at the planning table and offers readily available resources to facilitate emergency planning.

"Emergency Preparedness and Response for the Industrial Hygienist." This technical framework discusses the distinction between emergency preparedness and emergency response and covers the field execution of planning for and responding to emergencies. OEHS professionals are likely to fill three principal roles: safety officer, assistant safety officer, or technical specialist. The latter has expertise in matters such as personal protective and respiratory equipment, instrumentation, or release modeling. For each planning or response role that an OEHS professional can fulfill, this technical framework presents KSAs based on incident complexity, following a model created by FEMA. The technical framework also includes a substantial list of definitions and resources for use by members of the OEHS community engaged in emergency preparedness and response.

"Role of the OEHS Professional in Continuity Planning." Continuity planning transcends the traditional safety and health posture taken toward planning for and then responding to emergencies. This technical framework addresses maintenance of business operations in the aftermath of any crisis that interrupts the business's mission, including fires, floods, supply chain disruptions, and staffing shortages. Business impact analyses leverage risk assessments to identify threats and hazards that might create loss of continuity, as well as their implications. Following a model created by FEMA, this technical framework discusses how business operations can complete resource needs assessments in order to prioritize the allocation of labor, time, and budget to mitigate potential consequences of disruptive events.

According to the technical framework, these preparatory activities and sufficient management attention allow for the development of responsive continuity plans to set priorities for essential business functions, including when resources fall short. The technical framework details four phases of continuity plan implementation that will occur after disruptive events: readiness and preparedness, plan activation, continuity operations, and reconstitution and return to normal operations.

COMING SOON

AIHA is actively creating new technical frameworks, including one currently in development that focuses on protecting workers who are particularly susceptible to certain exposures and their associated health effects. This upcoming technical framework is founded on the anticipation that OEHS will be fundamentally changed by rapidly improving knowledge of genetics and shifting landscapes related to biometric devices and personalized medicine, and it will aim to establish a new core domain of practice. Using lessons learned from beryllium disease investigations, ongoing research into stressors such as noise, and the principles of Total Worker Health, this technical framework will deliver usable guidance for OEHS professionals when evaluating exposures to agents that may present identified or unknown factors that increase risk.

To learn more and download free PDFs of AIHA's technical frameworks, please visit **bit.ly/AIHAU frameworks**.

ROGER LEWIS, PhD, CIH, FAIHA, is professor emeritus of environmental and occupational health at the Saint Louis University College for Public Health and Social Justice. He can be reached at **roger.lewis@slu.edu**.

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Send feedback to **synergist@aiha.org**.

Toward a Sustainable EHS Academy

BY ROGER LEWIS

Prior to my retirement in 2021, I served on the EHS faculty for most of my 27 years at Saint Louis University. My experience includes four years as chair of the Department of Environmental and Occupational Health, a position that involved, among other duties, oversight of the departmental budget. This responsibility helped me develop a deeper understanding of the many pressures on our department in particular and on higher education in general and contributed to my growing concerns about the sustainability of the EHS academy.

To be sustainable, the EHS academy must meet several challenging goals. It must produce enough new doctoral graduates to replace retiring academicians who teach and conduct research. It must attract a wide number and diverse variety of students and address their funding needs. It must retain the best faculty by providing sufficient time for them to teach, conduct research, and recruit students. And it must increase both the enrollment in student-degree programs and the funding available for faculty research.

My concerns about the ability of the EHS academy to meet these goals informed my work on a survey of faculty with the late David Sterling from the University of North Texas. We distributed the survey in 2016 and shared our results at AIHce in 2018. Those results, together with information from a survey of EHS programs that AIHA conducted in 2021, provide benchmarks against which future research could measure sustainability.

To be sustainable, the EHS academy must produce enough new doctoral graduates to replace retiring academicians who teach and conduct research.

TWO SURVEYS

Developed by the former AIHA Academic Special Interest Group, the 2016 survey was distributed online to faculty who belonged to one of the following associations: AIHA, the American Society of Safety Professionals (ASSP), the Association of Schools and Programs of Public Health (ASPPH), and the National Environmental Health Science and Protection Accreditation Council (EHAC). A total of 102 surveys were sufficiently completed for a response rate of 24 percent. Key data from the survey include:

- Sixty-five percent of responses were completed by individuals within doctoral-granting universities that offer doctoral, master's, and bachelor's degrees.
- Seventy percent of respondents were male, and 86 percent were white.
- Twenty-nine percent of respondents were senior rank (that is, full professors).
- Half of respondents were over 50 years of age, and 32 percent were over 60.
- Sixty-one percent of respondents from master's-level programs indicated that they had enrolled fewer than 11 new full-time equivalents (FTEs).
- Only 25 percent of respondents from traditional (that is, not online) programs said they had 41 or more FTEs.

These data suggest that at the time of the survey, EHS faculty comprised predominantly older white males, and that EHS master's programs were struggling to attract new students. The responses from faculty affiliated with EHAC indicated greater diversity: historically black colleges and universities (HBCUs) are well represented within EHAC, and only 15 percent of respondents from EHAC were white, with the majority of either African American or Asian descent. In addition, 42 percent of respondents from EHAC-affiliated programs were women.

EHAC responses also indicated that bachelor's programs at these schools experienced tremendous growth, each bringing in approximately 50 new FTEs per year while graduation rates remained steady. But EHAC master's-level programs were reported to be similar in size to other programs, enrolling fewer than ten students per year. In addition, recent graduated data from EHAC shows that graduate students receiving their diplomas in EHAC programs declined by 55 percent from 2016 through 2021.

The 2016 survey also suggested, paradoxically, that EHS degree programs accredited by ABET and those supported by NIOSH funding did not attract more students than programs without this accreditation and type of funding. Respondents from programs that were either ABET accredited or NIOSH funded reported matriculating only 11 new FTEs per year.

The survey also asked EHS faculty to reveal the percentage of time they spend on research. Overall, a large majority of respondents indicated that funding had remained the same or decreased in the five years prior to the 2016 survey. The top research-related needs identified by respondents were release time, lab support, and pre-grant support. Approximately 30 percent of respondents from doctoral programs, where most research is conducted, reported that less than 25 percent of their time was spent on research, and half said that support for research at their universities was unacceptable. It's possible that the experiences of EHS faculty regarding research are like those of faculty in other science departments or at research institutions in general.

In 2021, AIHA surveyed academic programs that provide undergraduate- and graduate-level instruction in industrial hygiene. Out of 132 surveys, 56 were completed for a response rate of 42 percent. The survey had several goals; the data that are most relevant for comparison with the 2016 survey results include the following:

- Respondents reported that students were supported by scholarships (76 percent of responses), assistantships (62 percent), research grants (56 percent), NIOSH Education and Research Center grants (30 percent), and training program grants (18 percent).
- For master's programs, the median annual enrollment reported by survey respondents was 10 students and the median number of graduates was less than 10 per year.
- For bachelor's programs, the median annual enrollment reported by survey respondents was 25 students and the median number of graduates was 20 per year.

Unfortunately, the 2021 survey data suggest that student enrollment and graduation rates for master's programs were almost identical to those in 2016. However, bachelor's programs enrolled and graduated almost twice the number of students in 2021 that they did in 2016.

Both the 2016 and 2021 surveys asked respondents to suggest ways to improve instruction and research in EHS. These questions generated similar comments about the need for more faculty, increased student enrollment to justify specialized industrial hygiene courses, and improvements in resources such as laboratory equipment.

THE LIFEBLOOD OF EHS

The 2016 and 2021 surveys identified several questions that everyone invested in the future of the EHS academy should want to see answered. How can we address the funding needs of students? Are we doing enough to keep and retain the best faculty? What equipment does a robust EHS academic program need? How should we address the small enrollment in master's programs? How can we advocate for more time for teaching, research, or recruiting?

The data from the 2016 and 2021 surveys can be used to help stakeholders—including practitioners, faculty members, and representatives from government agencies and accrediting bodies—develop criteria for a sustainable EHS academy. We then need to track the sustainability of these programs over time through focus group sessions, surveys, and collection of data that may complement what we learn from self-reported information. Finally, we need to recognize that the lifeblood of our profession, our EHS students, are recruited into the EHS academy, which continues to evolve as surely as our hazards change and mutate over the coming years.

RESOURCES

AIHA: "The Academic Climate in Today's Industrial Hygiene and Related Programs: 2016 Survey of the EHS Faculty," AIHce EXP 2018 (presentation by Roger D. Lewis, David Sterling, and Lawrence Whitehead, May 2018).

AIHA: "IH/OEHS Program Benchmarking Survey Report" (December 2021).

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The Chronicle of Higher Education: "Student Activists Tell Colleges: To Improve Racial Climate, Look Hard at Tenure," **bit.ly/chetenure** (May 2016).

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National Academies Press: *Safe Work in the 21st Century: Education and Training Needs for the Next Decade's Occupational Safety and Health Personnel* (2000).

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National Environmental Health Science and Protection Accreditation Council: "2020–2021 Update of Accredited Programs," **bit.ly/nehspac20-21** (PDF, 2021).

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NIOSH: "National Assessment of the Occupational Safety and Health Workforce," **bit.ly/oshworkforce** (October 2011).

PE Magazine: "Survey: PE License Crucial in Academia but Not Always Encouraged," **bit.ly/pemlicense** (December 2014).

Research Triangle Institute: "A Study of the Impact of Occupational Safety and Health Training and Education Programs on the Supply and Demand for Occupational Safety and Health Professionals" (1985).

The Synergist: "Stress Tests: Trends in OEHS Academic Programs" (September 2014).

CHEMICAL AND MATERIAL HAZARDS

DRAFT TOXICOLOGICAL PROFILES FOR MERCURY, OTHER CHEMICALS PUBLISHED

A new draft toxicological profile for mercury is now available from the Agency for Toxic Substances and Disease Registry (**bit.ly/Hgprofile**). According to ATSDR, mercury is used in the manufacture of electronics and fluorescent lighting and in dental products such as fillings. Occupational exposures to mercury are of concern among industrial and dental workers. ATSDR warns that mercury can affect the nervous system and the kidneys, leading to health effects such as tremors, incoordination, impaired vision, impaired learning and memory, and mood changes.

New draft toxicological profiles are also available for copper (**bit.ly/Cuprofile**); the synthetic chemical nitrobenzene (**bit.ly/c6h5no3tox**), which is used to produce other chemicals or to dissolve chemicals during manufacturing; and nitrophenols (**bit.ly/nitrophenols**), which include three chemical compounds. Nitrophenols are manufactured and used in the production of dyes, rubber, photographic chemicals, medicines, pesticides, and fungicides, ATSDR explains.

Learn more at **bit.ly/atsdr-toxprofiles**.

ASBESTOS

CDC Highlights Increase in Mesothelioma Deaths Among Women

Mesothelioma deaths among women increased significantly over the last 20 years even as asbestos use declined, according to a report published on May 13 in CDC's *Morbidity and Mortality Weekly Report* (MMWR). The report states that the annual number of women who died from malignant mesothelioma increased by approximately 25 percent from 1999, when there were 489 deaths, to 2020, during which 614 deaths were recorded. Malignant mesothelioma was listed as the underlying cause of death for more than 12,000 women during 1999–2020.

CDC notes that the increase in the annual number of mesothelioma deaths among women coincides with a decrease in the age-adjusted death rate for mesothelioma per one million women during the same time period. According to the agency's report, the age-adjusted death rate declined from 4.83 in 1999 to 4.15 in 2020. These trends "suggest that changes in underlying annual age distributions of the population over time are contributing to the observed increases in total mesothelioma deaths in women," the authors explain.

Occupational exposure to asbestos is most often recognized among men in industrial settings such as construction, where women are less likely to be employed. But women are also at risk for exposure to asbestos, CDC stresses. The agency estimates that about 23 percent of mesotheliomas among women were attributable to work-related asbestos exposure, compared to about 85 percent of mesotheliomas among men.

Information about industry and occupation was available for 567 of the mesothelioma deaths among women in 2020. The industry groups with the highest numbers of mesothelioma deaths were healthcare and social assistance, education services, and manufacturing, while the occupations with the most deaths were homemakers, elementary and middle school teachers, and registered nurses.

The annual number of women who died from malignant mesothelioma increased by approximately 25 percent from 1999 to 2020.

Women can also be exposed to asbestos indoors when older building materials containing asbestos are present. For example, exposures may occur when previously installed asbestos-containing materials are disturbed during maintenance or renovation, or when activities such as sweeping or cleaning cause settled fibers to resuspend in the air. Take-home exposures from family members who were exposed to asbestos fibers in workplaces outside the home are also of concern and are an example of how women can be exposed to asbestos indirectly. One study referenced in CDC's MMWR found that the relative risk for mesothelioma increased tenfold for women with a spouse or father employed in an asbestos-related industry. Findings that mesothelioma death rates among women are highest in states with shipyard industries or that are associated with mining and processing asbestos-contaminated vermiculite further suggest that take-home asbestos exposure may affect cancer development.

The authors of the report caution that its findings have several limitations. For example, complete information regarding all industries and occupations in which decedents worked during their lives and information about their family members' work was not available. Another limitation is that information about asbestos exposure or work tasks is not available on death certificates.

CDC's report stresses the importance of maintaining efforts to limit exposure to asbestos fibers, including among women.

"Ensuring future decreases in mortality because of malignant mesothelioma will require meticulous control of exposures in activities such as ship and building renovation and demolition, and in asbestos remediation and disposal," the report says.

The full MMWR report is available from CDC's website at **bit.ly/mmwr051322**.

BACTERIA AND VIRUSES

Researchers Describe Welder's Anthrax, a Newly Identified Occupational Disease

In an article published this March in the journal *Pathogens*, researchers from NIOSH and CDC's Bacterial Special Pathogens Branch highlight seven cases of welder's anthrax that affected six welders and a metalworker during 1994–2020. Welder's anthrax is severe pneumonia in a metalworker caused by *Bacillus cereus* group bacteria that produce anthrax toxin. In a *NIOSH Science Blog* post (**bit.ly/NIOSHblog0422**), the authors of the *Pathogens* paper characterize welder's anthrax as "a newly identified, deadly occupational disease." Although welder's anthrax is rare, researchers believe that cases may have been missed due to several factors, including limited detection and understanding of this pathogen.

