ENVIRONMENTAL HEALTH AND SAFETY

Lab Chatter

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SAFETY SPOTLIGHT:
Autoclaves

By Jesse Millen-Johnson

Two relatively recent autoclave accidents involving laboratory technicians/assistants at Weill Cornell Medicine (WCM) and the University of North Carolina at Chapel Hill (UNC) highlight important safety lessons.

Autoclaves use high pressure saturated steam in a pressurized chamber. This allows water to boil at a temperature higher than it would at atmospheric pressure and makes it effective for sterilizing tools, wastes, and other materials. Supervisors must fully train all autoclave users on safe operation.

At UNC, a laboratory assistant was burned by pressurized steam (a biohazard spill simultaneously occurred) when they opened an autoclave in a tissue culture facility. At WCM, a laboratory technician received serious burns when about 4 liters of hot liquid and steam sprayed them after a bottle ruptured upon opening an autoclave.

The UNC autoclave was overloaded with biohazardous waste bags. Its drain/strainer was also clogged, which led to the chamber over-pressurizing and filling with hot water, which then sprayed out when the door was opened. The drain/strainer was not being cleaned prior to each use, which ultimately blocked the autoclave unit from exhausting. The autoclave was also opened while still pressurized, even though gauges indicated high pressure. Security camera footage showed the laboratory assistant wearing long pants and closed toe shoes but not wearing an apron or eye/face protection.

All newer autoclaves should have safety features that prevent them from opening when pressurized. However, older units are still in use at some facilities. These older autoclaves should ideally be removed from service altogether. If this isn't possible, extra care and training is needed for all users.

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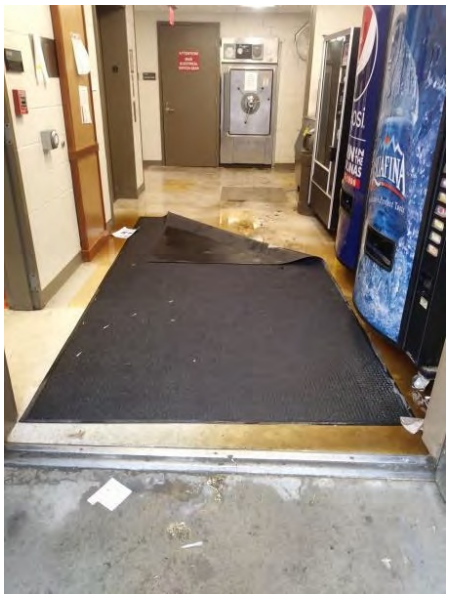

Liquid from biohazardous waste bags sprayed from an autoclave into a hallway at the University of North Carolina, Chapel Hill. A clogged drain/strainer was a partial cause (photos courtesy of UNC EHS).

During the incident at WCM, a laboratory technician was using an autoclave to sterilize tools and materials. He opened the door after the cycle finished and a bottle inside the autoclave burst. It sprayed him with hot liquid and steam, causing serious burns on multiple areas of his body.

Other laboratory workers had to lead him to the safety shower to douse the burned areas in cool water. They also called EMS, who then transported him to an emergency room.

Two half-full 10 liter bottles of phosphate-buffered saline had been autoclaved, with one bottle's cap sealed tightly. The sealed cap allowed a pressure buildup and subsequent explosion of that bottle. The technician was not wearing appropriate PPE, which should have included thermal gloves, face shield, and liquid-resistant apron. There was also no secondary containment for the vessels; they were placed directly on the autoclave rack. Secondary containment would have captured a significant portion of the liquid.

Both incidents at UNC and WCM were ultimately caused by lack of proper training and failure to wear adequate PPE.

Autoclave Safety Tips

- Thoroughly review the manual for each particular autoclave
- Lab personnel must know the nearest safety shower and eyewash locations
- Additional PPE must be worn when autoclaving, including latex gloves when handling potentially contaminated material, thermal gloves when retrieving objects after autoclaving, and face shields and liquid resistant aprons
- Check for items left inside by previous users before starting autoclave
- Ensure all materials are autoclave compatible
- Verify bottles are not overfilled AND loosen bottle caps, regardless of size

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- Use secondary containment
- Make sure materials and instruments are not touching the walls or floors of autoclave
- Do not overload autoclave
- Run all pre-checks required for unit, including checking drain strainer and verifying the door seals properly
- Choose the correct cycle
- Always make sure the chamber pressure has returned to zero before opening autoclave door
- Open the door slowly and carefully, standing behind it instead of in front of it
- Allow steam to release and wait 30 seconds before fully opening
- Wait for autoclaved materials to cool before retrieving them. This is especially important when autoclaving liquids, as they may still be cooling and returning to normal pressure
- Never autoclave animal carcasses or material that is flammable, corrosive, or radioactive

Burst bottle placed directly on autoclave rack.

The ruptured bottle cap (photos courtesy of WCM EHS).

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Training Modules for Employees and Volunteers

By Ronnie Souza

There are two questions Human Resources and EHS address every semester and prior to summer break:

1. *What are the training requirements for employees and volunteers working in UNE laboratories?*

2. *When is a worker an employee or a volunteer?*

Answers:

Employees and volunteers working in UNE labs are required by federal law to complete Human Resources core training modules. In addition, employees and volunteers working in laboratories are required to take lab training modules in the same manner as their annual training.

If you are a supervisor or manger, training is required for all new and returning students receiving compensation **or** volunteering (including federal work study), temporary and part-time employees, adjunct faculty, and non-student volunteers. In short, training modules are needed regardless of whether the worker is an employee or volunteer.

