Introduction to Instructor Materials
for
Foundations of Chemical Safety and Risk Management

The free online course “Foundations of Chemical Safety and Risk Management” has 17 units, each of which is designed to be completed in about an hour. This course is approximately equivalent to a one-semester-hour lecture course. The Instructor Materials that accompany this course are designed for those instructors who wish to incorporate this online course into their undergraduate curriculum as

- integrated chemical safety material for laboratory courses,
- a stand-alone chemical safety course, or
- a prerequisite activity for a research experience.

Suggestions for each approach are outlined below.

The slides in the Instructor Materials highlight important points or critical concepts. These materials should be considered only as a starting point for in-class discussions and not as a replacement for the ACS online chemical safety course or a matriculated chemical safety course.

Instructors are encouraged to lead students through active engagement in discovering practical applications of chemical principles. For example, a discussion about flammability might include requirements for a fire, vapor pressure, or flammability limits. These are topics that may have been discussed in their classes, and they could be used to reinforce solvent flammability and other chemical safety concepts. This could then lead into suggesting methods to minimize the risks from a fire, as well as responses to fires. This discussion could be further linked to OSHA and EPA regulations for flammable materials, along with the department’s protocols.

Discussions should go beyond risk management practices in the chemistry laboratory and include non-laboratory environments, such as the student’s dorm room, apartment, or home, places of business (grocery stores, auto shops, etc.), the sports arena, or even their car. Students should recognize that a strong safety culture is important in every setting and in every business. The goal is to nurture a safety mindset.

Storytelling is a powerful tool! Whenever possible, instructors are encouraged to use examples of incidents from current events or from their own experience to illustrate chemical safety principles and the lessons learned. Using examples that are familiar to students provides additional relevance. Instructors should emphasize that chemistry is about more than the fires and explosions seen in videos on the internet and that these events have very high risks, which must be carefully managed to avoid serious injury.

Students need a heightened sense of awareness that the laboratory is a special place where hazards may be more prevalent. To avoid injury, they must actively engage in practices that make the laboratory a safe place to work. Conducting experiments or activities (even at home!) without integrating risk management into the planning process may lead to serious injuries.

This online chemical safety course is organized around the RAMP concept of risk management:

- Recognize the hazards
• Assess the risks from the hazards
• Minimize the risks from the hazards
• Prepare for emergencies.

Instructors are encouraged to complete the online chemical safety course themselves so that they are familiar with the various topics and the RAMP approach to risk management. In addition, because key principles and regulations for chemical safety are continually being updated and revised, instructors are expected to familiarize themselves with these changing concepts so that they can provide guidance to students consistent with moving from a rule-based safety culture to a risk-based safety culture.

Use as integrated chemical safety instruction for a laboratory course during pre-laboratory sessions.

Some institutions may have a separate laboratory lecture, whereas others may include a pre-laboratory session immediately before the laboratory activity. The Instructor Materials are flexible and can provide resources (slides, suggested questions, and discussion topics) for in-class chemical safety discussions during either type of pre-laboratory session.

Student must complete the units of the online course in sequential order, but instructors may choose to emphasize certain points for a specific experiment. The Instructor Materials may be useful in these discussions.

Examples of lesson plans for both a 1-hour pre-laboratory lecture and a 20-minute pre-laboratory session are included below. The times included in the lesson plans are only suggestions. Instructors are encouraged to use their own teaching style to include the safety discussion in their session.

Use as the principal resource for a stand-alone chemical safety course.

An institution may decide to use the online chemical safety course as the principal resource for a one-credit-hour course. Students could be assigned units from the online course to be completed during the week. The unit topics could be discussed during the weekly class meeting. The Instructor Materials can provide slides and discussion questions for these class meetings.

An example of a 15-week semester outline is included below.

Use as a prerequisite activity for students planning to work on a research project.

A department or a research leader could ask students who are interested in conducting research to successfully complete the ACS online chemical safety course before beginning their research. Because many students are recruited to join a research team during the preceding semester, informing them of this requirement at that time will allow them ample time to complete the online course. The Course Completion Certificate issued to the student could be used as evidence of successful completion of the course. Some instructors may want to monitor a student’s progress through the course. Although monitoring is not available through the online course’s learning management system, this could be done by having the student submit a screenshot of each completed unit quiz in their institution’s learning management system.

In addition, beginning a laboratory activity with a safety discussion mirrors a common practice in industrial settings. Many work teams in industry begin each daily meeting with a “safety moment”
where a relevant safety topic is presented and discussed. This helps to build a safety consciousness and a positive safety culture where everyone has a responsibility for working safely.

**Additional Resources**
The following safety resources contain useful reading to accompany the online course and to use for assignments. They are freely available for use.

- **Safety in Academic Chemistry Laboratories, 8th Edition**: This booklet (known as SACL-8) aligns with the concepts of the online course, and the target audience is also students in the first two years of undergraduate chemistry. It is downloadable as a PDF or may be purchased from the [ACS Store](https://store.acs.org).
- **Guidelines for Chemical Laboratory Safety in Academic Institutions**: This is another booklet from ACS, available in PDF format or for purchase from the [ACS Store](https://store.acs.org). This booklet provides 104 learning outcomes for chemical safety.
- **Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards**: This is a comprehensive examination of chemical safety concepts. It can also be used as a support text for faculty or students. Published by the National Academies Press, it is freely available as a PDF or may be purchased.
- **ACS Examinations Institute 2019 Chemical Health and Safety Exam (CS 2019)**: This exam aligns with the online course and SACL-8.

**Closing Note**
Safety is everyone’s responsibility and requires knowing and applying the underlying principles of risk management. It is more than “following the rules”. It is ingrained in safe behaviors and the application of critical thinking. We wish you well in ensuring that your students embody the ideal of a positive safety culture.