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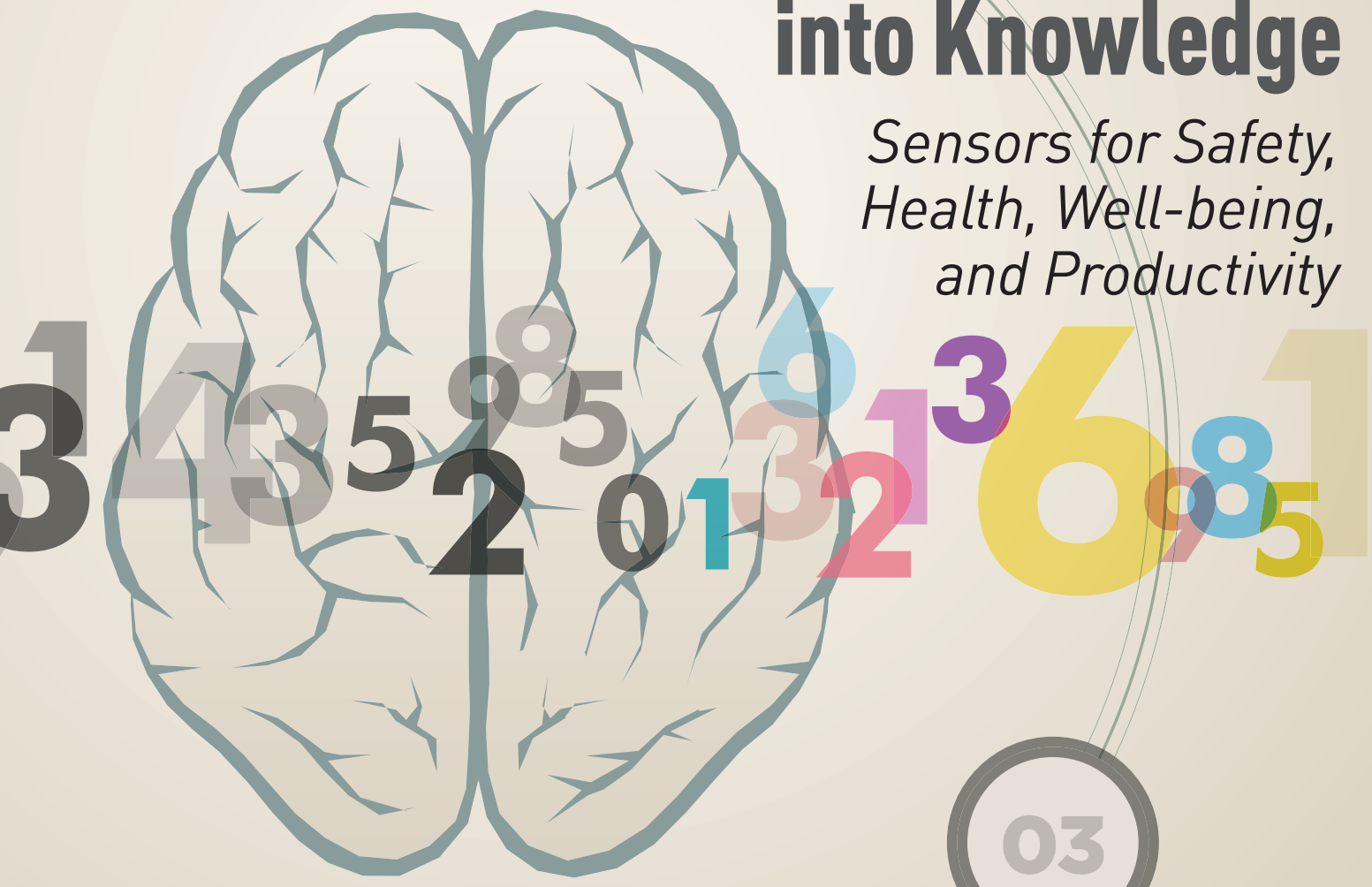

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FEATURES

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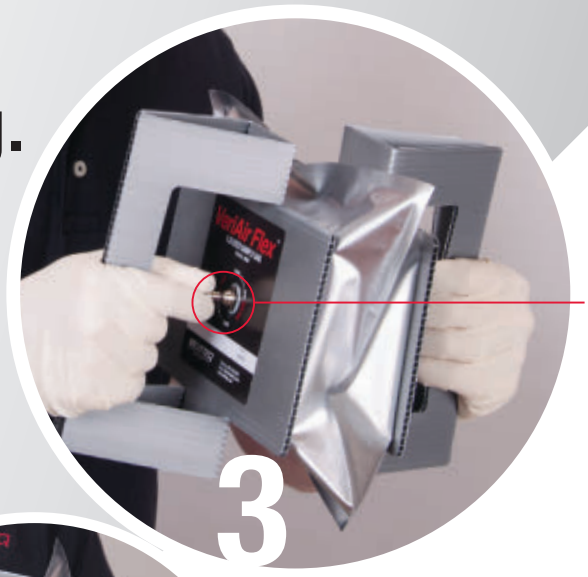

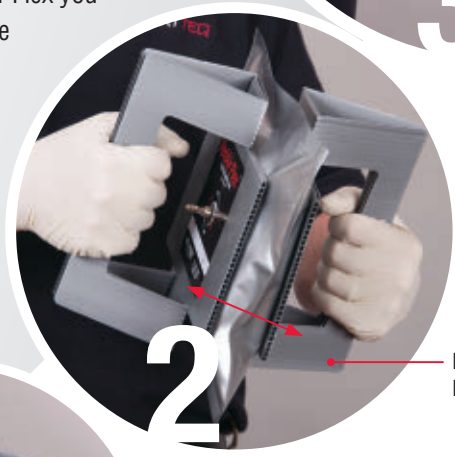

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AIHA
Protecting Worker Health

Edward J. Baier, 1929-2014

Edward J. Baier, AIHA's thirty-seventh president and the namesake for one of the association's most prestigious awards, passed away Dec. 13, 2014, in Frederick, Md. He was 89.

A graduate of the School of Public Health at the University of Pittsburgh, Baier began his distinguished career as an industrial hygienist with the Pennsylvania Department of Health in 1946. From 1956 through 1972 he led the state Division of Occupational Health and Bureau of Mine and Health Safety in Harrisburg. In 1972 he joined the federal government as the first deputy director of NIOSH. Following a brief stint as manager and corporate director of industrial hygiene with Diamond Shamrock Corp., Baier returned to public service as director of Technical Service for OSHA, a position he held until his retirement in 1989.

During his career, Baier authored more than 130 technical papers. He was active in many professional societies and served as AIHA president in 1975–76. He attained the rank of AIHA Fellow, received AIHA's Donald E. Cummings Award for outstanding contributions to industrial hygiene in 1982, and was later named an honorary member of AIHA.

In 1984, AIHA established the Edward J. Baier Technical Achievement Award to commemorate Baier's leadership and stature in industrial hygiene. The award honors individuals and organizations that have made significant contributions to industrial hygiene through technical expertise, technological innovations, scientific advancements, and interaction with or influence on other scientific disciplines. Baier himself was selected as the award's first recipient.

AIHA Past President Emil Christofano recalled Baier as a humble man widely liked and respected for his professionalism and easygoing demeanor. The two met in the late 1950s, while Baier was working for the Pennsylvania Department of Health and Christofano for the Atomic Energy Commission. Baier and Christofano collaborated on the temporary closing of a beryllium plant. When the plant reopened, its management offered Christofano a job, and he accepted. As a member of the regulated community, Christofano's respect for Baier continued to grow.

"We had to cooperate," Christofano said. "There was only so much you could do in the amount of time available, and he understood and we understood, and we just worked as hard as we could. We completely renovated the operation, improved the ventilation, improved the waste disposal practices—everything was pretty well cleaned up."

Their mutual respect grew into a lasting friendship.

"He was a very quiet and reserved gentleman," Christofano said. "Grace, his wife, fit with him perfectly."

Baier is survived by his son, Edward, his daughter, Grace, their spouses, seven grandchildren, and four great grandchildren. Edward and Grace Baier sent the following remembrance of their father to *The Synergist*:

> *We grew up with our dad talking about work around the dinner table. Coal mine safety, ventilation, accidents and how they could have been prevented, asbestos, and cooperation and non-cooperation with employers were some of the common topics. Grace and I met so many of our dad's coworkers and friends at our home or at conventions—Newell Bolton, Evan Campbell, the Pendergrass family, Emil Christofano, Dick Boggs, Mr. and Mrs. Clayton, and, during Dad's early days, the Zatecks and Memolos. Our mom, Grace, who passed away in October 2012, was also happily active in helping Dad, in proofreading, editing, and being an audience for his speeches. When overseas governments realized the importance of worker safety, Dad and his associates traveled to Taiwan, Egypt, Sweden, and other countries to speak on behalf of workers. Our father truly loved his profession and respected and admired all those he worked with. We are very proud of our father, and it's a privilege to have met so many of the people who have contributed so much to workplace safety.* Ⓢ

"He was a very quiet and reserved gentleman," Christofano said. "Grace, his wife, fit with him perfectly."

1975 Conference, Minneapolis. Left to right: President Ed Baier, President-elect Evan Campbell, Vice President Paul Woolrich, Past President John Pendergrass and Managing Director William E. McCormick.

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A Purposeful Approach to Content

BY CHRISTINE A.D. LORENZO, AIHA® PRESIDENT

For the past few years, AIHA has been transforming the way it approaches content development. Several previous articles in *The Synergist* have described elements of this transformation. This month, I'd like to discuss the broader context surrounding current AIHA initiatives and reveal the connections among various projects, some already underway and some scheduled to begin soon.

Developing an organization-driven content strategy was of primary importance—the foundation for nearly everything else we needed to accomplish.

THE FOUNDATION

Leading up to AIHA's 75th anniversary in 2014, the Board of Directors was grappling with developments both within and outside the industrial hygiene profession that had potential to affect AIHA's ability to remain viable and prosperous into the future. These trends included the revolutionary change in communications brought about by the Internet, the changing generational preferences for consuming information, and the staggering pace of change in technology. Given this environment, the Board's task was to figure out how AIHA could continue to thrive for another 75 years.

In the summer of 2013, the Board approved six recommendations intended to ensure that AIHA has a sustainable stream of resources that will allow us to fulfill our mission to protect worker health well into the future. These recommendations were to develop an organization-driven content strategy; convene scientific summits of science-based organizations; create "personalized" premium membership benefits; create science-based content collaborations; create an improved support system for AIHA's local sections; and align resources to support our members' careers.

These recommendations stemmed from input the Board received from members, vendors, partners, and other stakeholders. Additional input over the following months revealed that the first of these recommendations, for developing an organization-driven content strategy, was of primary importance—the foundation for nearly everything else we needed to accomplish.

