Ask the Experts

John H. Keene

Global Biohazard Technologies, Inc., Midlothian, Virginia

Do you have a biosafety question and you're not sure who to ask? Send your questions to the "Ask the Experts" column and I'll get them answered for you. Drawing from my own experience or that of other experts in the field, we'll try to compile a thorough and comprehensive answer to your question. Please e-mail your questions to jkeene@globalbiohazardtechnologies.com or Co-Editor Barbara Johnson at barbara_johnson@verizon.net or Co-Editor Karen B. Byers at karen_byers@dfci.harvard.edu.

How important is foot protection in the laboratory?

Question

I am having problems convincing lab personnel, particularly those right out of the university, that they should be wearing appropriate footwear in the laboratory. Are there any recommendations and/or regulations requiring that the feet of laboratory workers be covered, and are there any instances of injury reported because of not wearing the proper foot protection in a laboratory?

Answer

I cannot find any specific regulation requiring the use of appropriate footwear in the laboratory, with the exception of the OSHA Bloodborne Pathogen Standard, which indicates that the employer must ensure that personnel are protected from potential exposure of the skin to blood or other potentially infectious materials (OSHA, 1991). While not specifically requiring closed-toe shoes, ensuring appropriate covering of the skin is required. The Bloodborne Pathogen Standard (BBP) under *Personal Protective Equipment* 1910.1030(d)(3)(i) states:

> When there is occupational exposure, the employer shall provide, at no cost to the employee, appropriate personal protective equipment such as, **but not limited to**, (bold type added for emphasis) gloves, gowns, laboratory coats, face shields or masks and eye protection, and mouthpieces, resuscitation bags, pocket masks, or other ventilation devices. Personal protective equipment will be considered "appropriate" only if it does not permit blood or other potentially infectious materials to pass through to or reach the employee's work clothes, street clothes, undergarments, skin, eyes, mouth, or other mucous membranes under normal conditions of use and for the duration of time, which the protective equipment will be used.

Wearing appropriate footwear is noted in several well-respected texts on laboratory safety. Hawley and Eitzen (2000) in their chapter "Bioterrorism and Biological Safety," state: "As a minimum…fully fastened laboratory coat…closed-toe shoes, eye protection…." Stainbrook and Runkle (1986) in a chapter on personal protective equipment write: "An area of laboratory safety that is frequently omitted is foot protection. The laboratory can be a wilderness of foot injuries, from spilled chemicals…broken glass, hot liquids and dropped heavy objects." They suggest that "most foot exposure problems can be solved very simply by requiring that all employees wear low-heel, fully enclosed, leather shoes." Finally, in *Prudent Practices for Handling Hazardous Chemicals in the Laboratory,* Section 1.F.3 states that "shoes should be worn at all times in buildings where chemicals are stored or used. Perforated shoes, sandals or cloth sneakers should not be worn in laboratories or areas where mechanical work is being done" (NRC, 1990).

If these documents and recommendations are not sufficient to convince laboratory personnel to wear appropriate footwear, perhaps a little specific injury information will help. Several months ago, Dr. Pat Cox at Mississippi State University polled some laboratory safety personnel about the failure to wear proper footwear in the laboratory (personal communication). She submitted the poll responses to the Biosafety List Serve and they are published below with Dr. Cox's permission.

> "I worked in an academic research lab. Aside from my lab work, I was also responsible for ordering supplies. On one of my ordering days, I was wearing long pants with sandals. I figured it'd be ok since I wasn't performing any lab work that day. I opened one of our refrigerators to check supplies and a plastic conical tube fell from the door shelving onto the floor and shattered—splashing my bare foot with some of the contents. At first I'm thinking—'Dummy me…I know better than to wear sandals in the

lab! I need to clean this up.' Then my next thought was '...what's in this solution?!??!' because I was in the early stages of pregnancy. Fortunately, it wasn't anything bad and my child was unaffected as a result of my lax attitude. Moral of the story: It doesn't matter if you're doing the research or not...you can still be involved in a lab accident/exposure."

"We had a student drop a 2-liter aspirator flask of tissue culture media on her sandaled foot, requiring a trip to the ER and many stitches."

