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EHS Lab Chatter

UNE UNIVERSITY OF NEW ENGLAND

INNOVATION FOR A HEALTHIER PLANET

EHS ENVIRONMENTAL HEALTH AND SAFETY

Contents

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Safety Spotlight

Personal Protective Equipment Basics
by Jessica Tyre

Personal Protective Equipment (PPE) is your last line of defense after you have exhausted all engineering controls and administrative controls. All labs should know what their minimum PPE requirements are based on lab activities. All lab areas must require long pants and closed shoes to be worn at all times. The only exception to this is certain Biology and Marine Science field labs with no biological or chemical hazards present. A majority of labs on campus must also stock protective gloves and safety goggles/glasses. Lab coats or gowns should be worn in all research areas where biological or chemical hazards are part of normal lab operations. Teaching labs should always have disposable gowns and booties on hand in case students are not following proper lab dress code protocols.

The most important part of selecting PPE is doing a hazard assessment to understand and evaluate all the potential risks and exposures in a specific lab area. Lab activities may change daily so hazard assessments may be part of a lab's daily routine. If the lab is bringing in new or different chemicals a Safety Data Sheet must always be consulted. This document will provide the appropriate recommendations for PPE.

If hearing protection is needed, such as ear plugs or headphones, due to lab equipment with high decibel levels, the employee must enter the UNE Hearing Conservation Program. EHS can monitor equipment for decibel levels to determine if hearing protection is required. Once entered in the Hearing Conservation Program, the employee completes employer provided annual hearing tests and training. (OSHA standard 29CFR1910.95)

If respiratory protection is needed, such as a N95 HEPA mask, a half face respirator, an PAPR, etc., the employee is required to enter the UNE Respiratory Protection Program. In this program the employee must fill out an OSHA medical questionnaire which is submitted to HR to pass along to a physician for review. After the employee is medically cleared, the EHS department then aids in respirator training, selection, and fit testing. (OSHA standard 29CFR1910.134)

Web-Based Lab Safety Inspections

By Ronnie Souza

Starting in November EHS will switch to a web-based app, called iAuditor, to conduct EHS lab safety inspections semi-annually on both campuses. The iAuditor app allows EHS to perform lab safety inspections using our phones and other smart devices, eliminating several pages of paper inspection checklists.

At the completion of the Lab Safety Inspection, iAuditor automatically generates a report that lab staff can receive before we even leave the inspection location. iAuditor features include personalized free form notes, photos with annotations, action items, metrics that track inspection frequency, and performance detailed inspection reports.

The new reports will be a little different in format but will still be very easy to read and understand. You will see responses and notes for each question on the checklist. The report will also highlight any items that need corrective action at the beginning of the document. If you have any questions after reviewing the new reports you can always reach out to EHS for clarification.

This new program will allow for lab inspections to flow more smoothly and efficiently, remove the step of EHS having to type reports after the inspection, and log metrics for EHS and the lab community to review their inspection data. Please see the next two pages for examples of the "dashboard" for the app and a sample page of the report the app generates.

Each question is outlined in the new report with a yes/no answer and may have notes under the question that we generate during the visit.

Are the food and beverage rules observed? (Such as food and drinks are not stored in the lab area).

Yes

Are the ceiling tiles in place and free of any water leaks, or stains, etc.?

No

Notes

Some old stained tiles, EHS to place work order.

Is the garbage free of broken glass or hazardous materials? Are broken glass boxes being utilized?

Yes

Are doors closed, not propped, and free from obstruction?

Yes

Are bench tops and storage areas uncluttered and orderly?

Yes

Are aisles and exits free from obstruction?

Yes

Are Exit signs illuminated and unobstructed?

N/A

Are heavy objects stored on lower shelves?

Yes

Are there means available to reach items above shoulder level safely, such as a step stool?

Yes

Is there an 18" clearance from sprinkler heads? Is there a 24" clearance when there are no sprinkler heads?