This discovery led to the formation of the Content Portfolio Management Team (CPMT), whose role is to identify trends and emerging issues in industrial hygiene. Over several months the CPMT reviewed an environmental scan of key issues in IH, data related to AIHA members and customers, and other market research. Based on this review, the CPMT recommended that AIHA focus on developing products and services around six topic areas: exposure banding/OEL process; sensor technologies; emerging markets – global IH/OH standard of care; IH value strategy/business case development; changing work force demographics; and big data management and interpretation.

BODIES OF KNOWLEDGE

Before we can develop content in the six identified areas, we need to make sure that content is informed by the latest scientific research. Elsewhere in this issue you will read about AIHA's bodies of knowledge projects, or BoKs. The BoKs are one facet of our approach to research. BoK projects are currently underway in respiratory protection program administration, exposure assessment, and field use of multigas meters/PIDs. In the second half of 2015, we will launch new BoK projects in two of the CPMT's recommended areas of focus: exposure banding/OEL process and IH value/business case development. Calls for volunteers for these BoKs will be distributed in the coming months.

The cover article of this issue reflects another of CPMT's content recommendations. The rapid development of sensor technologies holds great promise for IH, but much work needs to be done to ensure that they are meeting our needs. In January, the Board approved plans to hold a scientific summit on sensor technologies during the first quarter of 2016. More information about this event will be forthcoming.

PURPOSEFUL CHANGE

The future-centered recommendations adopted by the Board in 2013 and the CPMT's recommendations for content development have guided much of AIHA's work over the last year and will continue to do so for the foreseeable future. AIHA members will have many opportunities to contribute and provide feedback. Ultimately, the work we've undertaken will help us better meet the needs of both our members and the marketplace. S

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AARON TRIPPLER
directs government affairs for more than 70 local sections and serves as AIHA's chief liaison with Congress and federal agencies. He can be reached at (703) 846-0730 or **atrippler@aiha.org**. Follow him on Twitter: **https://twitter.com/atrippler** or **@atrippler**.

What to Watch in 2015

BY AARON TRIPPLER, DIRECTOR, AIHA® GOVERNMENT AFFAIRS

The 114th Session of Congress began at the start of the new year. Although few legislative issues regarding occupational health and safety have been introduced so far—and I don't expect very many—it's clear that regulatory reform issues are at the top of Republicans' agenda.

Just across the street from the Capitol, OSHA leaders vow to move on several agenda items in the last two years of the Obama administration.

BILLS IN THE MIX

Rep. Bob Goodlatte, R-Va., has introduced HR 185, a bill to reform the process by which federal agencies analyze and formulate new regulations and guidance documents. This bill would alter the federal agency rulemaking procedures and require agencies to adopt the least costly regulatory alternatives, publish advance notice of proposed rulemaking for major rules, and hold hearings on high-impact rules. Agencies would also be required to adopt rules only on the best reasonably obtainable scientific, technical, and economic basis. The bill passed the House, and while it may pass the Senate, President Obama has already signaled his intent to veto if it makes its way to the White House.

It's interesting to note that during committee hearings for this bill, a failed attempt was made to amend it to exempt from this requirement any regulations or guidelines proposed by OSHA to prevent healthcare workers from contracting infectious diseases.

A similar bill, S 168, was introduced by Sen. Pat Roberts, R-Kan., and would require all federal agencies to review significant regulations and propose a timeline to repeal those deemed burdensome or unnecessary, or those that harm the economy or job creation. However, it has yet to pass the Senate and also faces the threat of veto from the president.

HR 128 is another attempt by Rep. Gene Green, D-Texas, to revise regulations concerning the recording and reporting of occupational injuries and illnesses. This bill would require employers to keep track of injuries and illnesses for all employees on a work site, regardless of whether they are employed by the site-controlling employer or are employed by contractors. The bill hasn't made it very far in the past and won't make it very far this time, either.

OVER AT OSHA

Just across the street from the Capitol, OSHA leaders vow to move on several agenda items in the last two years of the Obama administration. Some are long-time issues and some more recent. Unfortunately, reality will likely set in and few of these issues will be completed. Even so, give Dr. Michaels credit for trying to move these issues forward.

The issue of reporting requirements is complicated because there are actually three different reporting proposals. First, new requirements for what employers are required to report to OSHA went into effect Jan. 1. Employers are now required to report all work-related fatalities within eight hours and all in-patient hospitalizations, amputations, and losses of an eye within 24 hours of learning about the incident.

Next, OSHA has proposed changes to a rule that governs recordkeeping for injuries and illnesses. A 2012 federal court decision said that employers couldn't be cited for alleged recordkeeping violations more than six months prior to OSHA discovering an incident of injury or illness. OSHA is attempting to change the rule to clarify that it has authority to cite employers for recordkeeping violations up to five years prior to discovery of an incident.

Finally, the agency is in the process of drafting a final rule that would require employers to electronically file injury and illness records with OSHA. The agency proposes to publish this information on its website.

In addition to its activities related to reporting requirements, OSHA hopes to finalize rules on silica, confined spaces in construction, and beryllium prior to the end of the Obama Administration.

OSHA BUDGET: A CLOSER LOOK

The debate over the FY15 budget has concluded and spending is set—at least through Sept. 30. OSHA was provided a funding level of $552.8 million, down only a couple of million dollars from what the president requested, and actually about $500,000 more than what was appropriated in FY14. Of course, once upcoming federal salary increases and inflation are taken into consideration, OSHA will actually have less to spend than last year.

Significant changes from FY14 to FY15 include a $215,000 increase for federal enforcement, a $500,000 increase for whistleblower protection, a $950,000 increase for state programs, and a $1 million cut to federal compliance assistance.

Continued on page 12

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Continued from page 10

NIOSH received an increase from 2014: a small $2.5 million. More importantly, the final budget included continued funding for the agency's Education Research Centers.

However, there is a little more to this budget. When Congress approved OSHA funding for FY15, the bill included several riders that may pose problems for the agency. For example, the riders require OSHA to notify the House and Senate committees of any new national, regional, or local emphasis programs, including the data used to determine the new programs. Further, the riders require OSHA to consider all new and currently available technology as the agency moves forward with its silica rule.

NIOSH NEWS

NIOSH received a total of $334.9 million in the final omnibus bill, but what most don't know is that this was actually an increase from 2014: a small $2.5 million. More importantly, the final budget included continued funding for the agency's Education Research Centers. The allocation also included $114.5 million for the National Occupational Research Agenda (NORA).

Congress did express a concern in the final NIOSH budget regarding lack of progress in developing a certification standard for combination unit respirators. Another negative aspect related to NIOSH funding is that the agency has stopped collecting agricultural injury data due to increased costs and future budget uncertainty. This is likely only one of many issues NIOSH will face in the coming years of tighter federal spending.

I'm glad to see that NORA funding will continue and that it makes up a large part of the total NIOSH funding package. This program began in 1996 as a partnership to stimulate innovative research and improve workplace practices. With nearly 20 years of accomplishments, NIOSH is undertaking an evaluation for the second decade of NORA work. The agency is accepting feedback until the federal docket closes on March 24.

And yes, Ebola is still an issue, even though the media and others seem to have moved on to the next story. But NIOSH and OSHA haven't yet relegated the issue to the back room. In fact, the two agencies recently released a fact sheet to help healthcare workers, responders, and employers prevent work-related fatigue while tending to Ebola cases. The fact sheet is available at **http://bit.ly/ebolafatigue**.

Ebola will continue to keep NIOSH busy in 2015, but other issues will be just as important to the agency. For example, NIOSH Director John Howard, MD, hopes to take a closer look at how science is interpreted and used in developing standards.

However, many consider the most important NIOSH agenda item in 2015 to be whether Dr. Howard will remain as director of NIOSH. Dr. Howard, who headed NIOSH from 2002 to 2008 and was appointed to a second six-year term, will see his term expire in September of this year. There's no word yet on whether or not he wishes to be reappointed or if he will be reappointed, but it's hard to find anyone who disagrees that Dr. Howard has been the best leader of NIOSH to date. Ⓢ

CSB Drafts Recommendations to Improve Refinery Safety

In a final investigation report released in January, the U.S. Chemical Safety Board (CSB) identifies deficiencies in current industry standards related to mechanical integrity and leak evaluation and response. The agency found shortcomings in industry standards related to comprehensive inspection, effective facility upgrades, and the need for minimum safety requirements.

The report is the third and final one in the agency's investigation of the August 2012 Chevron Refinery fire in Richmond, Calif., which started when light gas oil leaked from a ruptured pipe and ignited. Nineteen refinery employees were endangered during the fire, and 15,000 people sought medical attention due to a vapor cloud that was released into the surrounding area.

CSB's report also details failures in Chevron's emergency response to the incident, including a lack of leak response guidance or formal protocol for operations personnel, refinery management, or emergency responders. Further, the report states that the company "did not effectively identify a likely piping damage mechanism and the possibility of catastrophic rupture."

The agency concludes its report with safety recommendations to help promote safer operations at petroleum refineries and protect workers and communities from similar accidents. Based on its findings, CSB recommends that the American Petroleum Institute establish and strengthen minimum requirements for preventing potentially catastrophic sulfidation corrosion failures and safety guidance for responding to hazardous process fluid leaks. CSB urges Chevron to ensure process safety and employee safety by developing an accountability method to identify and track effective implementation of industry best practices. Finally, the agency recommends revisions to the Richmond, Calif., Industrial Safety Ordinance to provide stronger regulatory oversight with community involvement to the existing safety culture review program.

Nineteen refinery employees were endangered during the fire, and 15,000 people sought medical attention due to a vapor cloud that was released into the surrounding area.

The report is available on CSB's website at **http://bit.ly/csbchevron3**.

The first CSB report on the incident, an interim investigation report (**http://bit.ly/csbchevron1**), cited "missed opportunities to apply inherently safer design, failure to identify and evaluate damage mechanism hazards, and [a] lack of effective safeguards" as contributors to the fire, which was caused by a catastrophic pipe failure. Tests commissioned by CSB and Cal/OSHA showed that the pipe failure was due to thinning caused by sulfidation corrosion. The second report (**http://bit.ly/chevroncsb2**) called on California to enhance its process safety management regulations for petroleum refineries and recommended "substantial" changes to the way those refineries are regulated in the state.

The three CSB reports on this incident include a total of 37 safety recommendations for the company, Chevron USA; industry organizations responsible for developing good practice guidelines; and state and federal regulatory bodies. All recommendations and related documents are listed on CSB's investigation page at **http://bit.ly/chevronpage**.

CSB Chairperson Rafael Moure-Eraso commended the state of California, indicating that the agency is "pleased to see California has begun acting upon" CSB's safety recommendations.

The agency previously released a computer-animated safety video that covers the sequence of events that led to the accident. The eight-minute narrated video is available on CSB's website at **http://bit.ly/chevronvideo**.

NANOTECHNOLOGY

EU-OSHA PUBLISHES GUIDANCE ON SAFE USE OF NANOMATERIALS

New guidance released by the European Agency for Safety and Health at Work (EU-OSHA) provides health and safety practitioners, employers, and workers with an overview of the safe use of manufactured nanomaterials in the workplace. According to the agency, this guidance should help address specific risks or concerns about nanomaterials and ensure that they are adequately controlled in the workplace. The guidance is intended for general use in occupational settings within the European Union where nanotechnology is used.

