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Faculty Success Center

QuickTool 9.3

TFS QuickTool 9.3: Ensuring Laboratory Safety

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An e-mail joke from a college science colleague provided the impetus for this Teaching For Success QuickTool. Titled "Chemists Last Words," it listed twenty-five facile statements after laboratory safety infractions. Some particularly whimsical ones were:

- "And now for the taste test."
- "And now a little bit of this...."
- "And now, just shake it a bit...."
- "Why is there no label on this bottle?"
- "Oh no, wrong beaker...."
- "Where did I put my gloves?"
- "This is a completely safe experimental setup."
- "Trust me, I know what I am doing."
- "And now, the detonating gas problem."
- "First the acid and then the water...."

On the surface these jokes may get a good laugh from college science faculty. However, deep in the minds of college faculty it stirs concerns of the hazards accompanying laboratory teaching. Laboratory safety in the academic environment is for many faculty project-by-project concern addressed secondary to teaching the laboratory protocols.

Good Science Equals Good Habits

Good science teaching is not only presenting facts, examples and applications using suitable instructional strategies. It also means modeling the behaviors expected for careers in the discipline. The sciences require sets of behavioral skills not typically found in most of the other teaching fields. For example, science students must be able to accurately and consistently calibrate, operate and troubleshoot technical equipment. They also need explicit manual dexterity skills for handling chemicals or specimens. Most important of these skills are those required to perform all tasks safely in the laboratory environment.

Industrial scientists know all too well the value of following safety guidelines when performing scientific procedures. These practices are obviously prudent for protecting the health of themselves and others. Safe laboratory operations are also important for protecting the Earth by minimizing the release of hazardous materials into the environment. However, industrial scientists know that of utmost concern is the legality of safety. Safety practices in the lab or in the field are mandated by federal and state guidelines. It is assumed by the government that scientists are versed in the appropriate safety methods.

Higher Education—Higher Risk

The proportion of laboratory accidents and incidents is at least 100 times greater in academic settings than in industrial facilities. Surprisingly the difference is not so much due to a lack of knowledge or training. It is primarily due to a paucity of safety attitude in colleges. Scientists in industry are surrounded in a safety-conscious environment. Academic scientists are more relaxed in the laboratory usually overlooking subtle behaviors that pose potential health and environmental hazards. Examples abound of incidents in academic labs in which faculty and students were contaminated, injured or shortened their lives because of imprudent attitudes. A more diligent safety philosophy can be instilled with instructional staff through proper training and reinforcement. It also helps to have forms, such as the Safety Assurance Check Sheet shown on page 5, that simplify the implementation of safety protocols.

What is a Safety Attitude?

The Secretary's Commission on Achieving Necessary Skills (SCANS) report mentions that students must be inculcated with a work ethic that ensures the safety on the job for all science careers. Adult learning theorists recommend that these skills are effectively imbued by having the students learn through seeing and practicing the modeled behavior. In addition, assessment is effectual only if the students are evaluated on how they carry out the behavior along with tests of knowledge about the practices. This may seem like a tricky proposition for college science faculty with little industrial safety experience.

According to the Laboratory Safety Institute, having a safety attitude means that faculty and students are aware of the following points:

- Knowing the hazards.
- Knowing the worst things that can happen.
- Knowing what to do and how to do it if accidents should happen.
- Knowing how to use prudent practices, protective facilities and protective equipment needed to minimize the risks.

Industrial scientists would add that faculty and students need to maintain a positive safety attitude. Safety must be viewed as a valuable skill rather than as a necessary evil. Behavior-based safety is one key to the success of industrial safety programs. Scientists in industry learn to make safety part of their everyday routine. Plus, they are regularly evaluated for safety performance through incentives and guided corrections. Most important is that everyone is part of the safety picture and each person encourages the other to model safe work practices.

Faculty have the power to impart a safety attitude in students by diligently exercising the same safety precautions that they teach. They must also regularly communicate the importance of safety and convince the students about the value of a safe work environment. A positive disposition about laboratory safety is fundamental to convey through a steadfast commitment to safety practices.

A Safety Strategy Checklist:

It truly helps to have a simple checklist to ensure consistent safety teaching. Checklists are part of the documentation requirements for industrial laboratory safety standard operating procedures. The checklist should be made available for all laboratory teaching faculty including adjunct faculty and teaching assistants. A quick safety training session is also recommended for ensuring that all instructors know the philosophy of the college's safety education practices. Some good questions to consider:

- Are students aware of laboratory safety principles?
- Do you have the safety protocols for the laboratory activity?
- Are all the safety precautions in place for the laboratory activity?
- Is there an accessible emergency plan posted?
- Have the students been given a brief safety overview before starting the activity?
- Is proper safety modeling being demonstrated in the laboratory session?
- Are students being assessed on safety skills?

* This can be ensured with a lesson on laboratory safety and the use of a student contract. A sample student safety contract can be viewed on the Flinn Scientific Inc. website at http://www.flinnsci.com. The comprehensive contract is also a great document for educating students about science lab safety.

Safety Practice Overview

Knowing and teaching prudent safety practices is fundamental to instructing college science students about laboratory safety. Remember that safety is as much a workforce skill as content knowledge of science. Safety education for students is only successful if all instructional staff are modeling safety practices and include safety assessment as part of the course work. Make safety part of the curriculum.

Instructors can include a laboratory safety activity at the beginning of the semester before having students perform procedures in the regular laboratory sessions. Grading science majors on laboratory safety skills is highly recommended and emphasizes the importance of safety as a life skill. See the reference, Shmaefsky, "A method for analyzing the safe handling of chemicals by students," for a sample activity appropriate for chemical handling. Keep in mind that safety thinking must be consistently applied. Classroom demonstrations should have the same safety precautions as exercised in the laboratory. A significant proportion of injuries result from classroom demonstrations.

Dr. Shmaefsky's Laboratory Safety Assurance Checklist

1. Before Laboratory Session:

- ❑ Date. _____
- ❑ Person leading the laboratory session. _____
- ❑ Building. _____
- ❑ Room number. _____
- ❑ Process description (describe what is being done).

- ❑ Protocol steps or copy of activity.

2. List of hazardous materials

- ❑ Potential hazardous material or other risks.

- ❑ Personal protective equipment for students.

- ❑ Location of instruction manuals or MSDS.

- ❑ Safety precautions being taken.

❑ Emergency or accident procedures in place.

3. After the Laboratory Session:

❑ Methods of waste disposal.

❑ Locations of spent equipment.

❑ Modifications not listed in protocol.

❑ List of unexpected incidents.

❑ Comments for next laboratory.