N/A

Are the interiors of refrigerators and freezers sound and free of chemical spills or contamination and with containers tightly closed?

Yes

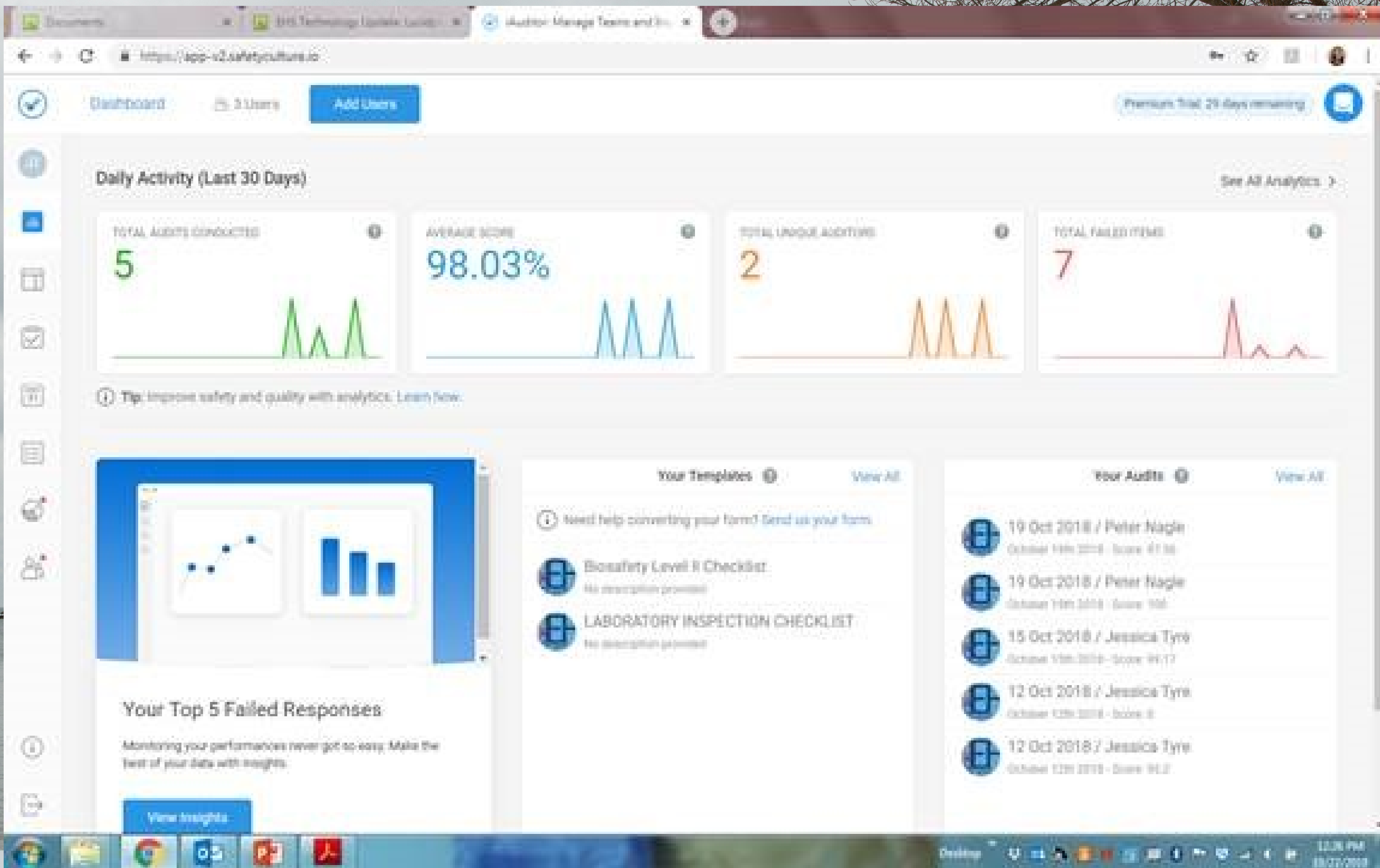
Are refrigerators and freezers labeled? "Flammables", "explosion proof" or "Not for Food Storage"?