For employers and health and safety professionals, the new guidance includes a section on risk assessment and risk management, which contains information on the identification of manufactured nanomaterials, exposure assessment, and control banding. The guidance for workers includes basic information on nanomaterials, current concerns about manufactured nanomaterials, routes of exposure, and commonly used risk management measures.

The guidance documents are available for download on EU-OSHA's website at **http://bit.ly/nanoeuosha**.

TOXICOLOGY

NTP to Conduct Toxicity Studies on Predominant Chemicals Spilled in W.Va. Leak

The National Toxicology Program (NTP) is set to conduct a number of toxicity studies on the predominant chemicals known to be involved in the January 2014 spill that released an estimated 10,000 gallons of chemicals used to process coal near the Elk River, contaminating the water supply for approximately 300,000 West Virginians. The primary spilled agent was 4-methylcyclohexane methanol (MCHM), but other chemicals such as dipropylene glycol phenyl ether (DiPPH) and propylene glycol phenyl ether (PPH) were present in smaller amounts. In July of last year, the Centers for Disease Control and Prevention/Agency for Toxic Substances and Disease Registry (CDC/ATSDR) nominated the spilled chemicals to NTP to obtain additional toxicology data, and NTP published its research project plan in December (available at **http://bit.ly/wvaresearchplan**).

NTP plans to study the major constituents of the spilled liquid in rodent and other model organisms to look for developmental effects. The organization will also use cellular, molecular, and computer-modeling approaches to identify biological systems that are affected by these chemicals and at what concentrations these effects might occur.

According to NTP, results from these studies will help determine if more comprehensive health assessment studies are needed. The organization plans to release findings from the studies on its website as they become available. For more information, visit **http://bit.ly/ntpwva**.

RESPIRATORY PROTECTION

Workshop Examines Use and Effectiveness of PAPRs in Healthcare

A report released Jan. 6 details the presentations, discussions, and outcomes of a workshop convened last year to help prioritize and accelerate NIOSH activities to update certification requirements for powered air purifying respirators (PAPRs) for use in healthcare. The workshop was convened by the Institute of Medicine (IOM) at the request of the National Personal Protective Technology Laboratory (NPPTL) at NIOSH, which has sponsored the IOM Standing Committee on Personal Protective Equipment for Workplace Safety and Health since 2005.

The report cites 2009's H1N1 influenza pandemic and the recent Ebola virus outbreak in West Africa as events that have highlighted the importance of personal protective equipment (PPE) and how best to ensure effective use of PPE to promote occupational health and safety and reduce disease transmission in healthcare settings. Representatives from government agencies, healthcare institutions, professional associations, device manufacturers, and health worker unions attended the workshop.

The report cites 2009's H1N1 influenza pandemic and the recent Ebola virus outbreak in West Africa as events that have highlighted the importance of PPE.

The workshop report summarizes the discussions on current standards and regulations related to PAPRs; the experiences of healthcare and emergency response workers relevant to PAPRs; perspectives of employers; and the design and research needs for PAPRs intended for use by healthcare workers.

Topics of discussion at the workshop included improving PAPR design and standards by assessing risks and protective factors; increasing education and training; and strengthening implementation and use of PAPRs in healthcare.

The workshop summary is available to read online for free on the National Academies Press website at **http://bit.ly/paprsonline**. A free PDF download is also available at **http://bit.ly/paprspdf**.

RESEARCH

MARCH JOEH LINEUP

The March issue of the *Journal of Occupational and Environmental Hygiene* (JOEH) features these and other articles:

- Modeling Flight Attendants' Exposure to Secondhand Smoke in Commercial Aircraft: Historical Trends from 1955 to 1989
- Working in Hot Conditions – A Study of Electrical Utility Workers in the Northern Territory of Australia
- Detection of Airborne Carbon Nanotubes Based on the Reactivity of the Embedded Catalyst
- Comparing Written Programs and Self-reported Respiratory Protection Practices in Acute Care Hospitals
- A Comparison of the Closed-face Cassette at Different Orientations While Measuring Total Particles
- The Relationship between Elemental Carbon and Diesel Particulate Matter in Underground Metal/Nonmetal Mines in the United States and Coal Mines in Australia

AIHA® members can access the full texts of JOEH articles through the Member Center on **www.aiha.org**, as well as the full-text archives of AIHA journals from 1940 to 2003. Full-text archives of *Applied Occupational and Environmental Hygiene* from 1986 to 2003 are also available.

INFECTIOUS DISEASES

AGENCIES RELEASE NEW RESOURCES FOR EBOLA PREPAREDNESS AND RESPONSE

Earlier this year, OSHA, NIOSH, and CDC released new Ebola resources related to fatigue and personal protective equipment (PPE) for workers, employers, responders, and healthcare facilities. OSHA and NIOSH collaborated to publish a fact sheet on preventing fatigue among healthcare workers and responders, and CDC released guidance for U.S. healthcare facilities to ensure adequate supplies of PPE for Ebola preparedness.

The fact sheet, available at **http://bit.ly/ebolafatigue**, provides information on worker fatigue and its effects, and highlights the shared responsibility between employers and workers to prioritize quality sleep. Employers will find information on developing and implementing a fatigue risk management plan, and examining shift lengths and workloads to ensure appropriate work-rest cycles.

CDC's guidance on PPE summarizes the current supply situation in the U.S. and recommends approaches for healthcare facilities to increase PPE as part of their Ebola preparedness planning. View the new PPE guidance at **http://bit.ly/ebolappesupplies**.

CHEMICAL REGULATIONS

New EPA Rules Target Chemicals in Imported Products

EPA has issued significant new use rules (SNURs) to allow the agency to review any efforts by manufacturers and importers to introduce potentially harmful chemicals into the marketplace. Chemicals covered by the new rules include most uses of certain benzidine-based dyes; most uses of DnPP, a phthalate; and Alkanes C_{12-13}, chloro, which are short-chain chlorinated paraffins. These chemicals are not currently used in the U.S. market, but they have previously been used in consumer products and could find their way into the marketplace through imported products.

According to EPA, benzidine-based dyes can be used in textiles, paints, and inks, and can be converted in the body into a chemical that is known to cause cancer. DnPP has been shown to cause developmental and reproductive effects in laboratory animals, and can be used in PVC plastics. The agency notes that Alkanes C_{12-13}, chloro, can be used as industrial lubricants; can be transported globally in the environment; and are persistent, bioaccumulative, and toxic to aquatic organisms.

Benzidine-based dyes can be used in textiles, paints, and inks, and can be converted in the body into a chemical that is known to cause cancer.

The new rules were issued under the Toxic Substances Control Act and will require those who wish to manufacture, import, or process these chemical substances to notify EPA at least 90 days prior to starting or resuming new uses of these chemicals. The agency would then evaluate the intended use of the chemicals and have the opportunity to prohibit or limit that activity, if necessary, to ensure that human health and the environment are protected.

These rules went into effect on Feb. 27. For more information, visit **http://bit.ly/epaharmfulchemicals**.

COAL MINING

MSHA Requires Proximity Detection Systems on Continuous Mining Machines

MSHA has issued a final rule intended to protect miners from pinning, crushing, or striking accidents caused by continuous mining machines in underground coal mines. Continuous mining machines are large, high-powered scrapers that extract coal from mines' seams. The new rule will require mine operators to equip these machines with proximity detection systems, which use electronic sensors on both mining machines and miners to detect motion or the location of one object relative to another. Proximity detection systems can be programmed to send warning signals and stop mining machines before they injure or kill workers in underground coal mines. MSHA's final rule establishes performance and maintenance requirements for proximity detection systems and requires training for those performing the installation and maintenance.

According to the agency, nearly half of the approximately 863 continuous mining machines currently in operation have already been equipped with proximity detection systems. MSHA's press release states that most of these systems will likely need only minor changes to meet the standards set in the rule.

Proximity detection systems can be programmed to send warning signals and stop mining machines before they injure or kill workers in underground coal mines.

The rule will take effect on March 16, and will be phased in over eight to 36 months. MSHA estimates that the rule will prevent 49 injuries and nine deaths over the next 10 years. For more information, visit **http://bit.ly/proximitydetection**.

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See this month's Product Features on page 35.

ERGONOMICS

NIOSH Emphasizes Workstation Design, Training to Mitigate Ergonomic Hazards

During a recent health hazard evaluation (HHE) of a label manufacturing facility, NIOSH staff observed employees working in awkward postures that put them at risk for developing work-related musculoskeletal disorders (MSDs). The HHE, which was requested by facility management, indicates that workstations were not designed so employees could safely perform tasks. Specifically, NIOSH staff noted that hand-working heights were too low or too high, and reach distances were too long. Employees continually bent at the waist while working. The authors of the NIOSH report also indicate the lack of a formal training program covering ergonomics and instruction on how to safely perform job tasks. This lack of training "resulted in a work force that had inconsistent knowledge of how to do its job safely," according to the report.

The report lists several recommendations to the employer to improve health and safety at the facility, including:

- adjust staffing or assigned work hours to increase employees' rest and recovery times
- provide ergonomics training to all employees annually
- write standard operating procedures for each job task to reduce overexertion injuries
- implement a formal training program for new workers that includes a skills and safety evaluation by a supervisor before a new employee is permitted to work unsupervised
- redesign workstations to match ergonomic design guidelines as detailed in the report

View NIOSH's full report at **http://bit.ly/hhelabelfacility**. Other NIOSH HHE reports are available at **http://bit.ly/hheprogram**.

RISK ASSESSMENT

EPA: Chlorpyrifos Pesticide Poses Potential Risks to Some Workers

EPA has released a revised human health risk assessment of the organophosphate pesticide chlorpyrifos, which the agency says shows some risks to workers who mix, load, and apply chlorpyrifos products to agricultural and other non-residential sites. EPA also notes concern for those who work around areas that are treated with the pesticide, even if they are not using chlorpyrifos as part of their own jobs. According to EPA, when used in large amounts, the pesticide could pose risks in limited geographic areas where drinking water comes from small watersheds. In its press release, the agency states that additional restrictions may be necessary to protect drinking water sources and ensure worker protection in areas treated with the pesticide. However, EPA found no additional risks from pesticide exposures to workers and bystanders from airborne chlorpyrifos.

At high enough doses, chlorpyrifos can impact the nervous system and cause nausea, dizziness, and confusion, according to EPA. The agency states that very high exposures can cause respiratory paralysis and death.

The revised document updates the agency's preliminary human health risk assessment from June 2011, and incorporates considerations such as exposures from multiple sources, including exposures from food and water and inhalation and dermal exposures. The revision also includes information from a 2012 assessment of spray drift exposure.

EPA's revised risk assessment on chlorpyrifos is available at **http://bit.ly/epachlorpyrifos**. The public comment period on the risk assessment is open through March 16, 2015. An EPA fact sheet on chlorpyrifos is available at **http://bit.ly/factsheetchlorpyrifos**. For more information, visit **http://bit.ly/chlorpyrifosra**.

