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Navigating Safety & Compliance at Small Liberal Arts Institutions: A Professor's Perspective

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Abstract As a chemistry professor, I have spent over a decade guiding my university through compliance with chemical hygiene and chemical waste regulations. Through that work, I encountered both challenges and opportunities and have discovered that with the right strategies in place, ensuring compliance with chemical hygiene regulations is a responsibility that pays off both in safety and cost savings.

Keywords Chemical Hygiene, Laboratory Safety, Compliance Program

1. Introduction

Professors at small universities wear many hats. For those of us in the physical and biological sciences, one of those hats may include managing hazardous materials. While large universities employ dedicated chemical hygiene professionals to handle hazardous materials management, smaller colleges and universities often do not have those resources.

In smaller colleges and universities, professors in the sciences may be tasked with the responsibility of developing waste management and lab safety procedures. By using science professors, schools can leverage the technical expertise of these academics and avoid hiring chemical hygiene professionals. While many chemists have the technical knowledge to understand the science of hazardous materials management, they often lack the experience with and knowledge of federal and state regulations.

As a chemistry professor, I have spent over a decade guiding my university through chemical hygiene and chemical waste management. I helped craft our compliance policies and have worked through a number of challenges in the process. The following is a discussion of some of those challenges and opportunities. [1] [2]

2. Rules are Set by Federal and State Governments

Every laboratory is required by law to have a chemical hygiene plan and a waste disposal plan. The Occupational Safety and Health Administration (OSHA) requires a chemical hygiene plan to protect people working in labs from harm due to exposure to hazardous chemicals.

How do we determine what qualifies as a laboratory and what qualifies as hazardous waste? A laboratory is defined as a facility where hazardous chemicals, even relatively small amounts, are used. We most typically think of chemistry, biology, and physics labs as the primary zones that fit this definition.

Hazardous materials are any chemical that can cause physical harm or is a health danger. Other facilities or programs may use hazardous chemicals such as art, exercise science, engineering, and athletics. [3]

3. Challenges in Creating a Culture of Compliance

As professor of chemistry, I helped guide my institution in the administration of chemical safety and waste and have seen firsthand the various challenges faced by academic departments in complying with state and federal safety regulations for a very small quantity generator (VSQG), aka conditionally exempt small quantity generator.

3.1. One Challenge is the Lack of Awareness of the Rules and Regulations

As professor of chemistry, I helped guide my institution in the administration of chemical safety and waste and have seen firsthand the various challenges faced by academic departments in complying with state and federal safety regulations for a very small quantity generator (VSQG), aka conditionally exempt small quantity generator.

One of those challenges is the lack of awareness of the rules and regulations.

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No academic institution wants to risk violating state or federal regulations, or, just as critically, experience a preventable chemical accident due to overlooked safety protocols. Yet at small colleges, dedicated environmental health and safety (EHS) departments are rare. Science departments often operate independently, without the funding or support needed to build formal EHS programs. The development and implementation of safety programs can fall to each individual academic department. Professors and instructors may lack firsthand experience in developing and overseeing these responsibilities themselves.

Availability of resources is another challenge and a critical foundation. Academic administrators may recognize the need for regulatory compliance but often underestimate the vital role that robust waste and safety programs play supporting teaching and research. Maintaining these programs can easily slip in priority and take a back seat to other pressing academic concerns.

To ensure continuing support, an advocate in administration who keeps safety and waste management on the agenda —even as programs grow and mature—is essential. [4]

3.2. Professor as Chemical Hygiene Officer

As I mentioned earlier, a professor in the sciences may be asked to provide the expertise needed to develop a chemical hygiene plan, manage hazardous waste, and serve as the institution's chemical hygiene officer (CHO). In brief, a CHO is responsible for developing a chemical hygiene plan, training those involved, and ensuring compliance. Ensuring compliance is often a challenge for professors as they do not typically have that type of position. [5]

That being said, my experience has been that a trained faculty member in areas impacted by chemical hygiene regulations can play an important role in guiding colleagues into compliance. Best results are obtained by an open, interactive dialog that develops a program where faculty concerns are addressed.

A related consideration for academics is the time needed to develop expertise in regulations for both safety and hazardous materials management and to stay current on changes. Managing a waste/safety program can take significant time away from teaching and research without contributing directly to assessable academic goals. Plus, becoming conversant with regulations is time consuming and probably best accomplished by seeking training from professionals. To sign hazardous waste manifests, a higher level of certification is needed, and that training can also be accessed through professional consultants in the field. The training and time requirements are much easier to manage if administration is fully committed.

3.3. Collectors

Another issue that I have seen often is the "collector". Faculty and/or staff may have collected chemicals for years. There are any number of reasons for collecting. Professors may feel that chemicals might be needed in an emergency, for convenience, or to save money. Those chemicals can include pounds of liquid mercury, exotic organic chemicals, or specimens stored in formaldehyde. Very seldom do these legacy collections consist of nonhazardous materials like baking soda and salt.

As a professor myself, I understand the convenience, both in terms of time and budget, of having reagents readily available. However, maintaining a large inventory of hazardous materials can raise significant safety concerns and complicate waste disposal efforts, especially for chemicals that may ultimately go unused.