"I usually tell them about a friend of a friend years ago who went to pull a 2-liter flask of hot agar out of the autoclave, bumped the bottom of the flask against the lip, broke the flask and had boiling agar spill over her bare legs and feet—second and third degree burns."

"We had a biology graduate student decide that he would make up several solutions of nitric acid/alcohol in plastic bottles to use as a cleaning solution, particularly for glassware. He was wearing shorts and sandals, but had put on a lab coat that went down to about mid-calf level. The build-up of pressure in one of the bottles caused a rupture and getting the solution over his back when he was turned around. Unfortunately his lower legs and feet, and neck, were severely burned as he was working alone after normal working hours."

"In my previous life as a lab rat in a lab, a girl in a lab booted a piece of glassware accidentally, while wearing sandals, and had about a 6-inch laceration requiring stitches on her foot."

"We got a call from our HazMat team about a small (4 liter) concentrated H_2SO_4 spill in one of our labs. When I got there and entered the lab, one of the first things I see is a pair of shoes submerged in a bucket of water. Turns out a grad student had not so much spilled as dropped a 4-liter bottle of concentrated H_2SO_4 right at his feet. Fortunately, the bottle really contained only1 liter of acid. Unfortunately, it soaked his brand new and expensive Nikes, which were what I saw soaking in the bucket. Had he been wearing sandals, it would have been his feet drenched in concentrated sulphuric acid (and, presumably, soaking in the bucket). And had it been full and landed on his toes, he probably would have been on his way to the hospital to have his broken toe(s) set."

"One hot summer day, in the basement of a then non-air conditioned university building, a lab tech was transferring concentrated nitric acid from a carboy to individual bottles (for a chem. lab) via a pressurized line. The line came loose and sprayed the acid; her PPE protected her and that PPE included canvas sneakers. There were holes burned through the sneakers, but the acid was all used up in that process. Her feet did not get burned. If she had been wearing sandals (this was pre-flip-flop craze)—and given the heat and humidity of that day, wearing sandals would have been more comfortable—her feet would have been badly burned."

"Actually, as a young punk scientist, I was mixing a xylene solution and did not know xylene melts parafilm, as I flipped over a parafilm-covered 2-liter cylinder. Much to my surprise, the solvent (2 liters) passed thru the parafilm to the floor. As I went to get a spill pillow, I meandered thru the xylene. Several minutes later, I could feel the floor with my socks. The xylene had completely melted the bottoms of my tennis shoes. I decided to take an early lunch and walked out with my 'shoe covers' to get replacements. Needless to say, the snow was very cold and wet walking in socks!!!"

There is a suggestion within the BBP regulation that "skin must be covered" but not a specific requirement for foot covering. However, several well accepted laboratory safety texts indicate that personnel should wear appropriate footwear while working in the laboratory. These documents constitute a "standard of the industry," which an employer should adhere to. In addition, during a lab safety evaluation following a laboratory accident, an OSHA inspector could cite for failure to wear appropriate footwear. That, in and of itself, might not convince a researcher to wear shoes in the lab, but the answers to the poll published by Dr. Cox should be enough to make him or her consider the problems that might be encountered.

References

Hawley, R. J., & Eitzen, Jr., E. M. (2000). Bioterrorism and biological safety. In D. O. Fleming & D. L. Hunt (Eds.), *Biological safety principles and practices* (3rd ed.) (pp. 567-578). Washington, DC: ASM Press.

National Research Council (NRC). (1990). Procedures for working with chemicals in laboratories (1.F.3). In *Prudent practices for handling hazardous chemicals in laboratories*. Washington, DC: National Academy Press.

Occupational Health and Safety Administration (OSHA). (1991). Occupational exposure to bloodborne pathogens (29 CFR 1910.1030). *Federal register, 51*, 64175-64182. Available at: www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10051&p_text_version=FALSE

Personal Communication. (2007). Dr. Patricia Cox. Mississippi State University.

Stainbrook, B. W., & Runkle, R. S. (1986). Personal protective equipment. In B. M. Miller (Chief Ed.), *Laboratory safety: Principles and practices* (pp. 164-172). Washington, DC: American Society for Microbiology.