HAZARDOUS DRUGS

NIOSH Requests Feedback to Protect Healthcare Workers' Reproductive Health

NIOSH seeks public comment on a new draft Current Intelligence Bulletin (CIB), *Reproductive Risks Associated with Hazardous Drug Exposures in Healthcare Workers and Recommendations for Reducing Exposures*. The CIB reviews and summarizes all published studies on adverse reproductive effects of occupational exposures to antineoplastic drugs and provides recommendations for preventing exposures and protecting the reproductive health of workers and their offspring. According to NIOSH, the primary focus of the CIB is workers in healthcare because of their potential to be in an environment of multiple exposures. Based on its review of published data, the agency recommends steps to reduce occupational exposure to hazardous drugs for all healthcare workers, especially those at reproductive risk, including both males and females who are trying to conceive, women who are or may become pregnant, and women who are breastfeeding.

The primary focus of the CIB is workers in healthcare because of their potential to be in an environment of multiple exposures.

NIOSH seeks information on the appropriateness of the guidance, its effect on work practices, confidentiality issues, and financial impact. The agency also requests materials to evaluate relevant publications not included in the CIB, institutional and organizational policies in effect, and other relevant information on this topic.

Comments are due by March 24. For more information, see the *Federal Register* notice at **http://bit.ly/hazdrugsfr**. The draft CIB is available for review at **http://bit.ly/hazdrugscib**.

HEALTHCARE

Healthcare Workers Neglect Precautionary Measures When Handling High-level Disinfectants, Survey Finds

NIOSH survey findings indicate that healthcare workers who disinfect medical and dental devices do not always use precautionary measures to protect themselves from exposure to high-level disinfectants (HLDs). According to NIOSH, some of these chemicals—including glutaraldehyde, orthophthaldehyde, peracetic acid, and hydrogen peroxide—are respiratory and skin irritants and sensitizers, and workers who use HLDs are at risk of exposure. Results of the study were recently published in *Infection Control and Hospital Epidemiology*. The authors conclude that the findings highlight the importance of improved employer and worker training and education regarding these hazards.

The survey respondents included members of professional practice organizations representing nurses, technologists and technicians, dental professionals, respiratory therapists, and others who reported handling HLDs in the previous week. Of the workers who responded to the survey, 44 percent said that they did not always wear water-resistant gowns. Twelve percent reported skin contact with HLDs during the past week, and nine percent said that they did not always wear protective gloves. The most frequently reported reason for not wearing personal protective equipment was that "exposure was minimal."

Further, 17 percent of survey respondents reported a lack of safe handling training, and 19 percent said that standard procedures for minimizing exposure to HLDs were unavailable.

This study is one of a series detailing results from the NIOSH Health and Safety Practices Survey of Healthcare Workers, a voluntary, anonymous, Web-based survey of healthcare workers in the U.S. that was conducted in 2011. The study is available at **http://bit.ly/hldarticle**. For more information, visit **http://bit.ly/nioshhld**.

CHEMICAL REGULATIONS

EPA PROPOSES RULE ON NEW USES, IMPORTS OF TOLUENE DIISOCYANATES

EPA has proposed a significant new use rule (SNUR) to protect consumers and workers from new uses and imports of toluene diisocyanates, chemicals that the agency says are currently used in residual amounts in the production of polyurethanes and consumer products such as coatings, adhesives, and sealants. According to EPA, diisocyanates are well-known dermal and inhalation sensitizers in the workplace and can cause asthma, lung damage, and fatal reactions. The agency's action plan for the chemicals focuses on the potential health effects from exposures to consumers or self-employed workers while using products containing uncured diisocyanates.

EPA's proposed SNUR would require manufacturers and importers to notify EPA at least 90 days prior to starting or resuming new uses of toluene diisocyanates in consumer products at levels above 0.1 percent by weight.

The SNUR is available for public comment through March 16. For more information, visit **http://bit.ly/epatdi**.

Thea Dunmire, JD, CIH, CSP, is the president of ENLAR Compliance Services, Inc., where she specializes in helping organizations implement management systems. She can be reached on her blog about management system standards at **www.managementsystemexpert.com**.

When Things Go Wrong

Dealing with Emergencies, Incidents, and Nonconformities

BY THEA DUNMIRE

Many of the requirements set out in occupational health and safety (OHS) management system standards focus on ensuring that things go right. When organizations implement management systems, they typically focus on establishing the appropriate processes for identifying hazards, implementing controls, and assigning responsibilities to competent individuals with the goal of everything going as planned.

The goal is to learn from the bad experience of others.

Yet sometimes things don't go right.

There are three sets of requirements in OHS management system standards that focus on when things go wrong: the requirements for dealing with emergencies, incidents, and nonconformities. Although these three concepts are similar in some ways, they differ in focus. This means that the associated management system requirements also vary.

EMERGENCY PREPAREDNESS

The Oxford dictionary defines an emergency as "a serious, unexpected, and often dangerous situation requiring immediate action." Common emergency situations include weather-related events (such as blizzards, hurricanes, tornados, or floods), human-related events (workplace violence or terrorist attacks, for example), and equipment or infrastructure failures (like building collapses, tank failures, or ground subsidence).

For the most part, the requirements for dealing with emergencies focus on being prepared for events that can be characterized as low probability ("unexpected") and high severity ("serious") where some kind of *immediate* action is needed to prevent death or serious injury. What emergencies have in common is a focus on being prepared in the event that the emergency does occur, even when the probability of occurrence may be extremely low.

The management system requirements for emergencies include:

- identifying potential emergencies and the associated health and safety risks
- developing plans and procedures to be prepared in the event an emergency does occur
- communicating these plans to appropriate individuals so they know what to do if an emergency does occur
- periodic testing of emergency plans and updating of these plans as needed

Preparedness is the key in dealing with an emergency situation.

INCIDENT INVESTIGATION

In the context of an OHS management system, an incident is an event or occurrence that results, or could have resulted, in a work-related injury or ill health. This term includes accidents, where some kind of injury does occur, and near-misses, where no one was injured but the situation could have resulted in an injury. Incidents range in severity from an individual paper cut to events with multiple fatalities. In the case of an incident, both the probability and severity of harm are known (at least for the event that occurred).

For purposes of a management system, the focus for incidents is on having appropriate processes in place to analyze what happened (particularly for near-misses) so appropriate steps can be taken to prevent others from being harmed in the future. In other words, the goal is to learn from the bad experience of others.

The management system requirements for incident investigation include:

- having processes in place to identify ("report") incidents
- having processes in place to investigate and analyze incidents in a timely manner, focusing on how similar events can be prevented in the future

ACCIDENT, INCIDENT, OR KERFUFFLE?

One of the ongoing debates among OHS professionals is whether to use the term "accident," "incident," or both. These debates can be spirited at times.

Both ANSI Z10-2012 and OHSAS 18001:2007 use the term "incident"; ISO 14001:2004 uses the term "accident." In the drafting of the ISO 45001 standard, discussions are ongoing about which terms to use, how to define them, and the requirements that should be associated with each term.

For a lighthearted discussion of this issue, including a suggested term for resolving this debate, check out "Accident vs. Incident," a video by safety speaker Richard Hawk, at **http://bit.ly/richardhawk**.

- ensuring the results of investigations are communicated so others can learn from the experience

The focus when dealing with incidents is on analysis of the underlying causes and implementation of appropriate actions to prevent future injuries. There are clear links between incident investigation and the management system processes for hazard identification and risk assessment. The main difference for incidents is that the probability of harm is 100 percent, or close to it.

ADDRESSING NONCONFORMITIES

For the purposes of ISO management system standards, a nonconformity is defined as "non-fulfillment of a requirement." In general, a nonconformity occurs when an organization fails to meet a management system requirement that it has identified as applicable or has established for itself.

In the United States, a requirement is often viewed as a legal obligation enforced by OSHA or another government regulator. Although nonconformities include the failure to meet regulatory requirements, the meaning is broader for purposes of an ISO management system. Examples of nonconformities include failure to implement established management system processes, lack of competence on the part of individuals assigned OHS responsibilities, internal communication failures, and inadequate preservation of required documentation. Some of these may be related to legal compliance; others are associated with internal requirements set out in organizational procedures.

Particularly for internally imposed requirements, one way of addressing a nonconformity is to assess whether the requirement can be changed. Sometimes organizations establish internal processes that sound good in theory but are impractical when it comes to actual implementation.

The mantra to remember when it comes to implementing management systems is "Say what you do; do what you say." If an internally set requirement is too difficult to meet, consider changing it.

The management system requirements for addressing nonconformities include:

- having processes in place to identify nonconformities
- taking immediate action to deal with the nonconformity (sometimes referred to as "correction")
- having processes in place to investigate and determine the causes of the nonconformity, focusing on identifying appropriate actions to ensure it does not happen again (also called "corrective action")
- assessing whether actions are needed to address similar situations to ensure the problem doesn't occur elsewhere (sometimes referred to as "preventive action")
- implementing the actions identified and reviewing whether they are, in fact, effective in preventing the nonconformity

Having effective processes for corrective action is an important part of an effective OHS management system.

COMPARING CONCEPTS

This article outlines the management system requirements for emergency preparedness, incident investigation, and corrective action. So how do these concepts compare? The table below describes key similarities and differences.

	Emergency Preparedness	Incident Investigation	Corrective Action
Management system process required	Yes	Yes	Yes
Advance preparedness needed	Yes	Yes, to address an injury	Maybe, when correction is needed
Reporting or notification process required	Yes	Yes	Yes
High probability of injury or ill health	Yes	Yes	Not necessarily; nonconformities include system issues that are unlikely to cause injury or ill health
Time-critical response required	Yes	Sometimes (yes for injuries; probably for near misses)	Not necessarily; not all nonconformities need a time-critical response
Analysis of underlying causes required	Maybe, if plans need revision	Yes	Yes
Communication with others important	Before an event for coordination	After the event for learning purposes	Depends on the nonconformity

Turning Numbers

Sensors for Safety, Health, Well-being, and Productivity

BY MARK D. HOOVER AND D. GAYLE DEBORD

into **Knowledge**

The industrial hygiene community has witnessed exponential growth in the use of sensors, especially by individuals. Remote wireless sensors are now monitoring worker health, the environment, agriculture, work sites, disaster relief, and "smart" buildings and facilities.

Sensors hold great promise for empowering workers and improving risk-informed management decisions. But how will we validate and apply the rapidly evolving sensor technologies, some of which have not yet been invented or even imagined?

Our community can take practical steps to transform the incredible promise of sensors into credible industrial hygiene practice. The vision discussed in this article describes how NIOSH is combining an informatics-based mindset with the industrial hygiene decision-making framework (anticipate, recognize, evaluate, communicate, control, and confirm) to apply a comprehensive life-cycle approach to sensor development, validation, and application. Effective partnerships will help us engage the community, inform the interested, reward the responsive, and understand and incentivize the reluctant to develop and apply sensors wisely.