A CDC report published in October at **bit.ly/mmwr1021** describes *B. cereus* group bacteria as "gram-positive facultative anaerobes, often toxin-producing, that are ubiquitous in the environment and reside naturally in soil and dust." The *Pathogens* journal article discusses possible mechanisms of infection and disease, including the hypothesis that the risk of infection is primarily from occupational exposure to metal fumes. The authors note that previous research findings suggest that inhalation of metal fumes may predispose workers to lung infections.

Researchers urge communication and cooperation between clinicians, employers, and public health practitioners to identify cases of welder's anthrax and identify occupational and personal risk factors. They also recommend future research to examine the possibility of increased susceptibility to and severity of lung infection among welders and metalworkers.

The full text of the *Pathogens* article is available to read at **bit.ly/deperio0322**.

INDUSTRIAL ACCIDENTS

CSB: Mixture of Incompatible Chemicals Caused Fatal 2019 Explosion

A 15-minute video by the U.S. Chemical Safety and Hazard Investigation Board (CSB) discusses a May 2019 chemical explosion that occurred after two incompatible chemicals were mixed at a Waukegan, Illinois, facility operated by AB Specialty Silicones (**bit.ly/abspecialvid**). The incident caused the deaths of four workers, injured a fifth, destroyed AB Specialty's facility, and extensively damaged nearby businesses.

The video includes animations demonstrating how, on May 3, 2019, an operator unintentionally mixed two incompatible chemicals that had been stored in identical drums. As the chemical mixture overflowed its tank, the operator and other workers realized an adverse reaction had occurred but not that the reaction had released flammable hydrogen gas into the production building. Two workers were instructed to vent the building, but before they could do so, the hydrogen gas ignited.

Although AB Specialty used chemicals capable of causing dangerous reactions, the company was not required by existing regulations to implement process safety measures. CSB reiterated recommendations for OSHA to amend its process safety management standard and for EPA to revise the accidental release prevention requirements of its risk management plan rule to cover reactive hazards.

AB Specialty did not have an effective hazard analysis program that could have identified safety issues.

CSB's investigation found that the facility lacked written procedures for safe storage of incompatible chemicals, did not implement local exhaust ventilation, and needed a functioning hazardous gas detection system. AB Specialty also did not have an effective hazard analysis program that could have identified safety issues.

For more information, read CSB's news release (**bit.ly/csb042822**).

CHEMICAL AND MATERIAL HAZARDS

EUROPEAN AGENCY ADDS SUBSTANCE USED IN POLYMERS TO HAZARDOUS CHEMICALS LIST

In June, the European Chemicals Agency (ECHA) announced the addition of the compound N-(hydroxymethyl)acrylamide to its Candidate List of substances of very high concern for authorization. N-(hydroxymethyl) acrylamide is used in polymers as well as in the manufacture of other chemicals and products such as textiles, leather, or fur, according to ECHA. The substance was added to the hazardous chemicals list due to its carcinogenic and mutagenic properties. An "infocard" published by ECHA at **bit.ly/infocard0622** stresses that N-(hydroxymethyl)acrylamide may also cause an allergic skin reaction; a majority of companies that have submitted data to ECHA about the substance agree that it is skin sensitizing, the agency explains.

Identifying a chemical as a substance of very high concern and including it in the Candidate List is the first step of the authorization procedure under REACH, the European Union's Regulation on Registration, Evaluation, Authorization and Restriction of Chemicals. Learn more on ECHA's website at **bit.ly/echa0622**.

ADVERTISERS' INDEX

See this month's Product Features on page 43.

ENGINEERING CONTROLS AND VENTILATION

CDC Examines Ventilation Strategies in Public Schools

A CDC report published in June found that while "substantial federal resources" are available to improve ventilation in schools, schools more frequently employ lower-cost strategies such as inspecting and validating existing heating, ventilation, and air conditioning (HVAC) systems and opening doors or windows rather than implementing more resource-intensive strategies. According to the National School COVID-19 Prevention Study, a survey that provides a nationally representative sample of kindergarten through grade 12 (K–12) public schools in the United States, only 38.5 percent of schools have replaced or upgraded their HVAC systems since the beginning of the COVID-19 pandemic. Even smaller proportions of schools reported the use of high-efficiency particulate air (HEPA) filtration systems in classrooms (28.2 percent) or areas where students eat (29.8 percent).

CDC's analysis found that the use of ventilation strategies in schools differed based on location and poverty level. For example, mid-poverty schools—those with one-quarter to three-quarters of students eligible for free or reduced-price meals—were less likely than higher-poverty schools to implement resource-intensive ventilation strategies, such as replacing or upgrading HVAC systems. Researchers posit that one reason mid-poverty schools may be less likely to implement such strategies is that they may have less experience in accessing and using federal funds than higher poverty schools.

As improved ventilation can reduce the transmission of SARS-CoV-2 and other infectious diseases in schools, the report urges public health professionals to support schools' implementation of resource-intensive strategies to improve ventilation and indoor air quality. The full report can be found at **bit.ly/mmwr061022**.

OSHA

Report Describes Significant Enforcement, Data Challenges Facing OSHA

OSHA faces significant challenges in its efforts to enforce workplace safety and health standards and collect injury and illness data, according to a report issued in May by the U.S. Government Accountability Office. GAO states that it conducted this study due to concerns about OSHA's crisis preparedness arising from its efforts to protect workers from COVID-19.

The report notes that from February 2020 through June 2021, OSHA responded to the pandemic mainly through enforcing its existing applicable standards, such as those related to respiratory protection, and its general duty clause, which can be applied for hazards that lack specific standards when certain criteria are met. But GAO found that OSHA inspectors experienced difficulties with both strategies, in part because citing general duty clause violations requires significant documentation.

GAO also identified obstacles to OSHA's data collection efforts. Between 2016 and 2018, GAO estimates that employers for more than 50 percent of establishments did not report required injury and illness data. The GAO study also found that OSHA issued significantly fewer citations for recordkeeping violations after a 2012 court decision that limited the time period in which OSHA was allowed to cite these violations, and that the agency has few procedures for encouraging compliance and penalizing noncompliance to recordkeeping requirements. GAO's report explains that these challenges are significant because OSHA uses injury and illness data to target inspections.

For more information and to download a PDF of the report, visit **bit.ly/gao052522**.

PERSONAL PROTECTIVE EQUIPMENT

Tool for Estimating N95 Needs of Essential Workers Developed by NIOSH

NIOSH researchers have developed a spreadsheet-based tool for estimating the number of N95 respirators needed to protect essential workers in nonhealthcare occupations during a future pandemic. According to the agency's June 2022 e-newsletter (**bit.ly/enews0622**), estimates generated using this tool can assist public health officials and policymakers in preparing for future emergencies. The tool can also be applied to other types of personal protective equipment.

Researchers estimate about 85 million nonhealthcare essential workers could need N95 respirators during another pandemic spread through aerosol transmission. For a minimum possible scenario—a pandemic lasting 15 to 40 weeks, requiring one N95 respirator per worker per week—NIOSH's tool estimates that these workers would need about 1.3 billion N95 respirators during the first 15 weeks. Estimates increase to 2.6 and 6.4 billion respirators needed for the first 15 weeks for intermediate (two N95s per week) and maximum (five N95s per week) scenarios, respectively. The tool estimates that a 40-week-long pandemic would require 3.4 billion respirators for the minimum scenario, 6.8 billion for the intermediate scenario, and 17 billion for the maximum scenario.

The sources and methods used to develop the tool are described in an article in the journal *Health Security* at **bit.ly/fetcher0422**. The tool may be accessed for free in the article's supplemental material at **bit.ly/n95tool**.

SILICA

MSHA to Increase Inspections, Silica Sampling at Mines

A new enforcement initiative launched by the Department of Labor's Mine Safety and Health Administration (MSHA) is intended to improve U.S. miners' protections from respirable crystalline silica hazards. In a press release published on June 8 (**bit.ly/msha060822**), MSHA explains that the initiative will involve mine inspections related to silica dust and expanded silica sampling at mines. The agency says it will also renew efforts to notify miners of their right to report hazardous working conditions and assist mine operators in compliance and implementation of best practices. MSHA's webpage for its silica enforcement initiative at **bit.ly/mshaSI02** further outlines the program's components.

According to MSHA, thousands of miners per year are exposed to respirable crystalline silica during common mining activities such as cutting, sawing, grinding, drilling, and crushing stone and rock. Without proper protection and engineering controls in place, the agency stresses that miners face increased risks for serious, potentially fatal illnesses such as coal workers' pneumoconiosis, progressive massive fibrosis, silicosis, lung and other cancers, chronic obstructive pulmonary disease, and kidney disease.

NOISE

OSHA Initiative Aims to Reduce Noise-Induced Hearing Loss in Manufacturing

In May, OSHA began the enforcement phase of a Regional Emphasis Program intended to identify, reduce, and eliminate occupational exposures to hazardous noise levels in the states of Colorado, Montana, North Dakota, and South Dakota. The program targets manufacturing industries with high rates of occupational hearing loss. According to OSHA's program directive (PDF, **bit.ly/noiseREP**), enforcement activities include inspection and review of operations and working conditions, injury and illness records, and safety and health programs.

OSHA used Bureau of Labor Statistics (BLS) data to select industry sectors with incident rates for hearing loss of at least nine per 10,000 full-time workers for inclusion in the emphasis program. These sectors include food manufacturing, wood product manufacturing, primary metal manufacturing, and fabricated metal product manufacturing. According to BLS, in 2019, wood product manufacturing had an incident rate for hearing loss of 21.7 per 10,000 full-time workers, while the subsector of prefabricated wood building manufacturing had a rate of 31.1. BLS data for 2019 indicate that the incident rate for hearing loss for all industries in the United States was 1.4 per 10,000 full-time workers.

More information on the Regional Emphasis Program can be found on the Department of Labor's website at **bit.ly/dol051022**.

ASBESTOS

New EPA Rule Would Require More Comprehensive Reporting on Asbestos

A proposed rule announced by EPA in May would include reporting and recordkeeping requirements for asbestos under the Toxic Substances Control Act. The agency is proposing a one-time reporting obligation under which asbestos manufacturers and processors would be required to report certain use and exposure information on asbestos, including asbestos that is a component of a mixture, from the last four years. EPA would seek exposure-related information such as quantities of asbestos or asbestos-containing articles that were manufactured or processed, types of uses, and employee data. The agency says the data collected through this proposed rule would be used to inform future EPA actions involving asbestos.

The proposed rule would require the reporting of employee data such as the number of workers associated with the activity, whether personal protective equipment was used, and any workplace exposure measurement assessment data.

EPA's proposed requirements for asbestos were announced in the *Federal Register* at **bit.ly/asbestosreporting**. Information on additional EPA activities involving asbestos can be found at **bit.ly/epa050522**.

SPECIAL SECTION

AIHce EXP
Advancing Worker Health & Safety

AIHce Strikes a Chord

Nashville Hosts First In-Person Conference Since 2019

BY ED RUTKOWSKI AND KAY BECHTOLD

After more than two years of online-only conferences, OEHS professionals came out in droves for AIHce EXP 2022 in Nashville, Tennessee, May 23–25. The ongoing pandemic was, of course, a focus of many presentations. The descriptions on these pages offer a glimpse of the education offered at AIHce, which drew a sizable audience of both live and virtual attendees. For longer summaries of these sessions, visit **bit.ly/aihcedaily2022**.


AIHce EXP 2022 keynoter Chris Cassidy.

AN ASTRONAUT REFLECTS

As a teenager in the 1970s, Chris Cassidy decided to apply to the United States Naval Academy in Annapolis, Maryland. The service academies required an official nomination from his Representative in Congress, which Cassidy obtained, but he somehow forgot to complete the more mundane requirement of submitting an application. Judging from Cassidy's keynote address on May 23, which highlighted the importance of training and readiness, the story of how he nearly didn't get accepted to the Naval Academy seems to illustrate one of the few times in his life he wasn't prepared. It took the intervention of a kind-hearted Marine for Cassidy to eventually make his way to Annapolis, launching a career that included two tours of duty in Afghanistan and 17 years of service as an astronaut.

In 2004, Cassidy led his Navy SEAL platoon on a mission in Tora Bora, the mountainous region where Taliban fighters had taken refuge. Right before the mission, Cassidy's commanding officer told him, "I expect you to make good decisions and bring the men home." The moment helped Cassidy realize that the skills he'd learned in training were secondary to his ability to use his judgment to keep people safe.

That judgment came into play in dramatic fashion during a spaceflight nine years later. While conducting a planned spacewalk, Cassidy's partner experienced a malfunction with his spacesuit that resulted in water entering his helmet, obscuring his vision. Sensing his partner's distress, and acting on instinct, Cassidy helped him return to safety.

Cassidy expressed thankfulness for being among the small group of people who know what it's like to leave earth's atmosphere, and he reminisced about looking down from space and seeing the planet's surface zip by. "I think the world would be a better place if every single one of us could look out that window," Cassidy said. "It really made me appreciate earth for what it does for all of us."

MEASURING WORKER WELL-BEING

On May 23, NIOSH's Chia-Chia Chang introduced the agency's Worker Well-Being Questionnaire, or WellBQ, a tool intended to assess quality of working life, circumstances outside of work, and physical and mental health status. The development team, which included researchers from NIOSH and the Rand Corporation, first completed a literature review that informed the creation of a worker well-being framework, which comprises work evaluation and experience; workplace policies and culture; workplace physical environment and safety climate; health status; and home, community, and society. People don't work in a vacuum, Chang said, and these areas outside of work all relate to one another.