Yes

Do fridges/freezers have EHS contact cards on them that contain PI names/numbers and hazard information?

Yes

A snapshot of what we see on our "dashboard" in the app. We can look at metrics several different ways, see what inspection templates we have, and look at audits we have completed.



Making Safety an Inseparable Part of All Lab Activities

By providing guidance, suggestions, and recommendations specific to laboratory safety here, our goal is to help like-minded managers strengthen the safety culture in their labs.

By Vince McLeod | June 04, 2018 via Lab Manager Magazine

A rash of recent devastating incidents, including fatalities, has rekindled the need for a stronger safety culture, especially in laboratories.

To be fair, laboratories are not alone when it comes to such incidents. And it can certainly be argued that accidents in large manufacturing and production facilities have been more catastrophic, both in terms of infrastructure damages, injuries, and loss of life. But, by providing guidance, suggestions, and recommendations specific to laboratory safety here, our goal is to help like-minded managers strengthen the safety culture in their labs. In fact, we want to encourage you to “nurture basic attitudes and habits of prudent behavior so that safety is a valued and inseparable part of all laboratory activities.”1

According to a recent OSHA publication, there are more than 500,000 workers employed in laboratories in the United States.2 As lab managers, we know that lab workers are potentially exposed to myriad hazards: chemical, biological, physical, radioactive, and other types. In addition, repetitive tasks of production labs and high-volume analytical labs, as well as the challenges of handling research animals, can also lead to musculoskeletal disorders.

For our lab employees to perform their tasks in a safe manner, they need to understand the potential hazards associated with the work. The ability to accurately identify and assess these lab hazards must be learned through training and encouraged by all levels of management. This is the core of developing a strong culture of safety.

A stronger safety culture is needed: We opened this article with a reference to recent incidents that have resulted in severe injury, extensive facility damage, and even fatalities. Fortunately, private organizations and governmental agencies such as the American Chemical Society (ACS) and Chemical Safety Board (CSB) have stepped up and conducted in depth analyses of these events and produced excellent reports calling for stronger safety cultures and better management programs. Here are a few examples of those incidents:

January 2010, Texas Tech University3: Two graduate students conducting research on explosive compounds were synthesizing and testing a new compound, a nickel hydrazine perchlorate derivative. The CSB found that although initially the compound was made in small batches of 300 milligrams, the students decided to scale up the production to 10 grams to make one batch of material for all their testing. During manipulation of the material by the senior team member, the material detonated. The student was severely injured, losing three fingers of his left hand, suffering a perforation of his eye, and sustaining cuts and burns to the rest of his body.

June 2010 University of Missouri(4): The biochemistry lab conducting research on anaerobic bacteria initially purged the chamber with nitrogen and then introduced small amounts of pure hydrogen to remove any remaining oxygen by combining to form water. Apparently, the lab's student researchers inadvertently left open the valve for the hydrogen cylinder. When the hydrogen reached an explosive level, it was ignited by a source in the chamber, according to investigators. Four researchers were injured and the lab was destroyed.

December 2008, University of California, Los Angeles(5) : Almost everyone has heard about this incident at UCLA. An experienced research associate was planning to upscale a reaction using tertbutyllithium (t-BuLi), a pyrophoric material. For reasons unknown, she was wearing only nitrile gloves, safety glasses, and street clothes, including a synthetic sweater. No lab coat was used. The syringe and plunger separated during the filling of the syringe and the t-BuLi and pentane spilled onto her hands and sweater, which immediately burst into flames. She sustained third-degree burns on her hands and second-degree burns on her arms and abdomen, covering about 40% of her body. After 18 days in a specialized burn center, her organs began to fail and she succumbed to her injuries.