AN INFORMATICS-BASED MINDSET

In a world saturated with information and data, we need to determine not only what *can* be measured, but what *should* be measured. Industrial hygienists have a rich and successful history of applying direct-reading instruments in the laboratory and the field. We also know the challenges of interpreting and converting "numbers" from such instruments into defensible and actionable decisions.

The concept of "informatics" can help us organize how we seek, create, curate, analyze, and apply modern information. Recent work described in *The Nanoinformatics 2020 Roadmap*, a publication of the National Nanomanufacturing Network, has resulted in a working definition of informatics that we have expanded and adopted for our purposes. We define sensor informatics as

> *the science and practice of determining which information is relevant to meeting our measurement objectives; and then developing and implementing effective mechanisms for collecting, validating, storing, sharing, analyzing, modeling, and applying the information; confirming that appropriate decisions were made and that desired mission outcomes were achieved as a result of that information; and finally conveying experience to the broader community, contributing to generalized knowledge, and updating standards and training.*

Successful missions apply all of the steps in the informatics process.

THE IH DECISION-MAKING FRAMEWORK

Our traditional industrial hygiene decision-making framework provides a robust approach to addressing any analytical problem. To determine sensible use of sensors, we can:

- **anticipate and recognize** specific situations where real-time monitoring might contribute to improved assessment of exposures, hazards, and resulting risks
- **evaluate and communicate** options for the

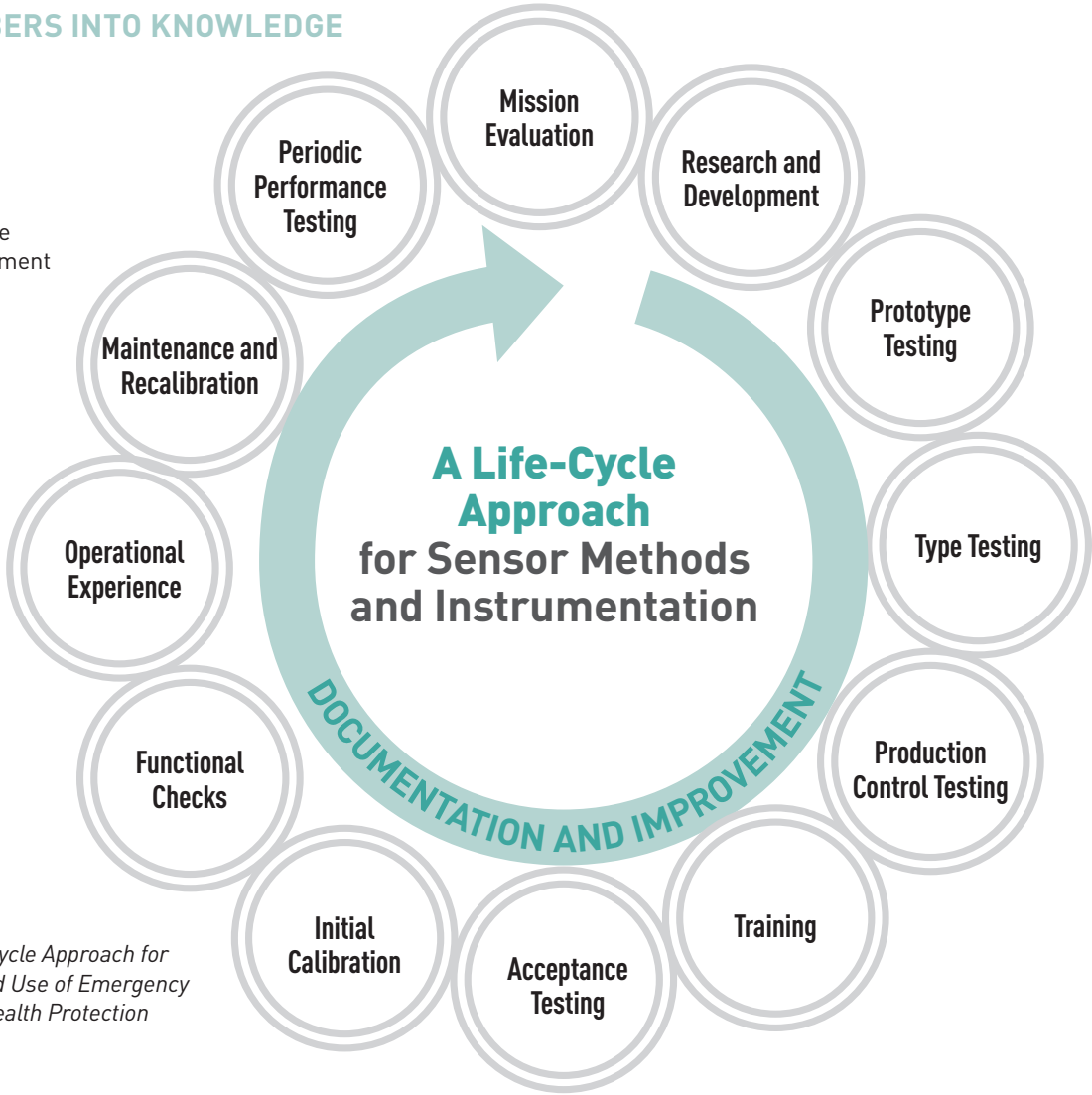

Figure 1. Life-cycle stages for development and application of sensors.

Source: *A Life-Cycle Approach for Development and Use of Emergency Response and Health Protection Instrumentation.*

development, validation, and use of methods, including considerations for the temporal and spatial deployment of monitors and the collection, quality assurance, and interpretation of associated data

- **control and confirm** the effective implementation of all aspects of the sensor life cycle to meet critical objectives from research to routine practice and regulatory compliance

SENSOR DEVELOPMENT AND USE

The recent launch of the NIOSH Center for Direct Reading and Sensor Technologies has created a home for NIOSH's longstanding work in the area of exposure assessment devices—work that has historically been performed across the Institute. In addition, the National Research Council's 2012 report *Exposure Sciences for the 21st Century* identifies direct-reading methods and monitors as important drivers for the future of the exposure sciences. And AIHA has indicated that it will prioritize research in sensor technologies as part of its new content portfolio (for more information, read Barry Graffeo's article "Six Priorities for IH Content Development" in the November issue at **http://bit.ly/graffeo1114**).

Both the NIOSH Center for Direct Reading and Sensor Technologies and the National Nanotechnology Initiative are applying a life-cycle approach to sensor development and use (see Figure 1). The life cycle encompasses twelve distinct phases throughout an instrument's journey through concept development, testing, training, maintenance, and evaluation.

Mission evaluation is the first step of the life cycle. This step serves the role of "problem formulation" as described in the National Research Council's 2009 publication *Science and Decisions: Advancing Risk Assessment*. Mission evaluation for sensors defines the objective and context of the measurement, including constraints such as size, cost, the user's abilities, and the setting (where and when the instrument will be used). What concentrations must candidate technologies be able to measure? What interferences must be dealt with? If there is an "incumbent" technology, why is it no longer deemed adequate? Clear thinking and analysis at the mission evaluation step make the science and business case for the instrument.

The **research and development** step investigates the ability of a specific technology or instrument design

to meet the mission requirements. If a new "lab-on-a-chip" technology has been demonstrated for one family of chemicals, can it be adapted for other applications? Is the technology likely to meet the required level of detection and the needed duration of performance? Understanding such requirements and opportunities can enable manufacturers to produce a sensor that is likely to meet the engineering requirements set in the mission evaluation step.

Prototype testing and **type testing** define and document the actual performance and limitations of the sensor. Input from field industrial hygienists during mission evaluation can specify realistic test requirements for these steps. The major difference between prototype testing and type testing is that type testing involves formal requirements for the sensor to meet performance or procedural specifications set by national or international standards. Few existing instruments or methods have formal ANSI, ASTM International, AIHA, governmental, or other testing procedures. Additional guidance is needed.

Production control testing ensures that manufactured sensors meet requirements for enhanced reliability and performance in accordance with documented procedures for quality management and assurance. Do all sensors and sensor features need to be tested at the manufacturing stage, or will testing a representative sample suffice?

Training is a crucial cross-cutting step conducted at each phase of the life cycle. This step is a consideration for both instrument developers and instrument users. Effective stakeholder engagement from field industrial hygienists and managers about the realities of instrument use and interpretation is essential to ensuring that training is both relevant and reliable.

An organization that is using a new instrument will conduct **acceptance testing** upon receipt of the instrument. Did it arrive in an undamaged state, with all appropriate documentation? Appropriate attention at the mission evaluation step should ensure that the details of instrument configuration and operation are compatible with the capabilities of those who will actually use the instrument.

Initial calibration may be performed as part of production control testing, but is generally performed after acceptance testing and before initial use of the instrument. How does the instrument work at the temperatures, pressures, humidity, and interferences of actual use? Are relevant calibration conditions or atmospheres available, affordable, and reliable?

Functional checks determine that an instrument is operational and capable of performing its intended function at the actual time of use. Many modern software and firmware packages have automatic diagnostics and self-checking features. Such features are especially valuable for single-use sensors. Unfortunately, many single-use sensors have limited or no self-checking capability and may require extensive quality assurance testing.

Operational experience involves careful tracking and evaluation of actual measurement experience to ensure proper instrument operation and interpretation of results. Are measurements consistent? Do concentrations for similar activities vary by time of year, possibly indicating unwanted influences of seasonal environmental conditions? How can the deployment of more sensors with faster response times improve both the control of hazards as well as the assessment of worker exposure and the characterization of cumulative risk for both workers and members of the public? How can brief temporal peaks or varying spatial concentrations be interpreted and responded to in a manner that reflects actual health and safety considerations? What advances in modeling and understanding will be required to translate "more numbers" into "more knowledge and wisdom"?

How will we validate and apply these rapidly evolving technologies, some of which have not yet been invented or even imagined?

Maintenance and calibration ensures that sensor components, including replacement parts or alterations, have been successfully integrated in the supply chain and are equivalent to those specified by the manufacturer. Modified sensors, in particular, would require additional performance tests and documentation prior to issuance for field use, unless the modifications are shown not to affect the instrument performance or intended use for regulatory purposes.

Periodic performance testing ensures that the sensor continues to provide adequate performance under intended and actual conditions of use, including the hazards' changing composition or concentrations and

associated exposures. Have process or environmental conditions changed in ways that can render the sensor unworkable or the measurement irrelevant?

PARTNERING FOR SENSOR SUCCESS

Our community must keep abreast of new sensor technology advancements and adapt those developments for the workplace. One of NIOSH's core missions is to establish and maintain leadership in all aspects of worker exposure assessment, including direct-reading and sensor technologies. The initial activities of the NIOSH Center for Direct Reading and Sensor Technologies focus on coordinating a national research agenda, developing guidance documents such as validation and performance characteristics, developing training protocols, and establishing partnerships to collaborate in the Center's activities.