According to Chang, the data from the NIOSH WellBQ can be used to assess the impact of interventions and compare results between groups, including groups within the same workplace or across worker populations. She recommended using the questionnaire in its entirety to ensure that the full concept of worker well-being is captured—and because many parts of the tool were adopted from other instruments and permissions to use copyrighted pieces of the tool are granted only when using it in full. For more information, visit **bit.ly/nioshwellbq**.

THE CHALLENGES OF BIOAEROSOL SAMPLING

During the COVID-19 pandemic, OEHS professionals have been called on to conduct sampling designed to determine the presence and concentration of SARS-CoV-2. But, as bioaerosol scientist Quinn Aithinne demonstrated in a presentation on May 23, that seemingly simple charge is fraught with difficulty.

The first challenge, Aithinne said, is that "anyone who is breathing is a potential source." As a result, deciding where to collect a sample is highly uncertain, and sample sizes are typically low. Often, the analytical laboratory is unable to detect any virus in the sample. If a biological assay will be conducted, the virus must be alive, but sometimes the sampling method kills what it collects. A smattering of viral parts will work for analysis by polymerase chain reaction (PCR), which can verify the presence of virus in a sample but can't say whether it's infectious. And trying to determine whether the amount of virus exceeds what would be expected from background is impossible because no information on background levels exists. For these reasons, Aithinne said, "all your estimates are low-faith."

Even if OEHS professionals overcome these challenges, the lack of an enforceable OSHA standard for infectious diseases means that it's difficult to know what to do with the information they've obtained. As if these complications weren't enough, the equipment used to conduct bioaerosol sampling is expensive and limited by design flaws. "That's why we need industrial hygienists in research design," Aithinne said.

PANDEMIC PLANNING AND COMMUNICATION

In the early 2000s, the focus of pandemic planning was on a potential flu outbreak. As Dana Stahl explained in a presentation on May 23, much had been learned about the flu virus, and planners assumed a vaccine could be developed within six months and that demand for the vaccine would create significant challenges in determining how to distribute it equitably. Public health interventions such as school closures would be difficult to achieve, they thought, and would probably last only for short durations.

Of course, the pandemic these planners prepared for didn't occur. The pandemic they got instead stemmed from a novel coronavirus about which nothing was known when it was first detected in December 2019. Schools were closed almost immediately, and in many parts of the United States, they stayed closed for more than a year. While a safe, effective vaccine was developed with astonishing speed, the anticipated demand never materialized. Against expectations, the main problems were distrust of the vaccine and disbelief in the seriousness or even the existence of the viral threat.

Among the issues that pandemic planners hadn't considered was the extreme difficulty of communicating effectively. Stahl listed several reasons for the communication struggles, including distrust of government and the ease with which social media allowed individuals who were not experts or who wished to spread misinformation to reach a huge following. She suggested that communication during the pandemic has not fully accounted for the public's incomplete understanding of the scientific method. While scientists expect recommendations to change as more data becomes available, these changes have confused people and fostered distrust.

The respirator shortages at the beginning of the pandemic further complicated communication efforts, leading OEHS professionals to recommend actions that they wouldn't have contemplated otherwise. "In all of our pandemic planning, we never considered that we would be recommending people wear cloth masks," Stahl said. "In the end, we recommended it because it was the least bad option."

USING ROBOTS TO SIMULATE HUMAN EXPOSURES

One of Jennifer Shin's first projects for ExxonMobil was measuring dock workers' exposures to hydrocarbons during transfer of a petroleum product. The task was carried out only once or twice a year, and if she wasn't available to take samples on the appointed day, or if someone neglected to tell her when the task would be performed, she had to wait months before getting another chance. In addition, the limitations of data collection methods meant that she might get only one or two samples. Was this enough data to make confident assessments of worker exposures?

Since transferring to ExxonMobil Biomedical Sciences Inc. in 2012, Shin and her colleagues have been exploring ways to use robots to generate more high-quality personal exposure data. As she explained in a presentation on May 23, Shin and her team partnered with a robotics group at the University of Texas at Austin, which developed a robotic arm that could hold a spray can and mimic the motions of human workers performing two different spraying tasks.

"We felt that robots offer a unique advantage," Shin said, because they can perform tasks repeatedly and allow the collection of potentially endless samples. She added that using robots eliminates any ethical or privacy concerns that may apply when trying to measure human exposures.

The sampling equipment Shin's team used included photoionization detectors, whole air sampling canisters, and charcoal tubes. Measured parameters included the volume of the experimental area, room ventilation and airflow, temperature and relative humidity, sampling duration, the amount of product released, and the amount in the air. The results, Shin said, showed that exposures were low—and that the use of robots has the potential to fill some of the data gaps that have long plagued OEHS professionals.

IMPLEMENTING EHMRS IN HEALTHCARE

Two representatives from a regional hospital system joined AIHce on May 24 to discuss practical considerations related to distributing elastomeric half-mask respirators, or EHMRs, to a large population of healthcare workers. Because EHMRs can be cleaned, disinfected, and reused, they have potential to meet the needs of healthcare workers and can ease concerns about personal protective equipment supply during shortages of N95 filtering facepiece respirators.

As shortages of N95 FFRs at the onset of the pandemic created high demand for respiratory protection for healthcare workers, Hope Waltenbaugh, the vice president of surgical services at Allegheny Health Network (AHN), arranged to have a team of surgeons, nurses, and support staff wear the masks and provide feedback. "The first thing they said was, 'We feel safe'" wearing EHMRs, Waltenbaugh told attendees.

While EHMRs and FFRs provide an equal level of protection, healthcare workers' acceptance of the new devices was vital to their success. Waltenbaugh felt that the decision to first seek workers' approval instead of simply mandating EHMRs helped overcome barriers to their use.

Sara Angelili, AHN's director of perioperative education, was responsible for implementing EHMRs across nine hospitals and training workers on how to properly wear and clean the devices. Workers were given written instructions and videos, followed by small group demonstrations on how to don, doff, and decontaminate the respirators, and how to perform a seal check. According to Angelili, surveys indicated that 93 percent of staff members were satisfied with their training and 97 percent were confident they knew how to use EHMRs correctly.

OSHA'S FREDERICK DISCUSSES AGENCY PRIORITIES

OSHA Deputy Assistant Secretary James Frederick addressed attendees at the closing session on May 25, summarizing the agency's priorities and providing updates on several rulemakings. Addressing the ongoing pandemic, Frederick asked attendees to review OSHA's "Guidance on Mitigating and Preventing the Spread of COVID-19 in the Workplace" (**bit.ly/covidsafework**), which the agency continues to update. Despite the Supreme Court's action vacating OSHA's Vaccination and Testing Emergency Temporary Standard, the agency continues to investigate complaints from workers related to COVID-19 and is using the General Duty Clause of the Occupational Safety and Health Act for enforcement purposes. Frederick said that a forthcoming rule on infectious diseases will provide "ample opportunity for stakeholder engagement and involvement" on matters related to COVID-19.

James Frederick, closing keynote speaker at AIHce EXP 2022.

In recent months, OSHA has been particularly active in relation to heat hazards at work. In addition to an Advanced Notice of Proposed Rulemaking on heat injury prevention (**bit.ly/frheatanprm**), the agency has also launched a National Emphasis Program (**bit.ly/osha220412**) to protect workers from outdoor and indoor heat hazards.

Frederick also mentioned the Infrastructure Investment and Jobs Act, which will provide $500 million for construction projects around the country. The influx of workers on these projects will be enormous, Frederick said, and will require health and safety protections from the outset.

Frederick ended his prepared remarks by providing perspective on OSHA enforcement efforts. He acknowledged that most employers try to protect their workers but need help from OSHA, particularly through the agency's compliance assistance program and other training initiatives. "We really want to make sure employers are going well above OSHA regulations," Frederick said.

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AIHce EXP 2023 is scheduled to be held in Phoenix, Arizona, May 22–24. Visit **aihceexp.org** for more information.

Laser Safety Basics for Laboratories

By Rich Greene

A laser environment in a laboratory should reflect rational and deliberate economic choices that mitigate an identified sea of potential hazards. This article presents an overview of safe laser management in a lab environment. Hopefully, it will take you one step closer to creating a safe laser environment that meets the requirements of end-users with the demands of a laser safety program.

Laser Beam Safety

The safest beam direction is usually straight down. Ideally, laser beams point down, sometimes point horizontal, and rarely point up. Of course, even when the beam is carefully controlled, accidents can happen. A misaligned optic or a carelessly placed processing article may send a laser beam in unexpected directions.

Laser beams should stay on a worktable or within an enclosure. The open segments of a beam line should remain within a carefully controlled work area or enclosed space. In a controlled area, the beam never crosses pedestrian paths unless a beam tube or other device encapsulates the energy. Similar care should be taken when laser beam energy is directed to upper levels of an experimental setup.

Avoid horizontal beams at eye level when sitting or standing. Labs typically use optical tables with laser experiments mounted on top. Most optical tables are also at desk height, which means the eye level of a person at a workstation is usually in the same plane as the laser experiment. If the laser beam can't be enclosed, laser barriers or beam blocks should be installed at the table perimeter to protect staff sitting at desks and workstations.

Laser Safety Standards

According to ANSI Z136.1, *Safe Use of Lasers*, a laser safety officer (LSO) is "one who has authority and responsibility to monitor and enforce the control of laser hazards and effect the knowledgeable evaluation and control of laser hazards." The LSO is designated by management and helps determine the required safety protocols to keep the lab safe. The LSO's specific duties and responsibilities are outlined in ANSI Z136.1.

Another useful standard is ANSI Z136.8, *Safe Use of Lasers in Research, Development, or Testing*, which was updated in 2021. This standard is intended to provide guidance for the safe use of lasers in environments where the requirements of ANSI Z136.1 are not practical.

Laser Lab Entryway Controls

ANSI Z136.1 requires one of three entryway control methods:

1. Non-defeatable. Non-defeatable safety latches, entryway, or area interlocks are used to deactivate the laser or reduce the output to a safe level upon entry.
2. Defeatable. Defeatable safety latches, entryway, or area interlocks can be temporarily overridden by authorized personnel if there is no laser hazard at the point of entry, provided they have been trained and have adequate personal protective equipment.
3. Procedural. In this case, safety latches or interlocks are not feasible or are inappropriate. All authorized personnel are trained and adequate personal protective equipment is provided upon entry. A blocking barrier, screen, or curtain is used to attenuate the laser radiation at the entryway, an area warning device is located at the entryway indicating that the laser is energized and operating at Class 4 levels, and the appropriate laser warning sign is posted.

When entering a lab, you should not see a laser source. Consider running a linear laser process line away from the door or installing guards or blocks on the end of your optical table. Laser eyewear should be available when entering a lab and is normally required by all entering usage areas for Class 3B (medium-powered) or Class 4 (high-powered) lasers.

Choosing the proper laser eyewear can sometimes present a challenge. To improve safety for all staff, first determine who will be allowed access to the lab. Next, evaluate options for containing the beam. Finally, choose eyewear appropriate for the laser hazard that does not unnecessarily impair working conditions.

Non-Beam Hazards

Certain non-beam hazards exist in most lab environments. Be sure to minimize trip and electrical hazards where possible. Do not forget air quality; some laser processes create hazardous fumes. Pathogens should not pass through extraction systems shared with other users, and dust or heat in materials processing must be managed. Also, pay attention to the management of gases used to generate the beam or to enhance a laser process as pressurized gas presents explosion and combustion hazards.

Laser Lab Control Measures

Control measures are designed to reduce hazardous levels of laser radiation to the eyes and skin. Engineering controls are the preferred method and include items such as interlocks, protective housing, area warning devices, and barriers, curtains, or enclosures—anything that is always in place for safety. If engineering controls are not practical, administrative controls and PPE controls should be implemented. Administrative controls include standard operating procedures, training on laser safety, restricting lab access to authorized personnel, and setting up a temporary laser-controlled area. PPE includes laser eyewear, face shields, and protective clothing such as gloves.

Laser Safety Tools

The laser safety process involves identifying the hazards, analyzing and measuring the hazards, and managing or mitigating the hazards. Many tools are available for analyzing and managing laser safety hazards. Though not a comprehensive list, the following are some of the most common tools available to the LSO:

- IR viewers allow for active viewing of the IR beam as it travels. IR viewers are useful when there is a strong chance that a beam is escaping a controlled area. Some models can be connected to or integrated with cameras and other video output devices.
- IR viewing cards and discs convert infrared radiation to visible radiation. Some IR cards store energy from a conventional light source, such as indoor room lighting or sunlight, which is released in the form of visible light when stimulated by IR radiation. Other IR cards use photosensitive materials.
- Ultraviolet viewers and viewing cards are similar to IR viewers, viewing cards, and cameras, but are sensitive to the UV range.
- Specialized coated or layered burn papers are available to visually display a laser beam's size, shape, or mode structure. Depending on the type of burn paper used, either a cross-sectional image of the beam is etched or burned onto the surface of the product or a temperature change reveals the laser.

As you consider the complexity of laser safety, also realize that no one person can possibly know how to solve all laser safety puzzles. The laser safety community comprises smart, generous people willing to share their extensive knowledge with you. Be smart and connect with this network, examine the safety products available, and take a course in laser safety.

RICH GREENE is a laser safety specialist at Kentek Corp. He can be reached at **rgreene@kenteklaserstore.com**.

Send feedback to **synergist@aha.org**.

What More Can We Do to Protect Our Workers from Silica Exposure?

By Winnie Chu

In 2018, a $400 million settlement was reached between six global mining companies and South African miners who suffered deadly health issues from inhaling silica and other harmful airborne particulates on the job. Mining processes, as well as many other industrial operations, generate hazardous aerosols that potentially contain lead, silica, coal, arsenic, alumina, and asbestos fibers. Such operations require ongoing air sampling for exposure and health and safety compliance purposes.