The investigation reports following these incidents found a few common issues. One was that there was no formal system for communicating, training, and documenting the specifics of the primary task. Another was a lack of or weak auditing by the lab managers/principal investigators to verify standard operating procedure compliance, personal protective equipment training, and the use of incident reviews.

These reports and studies by the National Academy of Sciences, National Research Council, ACS, CSB, and others point to a strong need to develop a culture of safety consciousness, accountability, organization, and education in industrial, governmental, and academic laboratories.

So, how do we accomplish this?

Building safety culture: "The Safety Ethic: Value safety, work safely, prevent at-risk behavior, promote safety, and accept responsibility for safety"—Robert Hill.6

The Nuclear Regulatory Commission (NRC) defined safety culture in its Safety Culture Policy Statement of June 2011 as "an organization's collective commitment, by leaders and individuals, to emphasize safety as an overriding priority to competing goals and other considerations to ensure protection of people and the environment."7

OSHA research has found that a strong safety culture is the best approach to accident and injury prevention and noted that organizations that have strong safety cultures also show fewer at-risk behaviors and have lower accident rates, employee turnover, and absenteeism, as well as higher productivity.

The ACS Task Force provides 17 succinct recommendations for creating a better safety culture. Though focused on academia, they can apply across the board. We do not have the space to discuss each one here, but we will highlight those we feel are most important.

making safety part of all lab activities continued...

Leadership: To build a strong culture of safety, you must start at the top. As the NRC states, commitment is paramount and must be demonstrated at the very top of the organization. Strong and committed leadership ensures an effective safety program that is embraced by all. Safety as a priority will then flow through managers to supervisors and end with the individuals. Safety thus becomes the priority.

Attitudes and awareness: Developing strong safety attitudes and awareness is a long-term process. Continually teaching and highlighting safe practices and emphasizing their importance will build a deep, positive attitude and ethic in employees. Drawing attention to at-risk behavior and recognizing or rewarding safe behavior will encourage positive and safe habits.

Training: Safety training is intimately tied to building awareness. Laboratories are unique and complex workplaces. Some level of training will always be needed. Do not settle for doing the minimum required by current regulations. Strive to make training interesting, innovative, and interactive. Keep up with new technologies and update all training regularly.

Learn from incidents, close calls, and near misses: When we take a few moments to think about it, it is evident that most of what we know has been learned from mistakes and incidents. Perform detailed and immediate investigations and follow-up for all accidents, close calls, and near misses. Use the information gathered for case studies and lessons learned. You will find these scenarios capture employee interest and force them to think about improving safety procedures to prevent future incidents.

Collaborate and involve: Involvement promotes a strong safety culture by reaching and immersing as many employees as possible. Establish safety committees and keep them active. Involve a large representative cross-section of the organization's management and workers. Use the meetings to develop and revise safety procedures and policies. But keep it positive, interactive, and if possible, entertaining.

Communicate and promote: A robust safety culture needs constant promotion. The best promotion is by example. This loops back to developing positive attitudes, as promoting safe work practices goes hand in hand with having a good attitude and exercising safe behavior. Encourage all employees to advocate for and recognize safe actions. Communicate successes and (especially) failures openly. Give thought to publishing newsletters or bulletins. Conduct open case study and close-call discussions. Just keep the "work safe" and "safety first" messages out there.

A final thought : "During the 'heroic age' of chemistry, the notion of martyrdom for the sake of science was actually accepted widely, according to an 1890 address by the great chemist August Kekulé: 'If you want to become a chemist ... you have to ruin your health. Who does not ruin his health by his studies, nowadays will not get anywhere in Chemistry.'"8

In the nearly 130 years since, we have definitely progressed. Yet we cannot be satisfied or become complacent. There is still work to be done. Hopefully, this shallow dive into laboratory safety culture will inspire you to pick up the torch and continue to move us all forward. Safety first!