A recent example of sensor-related work at NIOSH involved the evaluation of smartphone sound measurement apps. The potential to turn every smartphone into a sound-level meter or dosimeter can have tremendous influence on noise research and noise control in the workplace. The study, published in the *Journal of the Acoustical Society of America*, found that the quality of the smartphone microphone makes a significant difference in the accuracy of these apps. (Further details are available from the NIOSH Science Blog at **http://bit.ly/noiseapps**). NIOSH researchers have expanded the study to examine the performance of smartphone sound measurement apps with external microphones that comply with the OSHA minimum requirements for general purpose noise measurements (that is, microphones that are ANSI Type-2 compliant, or accurate within 2 dB). Results of the expanded study will be published shortly. In addition, NIOSH is developing its own sound measurement app and will make it available to the public.

Another recent sensor development example is related to concerns about respirable dust in mining. The personal dust monitor (PDM) is a real-time dust monitor developed by NIOSH over the last decade. Extensive NIOSH testing has demonstrated that the PDM is an accurate dust sampler, and MSHA has specified that the PDM will be used for compliance dust sampling in its new respirable dust regulations, which have just completed the final stages of the rulemaking process. The PDM is a success story for research-to-practice efforts and for sensor technology. Additional information about the PDM can be found at **http://bit.ly/respirabledust**.

An exciting current partnership funded through the NIOSH extramural grant program is development at the University of Michigan of a belt-worn monitor to detect volatile organic compounds. Current extramural research grants in the area of sensors include biosensors for different chemical exposures, wearable monitors for a variety of work sites, monitors that can be used in exposure characterization for ultrafine and nanoparticles, and noise dosimeters. Information about funding opportunities provided by the NIOSH Grants Program can be found at **http://bit.ly/nioshgrants**.

We invite you to partner with us to identify gaps in our knowledge and to create research strategies for reliable development, validation, use, and interpretation of direct-reading and sensor technologies. These technologies can better characterize cumulative risks and empower employers and workers to help reduce harmful exposures and become active partners in preventing occupational illnesses and injuries.

RESOURCES

Journal of the Acoustical Society of America: "Evaluation of smartphone sound measurement applications," **http://bit.ly/smartphonesound** (April 2014).

Medical Physics Publishing: *A Life-Cycle Approach for Development and Use of Emergency Response and Health Protection Instrumentation, in Public Protection from Nuclear, Chemical, and Biological Terrorism* (2004).

National Academies: *Exposure Science in the 21st Century* (2012).

National Nanomanufacturing Network: *Nanoinformatics 2020 Roadmap*, **http://eprints.internano.org/607/** (2011).

National Nanotechnology Coordination Office: "Nanotechnology for Sensors and Sensors for Nanotechnology: Improving and Protecting Health, Safety, and the Environment," **www.nano.gov/node/847** (2012).

National Research Council: *Science and Decisions:* Advancing Risk Assessment (2009).

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Additional information about the Center can be found at ***www.cdc.gov/niosh/topics/drst***.

Upcoming Webinar

Interested in learning more about sensor technologies?

Register for AIHA's upcoming webinar

→ **Turning Numbers into Knowledge: Sensors for Safety, Health, Well-being, and Productivity**

Friday, April 24

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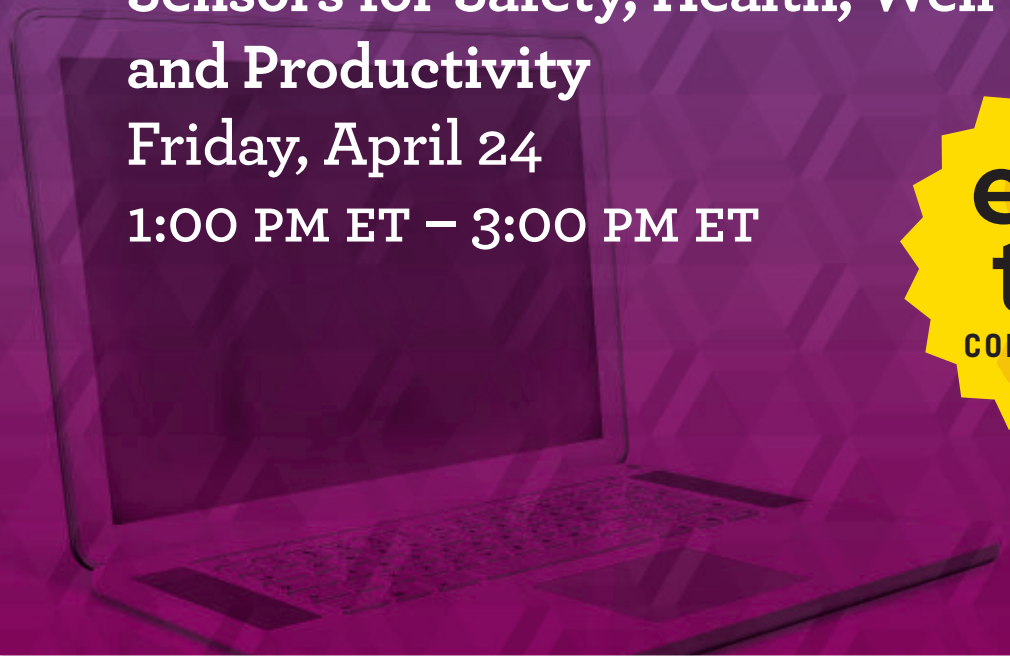

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Building Bodies of Knowledge in Industrial Hygiene

BY ED RUTKOWSKI

In the early 1980s, when Steve Jahn was in graduate school at the University of Cincinnati, he had an idea of what his career in industrial hygiene would be like: he would be the one with knowledge of how to protect workers, and management would graciously defer to his judgment.

"When I got out of school, I was looking for a company that was going to call me the expert," Jahn recalls. "They would say, 'Jahn, what do you think?' and I'd give them an answer. I would be the smart guy in the room, and off we'd go."

That's not how it works, of course. Jahn still knows something about protecting workers, but upper managers don't simply accept his recommendations. They're smart, too, and one of the many things they're responsible for is the bottom line. And if one of Jahn's interventions costs thousands of dollars, they want to know why it needs to be done that way. Could it be done differently—more cheaply, but just as effectively? And if it can't, why not?

Many industrial hygienists are familiar with this scenario. No matter your experience and educational background, establishing your credibility is vital, and persuasion is part of the job. And when a manager asks, "Why are you doing it that way?" it would be very persuasive to reference an official, independently developed explanation of competent industrial hygiene practice.

Why? That's why.

There are good reasons why such a reference doesn't exist. The profession is too broad, the roles IHs play too various. Differences between industries and practitioners' experiences can be significant. A thirty-year veteran CIH and exposure assessment expert like Jahn needs to know different things than a new graduate.

But a series of new AIHA-led projects is intended to fill those gaps. Teams of volunteers working on these bodies of knowledge, or BoKs, are attempting to define what IHs need to know, no matter their industry, specialty, education level, or career stage.

A PIECEMEAL APPROACH

A body of knowledge comprises the concepts, terms, and activities that make up a professional domain. "Think of it as a complete set of learning objectives," says Mary Ann Latko, AIHA's managing director for Scientific and Technical Initiatives, which is supporting the BoK effort.

Once completed, the BoKs will occupy a central position in AIHA. They will be "the starting point from which we will decide what education we need to build, whether it's PDCs or books or webinars," Latko says. "Maybe there would be a registry. We'd see if there's a need for it both from a technical standpoint and from the marketplace."

Often, a BoK is accompanied by an annotated bibliography of resources mapped to specific skills or areas of knowledge. Common features of BoKs include lists of applicable standards and regulations, rules for practicing the profession, and options for professional development and continuing education.

Building a single body of knowledge for the entirety of the profession would be a Herculean task, so AIHA is focusing on smaller areas of practice. BoKs are currently under development for exposure assessment, respiratory protection program administration, and field use of multigas meters and photo-ionization detectors. Latko compares this piecemeal approach to the way the American Board of Industrial Hygiene (ABIH) has structured the Certified Industrial Hygienist credential around a series of rubrics, or subject areas. The main difference, Latko says, is that the CIH rubrics concentrate on the highest level of industrial hygiene practice, while the BoKs may address different levels of practitioner skill, what we might call apprentice, journeyman, and master levels.

STARTING FROM STRAW

The difficulty of the undertaking is not lost on Lisa Greene, who is working with AIHA on a contract basis to help develop the BoKs. "It's really a big task," she says, "and the strategy is to take small bites of a large apple."

A director of Microanalytical Sciences at RTI International in Research Triangle Park, N.C., Greene has worked with AIHA for many years through RTI's role as a contractor to the AIHA Proficiency Analytical Testing (PAT) Programs, LLC. RTI is a not-for-profit research organization whose researchers provide training and technical services to governments and businesses in more than 70 countries. For AIHA's BoKs, RTI has hosted meetings of each project's core team of volunteers. In addition to facilitating those face-to-face meetings, Greene has led the teams through several virtual exercises where discussion was managed through a collaborative Web-based tool supported by RTI's Center for Forensic Sciences.

The core teams comprise experts from every corner of the profession, including some whose training, like Greene's, is outside of traditional industrial hygiene. Some team members are toxicologists; others represent first responders and firefighters. Some are responsible for using equipment or implementing standards. Equipment manufacturers are also represented. And there are, of course, a variety of CIHs: some who are in daily practice, some in management, some in consulting.

These diverse groups needed to find some common ground, and they needed a starting point. For this purpose, Greene and Jahn researched the three focus areas and developed "straw-men" BoKs—sample lists of the tasks, skills, and knowledge necessary for IHs at different levels of expertise. In creating the straw men, Jahn drew on extensive experience relevant to all three BoKs: he has formerly served as IH manager responsible for a respiratory protection program that involved all classes of respirators and issued 50,000 per year at its high point, and was responsible for a full suite of field sampling instrumentation supporting 35 IH and technician staff.

> "I anticipate that there will be a number of these [BoKs] that would serve a hygienist who is tapped on the shoulder and told, 'You know, we're going to need you to tackle X for us.'"

"The straw men are out there for the subject matter experts to rip apart and to say, 'This doesn't make sense' and 'This is not how it would be best presented in this

focused area of industrial hygiene,'" Greene explains. She credits the relative anonymity of the virtual meetings for helping spur discussion; some of the least experienced team members have made the most incisive and helpful contributions.

Greene finds that her status as a relative newcomer to IH has helped her in her role as facilitator.

"It's very good that I am technical," Greene says. "But it's also good that I am not an industrial hygienist by education or training or professional practice, because I am able to look at [the BoK] as a novice would look at it, and see whether it makes sense. Because by their very expertise, the subject matter experts—sometimes things are so obvious to them that they might use jargon or acronyms that are not universal, or they might speak from their frame of reference. Maybe they've had a long career at a DOE facility, and it doesn't translate to every other facility. Or they may know the 'why' of an action so well that it never occurs to them that you need to include that in the task statement."

FROM A TO BOK

Once completed, the BoKs will have many practical applications. First, they will help master-level IHs persuasively answer the "why are you doing it that way" question.