Standard occupational particulate sampling involves drawing a known volume of air from the worker's breathing zone and collecting the aerosol sample onto a filter. Filters are then sent away to an accredited lab to identify and quantify hazardous materials. It can take weeks to obtain the filter analysis data, which seriously impedes timely interventions to pinpoint and correct problems. Without timely interventions, an entirely preventable class of occupational diseases that may include silicosis and chronic obstructive pulmonary disease (COPD) continues to threaten workers' health.

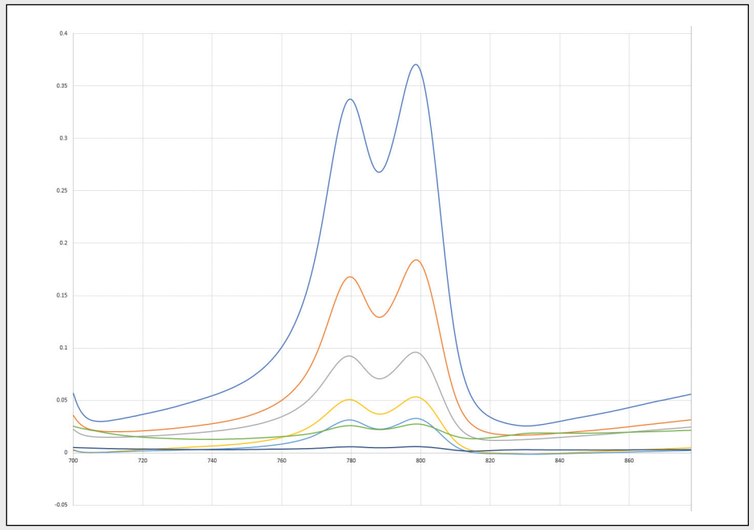

Figure 1. FTIR calibration spectra of silica with doublet peak around 800 cm^{-1}.

Validating Controls

In January 2022, the International Council on Mining and Metals (ICMM) published a position paper (**bit.ly/icmm particulate**, PDF) on considerations for the adoption of real-time particulate monitoring (RTPM). According to the paper, global mining companies Teck, BHP, Vale, Alcoa, and Freeport-McMoRan have all taken the initiative and used considerable internal resources to investigate and study the use of real-time particulate monitoring in real-world settings. Anglo American, though not included in the position paper's reported case studies, indicated through personal communication to me that it is also investigating RTPM.

Teck's study focused on building a business case for implementing real-time monitors to mitigate respiratory disease, which is the major cause of premature death for miners. BHP investigated a scalable solution for minimizing respiratory risks by combining RTPM data with geolocation, as well as integrating sensors into Industrial Internet of Things (IIoT) frameworks. Vale evaluated RTPM instruments as tools to reduce silica exposure, and Alcoa focused on RTPM's usefulness for validating critical control effectiveness and monitoring protocols. Freeport-McMoRan evaluated both real-time particulate instruments and same-shift silica analysis tools.

ICMM and the mining companies recognized the value of real-time particulate monitors as an integral part of critical control management, especially for identifying unexpected or uncontrolled hazardous situations. Real-time particulate monitors—specifically, optical particle counters, or OPCs, calibrated with the aerosol of interest—are necessary to verify that critical controls are performing effectively at all times. The mining company group set out eight guiding principles for effective monitor use, including preparing for field work, selecting the most appropriate instrument, validating control effectiveness, conducting field sampling, communicating findings effectively, and communicating with stakeholders.

For example, in 2020, Teck Resources in Canada issued a press release (**bit.ly/tecksilicapr**) that describes how crystalline silica dust can enter a worker's breathing zone during mining operations. Teck took advantage of real-time dust monitoring technology to gain detailed, rapid data on dust exposure levels. "This advancement in real-time particulate monitoring represents a fundamental shift for the industry and helps us improve on our commitment to protecting the long-term health of Teck employees," said Lawrence Watkins, Teck Resources' vice president of health and safety.

ICMM has issued several calls to action to manufacturers of real-time monitors, including enabling compositional identification of particulates such as silica. Among inhalation hazards, respirable crystalline silica (RCS) has received much attention for its comparability to asbestos fibers. While it will take time for manufacturers to productize real-time monitors capable of compositional identification, the United Kingdom's Health and Safety Executive (HSE) has developed a direct-on-filter method—MDHS101/2, *Crystalline Silica in Respirable Airborne Dust: Direct-on-Filter Analyses by Infrared Spectroscopy or X-ray* (**bit.ly/hsemdhs101-2**, PDF)—to determine RCS concentration. Utilizing portable Fourier Transform Infrared Spectrometry (FTIR), this method can now be conducted on site, immediately post-shift, without having to send filters out for lab analysis. Some of the mining companies' reported case studies include the use of the portable FTIR method. (A similar method is also available from the International Organization for Standardization: ISO 16258-1:2015, *Workplace Air—Analysis of Respirable Crystalline Silica by X-ray Diffraction—Part 1: Direct-on-Filter Method*.)

Whereas HSE developed the FTIR method for 25 mm filters, NIOSH's Field Analysis of Silica Tool (FAST, **bit.ly/niosh fast**) was developed for 37 mm filters. This analysis method takes advantage of the specific silicon-oxygen doublet peak in the infrared spectroscopy (see Figure 1) to identify and quantify silica collected on a PVC filter. The original study, published in the *Journal of Occupational and Environmental Hygiene* in October 2018, compares seventy-five dust samples from both metal and nonmetal mines with FAST FTIR as well as the regulatory-approved traditional laboratory X-ray diffraction analysis (XRD). NIOSH concluded that mine-specific calibration factors can improve the level of agreement between RCS concentrations determined via a field-based FTIR method as compared to XRD analysis in the laboratory.

To determine silica on a filter, FTIR on-filter analysis requires placing the filter or filter cassette directly in a portable FTIR instrument in the field. This FTIR instrument will require the creation of calibration curves for RCS (or other aerosol chemicals such as nickel oxide and nickel sulfide) that have been validated once using traditional laboratory analytical instruments. For example, silica can be analyzed by either laboratory X-ray diffraction or inductively coupled plasma mass spectrometry (ICP-MS). Since the infrared spectroscopy method is non-destructive, filters can still be sent away for analysis either as validation or quality control, if required. Many other industries besides mining companies are using this on-site direct-on-filter method to obtain crucial exposure and control data immediately post-shift. These filters can then be shipped away to the lab; besides XRD or ICP-MS, they can perhaps be analyzed by liquid chromatography mass spectrometer (LC/MS) instruments for organics.

Effective Protection

Effective and timely quantitation of respirable crystalline silica is crucial to reduce the risk of developing RCS-related lung disease and cancer. The direct-on-filter analysis method has proven to be a very powerful tool for timely identification of sources and problem areas. Hygienists increasingly employ this cost-saving methodology on site. The percentage of RCS over a full shift can be determined as soon as it ends. Dangerous conditions can be discovered immediately, and corrective actions taken to implement controls and protect workers more effectively.

The case studies initiated by ICMM and a group of major mining companies confirm the urgent need for additional IH tools besides the pump/filter and current analysis methods to improve protection of workers from harmful airborne exposures. The mining companies' initiatives determined that real-time particulate monitors were able to provide early detection of equipment performance degradation and timely exposure warnings. Combining real-time data with geolocation allows the source of particulates to be pinpointed and controlled much faster than was previously possible, greatly improving prevention of overall aerosol exposures in a workplace.

Resources

Health and Safety Executive: Method MDHS101/2, *Crystalline Silica in Respirable Airborne Dust: Direct-on-Filter Analyses by Infrared Spectroscopy or X-ray*, **bit.ly/hsemdhs101-2** (PDF).

International Council on Mining and Metals: "Considerations for the Adoption of Real-Time Particulate Monitoring," **bit.ly/icmmparticulate** (PDF, January 2022).

Journal of Occupational and Environmental Hygiene: "A Comparison of Respirable Crystalline Silica Concentration Measurements Using a Direct-on-Filter Fourier Transform Infrared (FT-IF) Transmission Method vs. a Traditional Laboratory X-ray Diffraction Method" (October 2018).

NIOSH: "Mining Product: FAST—Field Analysis of Silica Tool," **bit.ly/nioshfast** (September 2018).

Teck: "Real-Time Air Quality Monitoring Technology Helps Inform Decisions to Reduce Dust Exposure Inside Haul Truck Cabs," **bit.ly/tecksilicapr** (March 2020).

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ANALYSIS OF WILDFIRE AND STRUCTURE FIRE COMBUSTION RESIDUES

Microscopy Methods and Other Considerations

BY DANIEL M. BAXTER, RUSS CRUTCHER, BRAD KOVAR, AND LARRY WAYNE

The collection of samples as part of a wildfire or structure fire investigation typically has two related goals. The first goal is to determine whether the particle types or concentrations, or the ratio of combustion-generated residues, indicate an atypical impact above background. If analysis shows that the particles and residues are greater than background, the second goal comes into play: to determine whether the impact—defined by the assemblage of particles found—is more likely to be associated with a specific fire event or with a site-specific background condition identified by the investigator.

As described in AIHA's *Technical Guide for Wildfire Impact Assessments for the Occupational and Environmental Health and Safety Professional*, these goals can be achieved only by preserving the in-situ sample integrity of the deposited particles for direct light (optical) microscopical analysis without introducing significant sample alteration or particle loss. The ultimate reliability of analytical results produced by the laboratory depends on the use of sampling and analytical methods that preserve the sampled particles' chemical and physical properties, including their size, morphology, and deposition patterns. It is also vital that the methods do not alter, destroy, or inhibit the detection of the collected combustion particles or residues.

WILDFIRE VS. STRUCTURE FIRE PARTICLES

Wildfires can generate a wide range of vegetative combustion particles and lofted burned soil debris. The particles are generally classified into three generic categories:

- Soot, also called "black carbon," is a fine carbonaceous material with aciniform structure produced during incomplete combustion. The distinguishing features of aciniform morphology are grape-like clusters or open branch-like structures. Although soot is produced in great abundance in a wildfire, it is not a common constituent of settled wildfire residues.
- Wildfire char comprises large, irregular, mostly carbonaceous fragments of burned vegetation from leaves, twigs, and bark.
- Wildfire ash is the decarbonized residue of cellulose material. It typically comprises soluble mineral salts, carbonates, oxides, insoluble plant phytoliths, and noncombustible compounds.

See Figure 1 for images of these materials. More information is available from the *Technical Guide for Wildfire Impact Assessments for the Occupational and Environmental Health and Safety Professional*.

Wildfire smoke damage investigations rely on sampling methods and analytical procedures designed to identify specific characteristics of the primary wildfire

particle categories including char and ash. The presence of particles such as burned plant phytoliths and plant structures, burned soil or clays, and other vegetative structures can help identify the type and source of the fire. Based on the analytical experience of the authors of this article, over 95 percent of the burned particles associated with a wildfire range in size from approximately 2 µm to 5,000 µm (5 millimeters). The average size of the wildfire char, ash, and other particles found as infiltrated settled debris indoors ranges from approximately 2 µm to 50 µm.

Wildfire particles and surface depositional patterns can be identified and quantified by collecting surface tape-lift samples of the settled dust and then analyzing the particles with a light microscope equipped with simultaneous reflected light (dark field) and transmitted or polarized light imaging capabilities covering a magnification range of 50x–500x. The primary identification of vegetative char, ash, and other optically opaque particles is obtained by a direct light microscopical examination of their morphological and reflected light surface properties.

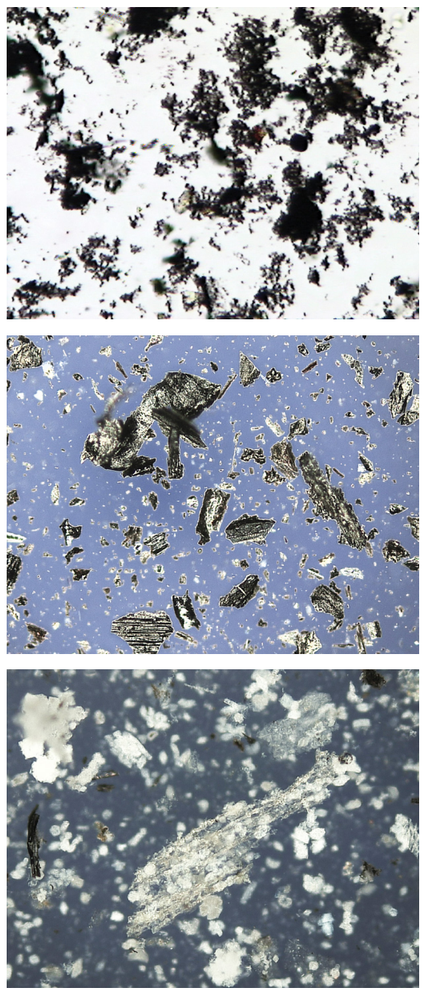

Figure 1. Examples of wildfire particles: soot (top, approximately 600x), char (middle, approximately 200x), and ash (bottom, approximately 400x). Images courtesy of Daniel M. Baxter, Russ Crutcher, Brad Kovar, and Larry Wayne.

Structure fires contain different organic and inorganic fuel sources and can include a mixture of burned construction materials, furniture, cloth, decorative materials, paint, metal corrosion, foodstuffs, cooking oils, and other materials common to the indoor environment. The particle classifications include soot, vegetative and non-vegetative char (from wood, paper, and fabrics), cellulosic ash, melted organic debris, and corrosion (that is, oxidized particles from metals, paint, and so on). The distinction between what would be classified as char or ash in structure fires is more complex than in wildfires. See Figure 2 for examples of particles from structure fires.

Smoldering fires can generate copious amounts of organic compounds that condense as large aciniform soot clusters and—when these compounds come into contact with cooler surfaces such as walls and ceilings—chaining patterns and organic films. These characteristically uniform "indicator" patterns can only be observed when collected on tape-lift samples where the spatial integrity of the sample is preserved. In our experience, the unique settled burned char and ash particles found in structure fires range in size from 1 µm to 5,000 µm. Their depositional patterns, especially for soot condensates, can range from 5 µm to several millimeters. These properties can also be identified by using a combination of tape-lift sampling and a properly equipped light microscope.

