General Guidelines on PPE and Laboratory Safety

Preamble

Chemistry is an exciting scientific endeavor with broad horizons, and a great diversity of practices. The conventional division of chemists between academia and industry is blurring perhaps nowhere more profoundly than in the domain of chemical safety. Here, high-profile accidents in academic chemistry have driven a heightened awareness of the consequences of failing to adhere to legislated requirements and standard practices, and there have been increased efforts to translate key industrial chemistry safety practices to the academic setting. Professional organizations such as The American Chemical Society provide laboratory safety recommendations, including summaries especially for the academic setting. URI has its own internal policies. Given the breadth of the chemical enterprise, and its ongoing expansion of knowledge frontiers, the careful and considered guidance and example of expert practitioners fills a vital role. Principal investigators, for example, have the potential to be formative in the development of the next generations of professional chemists far beyond the edicts of legislation—in particular in mentoring students and trainees to safely navigate the exciting challenges and opportunities offered by chemistry.

The Department of Chemistry at the University of Rhode Island has three major, and overlapping, divisions of effort: chemistry research, chemistry education, and chemistry services. The chemistry stockroom, for example, handles the receipt and distribution of all supplies, typically characterized by large quantities of generally routine chemicals to the teaching labs; a research lab will be distinguished by an often diverse mixture of types and amounts of chemicals, including novel molecules and materials. This mission takes place in a mixed-use building with building access permitted to chemistry professionals and students, to other students and staff of the university, and to the general public. It is essential to develop a consistent policy that recognizes the distinct challenges of such a complex working environment.

Practitioners should recognize that chemical hazard assessments can be fluid in the face of a changing regulatory framework and because of ongoing progress in chemical safety investigations. Research products often have no weight of safe use history behind them, and chemical hazard assessment necessarily occurs in the context of this uncertainty. It is important that practitioners be aware that conventional best-practices may not be sufficient for all activities, and that, e.g. engineering solutions offer the protections for which they were designed only when they are properly functioning.

Teaching Labs

Teaching labs have been crafted and refined over the years to provide the maximum learning experience while reducing risk for the participants. There are a number of additional supports for student safety, including written experimental procedures, chemical safety documentation, and teaching assistants with training in chemistry or closely related fields. Teaching assistants should strive to model appropriate behavior concerning PPE, and engage in best-efforts at correcting student errors: the most pressing emphasis should be on harmful behavior likely to cause immiment and long-term harm (e.g. eye protection).

Some laboratory experiments may not, themselves, require personal protective equipment (PPE), and when work areas are clean and free of chemical hazards, entry to the labs may be permitted without PPE. Under all other circumstances, students and staff should only enter the teaching labs once they have donned their chemical safety glasses and laboratory coats. Gloves may be recommended for use, in which

case they should be appropriate (e.g. chemical compatibility) for the particular hazard. It is essential to keep chemistry workspaces clean, so that chemical risks are not left unseen. One mission of the teaching laboratories is to inculcate the students with a thoughtful and disciplined approach to chemical safety: gloves should not be touched to, e.g. bare skin or common area surfaces such as door handles. More broadly, students should develop good working habits in a safer environment, in preparation for possible eventual work in a more hazardous setting. Students should be discouraged from wearing their PPE outside the moments from just before they enter the lab to just after they exit the lab unless they are actively engaged in chemistry-related activities (e.g. fetching ice for an experiment, or delivering a sample to an instrument lab; precautions such as not using a gloved hand on a door handle should be scrupulously adhered to).

Departmental Instrument Labs (Including Teaching Lab Instrumentation)

Departmental instruments represent a common point of contact for many users working with materials with many different properties and possible hazards. Safety practices should focus on protecting the current user (including any surrounding workers—it is unacceptable for a nearby, at-risk worker to be wearing insufficient PPE) *as well as* the next user(s).

All efforts should be made to minimize unnecessary chemical contact with instrumentation, both to maintain instrument function and lifetime, and to avoid leaving chemical contamination for the next user. Policies governing, e.g. “no gloves to be used on keyboards” should be developed and posted. Similar policies might include posting if one may sit on chairs while wearing a lab coat. The use of prep rooms should be maximized, so that barring exceptional circumstances, only sample-sized amounts of chemicals are near to instruments.