"These bodies of knowledge are a foundation for a hygienist to say, 'Well, this is how it's done,'" Jahn says. He notes that AIHA's status as an independent organization carries weight with employers: "I'm not [the one] saying I'm competent. These external people say I'm competent."

Entry-level and mid-level hygienists can refer to the BoKs to learn how to get from point A to point B in their careers. Jahn uses exposure assessment as an example of how a BoK can help in professional development. "You might be right out of school, and you may or may not have learned certain things about how to conduct a baseline characterization, write a good report, collect a sample, et cetera. You may have that same trouble at different points in your career," he says. "I anticipate that there will be a number of these [BoKs] that would serve a hygienist who is tapped on the shoulder and told, 'You know, we're going to need you to tackle X for us.'"

Greene notes that changes in work force demographics and the larger economy are causing an increasing number of industrial hygienists to switch roles. An IH who spent most of her career in management may find herself back in daily practice as she nears retirement. Another IH could suddenly find himself performing the tasks of a team member who left the company and hasn't been replaced. The BoKs can help these professionals identify what they need to know and where they can go to learn it.

To explain the benefits of the BoKs, Greene uses her own company as an example. "We do all types of technical research in the physical sciences and life sciences," she says. "Our own industrial hygienists are faced with a lot of different exposure scenarios. And they're dealing with labs that handle radioactive materials, labs that handle pharmaceutical compounds, labs that handle asbestos and other toxic minerals, labs that have radiation-producing equipment. They're also dealing with people in an office environment.

"Having the bodies of knowledge, especially organized, as they will be, at the focus areas of industrial hygiene practice—I think that is a great tool, because I can't think of many industrial hygienists who have a more varied day-to-day responsibility than our own occupational health people."

Managers, too, will be able to use the BoKs to determine which competencies they can expect from their employees at different levels of experience or responsibility, or, when hiring, to develop descriptions for open positions. This is a benefit that AIHA Board member Donna Heidel, the industrial hygiene practice leader with Bureau Veritas, finds especially appealing.

"I need to continually look at the industrial hygienists that we have on our staff, make sure that their supervisors can accurately assess their abilities and skillsets, and then prepare them for activities in the field or even help them establish a development plan," says Heidel, who is leading AIHA's exposure assessment BoK. "So [the BoK] will support our talent recruitment. It will also give us a method for evaluating the skills in our existing staff. And it also will also help us say, when our IH staff members are ready for development to that next level, 'Here are the courses you need to take' or 'Here's the additional knowledge you need to gain,' 'Here are the skills that you need to show us competency in for us to be able to say, Yes, you're ready for that next level.'

"It's really wonderful because, quite frankly, I have my own little body of knowledge in my own company here, but I'd love to be able to have one that's developed by the American Industrial Hygiene Association."

ED RUTKOWSKI is editor in chief of *The Synergist*. He can be reached at (703) 846-0734 or **erutkowski@aiha.org**.

Hidden Hazards

Protecting Wastewater Treatment Workers from Endotoxins and Hepatitis A

BY BRADLEY A. PRILL

Wastewater treatment plant workers face a multitude of obvious hazards, including drowning; slips, trips or falls; confined spaces; inadvertent exposure to energized equipment; and exposure to hazardous chemicals or gases. Still other hazards aren't visible to the naked eye. For occupations that have potential to come into contact with human feces, illnesses associated with bacteria, viruses, and parasites are a constant threat. As a precaution, wastewater treatment plant workers use personal protective equipment (PPE), wash their hands frequently, and get vaccinations for Hepatitis A and tetanus/diphtheria. This has been the routine practice.

The solid waste hazards are well known in the wastewater treatment industry. But it appears that few extensive studies have been conducted on potential airborne and surface hazards. This article describes work my company, Industrial Safety Solutions, completed at a California wastewater plant in response to the client's request to assess airborne and surface Hepatitis A (HAV) and bacteria (endotoxins) throughout the treatment facility. The project yielded several insights about best practices for protecting workers at wastewater plants.

WASTEWATER TREATMENT PROCESS

The plant processes approximately eight million gallons of wastewater a day from homes and businesses. It uses a tertiary treatment with a combination of physical, chemical and biological processes to remove contaminants. Sludge, or biosolids, is the unavoidable end-product of the wastewater process.

Primary treatment involves screening, clarification, and sedimentation. This is achieved through use of a series of screens and grit-removal clarifiers referred to as "headworks." Secondary treatment removes dissolved and suspended biological matter by using indigenous, waterborne microorganisms in a managed habitat, such as aeration tanks and settling ponds. Tertiary treatment offers enhanced clarity, filtration, and disinfection through the use of reverse osmosis or media and gravity filtration. Sludge is dewatered in the biosolids building in drying beds and large centrifuges. The end product can be recycled as fertilizer. The treated water leaves the wastewater plant in purple pipes as recycled water to irrigate parks, golf courses, school fields, and cemeteries.

At the time of our study, HAV air monitoring had not been conducted. In collaboration with the analytical laboratory, we developed a new technique for conducting these measurements. The monitoring was intended to determine whether a PPE hazard assessment and current administrative control procedures, including vaccinations, were adequate to protect employees from possible exposures. There were two key questions we sought to answer: had HAV and bacteria become airborne, and could HAV be found on surfaces throughout the facility?

SAMPLING FOR BACTERIA (ENDOTOXINS)

According to the *Textbook of Bacteriology*, the term "endotoxin" applies to any cell-associated bacterial toxin. It properly refers to the lipopolysaccharide complex and can be associated with the outer membrane of Gram-negative pathogens such as *Escherichia coli*, *Salmonella*, *Shigella*, *Pseudomonas*, *Neisseria*, *Haemophilus influenzae*, *Bordetella pertussis*, and *Vibrio cholera*. ("Gram-negative" bacteria are those that can be identified via the Gram staining method of bacteria differentiation. Gram stain tests target the cell walls of bacteria.) Many of these Gram-negative bacteria have been associated with foodborne illness and may cause diarrhea, fever, cramps, vomiting, headaches, weakness, or loss of appetite. In severe cases, hospitalization may be necessary.

Our approach collected bacteria (endotoxin) samples using sterile Endotoxin cassettes, which were analyzed in the laboratory by kinetic chromogenic method analysis. The results were provided in endotoxin units (EU). Personal and area samples were collected from the aeration base, clarifier, equalization channel (EQ), ultraviolet channel (UV), outside the biosolids building, and drying beds. Personal air samples were collected for the duration of the employees' shift. Area samples were collected on catwalks or platforms above the area of concern and simulated the amount of time workers typically spend in the location.

SAMPLING FOR HEPATITIS A

The Centers for Disease Control and Prevention (CDC) states that HAV is an acute, contagious liver disease that can range in severity from a mild illness lasting a few weeks to a severe illness lasting several months with an incubation period of approximately 28 days. HAV replicates in the liver and is shed in high concentrations in feces from two weeks before to one week after the onset of clinical illness. Hepatitis A is usually spread when a person ingests fecal matter from contact with objects, food, or

Table 1. Recommended Exposure Guidelines for Endotoxin

Disease	Concentration (ng/m^3)	Approximate conversion to endotoxin units (EU/m^3)
Airway inflammation	10	100
Systemic effects	100	1000
Toxic pneumonitis	200	2000

Source: EMLab P&K (http://bit.ly/labpk_endotoxins)

drinks contaminated by the feces, or stool, of an infected person. The infection is considered a self-limited disease and does not result in chronic infection or chronic liver disease.

HAV area air samples were collected on catwalks or platforms above working areas including the biosolids building, aeration tanks, clarifiers, inlet channels, and headworks. Wipe samples were collected in areas routinely used by employees including door and bin handles along with steering wheels. The laboratory analyzed the samples by molecular real-time polymerase chain reaction (RTPCR). Results were provided as negative or positive.

REGULATORY REQUIREMENTS AND BEST PRACTICES

Currently, no regulatory requirements or OSHA permissible exposure limits (PELs) exist for HAV or endotoxins. In addition, ACGIH has not set any threshold limit values (TLVs) for HAV or bacteria (endotoxin). As a reference for endotoxin, a paper that appeared in the *International Journal of Occupational and Environmental Health* recommended a "no-effect level" based on field studies. These levels are presented in Table 1.

The survey described in this article was in no way able to determine whether the HAV and bacteria (endotoxins) were viable or able to propagate within the human body. All wipe samples and more than half of the area air samples were positive for HAV, demonstrating that HAV is present throughout the plant and on commonly used surfaces. All endotoxin results were below the level referred to in Table 1 as potentially causing airway inflammation.

Because HAV and endotoxins were found at the wastewater plant, it is prudent to focus on the prevention of illness. Currently, CDC recommendations do not support the Hepatitis A vaccination for sewage workers. They recommend only the tetanus-diphtheria immunization. Hand washing and personal hygiene must be used in these facilities.

At a minimum, workers and visitors should use nitrile gloves. When assigned tasks have the potential for contact with human waste, employees should consider double gloving with nitrile on the interior and thicker rubber gloves on the exterior. It is important to consider dexterity when selecting gloves. Employees typically won't wear gloves that make work tasks difficult to perform. Handwashing stations with automatic sensors or foot pedals should be placed throughout the plant. Rigorous handwashing before eating, drinking, or smoking is recommended. A separate room away from the work area should be available for employee breaks. Handwashing and sanitizing stations should be made available for visitors.

Because some pathogens can be absorbed by mucous membranes, face shields worn with safety glasses or goggles can help prevent splashes to the eyes, mouth, and nose. At a minimum, respiratory protection such as N95 filtering facepieces should be used where biosolids are aerosolized, as in the aeration and digestion process. In these facilities, workers walk over open tanks on catwalks. Hardhats and hearing protection will most likely be needed throughout the plant.

Steel-toed boots that are slip- and puncture-resistant will help protect feet. Employees should be encouraged to change shoes before leaving work and not to wear soiled clothes home. This can be challenging if the facility does not have showers. Installation of showers should be considered in upgrades or new construction of wastewater plants. If soiled clothes do go home, they should be washed separately from family clothes, and each load should be washed twice. Cleaning the washer tub with bleach or commercial product between loads is also recommended.

Providing employees with first-aid kits containing bandages and finger cots may encourage them to cover cuts to help prevent illnesses. The first-aid kits will need to be restocked on a routine basis. Employees should be instructed on proper use of their PPE, including disinfection and storage, as well as the limitations of PPE. Lastly, employees need to know how to report safety concerns. Addressing concerns up front will help prevent injuries and provide a platform for educating front-line workers.

HIDDEN HAZARDS

This study demonstrated that HAV and endotoxins are present in the wastewater treatment facility environment. HAV was found on both surfaces and in the air, and endotoxins were found in the air. Further monitoring and research is needed to truly assess the potential for infection of HAV and illnesses related to endotoxins, but based on the results of this study, it appears prudent to offer HAV vaccinations to wastewater employees. S

BRADLEY A. PRILL, CIH, CSP, is president, Industrial Safety Professionals, Inc., in Temecula, Calif. He can be reached at **brad.prill@indspi.com** or (951) 217-3053.

