

# Environmental Health & Safety

## Safety Matters

### Are You Ready for the Unexpected?

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In terms of accident prevention the only legitimate goal is zero accidents. Because systems and people are imperfect however, we also must know what to do, **in advance**, to mitigate the consequences of laboratory accidents.

Recently, two college chemistry students (at another University) were treated for first- and second-degree burns after their clothes caught fire during an experiment. Mistake followed mistake. One student reached for napkins to pat out the fire, while the other reached for the nearest squirt bottle. Instead of water, it contained acetone, a flammable liquid that intensified the fire. (Label ALL secondary chemical containers; here, mistaking flammable acetone for water made a bad situation worse).

Fiery napkins fell on the floor, and one of student's socks caught fire. When one of the panicked students screamed "fire!" the professor rushed into the laboratory from his office, grabbed an extinguisher and put out the flames. While it seems that EVERYTHING went wrong in terms of incident response, it actually could have been worse. A follow up investigation revealed:

- ◆ No one was wearing safety glasses or lab coats
- ◆ One student was wearing shorts; another, flip-flops
- ◆ One student with long hair did not have it tied back

Unfortunately, lab fires, explosions, and other mishaps occur with a greater frequency in academic settings than in chemical industry settings. One of the most effective proactive measures is to keep your eyes

wide open and **know where your safety and response equipment is located and how to use it** in case of an emergency. QUICK!! Do you know the locations and uses of the following items in your laboratory?

- ◆ Personal Protective Equipment (lab coat, safety glasses, and gloves)
- ◆ Fire extinguisher & fire blanket
- ◆ Eyewash station & safety shower
- ◆ Chemical spill kit
- ◆ Current EH&S wall guide describing response procedures for fires, chemical, biological, or radioactive spills

EH&S regularly surveys labs for the presence of appropriate spill/accident response materials. But, if you have any questions, DON'T WAIT, call us for an assessment.

#### ENVIRONMENTAL HEALTH & SAFETY

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### The Safe Use of Pyrophoric Reagents

Tragedy struck the UCLA community recently when a researcher succumbed to complications from burns received during an accident involving the mishandling of

t-Butyl lithium. Several lessons about preparation can be learned from this incident that might serve to prevent future catastrophe (see article above). Pyrophoric reagents are extremely reactive to

oxygen and moisture, and precautions must always be taken to prevent contact with air or water. Reactivity danger is often exacerbated by their storage in extremely flammable solvents.

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## The Safe Use of Pyrophoric Reagents *continued*

Despite these hazards, pyrophoric materials can be safely manipulated and stored if the proper techniques and precautions are scrupulously followed. Lab workers must keep extraneous flammable or combustible materials away from areas where pyrophoric reagents are used or stored. Solid pyrophorics must only be handled in glove boxes flushed with inert gas, while liquid reagents, usually contained in glass bottles with PTFE-lined septa, can be manipulated with a cannula or syringe flushed with inert gas. The latter techniques should always be conducted in a fume hood if a glove box is not available, preferably behind a blast shield, and always with appropriate personal protective equipment

(PPE) – at a minimum, gloves, a lab coat, and safety glasses. Any fires involving pyrophoric materials may be extinguished by smothering with soda ash or sand. Contact EH&S to determine if your procedure necessitates maintenance of Class D fire extinguishing materials on hand; standard laboratory CO<sub>2</sub> or Class ABC fire extinguishers should not be used on most pyrophoric fires, as this can disperse the fire. If you find yourself or a colleague on fire, first attempt to smother the flames with a lab coat, fire blanket, or by “Stop, Drop, and Roll”. Always know where your safety equipment is, should you need to use a safety shower or eyewash.

The importance of experience and comprehensive knowledge of the correct techniques for using pyrophoric and air-sensitive reagents cannot be overstated. Only qualified and experienced laboratory workers should ever manipulate these materials, and only after they have attained a complete understanding of the hazards involved and received hands-on instructions from knowledgeable peers regarding correct handling techniques. Read more about the Safe Use of Pyrophorics Reagents @ <http://www.ehs.columbia.edu/pyrophorics.pdf>

### SEE SOMETHING, SAY SOMETHING

IN A LAB SAFETY POLL TAKEN AT OHIO STATE UNIVERSITY, NINETY-FIVE PERCENT OF THE GRADUATE STUDENTS POLLED SAID THEY WOULD NOT LIKELY REPORT A SAFETY HAZARD BECAUSE THEY FEARED REPRISALS FROM FACULTY OR STAFF. UNREPORTED SAFETY HAZARDS ARE ONE OF THE MOST COMMON CAUSES OF ACCIDENTS WITHIN A LABORATORY. WE ENCOURAGE YOU TO PLEASE CONTACT EH&S TO REPORT A SAFETY HAZARD.

## RASCAL Enhancements

The University’s RASCAL system is a critically important portal for many research and administration needs. In addition to hosting training modules and worksheets for creating grant proposals, RASCAL is also used to create and submit IACUC and IRB protocols, along with their associated Hazardous Materials Appendices. These Appendices are used by EH&S to evaluate safety and compliance aspects of the research protocol. The Appendix submission process, as well as the process of updating or modifying an existing Appendix, can

sometimes be a source of frustration however, particularly for those who do not regularly use the RASCAL system.

