

## RESEARCH ARTICLE

# Baseline survey of academic chemical safety information practices

In the spring of 2017, the American Chemical Society (ACS) Divisions of Chemical Information (CINF) and Chemical Health and Safety (CHAS) partnered to conduct a survey of academic research chemists to understand their use of chemical safety information as they conduct risk assessments for laboratory work. This survey, funded by an ACS Innovative Project Grant, focused on three areas, addressing Information Practices, Risk Assessment Practices and Lessons Learned Practices. The survey received 238 responses and the reported demographics reflected the general ACS membership in terms of chemical fields. Half of the respondents have PhDs and half have worked in labs for 10 years or more. This article summarizes the results from this initial survey and identifies opportunities for improving support services from Environmental Health and Safety staff and Chemical Information specialists for conducting laboratory risk assessments.

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## OVERVIEW

In 2016, the American Chemical Society (ACS) identified *safety* as a core value of the society.<sup>1</sup> This decision is an outgrowth of ongoing national discussions about the best approach to improving the safety culture of research laboratories. One critical element needed to move towards a more effective safety culture is increased emphasis on *risk assessment skills for chemists*, particularly in the research environment. However, there are very few data available concerning the current training or practices of the academic laboratory sector in this

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regard. For this reason, the ACS Divisions of Chemical Health and Safety (CHAS) and Chemical Information (CINF), and the Committee of Chemical Safety (CCS) partnered to survey academic chemists on their risk assessment practices, training and education. This report provides an overview of the survey development process and summarizes the results from the first cohort of chemists to take a survey on this topic. The complete results are available upon request.

The overall aim of this effort is to support continuous improvement in the risk assessment practices in the academic chemistry sector. As described in the ACS Central Science Editorial, *Ingredients for a Positive Safety Culture*,<sup>2</sup> ACS leadership has the opportunity to support incorporation of safety culture into emerging expectations for education, publishing and responsible conduct. Several chemical safety training and information efforts are currently underway among the CHAS, CINF and Chemical Education (CHED) technical divisions, supported by previous innovative project grants and divisional strategic planning efforts. ACS outreach to the broader membership and development of technical and cultural resources that support best risk assessment practices can help reinforce these efforts. An example of such outreach is as the emerging partnership between

the Committee on Chemical Safety and the ACS Education Office around safety education materials.

## INTRODUCTION

The survey was funded by an ACS Innovative Project Grant to the CHAS and CINF Divisions and developed in collaboration with the Cornell Survey Research Institute. The goal of the survey was to benchmark current information practices related to laboratory scale chemical risk assessment and identify gaps in chemists' education that can be met by targeted training, information tools, or educational materials. Findings from this survey are also expected to inform broader ACS initiatives in chemical safety education and communication outreach efforts.

Focus groups were initially conducted to engage a variety of chemistry lab stakeholders, including high school and undergraduate faculty, undergraduate students, graduate students and academic research faculty. From these interviews, we learned that the uses of safety information by these groups are distinct enough to warrant separate inquiries into their risk assessment practices. We also found that these different stakeholders had different support needs for their safety efforts. For example, in discussions with high

school teachers, a clear need was expressed for more chemical safety information tailored to safety needs at earlier stages of both teachers' and students' science education. To this end, the CCS Safety Advisory Panel has partnered with ACS education offices to begin safety education outreach to secondary chemistry teachers.

As a result of the focus group discussions, the survey instrument was targeted to academic laboratory researchers as a distinct sector often conducting complex or novel processes. The survey was distributed to over 800 ACS approved Bachelor's programs during two weeks in early 2017. Department chairs were asked to distribute the survey to anyone currently involved in chemistry research, including students, postgraduate students, faculty and research staff. 283 responses were received, and the demographics reflect the overall ACS population of chemical specialties. About 60% of the respondents hold PhDs and half reported more than 10 years of laboratory experience.