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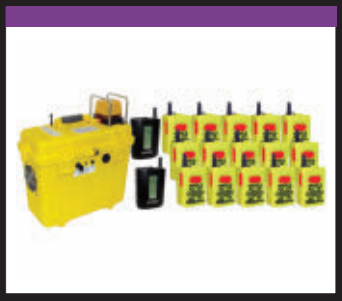

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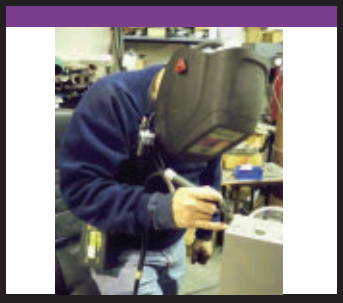

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ATTEND AIHCE 2015, SURROUNDED BY MOUNTAINS

Registration is now open for AIHce, the conference that helps industrial hygiene and occupational and environmental health and safety professionals address workplace challenges, work more effectively, drive revenue, and, most importantly, protect worker health. AIHce 2015 will be held in Salt Lake City, Utah, June 1–4, with preconference education taking place May 30–31. Join nearly 5,000 colleagues at the Salt Palace Convention Center for world-class education and networking opportunities. For more information or to register, visit **www.aihce2015.org**.

Meet the Opening Session Speaker. On Monday, June 1, Alison Levine, team captain of the first American women's Mt. Everest expedition, will present the AIHce 2015 Opening General Session, "On the Edge: The Art of High-Impact Leadership." Drawing from her experience leading a team to the summit of the world's highest mountain, Levine will discuss how leadership principles in the world of extreme adventure apply to today's business and workplace environments.

PAL Program. The Personal AIHce Liaison (PAL) Program made its debut at AIHce 2014 with the goal of helping first-time attendees get the most out of the conference. Back by popular demand, the PAL Program matches "first timers"—new professional attendees and students—with seasoned AIHce attendees, or "PALs." Interested attendees can sign up to participate when they register for the conference. Learn more at **http://bit.ly/2015palprogram**.

AIHce 2015 On Demand. Concerned about missing an important session at AIHce because you can't be two places at once? AIHce On Demand allows you to take advantage of all the conference has to offer. Browse the expo, attend committee meetings, and network with colleagues at social events without worrying about missing out on education sessions. After the conference is over, you will receive online access to recorded presentations that can be viewed on your computer, tablet, or smartphone. AIHce On Demand is available for purchase with conference registration. Learn more at **http://bit.ly/aihce2015ondemand**.

Virtual conference. Can't make it to Salt Lake City? The AIHce Virtual Conference provides valuable education and inspiring keynotes without the need to travel. Gather a team and learn together, or access the virtual conference individually. Virtual AIHce 2015 registration includes a multitrack session broadcast; opportunities to submit questions for presenters and interact with other virtual participants via chat; and post-conference access to session recordings. Learn more at **http://bit.ly/aihce2015virtual**.

Call for AIHce "Ignite" Presenters

AIHce is once again offering its own version of "Ignite." Ignite sessions—five-minute presentations where speakers share their professional and personal passions using 20 slides that auto-advance every 15 seconds—originated in the high-technology profession and has spread worldwide.

AIHA is now accepting applications for this year's Ignite presentations. The submission deadline is Monday, March 30. Don't delay: based on the past success of this format, AIHA is expecting a great deal of entries. For more information, visit **http://bit.ly/aihce2015ignite**.

Need ideas? View past AIHce Ignite sessions on YouTube at **http://bit.ly/aihceignite**.

Synergist Weekly to Replace *E-ssential Connection* Newsletter

The *Synergist* team is excited to announce that the weekly e-newsletter *AIHA E-ssential Connection* will re-launch as *The Synergist Weekly* later this month. *The Synergist Weekly* will be delivered to AIHA members every Wednesday, and will feature timely news from around the industry and AIHA news of interest, and will showcase content from the latest digital edition of *The Synergist*, including exclusive online-only content. The new *Synergist Weekly* has been designed to more closely integrate with the *Synergist* magazine, and readers can look forward to streamlined, high-quality information that comes with *The Synergist* brand.

The Synergist Weekly will be delivered from a new e-mail address: **email@aiha.org.** To ensure that you receive *The Synergist Weekly* and other e-mail communication from AIHA, please add the e-mail address **email@aiha.org** to your "safe senders" list.

Please send feedback or questions about the weekly e-newsletter to the AIHA editorial staff at **synergist@aiha.org**.

In Memoriam

Elden C. Cheatham, CIH, CSP, passed away at his home in Del City, Okla., on Dec. 23, 2014, at the age of 65. Cheatham was the safety officer for the OK-1 Disaster Medical Assistance Team, a federal asset under the National Disaster Medical System. He served as an officer or volunteer for the Oklahoma section of AIHA beginning in 2006, and was the South-Central Regional Representative for AIHA since 2010. Read more at **http://bit.ly/eldencheatham**.

Longtime AIHA member **Stephen C. Davis, CIH, CSP,** passed away in January. Davis was co-founder and managing member of the building and environmental forensics and consulting firm LaCroix Davis LLC, and was president-elect of the Yuma Pacific Southwest section of AIHA. He is survived by his children and wife of 37 years, Chris Laszcz-Davis, MS, CIH, current AIHA Board member.

ABIH Celebrates 55th Year in 2015

AIHA congratulates the American Board of Industrial Hygiene (ABIH) as it celebrates its 55th anniversary of service to the industrial hygiene profession this year. ABIH administers the internationally recognized Certified Industrial Hygienist (CIH) credential, which is a means to objectively assess and measure the professional knowledge and understanding of practitioners engaged in industrial hygiene. According to a January press release, more than 6,700 individuals are certified to use the CIH designation.

"We are proud to celebrate 55 years of service to those in the industrial hygiene profession and all of the government agencies, institutions, and companies that rely on CIHs worldwide," said Tracy Parsons, CIH, administrative program manager at ABIH. "Our work continues to improve the health and safety of millions of workers and local communities by supporting the industrial hygiene community in our role of administering the CIH program."

For more information, visit **www.abih.org**.

JOEH's New Look

Subscribers to the print edition of the *Journal of Occupational and Environmental Hygiene* are finding a new-look version of the journal in their mailboxes this year. The 2015 issues feature a new cover design that combines the colors of AIHA and ACGIH. The new cover is the first element of JOEH to be redesigned since its launch in 2004.

JOEH is a joint publication of AIHA and ACGIH. Digital access to JOEH and its predecessors, including the *AIHA Journal* and *Applied Occupational and Environmental Hygiene*, is a benefit of AIHA membership. Members can purchase print subscriptions for $66 by contacting AIHA Customer Service at (703) 849-8888 or **infonet@aiha.org**.

Dates and Deadlines

MARCH 10
AIHA webinar: Developing Respirator Cartridge Change Schedules. Register at **http://bit.ly/march10course**.

MARCH 23–26
Fundamentals of Industrial Hygiene in Columbus, Ohio. Register at **http://bit.ly/fihcourse**.

MARCH 28
Deadline for 2015 Golden Seed Award nominations. For more information, contact Thursa La at **tla@aiha.org**.

APRIL 20–24
Comprehensive Industrial Hygiene Review in Ann Arbor, Mich. Register at **http://bit.ly/cihreviewcourse**.

MAY 30–JUNE 4
AIHce 2015 (co-located with Stewardship 2015) in Salt Lake City, Utah. Visit **www.aihce2015.org**.

OCTOBER 24–28
AIHA Fall Conference in Orlando, Fla. Visit **www.aihafallconference.org** for more information.

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

AIHA® Accolades

The University of Illinois at Chicago School of Public Health honored **Barb Epstien, MPH, CIH**, with an Environmental and Occupational Health Sciences Alumni Achievement Award for outstanding professional achievement and contributions to the public health field. Epstien, an AIHA Fellow, recently joined Forensic Analytical Consulting Services, Inc. in Portland, Ore., as a senior project manager.

AIHA Board Approves Report on VOCs for LEED IAQ Sampling

In January, the AIHA Board of Directors approved a draft report by the AIHA USGBC Volatile Organic Compound (VOC) Team that focuses on VOCs for U.S. Green Building Council (USGBC) Leadership in Energy and Environmental Design (LEED) version 4 post-construction indoor air quality (IAQ) sampling. A group of AIHA members participated on the project team, with Donald Weekes, CIH, CSP, as chair. The report is available at **http://bit.ly/ieqcommittee**.

Corrections

Due to an editing error, the professional designations for **Deborah Nelson, PhD, CIH,** and **Lindsay Cook, CIH, CSP,** were omitted from the AIHA Candidates' Forum in the print edition of the February issue. The digital edition has been corrected.

CHRONIC KIDNEY DISEASE IN SRI LANKA

As reported by the Associated Press on Jan. 18, a large and growing number of Sri Lankans, particularly farmers, are falling ill to a mysterious disease referred to in medical literature as "chronic kidney disease of uncertain etiology," or CKDu. Symptoms usually appear in the late stages of the disease and include fatigue, panting, nausea, lack of appetite, and anemia. People suffering from CKDu gradually lose renal function, requiring dialysis.

Unlike CKD, which is typically caused by diabetes and hypertension, no strong evidence exists for a single cause of CKDu. Possible causes include chronic dehydration and exposure to agricultural chemicals. Other countries where CKDu is prevalent include El Salvador, Nicaragua, Costa Rica, Egypt, and India. In Sri Lanka, where CKDu was first identified in the 1990s, the affected population is generally between 30 and 60 years of age and lives primarily in the dry regions of the country.

4

Estimated percentage of Sri Lanka's public health budget that is spent on renal disease.

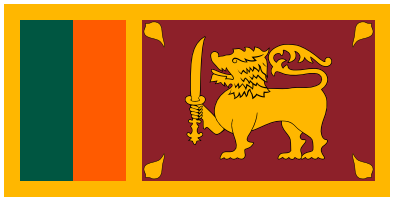
15

Percentage of the population aged 15–70 years in Sri Lanka's North Central and Uva provinces who have CKDu.

Total number of dialysis machines in Sri Lanka. Although dialysis is supposed to be given three times a week, Sri Lankan patients receive it only twice due to the machines' scarcity.

2,000

Estimated number of new patients in Sri Lanka per year who need dialysis.



40,000 – 70,000

Estimated number of people in Sri Lanka affected by CKDu.

20,000 Estimated number of Sri Lankans who have died from CKDu.

SOURCES

Associated Press, "Mystery Kidney Disease Killing Sri Lankan Farmers," **http://bit.ly/nytimes-ckdu**

RTI International, "Chronic Kidney Disease of Unknown Etiology in Sri Lanka: Quest for Understanding and Global Implications," **http://bit.ly/ckdu-rti**

MEDICC Review, "Chronic Kidney Disease of Unknown Etiology in Agricultural Communities," **http://bit.ly/medicc-ckdu**

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