ASTM METHOD D6602-13 AND CARBON BLACK

Some investigators and laboratories have mistakenly cited ASTM method D6602-13, *Standard Practice for Sampling and Testing of Possible Carbon Black Fugitive Emissions or Other Environmental Particles, or Both*, as a standard method for the analysis of wildfire and structure fire residues, which it is not. Like other wipe-sampling methods, ASTM D6602-13 has a limited application for wildfire and structure fire investigations because it alters particle deposition and sometimes the particles themselves.

Because of the wide range of fuel sources, temperatures, and oxygen availability found in wildfires and structure fires, the resulting combustion particles and organic condensates are complex mixtures of particles from materials fully and partially combusted that can contain a wide range of physical, morphological, and chemical properties. Many of these particles are mechanically fragile, soluble, or altered by the use of wipes, as noted in ASTM 6602 section 7.3.2. The procedures used to recover the residues from the wipe, and exposure to vacuum and heating by the electron beams used in analyses performed by transmission electron microscopy (TEM) or scanning electron microscopy (SEM), further damage or remove many of the particles required to identify a wildfire or structural fire source, as noted in ASTM D6602-13 section 4.1.

In addition, ASTM D6602-13 is intended only "for distinguishing ASTM type carbon black, in the N100 to N900 series, from other environmental particulates," as stated in section 1.1. Carbon black—the common name for several types of manufactured, amorphous carbon products mainly used as filler in tires, plastics, paints, inks, and as a color pigment—is very different from particles generated during wildfires and structure fires.

The residues generated during structure fires and wildfires can contain high concentrations of soluble minerals in addition to both volatile and soluble organic compounds not found in manufactured carbon black. The particles of burned materials and organically derived aggregates found in these fires are significantly larger (5–1,000 µm) than carbon black particles and can easily be altered or destroyed by using the sample collection, sample preparation, or analytical procedures prescribed by the ASTM D6602-13 method.

Section 1.2 of ASTM D6602-13 stresses the importance of proficiency in the identification of carbon black but states that only a "general knowledge" of other environmental particles is necessary. Further, section 4.2 states that "use of the [polarized light microscopy] analysis is not mandatory when the [transmission electron microscopy] analysis finds no aciniform aggregates resembling carbon black." The only technical reference mentioned in ASTM D6602-13 is *Carbon Black: Science and Technology* edited by Jean-Baptiste Donnet, and this book addresses only carbon black. How the light microscope is used to identify particle sources is not mentioned or alluded to in ASTM D6602-13, which is designed to analyze the disaggregated aciniform morphology of the sub-micron (1-300 ηm) manufactured primary carbon black particles (also called nodules) using TEM.

The identifying properties of combustion particle residues can include their concentration, assemblage distribution, and deposition patterns found on sampled surfaces. The amounts of soluble and semi-volatile organic compounds and of inorganic chemical residues are also instrumental in the formation of recognizable surface depositional patterns, especially in structure fires. These combined properties are critical to determine the extent of potential contamination, characterize the source of the combusted material, and interpret the extent of exposure. The use of wipes in ASTM 6602-13 alters, destroys, or removes these patterns entirely. For manufactured carbon black, the unstable impurities and organic compounds from well-defined fuels are removed through heating during the manufacturing process.

As described in a 2013 paper in *Environmental Pollution*, carbon black products are typically manufactured in reduced oxygen environments at controlled temperatures above 2,400 F, which results in very high concentrations of inert elemental carbon. During the manufacturing process, carbon black forms para-crystalline carbon with a high surface-area-to-volume ratio containing negligible polycyclic aromatic hydrocarbons (PAHs). This makes the individual particles more well-defined and highly inert—and dissimilar to the wide range and composition of organically derived soot condensates and char particles that are generated at uncontrolled lower temperatures (400 to 2,000 F) commonly found in wildfires and structure fires. Although both carbon black and soot have aciniform morphology, they are physically and chemically distinct substances, as demonstrated by a 2001 paper in the *AIHA Journal*.

Figure 2. Examples of structure fire particles: soot chaining patterns (top, approximately 600x); cardboard char (middle, approximately 200x), and melted wire insulation debris (bottom, approximately 200x). Images courtesy of Daniel M. Baxter, Russ Crutcher, Brad Kovar, and Larry Wayne.

Table 1. Characteristics of Carbon Black Manufacturing

Chemical Process	Manufacturing Method	Main Raw Materials
Thermal-oxidative decomposition	Furnace black process	Aromatic oils natural gas
	Degussa gas black process	Coal tar distillates
	Lamp black process	Aromatic oils or mineral oil
Thermal decomposition	Thermal black process	Natural gas (or mineral oils)
	Acetylene black process	Acetylene

Sources: **bit.ly/epcarbonblack** and **bit.ly/carbonblackoec** (PDF).

Table 1, summarized from information in the 2013 *Environmental Pollution* paper and in a 2015 resource published by Orion Engineered Carbons, characterizes some of the processes used to manufacture carbon black.

THOROUGH, ACCURATE ANALYSIS

The analysis of wildfire and structure fire residues is reliably performed using a combination of direct (tape-lift) sampling and specific light microscopy methods. The ASTM D6602-13 TEM method and wipe sampling procedures were specifically developed for the collection and analysis of the primary sub-micron nodules associated with carbon black, a manufactured material produced under highly controlled conditions. In addition to differences in how they are produced, carbon black and products of uncontrolled combustion are distinctly different in their structure and morphology, concentration of organic compounds, and response to solvents and thermal treatment. Therefore, using the ASTM D6602-13 method for the evaluation of other types of combustion particles is fraught with physical and chemical limitations that can result in both their under-reporting and non-detection. The ASTM wipe sampling and analysis methodologies do not result in a reliable analysis of wildfire or structural fire debris. They destroy or remove the larger, fragile combustion particles and depositional patterns associated with a wildfire or structure fire event.

Electron microscopy (TEM and SEM) analyses cannot be directly compared with the quantitative estimates obtained by light microscopy analysis. Electron microscopy and energy dispersive X-ray analysis (EDS) may be useful as a secondary tool to differentiate or confirm the composition of resilient particles that may interfere with the identification of the very small char or ash combustion particles observed during the light microscopy analysis.

There are well established procedures for using a light microscope (equipped with reflected and transmitted light, bright field, dark field, and polarized light capability) to accurately analyze the optical properties of combustion particles that are characteristic of a wildfire or structure fire. A thorough analysis must include a simultaneous examination of all reflected and transmitted light properties of combustion particles and their characteristic deposition patterns. The presence or absence of specific indicator or signature particles characteristic of the type of fire can also help confirm the source or origin of the fire. A transmitted polarized light microscope typically used for asbestos analysis does not provide sufficient information for this purpose. The appropriate use and limitations of these procedures are described in the *Technical Guide for Wildfire Impact Assessments for the Occupational and Environmental Health and Safety Professional*. Combustion particle analysis can be provided directly from tape-lift samples. The combined use of tape-lift sampling and light microscopy is the preferred combustion particle analysis procedure prescribed by the AIHA *Technical Guide* and is the current industry-accepted methodology.

RESOURCES

AIHA: *Technical Guide for Wildfire Impact Assessments for the Occupational and Environmental Health and Safety Professional* (April 2018).

AIHA Journal: "Carbon Black and Soot: Two Different Substances" (March 2001).

Air Pollution Control Association: "Light Microscopy as an Analytical Approach to Receptor Modeling" in *Receptor Models Applied to Contemporary Pollution Problems* (1983).

ASTM International: Method D6602-13(2018), *Standard Practice for Sampling and Testing of Possible Carbon Black Fugitive Emissions or Other Environmental Particulate, or Both* (2018).

Environmental Pollution: "Carbon Black vs. Black Carbon and Other Airborne Materials Containing Elemental Carbon: Physical and Chemical Distinctions," **bit.ly/epcarbonblack** (October 2013).

Marcel Dekker Inc.: *Carbon Black: Science and Technology* (1993).

The Microscope: "Thermally Modified Calcium Oxalate Phytoliths as Markers for Biomass Fire Sources" (2020).

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Wiley: "Sampling of Surface Dust in Buildings" in *Indoor Environment: Airborne Particles and Settled Dust* (2003).

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Teaching Laboratory Safety »

Empowering Students, Educators, and Researchers to Do Safe Science

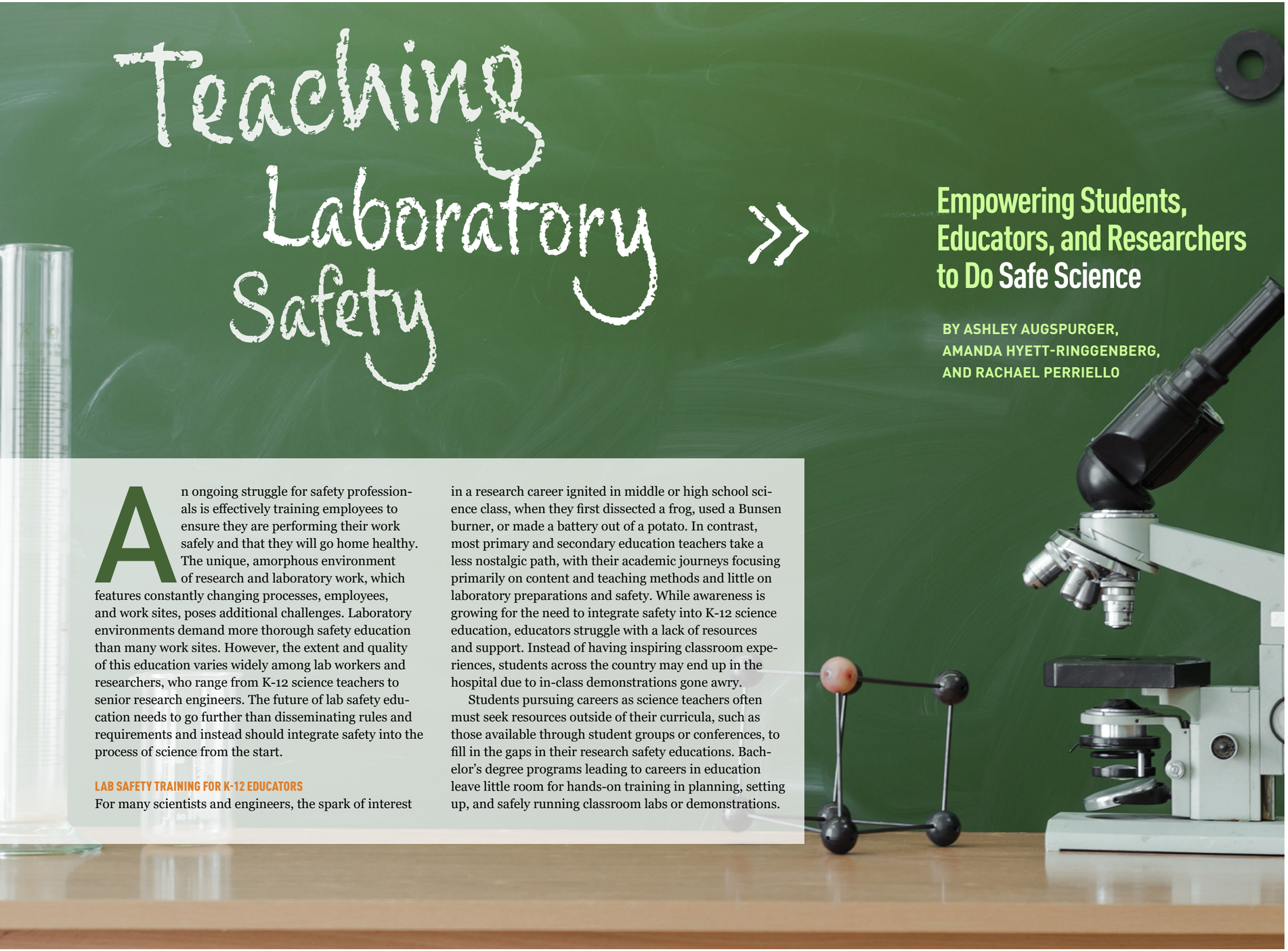
BY ASHLEY AUGSPURGER, AMANDA HYETT-RINGGENBERG, AND RACHAEL PERRIELLO

An ongoing struggle for safety professionals is effectively training employees to ensure they are performing their work safely and that they will go home healthy. The unique, amorphous environment of research and laboratory work, which features constantly changing processes, employees, and work sites, poses additional challenges. Laboratory environments demand more thorough safety education than many work sites. However, the extent and quality of this education varies widely among lab workers and researchers, who range from K-12 science teachers to senior research engineers. The future of lab safety education needs to go further than disseminating rules and requirements and instead should integrate safety into the process of science from the start.

LAB SAFETY TRAINING FOR K-12 EDUCATORS

For many scientists and engineers, the spark of interest in a research career ignited in middle or high school science class, when they first dissected a frog, used a Bunsen burner, or made a battery out of a potato. In contrast, most primary and secondary education teachers take a less nostalgic path, with their academic journeys focusing primarily on content and teaching methods and little on laboratory preparations and safety. While awareness is growing for the need to integrate safety into K-12 science education, educators struggle with a lack of resources and support. Instead of having inspiring classroom experiences, students across the country may end up in the hospital due to in-class demonstrations gone awry.

Students pursuing careers as science teachers often must seek resources outside of their curricula, such as those available through student groups or conferences, to fill in the gaps in their research safety educations. Bachelor's degree programs leading to careers in education leave little room for hands-on training in planning, setting up, and safely running classroom labs or demonstrations.



istock/Getty Images

These future educators receive most of their exposure to laboratory safety in their science courses, where labs are already prepared and safety rules are generally imposed rather than explained.