### SUMMARY OF FINDINGS

Several key themes regarding use of chemical safety information and risk assessment processes emerged from the study. These themes are discussed in more detail in the notable findings section.

1. Most researchers report some familiarity with formal safety management processes similar to those practiced in industry settings, however report little use of them in their day to day work.

2. Researchers generally report that available information is adequate to conduct risk assessments, however, few consistently share safety information in their publications.
3. Safety Data Sheets (SDS) are the primary chemical safety information source among researchers, however, they do not optimize the use of the information available in these documents, and most do not critically validate or augment this information with other authoritative safety information sources.
4. Consultation with colleagues is a predominant practice when planning for safety, which can reinforce either good or less desirable safety practices, especially among learners.

These findings suggest two important gaps between best practices and documentation for risk assessment and day to day reality in the academic research environment. First, as noted by the Chemical Safety Board's 2011 report on academic research safety, physical hazards (fires and explosions) tend to receive less attention by chemists in the planning process than chemical hazards such as unplanned reactions or unknown toxicities. High consequence lab incidents can result from this neglect of physical hazards.<sup>5</sup>

The second gap is education in critical analysis of safety information sources, which is a core skill in developing adequate laboratory risk assessments. For example, comparing Safety Data Sheets from different suppliers often reveals significantly different hazard profiles for the same chemical. In addition, because SDSs do not

address hazards associated with chemicals in combination with each other, review of a single SDS is unlikely to be adequate for experimental process planning. For these reasons, information literacy skills applied to the use of safety information is an important element in a complete risk assessment. Chemical safety education can thus engage multiple chemistry research skills outlined by the ACS Committee on Professional Training (CPT).<sup>4</sup>

### RECOMMENDATIONS

The ultimate goal of the sponsoring divisions and other ACS Divisions and Committees is to address these gaps in general and, more specifically, support the ACS Board of Editors' recent policy of including safety precautions in research articles.<sup>5</sup> See Table 1 for a partial catalog of these efforts. We believe that this can be done through improved safety programming and chemical safety information sources and tools. The survey results will continue to inform opportunities for CHAS, CINF and Division of Chemical Education (CHED) to partner in supporting improved lab risk assessment, management and documentation. Examples of such programs include:

- Maintaining and developing new CHAS national and regional meeting workshops and webinars;
- Further development of chemical safety information tools by CINF members; and
- Continued development of guidance documents by CHED and the Committee on Chemical Safety.

**Table 1. Related ACS Safety Resources.**

Division of Chemical Health and Safety website	<a href="https://dchas.org/">https://dchas.org/</a>
Division of Chemical Information website	<a href="http://www.acscinf.org">http://www.acscinf.org</a>
ACS Safety Webpages, managed by the Committee on Chemical Safety	<a href="http://acs.org/safety">http://acs.org/safety</a>
Division of Chemical Education Safety Committee	<a href="http://divched.org/committee/safety">http://divched.org/committee/safety</a>
Committee on Professional Training safety education supplement	<a href="https://www.acs.org/content/dam/acsorg/about/governance/committees/training/acsapproved/degreeprogram/laboratory-safety.pdf">https://www.acs.org/content/dam/acsorg/about/governance/committees/training/acsapproved/degreeprogram/laboratory-safety.pdf</a>
Hazards Assessment in Research Laboratories	<a href="http://www.acs.org/hazardassessment">http://www.acs.org/hazardassessment</a>
CINF safety information initiatives	
Organizing chemical information to support lab safety	<a href="http://surface.syr.edu/nyscilib/67/">http://surface.syr.edu/nyscilib/67/</a>
PubChem Laboratory Chemical Safety Summaries (LCSS)	<a href="https://pubchem.ncbi.nlm.nih.gov/lcss/">https://pubchem.ncbi.nlm.nih.gov/lcss/</a>
Pistoia Alliance Chemical Safety Library	<a href="http://www.chemicalsafetylibrary">http://www.chemicalsafetylibrary</a>

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