References: 1. "Culture of Safety," Occupational Safety and Health Administration, US Department of Labor. Washington, DC. April 2014. 2. "Safety and Health Topics: Laboratories," Occupational Safety and Health Administration, US Department of Labor. Washington, DC. April 2014. 3. "CSB Releases Investigation into the 2010 Texas Tech Laboratory Accident; Case Study Identifies Systemic Deficiencies in University Safety Management Practices," Chemical Safety Board. Washington, DC. October 2011. 4. "Investigation of Schweitzer Hall Explosion Complete," University of Missouri News Bureau. Columbia, MO. July 2010. 5. "A young lab worker, a professor and a deadly accident," Kate Allen, The Star. March 2014. 6. "Creating Safety Cultures in Academic Institutions," American Chemical Society. Washington, DC. 2012. 7. "Guide to Implementing a Safety Culture," Association of Public & Land Grant Universities. Washington, DC. 2018. 8. Prudent Practices in the Laboratory, Chapter: "The Culture of Laboratory Safety," National Academies Press. Washington, DC. 2018.

The Importance of Chemical Hazard Awareness

By Peter Nagle

Recently a couple of incidents at other universities occurred that demonstrate the importance of proper container labeling and chemical compatibility awareness while working in the lab.

At one university a graduate student sitting at a lab computer was surprised by a chemical waste bottle which burst and sprayed nitric acid and shards of glass all over the lab. Upon review, approximately 2L of nitric acid waste had been accumulated in a chemical waste bottle which originally contained methanol. Over the course of 12-16 hours, it is likely that some residual methanol reacted with the nitric acid waste and created enough carbon dioxide to over pressurize the container. Two other waste containers in the hood were severely damaged and several others were cracked or leaking. Fortunately, the laboratory worker was not injured.

At another school, a researcher was cleaning a piece of glassware with nitric acid/water. The researcher poured the waste nitric acid/water into a 250 ml brown glass container labeled only with the word “Waste” and sealed the bottle. The researcher did not know what the contents of the waste container were prior to adding the waste nitric acid/water. This container was placed near the front edge of the fume hood. This container developed pressure and exploded. A 1 L container of 70% nitric acid, a 250 ml container of 1-Hexene and another unknown brown glass chemical container were shattered by the exploding waste container. The flammable vapors found an ignition source and caught fire inside of the fume hood. The container of 1-Hexene was blown out of the fume hood, shattered, and landed on the floor next to the piece of equipment and caused the cooler and other combustibles to burn. It is unknown how the 1-hexene started to burn. By the time the Fire Department arrived, the fuel sources for both fires were mostly used up and the fires had partially extinguished. It was later determined that the brown waste bottle possibly contained cyclohexane and sodium metal, material that is incompatible with nitric acid.

With these incidents in mind, remember to follow the guidelines below when generating hazardous waste, creating stock solutions, or handling chemicals in the lab:

1. Clearly label all chemical waste containers and stock solutions with chemical names fully written out.

2. Never use vague terms like “Waste” as the only content description.

3. Never add waste to a container that is not clearly labeled.

4. Know the hazards of the chemicals you are working with.

5. Never mix incompatible chemicals.

6. If you are uncertain of the compatibility of different chemicals, make sure to ask someone who does know before mixing.

7. Recycling containers is encouraged; however make sure to collect wastes that are compatible with the original contents and the container material. A best lab practice would be to triple rinse the old container before generating hazardous waste in it.

8. Always segregate incompatible chemicals in both the Satellite Accumulation Areas (SAA) and in storage.

9. Always wear the proper PPE while in the lab.

10. Always know where good references are located, such as Safety Data Sheets (SDS), the Chemical Hygiene Plan (CHP), and Laboratory protocols specific to your lab.