We recently spoke with a current K-12 chemistry teacher who revealed their frustrations and concerns around the lack of safety resources and training for educators. This teacher said they wanted to better understand the hazards present in their lab, what to do in case of an emergency, and how to properly store chemicals, as well as why certain chemicals must be stored in particular ways. They said it "terrified" them that their school district had never informed them of any procedures to follow in case of an emergency and that they wished they had access to a document listing steps to take and phone numbers to call if an emergency were to happen. "I have a general idea of where to start on this," they said, "but would love a second opinion," that is, someone who could tell them what they needed to ensure lab safety. They also suggested that health and safety professionals could provide safety inventories, offer a service reviewing lesson plans over email, or teach online lab safety classes.

This teacher felt that access to a safety professional, such as an industrial hygienist, would be an invaluable resource. As safety professionals, community members, parents, and fellow scientists, industrial hygienists can also reach out to local school districts or teachers' unions to express concerns and offer support to educators who want to do the best, safest jobs possible.

While not as favorable as complete courses on lab safety or easy access to qualified professionals, there are some resources available for in-service teachers through professional societies. The National Science Teaching Association has published position statements in support of safe laboratories as well as safety alerts and other resources that can be used right away, while the American Association of Chemistry Teachers offers videos and teaching resources that can be applied to all sciences. Some secondary education programs are now implementing lab safety for teachers: for example, South Dakota State University offers lab safety education within the chemistry education master's degree program. Additionally, some school districts may even have on-staff safety professionals who can assist with lab planning, waste management, and emergency procedures. These resources and professional development opportunities should be broadly shared, further developed, and encouraged to provide a foundation of safety knowledge and skills that will benefit our educators and students for years to come.

LAB SAFETY AT THE COLLEGIATE LEVEL

The college and university environment presents opportunities for formal education in science and engineering safety as well as hands-on practice at safely working in

labs and performing independent research. While some accredited degree programs require safety instruction in their curricula, it is often up to individual instructors and principal investigators to incorporate education on research safety principles. This reliance on individual employees to decide how much safety education or training to include produces graduates with varied levels of safety knowledge and preparedness for the research field.

The university environment must maintain balance between minimizing liability and preventing accidents and stimulating knowledge and passion for the sciences. Introductory labs are modified to minimize risk to students by using less hazardous chemicals or involving less hands-on manipulation and, since the beginning of the COVID-19 pandemic, are now being adapted for performance within students' homes. While this represents an enormous achievement in eliminating and substituting hazards faced by students, it may lead to a false sense of security in the laboratory and lack of readiness and risk recognition. Additionally, when safety concerns arise in undergraduate laboratories, rules for compliance are usually presented to students with little or no explanation about why they are in place and what risks they are meant to address. To empower students and future researchers, instructors must teach them about the science of safety and laboratory risk assessment. Deans, department heads, and all individual instructors, principal investigators, and research staff must recognize and include safety as an institutional value.

Safety education in university curricula can look very different depending on the degree program and the level of hands-on work that students are required to perform. In the engineering curriculum, for example, safety education may be formulated as post-incident investigations of building collapses, industrial explosions, or large-scale exposure events, in which students work backwards through an incident using formal or informal analysis to determine where things went wrong and where safeguards, training, or procedures could have been put in place to prevent the incident. Curricula can also involve hazardous materials operations or other process safety reviews of student plant design projects that anticipate safeguards that should be implemented to maintain stable plants in cases of loss of power, containment, or cooling. Chemistry courses can incorporate safety by teaching theoretical knowledge of chemicals and reactions as well as safety considerations for working with specific functional groups, catalysts, and reactions. In the biological and earth sciences, hands-on safety practice can involve risk management planning in field work, such as by requiring students to complete field safety plans that consider factors from safely working with sample reagents to preparing for spills or medical emergencies.

Lab courses can integrate safety by requiring students to report not only the data they gathered and the conclusions they drew but also the risks involved in the experiments, what engineering and administrative controls and personal protective equipment were used to reduce risks, and how wastes were properly neutralized, sterilized, or disposed of. Students in research labs should be involved in procedure and experiment planning and invited to participate in departmental or institutional safety committees and training.

In fact, teaching students the skills necessary to recognize and mitigate risk can be another benefit of including safety education in STEM course curricula and integrating it into hands-on lab work. This empowers students to recognize and speak up or seek further information when they don't feel safe or want additional explanation at their lab, internship, or job site. Furthermore, STEM courses across the board can prepare students for industry work by teaching them about the history of safety and environmental regulations, how they are implemented, and how they affect professionals' everyday work.

The American Chemical Society has prioritized guidance and tools for enhancing safety knowledge in academia, in response to tragic incidents at UCLA in 2008 and Texas Tech in 2010 that led to the death of one graduate student and the severe injury of another. These accidents also highlight the lax safety cultures at universities compared to industry labs. Resources for integrating risk assessment and safety skills into curricula can be found in curriculum development publications and online resources, such as those offered by the American Institute of Chemical Engineers (AIChE). Additionally, the Accreditation Board for Engineering and Technology (ABET) has introduced a requirement for instructors to include safety education in chemical engineering curricula.

SAFETY FOR JUNIOR AND SENIOR INDUSTRY SCIENTISTS

Scientists come to industry having spent years learning and studying in their chosen fields. Scientists are inquisitive; they know how to ask questions about their research in order to move it forward. Safety professionals should take advantage of this quality by offering discussions, collaborations, and learning opportunities to teach scientists to ask questions about safety.

Safety training and education should be a continuous process, not something that only occurs once per year or during employee on-boarding. Training should go beyond compliance to allow researchers to learn and understand the science of safety. Not only does this help improve compliance, but scientists who have a deeper understanding of safety are more likely to apply safe practices to their work. Scientists should also be made aware of internal and external safety resources and how to use them during training.

Hosting webinars created by internal and external sources on relevant safety topics is an efficient method of providing training, education, and awareness of available resources and creates an opportunity for scientists to learn from safety professionals. Attendees will come away with more questions and become more engaged with the occupational health and safety field, fostering a more collaborative environment. Many of the resources previously discussed in relation to academic settings can also be applied in industry settings.

Allow scientists at your workplace to question how and why safety practices are implemented the way they are. This can lead to mutual learning between safety and research professionals, as discussions create an environment for open communication between the two groups. Scientists can learn about safety practices, why they exist, and how to apply them to their own research. From these discussions, scientists can also develop safety mindsets by asking themselves questions about their procedures, such as "What could go wrong?" and "If something does go wrong, what would be the result?" and identifying hazards in each step. Learning from industrial hygienists about the science of safety, including what safety-related questions to ask, helps scientists develop greater situational awareness during lab work. When an unexpected change occurs in a process, they are more empowered to stop and think about their options and choose a safer course of action.

Safety discussions shouldn't only occur between safety experts and researchers; they should also happen between researchers. Senior scientists can learn as much from their junior scientist counterparts as junior scientists can learn from senior scientists. For example, junior scientists may have learned safer research methods during their education that can be applied to their current work. This type of environment may also lead to abandonment of long-established bad habits.

Finally, safety discussions don't have to be limited to mentor-mentee relationships or within research groups. One means of potentially fostering safety-related collaborations between research groups is through creating networks among labs so that they can learn what safety best practices other labs have implemented. Within "focal point networks" for specific lab safety topics, each lab appoints a representative who meets with the other labs' representatives a few times a year to discuss what is going well, what isn't, and how processes can be improved.

ADVANCING LAB SAFETY

Between January 2001 and July 2018, the U.S. Chemical Safety and Hazard Investigation Board identified 261 accidents that occurred in lab, experiment, and presentation settings, according to a 2018 statement released by Kristen Kulinowski, CSB's then interim executive, and the 2018 president of the American Chemical Society, Peter K. Dorhout. One hundred thirty incidents occurred at colleges, universities, professional schools, or junior colleges, resulting in 185 injuries and five fatalities. Sixty-six incidents occurred in elementary and secondary schools, injuring 170 students in total.

The well publicized lab incidents such as the death of a UCLA graduate student in 2008 and an explosion at Texas Tech in 2010 have captured nationwide attention, but there are many more preventable incidents and injuries occurring in labs every day that most people don't hear about. Earlier this year, a middle school student was burned during a chemistry class demonstration. Many more similar stories can be found on the Laboratory Safety Institute's Memorial Wall for laboratory fatalities.

Tragedies such as these make it clear that safety is necessary and should be integrated into science education. This integration can be implemented in different ways, based on the academic or professional level of the affected researchers. To perform safe science in K-12 education, teachers must have training in creating inherently safe experiments that are still exciting for students. In higher education, safety should be implemented as hands-on laboratory course experiences. Finally, safety training in industry should go beyond formal training and incorporate a variety of learning opportunities.

For those wishing to get more involved in advancing lab safety, AIHA's Laboratory Health and Safety Committee provides a forum for industrial hygiene and safety in laboratories. The committee's stated goals include disseminating information relevant to lab safety to industrial hygienists and occupational health and safety professionals. The Laboratory Health and Safety Committee is also creating a lessons learned site with the goal of disseminating information about incidents, their causes, consequences, and corrective actions. AIHA members who are interested in exploring new methods and approaches to communications and training are also invited to join the Communication and Training Methods Committee, which strives to help the occupational health and safety profession learn how to create effective training.

ASHLEY AUGSPURGER, PhD, CIH, CSP, is the biosafety officer and chemical hygiene officer for Corteva Agrisciences in Iowa. She is also the chair of the AIHA Communications and Training Methods Committee.

AMANDA HYETT-RINGGENBERG, PhD, is the environmental, health, and safety specialist at the University of Minnesota Morris and an adjunct chemistry instructor at the University of Southern Indiana.

RACHAEL PERRIELLO, MPH, is the research safety professional at the University of Minnesota Duluth.

Send feedback to **synergist@aiha.org**.

RESOURCES

ACS Publications: "Teaching Chemical Safety and Information Skills Using Risk Assessment," **bit.ly/acs-safety**.

ACS Institute: "College and University Guidelines," **bit.ly/acs-guidelines**.

AIChE: "Strategies for Addressing ABET Safety Curriculum Guidance," **bit.ly/aiche-webinar** (Feb. 6, 2013).

AIHA: "Laboratory Health and Safety Committee," **bit.ly/AIHAlabhealthsafety**.

AIHA: "Laboratory Health and Safety Committee – Lessons-Learned Incident Reports," **bit.ly/lessonslearnedreports**.

American Association of Chemistry Teachers: "Safety," **bit.ly/AACTsafety**.

CSB: "Back to School Safety: The Importance of Laboratory Safety in the Classroom," **bit.ly/csblabstatement** (PDF, Aug. 17, 2018).

CSB: "Laboratory Safety," **www.csb.gov/laboratory-safety**.

Laboratory Safety Institute: "Memorial Wall," **bit.ly/lsimemorial**.

National Science Teaching Association: "Safety Resources," **bit.ly/NSTA-safety**.

MEASURING Airborne Particulates

The Science of Developing a New Proficiency Testing Program

BY ANGELA OLER

Choosing a laboratory is an important decision for you, your team, and your organization. High-performing laboratories are vital to the protection of worker health and safety. For this reason, many laboratories routinely undergo proficiency testing to make sure they provide you with reliable data.

For many years, AIHA Proficiency Analytical Testing (PAT) Programs has offered services integral to the work of occupational and environmental health and safety professionals. In 1974, the administration of the Industrial Hygiene Proficiency Analytical Testing (IHPAT) Program established AIHA as a leader in proficiency testing. Since then, PAT Programs has expanded to eight different proficiency testing areas, including industrial hygiene-focused programs that evaluate the analytical capability of laboratories to test for asbestos, metals, organic solvents, and silica in air; to test for lead in air, dust, paint, and soil; and to identify microbiological cultures and spore images. Our long history of proficiency testing and deep understanding of the needs of OEHS professionals positions us to provide meaningful programs to the industry. Now, we are using that knowledge to introduce a new proficiency testing program for the gravimetric determination of airborne particulates.

THE IMPORTANCE OF PROFICIENCY TESTING

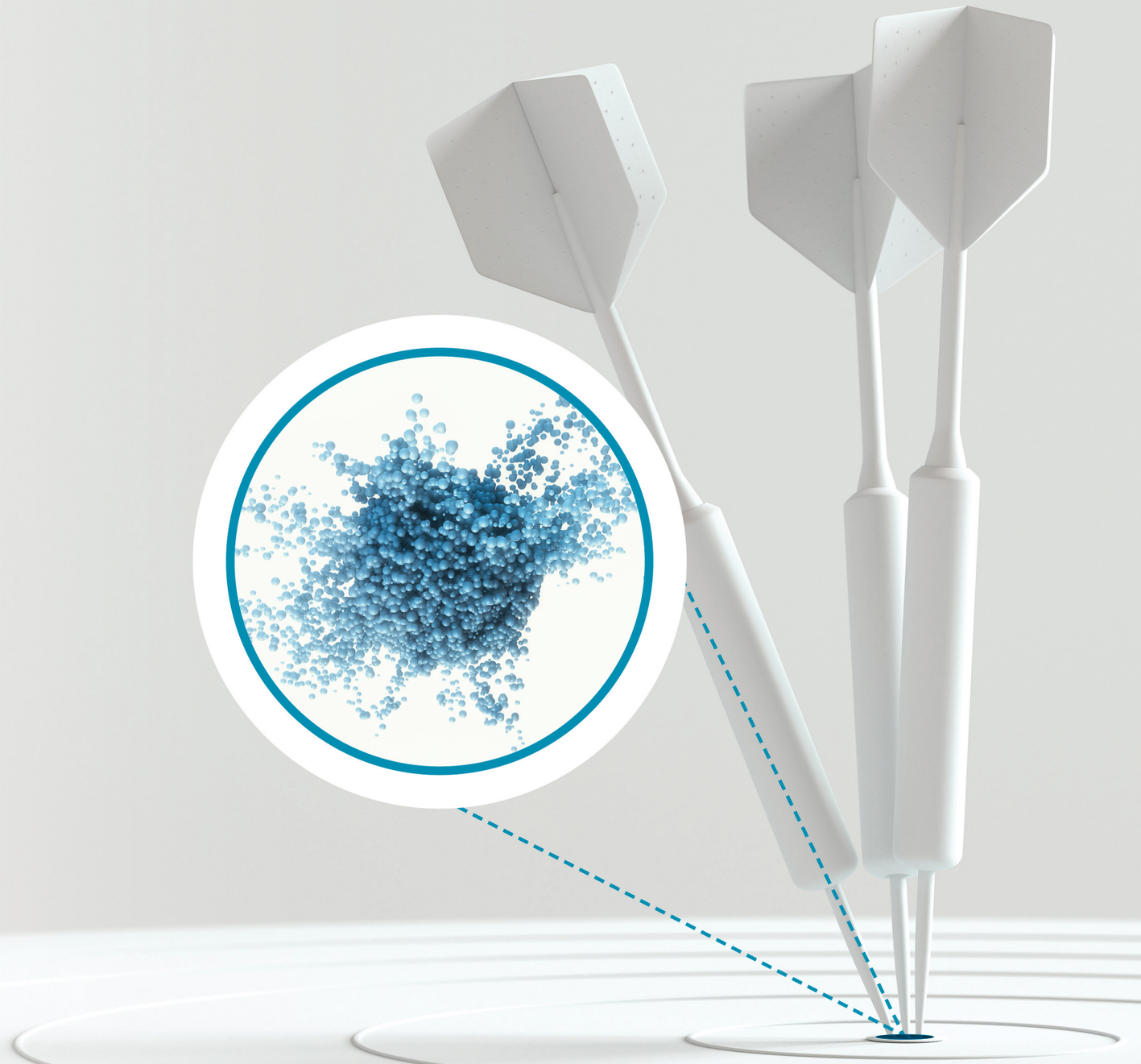
Have you taken a moment to consider why it matters that PAT Programs continuously improve and expand our offerings? It's because data is paramount to what you do. How can you protect those you are responsible for if you don't have reliable information about contaminants of concern?

