

# SAFE SCIENCE

## Actions for Laboratory Researchers

Interest in promoting safety in academic research laboratories has grown in recent years, following high-profile incidents in which researchers were injured or killed. Many colleges and universities want to go beyond complying with regulations to fostering a safety culture: affirming a constant, institution-wide commitment to safety and integrating safety as an essential element in the daily work of researchers.

A report from the National Research Council, *Safe Science: Promoting a Culture of Safety in Academic Chemical Research*, identifies steps that everyone involved in research and other activities using chemicals—from researchers to principal investigators to university leadership—should take to create and promote this approach to safety.

As researchers, you have enormous influence over the culture in the laboratories where you work. Some of the strongest laboratory safety cultures are those in which researchers have taken the lead in establishing that culture. The entire institution is responsible for promoting safety and providing you with the resources and training you need to work safely. But the day-to-day actions and practices that lead to safe laboratories demand the participation, commitment, and leadership of those who actually do the research, whose safety is at stake.

### ELEMENTS OF A STRONG LABORATORY SAFETY CULTURE

An ideal laboratory safety culture ensures that anyone who enters a laboratory, from inexperienced students to senior investigators, understands that they are entering an environment that requires special precautions. They are aware of the hazards posed by the materials they and others in the lab are working with, and they are prepared to take immediate and appropriate measures to protect themselves and their co-workers, especially in the case of unexpected events. At a minimum, laboratory safety includes:

- awareness of the physical and chemical properties and health hazards of laboratory reagents and equipment being used, gained by conducting hazard analysis,
- availability and use of proper apparatus and infrastructure needed to carry out the procedure safely,
- knowledge of and ability to execute any additional special practices necessary to reduce risks,

- use of proper personal protective equipment,
- access to a well-organized workspace that facilitates unrestricted movement about the laboratory and appropriate segregation of materials and processes, and
- familiarity with emergency procedures, including the use of safety showers, fire extinguishers, and eye stations.

A strong, positive safety culture encourages all laboratory workers to place the highest priority on these practices. Safe equipment, systems, and procedures are not enough if the culture of the organization does not encourage and support working safely.

One of the major barriers to the development of safety culture in academic laboratories is the attitude that safety practices inhibit research productivity. But the occurrence of a serious incident in a laboratory, in addition to being a tragedy in itself, stops research—certainly a dramatic impact on research progress, as anyone who has experienced or witnessed such an incident can attest.

It is part of the academic culture for researchers to work long hours, late at night, and often alone. These practices may reflect a pressure to produce results, influenced by power dynamics that are antithetical to the advancement of a strong safety culture. No amount of productivity justifies carrying out hazardous procedures alone and with inadequate sleep.

Safety is a core element of responsible research, not an impediment to it. Good science is safe science, fostering a productive and secure work environment. Like publishing papers and acquiring grants, conducting research safely is key to the success of a research group, and it must be held in high academic esteem.

### ACTIONS TO CREATE A STRONG SAFETY CULTURE

The university, the department, and the principal investigator are responsible for providing a safe work environment and encouraging a culture that promotes safety. For example, the university and principal investigator should ensure that you have:

- comprehensive, lab-specific safety training before you start work in the lab,
- opportunities for guidance and mentoring about safety issues, along with other research-related issues,

- personal protective equipment, including lab coats, and
- regular opportunities to bring up safety concerns and questions without fear of retaliation, in an environment where the focus is on solving problems rather than assigning blame.

You should also take steps to build and sustain a strong safety culture in the lab where you work, by initiating or participating in the following activities:

**Participate in and encourage open, ongoing dialog about safety.**

Researchers should bring up concerns and questions they have about safety; principal investigators should set up mechanisms to help this happen. For example, some departments regularly begin each laboratory meeting or faculty meeting with a “safety moment” when any safety-related issues or concerns can be discussed, and these are widely viewed as successful. Forming a department safety committee driven by graduate students and postdocs can be a powerful safety practice as well.

**Conduct a hazard analysis prior to conducting any experimental procedure.** Hazard analysis is a process to assess risks and to ensure that those risks are mitigated or eliminated before initiating any laboratory work. Many types of hazard analysis exist, and particular types may be suitable to certain situations; regardless of the approach used, it is important for researchers to assess the hazards in any experiment before it is undertaken. The principal investigator and all researchers involved in an experiment should incorporate hazard analysis into lab notebooks prior to an experiment. If a procedure yields unexpected results, the hazard analysis should be revisited.

**Take part in ongoing activities to encourage safety.** Doing so will ensure that collective experience and knowledge about safety are integrated with actual lab work, practiced, and maintained. Examples of such activities are—

- **Walk-throughs and unannounced inspections.** These are intended to assure that personal



protective equipment is being used, hazard analysis has been conducted, etc. These should be non-punitive, at least at the outset, since the inspections are intended to promote safety culture, not produce “gotcha” rule violations. As researchers, your presence on inspection teams—and that of your peers from other laboratories—will promote the right kind of discussion.

- **Reporting system.** A reporting system aims to reduce the potential for incidents by giving researchers a place to report near misses and injuries, share lessons learned, propose ideas, and give feedback to

the department. A near miss is an undesirable or unexpected event that could have resulted in an injury, incident, or property damage had the timing, space, or sequence of events happened under slightly different conditions. It also represents a learning opportunity for sharing experiences with others. Allowing anonymous reporting may make researchers more willing to report near misses.

The success of such measures depends on establishing a nonthreatening atmosphere. For example, if near-miss reporting is to make an impact, the identity of the person involved and the person who reported it should not matter. Instead, the focus should be on addressing the threat of the danger and eliminating it as quickly as possible. A positive safety culture supports the free exchange of safety information and assigns greater importance to solving problems than to placing blame.

**If you worry that stress is leaving you unable to work safely, seek assistance.** Given the highly competitive nature of academic research, researchers often feel stress from striving to meet deadlines, make reports, and achieve milestones in completing one’s degree. The level of stress can distract researchers from disciplined safety practice and may overwhelm an individual’s capacity to function safely in the laboratory. Most universities have counseling and stress management resources available to students and staff that need them. You should not hesitate to use these resources or to suggest them to a colleague in need.

The National Research Council report *Safe Science: Promoting a Culture of Safety in Academic Chemical Research* was written by an independent committee of experts including members from university administration, chemistry faculty, behavioral sciences, EHS, private industry, and national laboratories. It was sponsored by the National Science Foundation, U.S. Department of Energy, National Institute of Standards and Technology, American Chemical Society ExxonMobil Chemical, and E. I. du Pont de Nemours and Company.

This pamphlet is one of a series summarizing *Safe Science: Actions for...Laboratory Researchers, Principal Investigators and Department Chairs, Environmental Health and Safety Staff, Deans and Vice Presidents for Research, and University Senior Leaders*. They are available at <http://dels.nas.edu/Report/Report18706>. Read, purchase, or download a free PDF of the report at <http://www.nap.edu>.