GHS PICTOGRAMS

The chart on the right depicts GHS (Globally Harmonized System) Pictograms for hazard classes. These symbols are universal throughout the world, hence the term "globally harmonized". You will see these symbols on chemical containers, Safety Data Sheets (SDSs) and other warning labels. Please make sure that you and your lab staff are familiar with these warning symbols. If you ever have any questions on why a product has one of these symbols, you can always look to EHS for guidance.

Quarterly Hazardous Waste Pickup

November 14, 2018

If you have any chemicals or chemical waste to discard, please contact Peter Nagle or Jessica Tyre.

The Culture of Laboratory Safety (Part 3- Final)

By Ron Souza

Credit to: Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards

OTHER FACTORS THAT INFLUENCE LABORATORY SAFETY PROGRAMS

Several key factors continue to affect the evolution of laboratory safety programs in industry, government, and academe. These factors include advances in technology, environmental impact, and changes in legal and regulatory requirements.

Advances in Technology

In response to the increasingly high cost of chemical management, from procurement to waste disposal, a steady movement toward miniaturizing chemical operations exists in both teaching and research laboratories. This trend has had a significant effect on laboratory design and has also reduced the costs associated with procurement, handling, and disposal of chemicals. Another trend—motivated at least partially by safety concerns—is the simulation of laboratory experiments by computer. Such programs are a valuable conceptual adjunct to laboratory training but are by no means a substitute for hands-on experimental work. Only students who have been carefully educated through a series of hands-on experiments in the laboratory have the confidence and expertise needed to handle real laboratory procedures safely as they move on to advanced courses, research work, and eventually to their careers in industry, academe, health sciences, or government laboratories.

Environmental Impact

If a laboratory operation produces less waste, there is less waste to dispose of and less impact on the environment. A frequent, but not universal, corollary is that costs are also reduced. The terms “waste reduction,” “waste minimization,” and “source reduction” are often used interchangeably with “pollution prevention.” In most cases the distinction is not important. However, the term “source reduction” may be used in a narrower sense than the other terms, and the limited definition has been suggested as a regulatory approach that mandates pollution prevention. The narrow definition of source reduction includes only procedural and process changes that actually use less material and produce less waste. The definition does not include recycling or treatment to reduce the hazard of a waste. For example, changing to microscale techniques is considered source reduction, but recycling a solvent waste is not.

Many advantages are gained by taking an active pollution prevention approach to laboratory work, and these are well documented throughout this book. Some potential drawbacks do exist, and these are discussed as well and should be kept in mind when planning activities. For example, dramatically reducing the quantity of chemicals used in teaching laboratories may leave the student with an unrealistic appreciation of his or her behavior when using them on a larger scale. Also, certain types of pollution prevention activities, such as solvent recycling, may cost far more in dollars and time than the potential value of recovered solvent. For more information about solvent recycling, see Chapter 5, section 5.D.3.2. Before embarking on any pollution prevention program, it is worthwhile to review the options thoroughly with local EHS program managers and to review other organizations' programs to become fully aware of the relative merits of those options.

(safety culture continued)

Perhaps the most significant impediment to comprehensive waste reduction in laboratories is element of scale. Techniques that are practical and cost-effective on a 55-gal or tank-car quantity of material may be highly unrealistic when applied to a 50-g (or milligram) quantity, or vice versa. Evaluating the costs of both equipment and time becomes especially important when dealing with very small quantities.

Changes in the Legal and Regulatory Requirements

Changes in the legal and regulatory requirements over the past several decades have greatly affected laboratory operations. Because of increased regulations, the collection and disposal of laboratory waste constitute major budget items in the operation of every chemical laboratory. The cost of accidents in terms of time and money spent on fines for regulatory violations and on litigation are significant. Of course, protection of students and research personnel from toxic materials is not only an economic necessity but an ethical obligation. Laboratory accidents have resulted in serious, debilitating injuries and death, and the personal impact of such events cannot be forgotten.