For those who aren't familiar with proficiency testing, here's how it works. PAT Programs ships samples for analysis to participating laboratories on a quarterly or tri-annual basis; the frequency varies depending on the program. The samples contain the analytes of interest. The laboratories analyze their samples and report their results so PAT Programs can determine their proficiency. The PAT Programs Board, which comprises qualified technical experts, reviews and approves all summary data for each round. Then the scores are finalized and the results distributed to participants.

Proficiency testing is an easy way for you to confirm that your laboratory partner is providing you with valid data. We know you are already using an accredited laboratory, so you trust the data, but proficiency testing gives you a way to routinely verify the analytical capability of your laboratory partner. Ask for a PAT report and use it as another tool in your toolkit for keeping people healthy and safe.

WHY AIRBORNE PARTICULATES?

As a proficiency testing provider accredited to ISO/IEC 17043, *Conformity Assessment—General Requirements for Proficiency Testing* (A2LA Certificate 3300.01), PAT Programs routinely requests feedback from our participants. One of the standard questions we ask is what, if any, gaps



our participants have identified in the proficiency testing services available to their laboratory. In 2019, feedback indicated a clear need for proficiency testing for laboratories that analyze samples for airborne particulates using NIOSH method 0500, *Particulates Not Otherwise Regulated, Total*; NIOSH 0600, *Particulates Not Otherwise Regulated, Respirable*; or NIOSH 5000, *Carbon Black*. The resulting market research showed a large enough population of laboratories to support the investigation of a new program, so I facilitated the development of a detailed research and development plan. From 2020 through 2021, PAT Programs staff, the PAT Board, and experts at RTI International, the IHPAT sample generator, worked together to develop a sample generation process that produced homogeneous and stable samples, as required by ISO/IEC 17043. But internal determination of those properties is not enough for us. We needed to ensure the samples performed well after shipping, handling, storage, and analysis at participating laboratory locations.

To get real-world usage data on the samples, PAT Programs administered two pilot rounds. The following discussion pulls back the curtain on the science of planning, developing, and validating a proficiency testing product.

PLAN, DO, CHECK, ACT

The planning stages of the airborne particulate program began with a review of the common analytical methods to gather information on the sampling media and analytical ranges. One aspect of the NIOSH 0500, 0600, and 5000 methods that posed a challenge was the need for a tare weight of the filter before the sampling process takes place. Other gravimetric-based proficiency testing programs do not match the sampling method OEHS professionals are performing in the field because they use a different filter type and the concentration range is well above the range of concern. For laboratories using other proficiency testing programs, the administrative burden is high because it may require a back-and-forth mailing of the filter to obtain the tare weight prior to sample generation. We wanted to take an approach that was easy for laboratories to use and matched the sampling you are doing. But which was the better option: providing the tare weight directly, or providing matched-weight filters to use in lieu of a tare weight? This question would be the focus of Pilot Round 1.

Based on prior experience, the development team hypothesized two additional challenges to the technical feasibility of creating an airborne particulates program using 37 mm, 5 µm PVC filters:

1. NIOSH 0500 notes that "[static] electricity can cause erroneous weight readings." Would the effects of static electricity interfere with the use of an automated weighing system? An automated weighing system is the most efficient way to determine tare weight and perform validation testing of the generated pilot samples. This technical feasibility question was a go/no-go area of investigation, as automated weighing provides both highly reproducible measurements, which are integral to a gravimetric-based program, as well as lower labor cost per filter than manual weighing.
2. Unlike 46.2 mm PTFE filters used for EPA PM 2.5 ambient air monitoring, the 37 mm, 5 µm PVC filters do not have a support ring. Again, the go/no-go question was whether the automated weighing system could manage the filters effectively without a significant amount of filter loss due to damage or incidents of filters becoming lodged in the automated weighing system machinery.

After sending ten blank PVC filters through the automated weighing system and utilizing five duplicate readings per filter, it was determined that neither static electricity nor the lack of a stability ring posed a significant risk to program development.

Ultimately, using two pilot study rounds, we were able to create a program that streamlines the proficiency testing process by providing all the information needed to determine the net mass loading and uses the same media (37 mm, 5 µm PVC filter) specified in NIOSH 0500, 0600, and 5000. The range of the program is 0.5–5 mg per filter, with a plan to evaluate performance and potentially lower the range to 2 mg, matching the upper range of the NIOSH methods, in the future.

Figure 1. Visual display of the spread of the population (data with a z-score greater than ±10 removed for scale) and the clusters of data between the MW and tare groups.

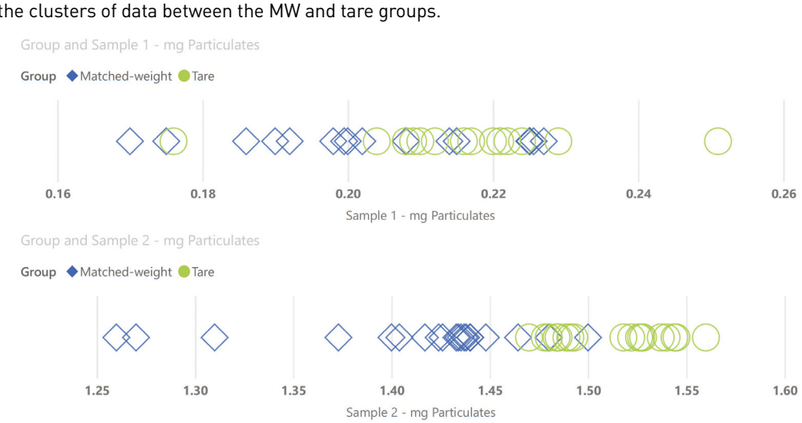


Table 1. Summary statistics, by group, using current IHPAT statistical procedures. Note the RSDs to produce the acceptance limits increased to 4 percent based on IHPAT data processing procedures for any ORSD values under 4 percent.

Group	Sample Number	Reference Mean	Lower Limit	Upper Limit	Standard Deviation	Relative Standard Deviation (RSD)	Measurement Uncertainty	Original Relative Standard Deviation (ORSD)
All	1	0.209	0.165	0.252	0.014	6.92	0.002	6.92
MW Group	1	0.203	0.155	0.251	0.016	7.82	0.004	7.82
Tare Group	1	0.215	0.190	0.241	0.009	4.00	0.002	3.59
All	2	1.463	1.279	1.647	0.061	4.19	0.010	4.19
MW Group	2	1.421	1.250	1.591	0.057	4.00	0.013	2.83
Tare Group	2	1.511	1.329	1.692	0.060	4.00	0.014	1.72

PILOT ROUND 1

The purpose of the first pilot study was to evaluate the technical capability of producing stable, homogeneous samples; evaluate the resulting data to ensure it fits within the accepted IHPAT statistics and participant evaluation processes and procedures; and gather end-user feedback on the samples. Collection of Pilot Round 1 data took place from Dec. 15, 2021, through Jan. 17, 2022.

In addition, the first pilot round evaluated the impact on the net mass loading (measured in milligrams) when presenting the laboratory with either a filter tare weight or a matched-weight (MW) filter set where one filter would serve as the tare weight value and the other would be the loaded sample. (As its name suggests, an MW filter is matched to the one in which the sample is generated, with a stated tolerance between the filters of up to 25 µg.) Each laboratory that participated in Pilot Round 1 was assigned to either the tare group or the MW group. To obtain the net mass loading, laboratories would subtract either the tare weight or the weight of the MW filter from the total weight of the filter that contains the sample, depending on group assignment. Either option would have provided a solid proficiency testing program, but the development team thought the MW option might reduce sample generation time because the samples would not require the labor hours to determine the tare weight using the automated weighing system. The logic was sound: fewer production steps and fewer labor hours lower the potential cost of generating samples, which lowers the costs of participating in the proficiency testing program. This potential labor cost savings of MW filters would be evaluated against the material cost of sending only a single loaded filter per sample with the tare weight option. The MW filters, sent as a set of two, are significantly more expensive than the single tare filter needed per sample.

To gather data on the aspects of concern and the technical success of the samples, PAT Programs sought 40 volunteer participants for Pilot Round 1. For the determination of net mass loading in mg, 20 pilot participants received a tare value and 20 received a matched-weight filter. A proprietary liquid deposition process was used to generate pilot samples. The concentration target for the samples was 0.2 mg and 1.5 mg for samples 1 and 2, respectively.

Once data submission for Pilot Round 1 closed, we evaluated data for each group—the tare group, the MW group, and all participants—using standard IHPAT statistics. We found a statistically significant difference between the mean values generated by the tare group and the MW group. This difference was consistent with homogeneity data generated by quality-control procedures performed prior to shipment of the samples to pilot participants.

To evaluate the pilot round, PAT Programs applied IHPAT scheme plan statistics, which required a minimum relative standard deviation (RSD) of 4 percent during data processing. Following this requirement, the RSDs for sample 1 for the tare group, and sample 2 for both the MW group and the tare group, were increased to 4 percent (see Table 1).

In a traditional proficiency testing round, the clear bimodality in the population data would have required PAT Programs to treat each group type as a separate population. As recommended in ISO/IEC 17043 as well as ISO 13528, *Statistical Methods for Use in Proficiency Testing by Interlaboratory Comparisons*, we removed visual outliers prior to statistical treatment.

Using original relative standard deviation (ORSD) as a performance indicator of the tightness of the datasets and considering the visual variability within the sample generation types, it was clear that the tare group performed better from a proficiency testing perspective (see Figure 1). Pilot Round 1 did not contain enough data to evaluate the influence of method selection on the summary statistics due to the high proportion of laboratories using NIOSH 0500. For this reason, the impact of method selection on the results was minimal and unlikely to be a concern during the evaluation of participants in future rounds.

PILOT ROUND 2

For Pilot Round 2, which was intended to validate the program and obtain data on the homogeneity and stability of the samples, we sought 50 volunteer participants. One participant received a replacement set and was able to

report data for both, so we ended up with 51 sample values for each of the two samples. Based on the results of the first pilot round, only tare samples were provided in the second pilot round, so participants determined net mass loading by subtracting the tare weight on the loaded samples from the total filter weight. A slightly modified proprietary liquid deposition process was used to generate pilot samples. The concentration target for the samples was 0.5 mg and 1.0 mg for samples 1 and 2, respectively. As with Pilot Round 1, nearly all participants used the NIOSH 0500 method, so the influence of method selection remained minimized.

To perform a stability study, pilot participants re-weighed and reported Pilot Round 1 sample values when submitting Pilot Round 2 data. Thirty-one pilot participants reported data from the first pilot round samples. The average difference of the filter total weight between weightings skewed slightly negative, averaging –0.0034 mg (1.62 percent of the 0.209 mg mean) for sample 1 and –0.0005 mg (0.03 percent of the 1.463 mg mean) for sample 2. Tare weight samples clustered more tightly around 0.00 mg, indicating less difference over time than the matched-weight filters, further supporting tare-provided sample generation as the mode of production. A one-way analysis of variance (ANOVA) determined that there was no statistically significant difference between the net mass loading means of the sample 1 and sample 2 results submitted during the first and second pilot rounds.

The development team also determined that the savings in labor time from use of the MW filters were not enough to offset their higher materials costs. So, the tare weight option not only led to better laboratory performance, it was also more efficient.

Only a few samples were shipped outside the U.S., but the data in Pilot Round 2 show that shipping long distances likely has little to no impact on sample effectiveness (see Figure 2).

SUCCESS! NOW WHAT?

PAT Programs was successful in developing, piloting, and verifying new proficiency testing samples using a tare weight sample generation process, and I am excited to launch the airborne particulates program with IHPAT Round 231 on Oct. 1, 2022. The sample matrix, measurement, and concentration match routine testing while offering a streamlined proficiency testing opportunity. The samples are stable and homogeneous, and they perform well in the laboratory setting. The data reported by pilot participants fit the IHPAT statistical analysis for determining the assigned values and evaluating the performance of participants.