If you have employees and/or volunteers in the categories below, you are required to register them for UNE training:

· Full and Half Time Salaried
· Full and Half Time Hourly
· Faculty 9, 10, 11, or 12 month
·Adjunct Faculty
·Part Time/Temp Salaried
·Part Time/Temp Hourly
·Student Paid
·Student Unpaid (volunteer)
·Graduate Assistant
·Volunteer (non-student)

Go to V:\UNEDocs\HUMAN RESOURCES\Training for the training registration form. Please note it is the responsibility of the person submitting the request to indicate the trainings needed. If unclear on which trainings are necessary, please contact the EHS Director at x2488.

Please forward the completed training registration form to Tammy Louko in Human Resources at tlouko@une.edu. She will provide the individual access to training, which can be taken on Okta by selecting the UNE Training tile.

PLEASE NOTE: Training requests must be submitted prior to starting in the lab; preferably sent to Human Resources by close of business on Wednesday or as soon as possible. The supervisor should confirm completion of the training by requesting a copy of the individual's training quiz scores. This must be done before letting them work independently in the laboratory.

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Foot Protection in the Laboratory

By Peter Nagle

Summertime often brings a more casual attitude to UNE. This can result in relaxed dress codes, flexible working hours, and a laid-back approach. However, it's important not to reduce your focus on laboratory safety. Accidents are just as likely to occur in the summer, so it's imperative to remain vigilant.

Footwear is of special concern in the summer, as many people wear sandals, flip-flops or Crocs. However, open toed shoes are prohibited in UNE labs. They offer no protection in case of a spill or other accident. The following foot injuries occurred in college laboratories due to improper footware:

- A student dropped a two-liter aspirator flask of tissue culture media on their foot while wearing sandals. This required a trip to the emergency room and many stitches.
- A researcher pulled a two-liter flask of agar from an autoclave and bumped the bottom of the flask against the lip, causing it to break. Boiling agar spilled over their bare legs and feet. They received second and third-degree burns.
- A researcher wearing sandals accidently kicked a piece of glassware, causing a six-inch laceration requiring stitches.
- The photo below shows burns on a researcher's feet when acid spilled while they wore flip-flops:

OSHA isn't specific about laboratory footwear but requires employers to ensure the use of appropriate personal protective equipment (PPE), which includes proper foot protection. UNE requires all personnel to wear closed toed shoes while in the laboratory. In addition, all footwear must meet the following conditions:

- Be constructed of a leather or synthetic upper (portion of shoe that covers toes, top and sides of foot, and back of heel), particularly in labs with hazardous or corrosive chemicals.
- Upper cannot be canvas or mesh, as these are easily permeable.
- Have a thick and durable rubber outsole that has sufficient tread for grip and traction.

Lab work can take a toll on feet, especially when standing all day. Luckily, safe footwear can be comfortable and supportive. An athletic shoe with ample cushion and arch support is recommended, as long as it has a leather or synthetic upper that liquids cannot permeate.

We often think of standard PPE (gloves, safety glasses, and lab coats) as crucial, yet fail to consider footwear. However, serious foot injuries can and do occur in labs. As summer approaches, make sure you protect your feet.

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Compressed Gas Cylinders

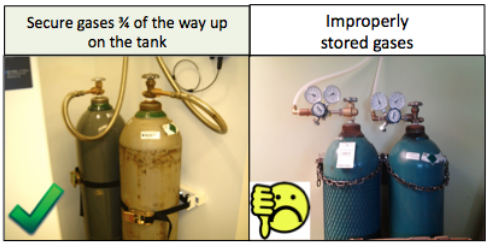
By Jesse Millen-Johnson

Gasses must be highly compressed to fit into cylinders, which leads to significant potential energy inside a relatively small, rigid tank. The volume of a typical gas compressed inside a cylinder would be more than 150 times greater at normal atmospheric pressure. If a tank tips over and the outlet valve breaks, a large amount of energy is suddenly released. The cylinder becomes a missile that easily shoots through walls, ceilings, and anything else in its way. Take a look at the **animated video** and this **security camera footage** to see what can happen.

This illustrates the importance of securely storing compressed gas cylinders with straps or chains. They must be kept upright at all times. Loose or improperly secured straps are too common in laboratories and other settings. It's important to frequently check straps and chains and tighten them if needed. When gas cylinder suppliers drop off newly filled tanks, they occasionally fail to properly secure straps. It's also vital to ensure tanks are not strapped to items that could move or tip over themselves and that fastening clamps are properly placed and tight.

Compressed gasses should never be stored in an office or closet. They need to be in well ventilated areas such as science laboratories. When moving cylinders, they must be securely strapped to a cylinder cart. Protective valve caps should be used. Make sure not to drop, bump, or roll cylinders. Wear footwear with toe protection and use gloves and safety glasses. Only use elevators to transport; never stairways.

Other important hazards of compressed gasses include asphyxiation due to the displacement of oxygen from a leaking gas cylinder, fires or injuries caused by flammable gas ignition, and health complications due to the inhalation of a toxic or asphyxiating gas. The PI is responsible for training lab personnel about compressed gases used in the lab. Training should include a review of the Safety Data Sheet (SDS), proper handling, storage, emergency plan, leak testing, and proper use. Ensure the correct regulator is used for the specific gas inside that cylinder. Never force a regulator connection and stop immediately if it doesn't fit correctly.



Straps and chains should be 3/4 up on the widest part of tank and below the neck area.

When cylinders cannot be secured to walls or benches, specially designed floor stands can be used (photos courtesy of the University of Vermont).

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