In 1990, OSHA issued the Laboratory Standard (29 CFR § 1910.1450), a performance-based rule that serves the community well. In line with some of the developments in laboratory practice, the committee recommends that OSHA review the standard in current context. In particular, the section on CHPs, 1910.1450(e), does not currently include emergency preparedness, emergency response, and consideration of physical hazards as well as chemical hazards. In addition, this book provides guidance that could be a basis for strengthening the employee information and training section, 1910.1450(f). Finally, the nonmandatory Appendix A of the Laboratory Standard was based on the original edition of Prudent Practices in the Laboratory, published in 1981 and currently out of print. The committee recommends that the appendix be updated to reflect the changes in the current edition in both content and reference.

The Laboratory Standard requires that every workplace conducting research or training where hazardous chemicals are used develop a CHP. This requirement has generated a greater awareness of safety issues at all educational science and technology departments and research institutions. Although the priority assigned to safety varies widely among personnel within academic departments and divisions, increasing pressure comes from several other directions in addition to the regulatory agencies and to the potential for accident litigation. In some cases, significant fines have been imposed on principal investigators who received citations for safety violations. These actions serve to increase the faculty's concern for laboratory safety. Boards of trustees or regents of educational institutions often include prominent industrial leaders who are aware of the increasing national concern with safety and environmental issues and are particularly sensitive to the possibility of institutional liability as a result of laboratory accidents. Academic and government laboratories can be the targets of expensive lawsuits. The trustees assist academic officers both by helping to develop an appropriate institutional safety system with an effective EHS office and by supporting departmental requests for modifications of facilities to comply with safety regulations.

(safety culture continued)

Federal granting agencies recognize the importance of sound laboratory practices and active laboratory safety programs in academe. Some require documentation of the institution's safety program as part of the grant proposal. When negligent or cavalier treatment of laboratory safety regulations jeopardizes everybody's ability to obtain funding, a powerful incentive is created to improve laboratory safety.

Accessibility for Scientists with Disabilities

Over the years, chemical manufacturers have modernized their views of safety. Approaches to safety for all—including scientists with disabilities—have largely changed in laboratories as well. In the past, full mobility and full eyesight and hearing capabilities were considered necessary for safe laboratory operations. Now, encouraged legally by the adoption of the Americans with Disabilities Act of 1990 (ADA) and the ADA Amendments Act of 2008, leaders in laboratory design and management realize that a nimble mind is more difficult to come by than modified space or instrumentation.

As a result, assistive technologies now exist to circumvent almost any inaccessibility, and laboratories can be equipped to take advantage of them. Many of the modifications to laboratory space and fixtures have benefits for all. Consider, as a single example, the assistance of ramps and an automatic door opener to all lab personnel moving a large cart or carrying two heavy containers.

It is a logical extension of the culture of safety to include a culture of accessibility.

Laboratory Security

Laboratory security is an issue that has grown in prominence in recent years and is complementary to laboratory safety. In short, a laboratory safety program should be designed to protect people and chemicals from accidental misuse of materials; the laboratory security program should be designed to protect workers from intentional misuse or misappropriation of materials. Security procedures and programs will no doubt be familiar to some readers, but others may have encountered it only in the context of locking the laboratory door. However, in the coming years, a working awareness of security will likely become a common requirement for anyone working in a chemical laboratory. Risks to laboratory security include theft or diversion of high-value equipment, theft of chemicals to commit criminal acts, intentional release of hazardous materials, or loss or release of sensitive information, and will vary with the organization and the work performed.

UNE Chemical Sharing Program

The UNE Chemical Sharing Program is a great way to reduce hazardous waste, reduce costs for your department, and have a positive environmental impact on campus. If you have any commonly used lab chemicals that you are thinking of disposing, please contact EHS so they can be listed in the next issues of EHS Lab Chatter as available for the UNE Chemical Sharing Program.

Items available:

No Items currently available. Please check back next issue!

To contribute a topic or article to EHS Lab Chatter,

email:jtyre@une.edu

****All background images are taken from the UNE Digital Asset Manager files****