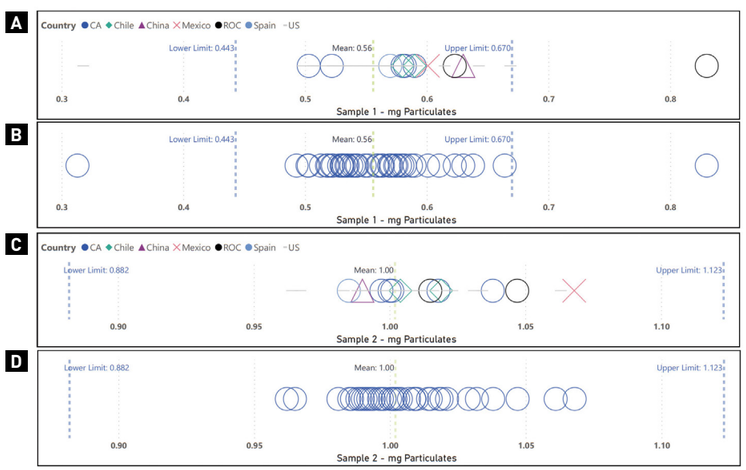
As an OEHS professional, you make extremely important decisions almost every day. You understand and appreciate how continuous improvement of your processes, equipment, and skillset impact those decisions. Make sure your laboratory partner values continuous improvement as much as you do: encourage them to enroll in the new airborne particulates program, and be sure to ask for a PAT report in late 2022 to verify their performance.

ANGELA OLER is managing director of AIHA Proficiency Analytical Testing Programs. She can be reached at **aoler@aiha.org**.

Acknowledgements: PAT Programs thanks participants who volunteered their time and equipment for the pilot studies and the PAT Board for their feedback and guidance during the planning of the pilot studies. We would not have been able to complete this project without our sample generation partner, RTI International, which developed, generated, verified, packaged, and shipped all pilot samples, under contract with PAT Programs.

Send feedback to **synergist@aiha.org**.

Figures 2 a-d. Visual display of the spread of Pilot Round 2 data. Figures 2a (sample 1) and 2c (sample 2) are grouped by country, with U.S. participants minimized, to highlight global participation. Figures 2b (sample 1) and 2d (sample 2) display the same data, without grouping applied.



GLOBAL PARTNERSHIPS TO PROTECT WORKERS

BY CHRIS LASZCZ-DAVIS, TOM FULLER, STEVEN VERPAELE, MARY O'REILLY, GARRETT BROWN, AND RICHARD HIRSH

AIHA members participate in several global organizations that strive to mitigate work-related risks in underserved parts of the world. These organizations often partner with each other to leverage resources, and they are always looking for volunteers. If you're interested in contributing, please reach out to the following groups:

The **AIHA International Affairs Committee (IAC)** serves as a point of contact with international organizations on professional development as well as technical and educational issues. IAC organizes every six weeks to discuss occupational hygiene conferences, ongoing projects, and other topics. During the pandemic, IAC members arranged sessions for AIHce EXP and organized a webinar on the multicultural workforce. Learn more at **bit.ly/aiha-iac**.

The **Developing World Outreach Initiative (DWOI)** focuses on building OEHS capacity by sponsoring technical projects and training workshops conducted by nongovernmental organizations and universities in Asia, Africa, and Central and South America. Volunteers from DWOI have led courses developed by the Occupational Hygiene Training Association and the University of California, Berkeley. Visit **bit.ly/ncls-dwoi** for more information.

Founded in 1993, the **Maquiladora Health & Safety Support Network (MHSSN)** comprises more than 300 occupational safety and health professionals who provide information, training, and technical assistance to workers and community organizations in the developing world. During 2020–2022, MHSSN and six labor, women's rights, and public health organizations conducted an emergency COVID response program in Dhaka, Bangladesh, that included three mobile clinics, a 24/7 medical hotline, and distribution of food, medicine, and educational materials on COVID and domestic abuse prevention. Visit **mhssn.igc.org** for more information.

AIHA members participate in several global organizations that strive to mitigate work-related risks in underserved parts of the world.

During the pandemic, **Workplace Health Without Borders (WHWB)** held monthly webinars that included presentations focused on aerosol transmission, ventilation, infection control, respirators, and informal work. The WHWB training group provided basic health and safety awareness training online for students from 17 countries. WHWB working groups are involved with workers in waste management, nail salons, brick kilns, mines, and other workplaces with high silica exposures. For more information, visit **whwb.org**.

The **International Occupational Hygiene Association (IOHA)**, a network of organizations that promotes, develops, and improves safety and health for workers and the environment worldwide, represents 18,000 members from 35 countries. IOHA has developed a strong relationship with the International Labor Organization (ILO), and two IOHA representatives gave presentations at the ILO Vision Zero Conference in May 2022. During the conference, IOHA was one of only five international organizations to sign the Tokyo Declaration on Vision Zero. Read more at **bit.ly/ioha-ilo**.

The **Occupational Hygiene Training Association (OHTA)** was formed to address the critical shortage of trained occupational hygienists, especially in underserved parts of the world. OHTA provides quality, peer-reviewed teaching modules that can be downloaded for free from **ohtatraining.org**. Translated or suitable for translation into local languages, these modules address core aspects of occupational and environmental hygiene that complement and enhance existing training opportunities available in academia and in many industrial organizations. Visit **ohtatraining.org** for additional information.

The authors are AIHA volunteers. For more information about the organizations discussed in this article, contact Chris Laszcz-Davis at ***chrisld@eq-organization.com****.*

Students Recognized for Best-in-Show Posters

Congratulations to the students whose posters were selected as best in show during AIHce EXP 2022 in Nashville, Tennessee. **Andrew Floeder** of the University of Minnesota came in first place with the poster "Analytical Sampling Method for Chemotherapeutic Surface Contamination in Occupational Settings." The second-place winner was Purdue University's **Chang Geun Lee**, whose poster was titled "Comparison of Size Distributions of Particles in Steel and Aluminum Welding Fumes." **Johnathan Klicker-Wiechmann** of Purdue University placed third for the poster "Dust, Mold, Heavy Metals: Health Hazards in Museums."

AIHce EXP 2023 is scheduled to be held in Phoenix, Arizona, May 22–24. The submission portal for the 2023 conference is now open, and proposals for student posters and presentations will be due on March 15, 2023.

AIHA Laboratory Accreditation Programs Announces Rebrand

Internationally recognized accreditation body AIHA Laboratory Accreditation Programs LLC, also known as AIHA LAP, has taken on a new brand identity. AIHA LAP's rebranding includes a new logo, mission statement, and vision as well as an updated website.

The new brand was developed through collaboration with the Chicago-based agency 88 Brand Partners to express AIHA LAP's primary function: supporting the health and safety missions of accredited testing laboratories and their clients through programs that assess and affirm lab performance. On AIHA LAP's updated website, users can access information about the programs offered by AIHA LAP and on topics such as the value of accreditation, how to become accredited, and how to find an accredited laboratory.

AIHA LAP has been helping labs and their clients have greater confidence in the dependability of their test data for almost 50 years. Programs offered by AIHA LAP include the Industrial Hygiene Laboratory Accreditation Program, the Environmental Lead Laboratory Accreditation Program, the Environmental Microbiology Laboratory Accreditation Program, the Food Laboratory Accreditation Program, and the Unique Scopes Laboratory Accreditation Program.

To learn more about AIHA LAP, visit **aihaaccreditedlabs.org**.

AIHA LAP to Accredit Laboratories to Conduct Food Testing on Behalf of FDA

AIHA Laboratory Accreditation Programs (AIHA LAP) learned in June that it is now recognized to accredit laboratories under the Food and Drug Administration's Food Safety Modernization Act (FSMA) final rule on Laboratory Accreditation for Analyses of Foods, or LAAF (**bit.ly/laafnotice**). Under the FDA program, LAAF-recognized accrediting bodies may accredit food testing laboratories to LAAF program specifications. FDA is expected to publish a *Federal Register* notice announcing when it has established sufficient accreditation body capacity, allowing AIHA LAP and other approved accreditation bodies to officially accredit labs to LAAF requirements. FDA's program is intended to support accredited laboratory testing when called for by the administration as it responds to issues related to food safety. LAAF-accredited laboratories (that is, those accredited by FDA-approved accreditation bodies) will be allowed to test food under certain circumstances.

Under AIHA LAP's Food Laboratory Accreditation Program (Food LAP), laboratories already have the option to be accredited to FoodLAP and the AOAC International Guidelines for Laboratories Performing Microbiological and Chemical Analyses of Food, Dietary Supplements, and Pharmaceuticals. Once FDA issues LAAF requirements and announces its full plans for LAAF accreditation, AIHA LAP will set up the LAAF program under FoodLAP and immediately begin accepting applications for laboratories that want to be accredited to LAAF so that they can conduct food testing on behalf of FDA. Laboratories already accredited under FoodLAP will simply need to add LAAF to their scopes and may not need another on-site assessment.

For more information on the FMSA final rule, visit FDA's website at **bit.ly/fda-fmsa**. Further details can be found in an FDA constituent update at **bit.ly/fdaupdate1221**. Individuals seeking information about AIHA LAP's current and planned food testing programs are encouraged to contact Cheryl O. Morton, managing director of AIHA LAP, at **cmorton@aiha.org**.

Dates and Deadlines

SEPT. 13–NOV. 17
Virtual Comprehensive Industrial Hygiene Review Course. Tuesdays and Thursdays, 12–2 p.m. ET, co-sponsored by the University of Michigan and the Michigan Industrial Hygiene Society. Visit **bit.ly/cihrfall2022**.

SEPT. 15
AIHA webinar: "The Role of Context and Reason in Ethical Decision-Making for the Industrial Hygienist." Visit **bit.ly/aihawebinars**.

OCT. 12
AIHA webinar: "Welding Field Guide, 2nd Edition: Updates and Control Banding Strategies." Visit **bit.ly/aihawebinars**.

OCT. 18–20
PSX 2022 in Louisville, Kentucky. Visit **psx.org**.

MAY 22–24, 2023
AIHce EXP 2023 in Phoenix, Arizona. Visit **aihceexp.org**.

For a complete list of events, visit **aiha.org/events**.

A Change of Address for AIHA

In September, the AIHA office will move to 3120 Fairview Park Drive, Suite 360, in Falls Church, Virginia. The new location is across the street from the building where AIHA has resided since 2012.

The AIHA office has been in northern Virginia since 1992 when it was relocated to Fairfax from Ohio.

In Memoriam

AIHA Fellow **Charles E. Adkins**, CIH, of Overland Park, Kansas, passed away on June 19. He was 89. Adkins served on AIHA's Board of Directors during 1989–1991. He was the 1990 recipient of the association's Edward J. Baier Technical Achievement Award, and in 2002 he received the Henry F. Smyth, Jr. Award. His obituary is available to read online at **legcy.co/3OT1xFu**.

James P. Bushnell, CIH, CSP, passed away on April 23. He was 63. Bushnell was a member of AIHA's Pacific Northwest Local Section and previously served as the section's president in 2013. His career focused on safety training, and he worked for more than four decades as a chemical engineer. According to his obituary, which is published online at **bit.ly/jamesbushnell**, Bushnell worked for the Navy, CH2M Hill, and the University of Washington.

Synergist Webinar Recordings

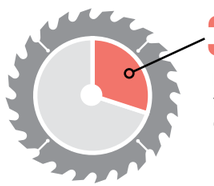
The Synergist hosts free webinars throughout the year, and AIHA members can access past recordings at any time. Delivered by experts from sponsoring companies in three distinct formats, these webinars can help you learn about best practices and emerging technologies relevant to your work. Learn more at **aiha.webvent.tv**.

SILICA OVEREXPOSURES AMONG STONE WORKERS

From the OSHA Regional Instruction "Regional Emphasis Program on Silica in Cut Stone and Slab Handling":

"[S]ilica exposure during the fabrication of artificial stone countertops is an emerging hazard that has been associated with several recent outbreaks of severe accelerated silicosis in young workers in the U.S."

A new Regional Emphasis Program (REP) developed by OSHA is intended to identify and reduce respirable crystalline silica hazards in the cut stone and stone products industry in OSHA Region 8, which comprises the states of Colorado, Montana, North Dakota, South Dakota, Utah, and Wyoming. According to the agency, this industry has had the highest documented overexposures to respirable crystalline silica in the region in recent years. Enforcement related to the REP began in May. The following information on silica overexposures among stone workers was selected from sources published by OSHA and CDC.



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Percentage of documented overexposures to silica attributed to the **cut stone and stone products industry** in OSHA Region 8 during the past 10 years.

18 Number of cases of silicosis identified by CDC among stone fabrication workers in California, Colorado, Texas, and Washington **during 2017–2019**. CDC's report notes that the affected workers worked primarily with engineered stone, which "contains substantially more silica" than natural stone.

2 Number of workers who died from silicosis among the 18 cases identified by CDC.

1 Number of cases of silicosis reported among engineered stone fabrication workers in the U.S. **before 2017–2019**, according to CDC.

>90 Percentage of silica found in **engineered stone**.

<45 Percentage of silica found in **granite**, a type of natural stone.

800 Percentage increase in **quartz surface imports** to the U.S. during 2010–2018, illustrating the rapidly increasing popularity of engineered stone countertops.

SOURCES

CDC: *Morbidity and Mortality Weekly Report*, "Severe Silicosis in Engineered Stone Fabrication Workers — California, Colorado, Texas, and Washington, 2017–2019," **bit.ly/mmwrsilica** (September 2019).

OSHA: "U.S. Department of Labor Emphasis Program Seeks to Identify, Reduce Silica Dust Hazards in Denver's Cut Stone, Stone Products Industry," **bit.ly/repsilicapr** (April 2022).

OSHA Regional Instruction: "Regional Emphasis Program on Silica in Cut Stone and Slab Handling," **bit.ly/repsilica** (PDF, February 2022).

RELATED

The Synergist: "Silicosis Among Stoneworkers in Queensland, Australia," **bit.ly/queenslandsilicosis** (April 2019).

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