Research Labs

Chemistry research labs are home to a wide variety of operations and materials. Operations are almost by default highly specialized, and materials are frequently novel without benefit of standardized safety information, so that standard operating procedures that meld best practices and expert knowledge from the principal investigator are essential to provide a cohesive safety framework. In some cases, for example, workers may be safely separated from hazards by robust engineering controls, which may then fulfill the role of PPE; it is important, however, for proximal hazards to enter into such hazard assessments. In other cases, optical hazards may require laser safety glasses instead of chemical safety glasses, and other operations may require hearing protection. Similarly, depending on operation, a high school intern may require quite different training than a graduate student with a background degree in chemistry (or closely-related field). All personnel working in a URI chemistry lab are required to participate in an annual safety refresher course, but it is important to have a holistic view of safety informed by general best practices melded with approaches drawn from the particular research area.

When handling chemicals, or engaged in work in a space where chemical exposure might reasonably be expected, chemical safety glasses are required by the department. Lab coats and gloves can provide a useful barrier to chemical exposure, when appropriate for the task and materials. All personnel should be conscious of both direct and indirect risks. For example, one chemist may be doing low-risk work, but be next to a colleague doing higher-risk work; a sealed waste container may conceal a looming explosion. All personnel should therefore be conscious of risks not only to themselves, but to surrounding colleagues, and it is useful to encourage colleagues to gratefully and thoughtfully engage in safety-related

conversations, even outside of formal reviews. As a part of ensuring a safe working environment, it is important to realize that safety resources include, for example, engineered solutions such as fumehoods, investigator expertise, chemical safety information including that generated by the worker such as lab notebooks. In the research lab in particular, all workers should be especially cognizant that new chemicals and materials, and novel experimental techniques, may pose unexpected risks.

Chemistry Stockroom

It is the responsibility of the Chemistry Stockroom to supply the teaching labs with the correct chemicals, solutions and equipment to run the teaching laboratories. The Stockroom is also responsible for maintaining a supply of proper personal protective equipment for the teaching and research laboratories. The Stockroom monitors all of the chemical waste in both the teaching and research laboratories and prepares the waste for shipment to the contractor waste disposal firm. In doing this the Stockroom has to maintain the chemical waste main storage area for the department in compliance with local, state and federal regulations.

The Stockroom receives all shipments into the department and barcodes all incoming chemicals. These chemicals are then properly stored or delivered to the chemistry research groups.

The chemistry stockroom manages many of the affairs related to student teaching laboratories, and assists with the needs of the department's research laboratories. The chemistry stockroom occupies several restricted access rooms that include two laboratories for chemical preparation, two chemical storage rooms, a hazardous waste room and an area for distribution of laboratory equipment to students. Stockroom personnel are specially trained undergraduate science major students who range from first to sixth year students along with an experienced supervisor who has over thirty years of experience in the chemical industry and over twenty years of experience in academia.

The functions of the stockroom include furnishing teaching laboratories with chemicals, equipment, and safety data, and chemical waste accumulation with proper management of the satellite accumulation and storage areas. Other functions involve the safe handling and categorizing of chemicals and hazardous waste and the preparing and proper packaging of shipments of both chemicals and equipment to the Providence, RI campus of the College of Continuing Education. The stockroom personnel are also responsible for the safe transport of chemicals, gas cylinders and liquid nitrogen and helium containers throughout the Beaupre building. The stockroom is also responsible for maintaining bulk solvents and nitrogen for all users in the department.

The stockroom personnel provide safety/environmental training at the onset of each academic semester for teaching assistants and instructors. Also provided are information and training for proper shipping of chemicals.

Common Areas

Hallways represent a transition zone between laboratory spaces in which the wearing of PPE should signal either presently ongoing chemistry-related work, forthcoming entry to a laboratory, or just-prior exit from a laboratory. In all cases, PPE such as gloves and labcoats should never be worn in areas where chemical

use is prohibited, such as kitchens, bathrooms, and classrooms (aside from recognized classroom chemistry work spaces). Chemicals should also be kept out of such areas.