Another important factor to consider is your institution's classification as a hazardous waste generator. Schools categorized as Very Small Quantity Generators (VSQGs) must produce less than 100 kilograms of non-acute hazardous waste and less than 1 kilogram of acute hazardous waste per month. Remaining within this classification is very advantageous. However, maintaining VSQG status also imposes limitations, particularly concerning acutely toxic chemicals, which again are restricted to less than 1 kilogram of waste generation per month. [6]

To minimize risks and regulatory burdens, I recommend keeping only the amounts of reagents needed for a single semester. Whenever possible, eliminate the use of acutely toxic substances altogether. I also suggest discontinuing the use of chemicals that OSHA subjects to special standards when possible.

Be cautious when accepting donated reagents. You will be responsible for proper disposal and the associated costs. This caution also applies to preserved specimens; verify the composition of the preserving solution, as many contain formaldehyde.

Finally, regulatory standards are continuously evolving. Federal agencies frequently reassess chemical exposure guidelines to enhance health and safety protections. For example, the OSHA has recently implemented stricter exposure limits for methylene chloride. Many smaller universities are now considering a complete ban on methylene chloride from their campuses. [7]

3.4. General Resistance to Change

There will always be those who are uncomfortable with change and struggle with accepting new procedures. Resistance may be due to a lack of understanding, a feeling that important teaching/research time maybe wasted, or perhaps a perception that these rules may limit types of laboratory experiments. Building a compliance program from scratch is time-consuming, especially when academic departments must develop their own plans. Adding to the challenge, many classic chemistry lab experiments use reagents that raise safety concerns.

All of these concerns are valid. However, the effort pays off in cost savings on disposal fees and helps maintain very small quantity generator (VSQG) status, which further reduces costs and simplifies regulatory requirements. The regulations can be complex, and training is essential to

ensure everyone fully understands them. Many resources are available through online platforms, educational journals, and professional societies to help revise experimental procedures and minimize hazardous waste generation. [8] [9]

Science is not the only academic area that falls under chemical hygiene umbrella.

Art departments, medical-related programs, athletics, and theater are just a few places where hazardous materials can be located. Additionally, some of these areas also can present risks from other hazards than chemical exposure. In my personal experience, personnel in these other areas can be the most difficult to convince. Most professors outside of the sciences do not have experience in chemical safety and certainly not in waste management. Consequently, these academic areas may pose a greater risk to the university's compliance status simply due to a lack of understanding and training.

The EPA has published an excellent resource for artists that discusses each sub-discipline. For example, painting requires the use of solvents, some of which are regulated waste. Ceramics can post an inhalation hazard and exposure to heavy metals including lead and arsenic. Printmaking may expose students & staff to corrosive and oxidizing reagents. Finally, while most modern photography is digital, the traditional film developing process presents inhalation hazards and produces regulated waste. [10]

4. Collegiality as Key to Starting a Compliance Program

As discussed earlier, one key to a successful chemical hygiene/waste management program is administrative support. This need for safety and waste programs has been made easier by a wider understanding of the consequences of non-compliance ranging from the potential of crippling fines to negative publicity that impacts school reputation from a lab accident. That being said, colleges may underestimate the ongoing financial commitment to maintain these programs. They may also be reticent to hire certified professional to manage these programs. This brings us back to the start where professors may need to build a compliance program.

As I began the process of developing compliance programs, I was fortunate to work with colleagues who understood the importance of lab safety. Most scientific academics are passionate about ensuring the safety of students and are open to formalizing procedures around lab safety. Consequently, this is where I suggest beginning. Start with lab safety procedures already in place. Using lab safety as a basis can help develop goodwill within a department and can provide a foundation for completion of your chemical hygiene plan.

Once an academic area understands the fundamental requirements and has administrative support, a chemical hygiene plan (CHP) can be developed. Various fact sheets are available from the EPA and OSHA on chemical hygiene and waste management. These provide excellent summaries of the requirements. Templates for chemical hygiene plans can be found online and are a good starting point. Some universities make their chemical hygiene plan public. Always customize for your organization. [11]

The most challenging requirement might be the control of inventory and developing a waste management system.

Entry level labs present an opportunity for all professors and instructors teaching those labs to evaluate current experiments. Keep those that meet your pedagogical requirements and consider changes to use of nonhazardous reagents. A review can identify any acutely toxic materials that are in use. Traditional organic chemistry labs generate larger quantities of waste and are a good target for reducing overall hazardous waste amounts. As stated earlier, a number of procedures have been published describing methods that will use less hazardous materials and/or replace hazardous solvents with better options for waste management.

5. Conclusions: Final Thoughts

As we have discussed, complying with federal and state regulations can be overwhelming, and developing effective programs that everyone will follow presents numerous challenges. However, minimizing chemical exposure for both students and faculty, as well as controlling waste, are essential practices that benefit any academic institution or department. Waste reduction not only enhances safety but also saves money, and formal safety procedures are essential to any successful program.

Creating a culture of compliance is vital. While compliance is legally required, imposing a one-size-fits-all plan on a department may seem like the easiest solution but is likely to face resistance. Professors often work independently, making it difficult—and, I would argue, counterproductive—to enforce compliance from above. Some professors may find it challenging to giving up what has been their long-time process so be sure to address their concerns. Involving faculty and staff in the development of your program greatly increases the likelihood that everyone will follow procedures and ensure ongoing compliance.

In conclusion, ensuring compliance with safety regulations and minimizing hazardous waste generation is a responsibility that pays off both in safety and cost savings. While the process may seem daunting at first, the investment in proper training, planning, and resources not only helps meet regulatory requirements but also fosters a safer, more efficient academic environment. With the right strategies in place, departments and institutions can navigate these challenges successfully and continue to prioritize both education and safety.

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