To facilitate this particular operation, EH&S, in conjunction with RASCAL’s administrative technical support staff, has developed a step-by-step worksheet that guides users through this process from start to finish. The worksheet can be found in the ‘What’s New’ section of our homepage, <http://www.ehs.columbia.edu/>

In addition to this document, the RASCAL system contains a “Help” function that answers many users’ most frequently asked questions about particular operations within the system. Often the answer to the question that will allow you to complete and submit your protocol can be found by clicking this “Help” button. As always, both the RASCAL staff and EH&S are available to assist those completing RASCAL-based documents with their technical questions.

For Lab Fire Safety Prevention tips, check out:

FDN(wh)Y Me @

[http://](http://www.ehs.columbia.edu/FDNYMe.html)

[www.ehs.columbia.edu/](http://www.ehs.columbia.edu/FDNYMe.html)

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## Needlestick Prevention

According to a CDC study in March 2000, approximately 60-90% of occupational sharps injuries could be eliminated by the use of safety-engineered medical devices. Fortunately, most of these injuries will never be as serious as the nightmare scenario experienced this spring by a German researcher, who was stuck by a needle potentially contaminated by a highly infectious strain of the Ebola virus, a Biosafety Level 4 organism. Nonetheless, apart from the advanced engineering containment and increased personal protective equipment requirements necessary to safely handle this highly infectious material, many of the same safety practices are also required for manipulation of “routine” Biosafety Level 1 and 2 organisms, including viral vectors and any human cell line. Since infection by these commonly used organisms occurs as a result of direct contact between the

organism and non-intact skin or mucous membranes, measures that reduce the risk of percutaneous injuries are important for reducing the overall risk of such exposures. The best way to reduce the potential for needlesticks and other sharps injuries is to remove, through substitution, those tools capable of causing them. For example, using plastic transfer pipettes in place of glass Pasteur pipettes, or plastic screw-topped test tubes instead of breakable glass.

For needles, this goes a step further. A provision of the OSHA Bloodborne Pathogens Standard, known as the Needlestick Safety and Prevention Act, requires employers to “document annually consideration and implementation of appropriate commercially available and effective safer medical devices designed to eliminate or

minimize occupational exposure.” Whether by covering the needle with a locking shield, or retracting it into the barrel of the syringe, these devices eliminate the potential of a sharps injury once the needle has been used and the engineering control has been deployed.

Several examples of these devices are pictured, and additional information on this requirement can be obtained by contacting EH&S.



LABORATORIES ON THE MORNINGSIDE CAMPUS CAN NOW RETURN STYROFOAM BOXES TO THE SENDER FOR RE-USE. THEY MUST BE CLEAN AND HAVE THE SUPPLIER'S 'POSTAGE PAID' RETURN LABEL. SEE THE 'WHAT'S NEW' SECTION OF OUR HOMEPAGE, [HTTP://WWW.EHS.COLUMBIA.EDU/](http://www.ehs.columbia.edu/).

## NIH Changes in Rules for Recombinant DNA

The NIH recently broadened the scope of their *Guidelines for the Use of Recombinant DNA Molecules* to specifically include synthesized nucleic acids. Previously, the *Guidelines* covered only those molecules derived from living cells. The amendment stems from the recognition that evolving technologies enable the manipulation of genetic materials in ways not envisioned when the *NIH Guidelines* were first

written. Thus, it is not surprising that the language in the existing *Guidelines* does not provide clear direction as to the applicability of these newer techniques. This revision (Federal Register, 3/4/09, p. 9411-9421) clearly places these activities within the *Guidelines'* scope because the work merits the same type of oversight as more traditional rDNA research. All activities using rDNA must be described in a

submittal to the University's Institutional Biosafety Committee. The NIH defines protocols which are 'exempt' from submission requirements, but this category is narrower than most people assume and investigators must, at a minimum, submit an initial application for the IBC to make this determination.

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EH&S  
Website:  
<http://www.ehs.columbia.edu>

## NIH Changes in Rules for Recombinant DNA continued

To submit your lab's rDNA work:

- ◆ Go <https://www.rascal.columbia.edu>.
- ◆ Select 'Hazardous Materials' from the menu on

the left side of the welcome screen

- ◆ Log in with your CU UNI and password
- ◆ Select and then complete and save "Recombinant DNA (Appendix A)" which can then

either be attached to an IACUC protocol or

- ◆ submitted directly to EH&S for in vitro-only
- ◆ activities using rDNA.

## Columbia Welcomes New York's Finest

Anyone who handles chemicals at Columbia knows that EH&S is equipped to respond to the vast majority of chemical incidents that one would expect to encounter in the laboratory, but additional preparation is also required for emergencies of greater magnitude where response by NYPD (New York City Police Department) or FDNY (Fire Department of New York City) would be needed. NYPD, along with FDNY, play a primary role in the Citywide Incident Command System and would serve as a primary responder in the event of a chemical emergency in NYC. As a research institution where chemical use is ubiquitous and hazardous waste from such use is generated, Columbia must prepare a plan to minimize hazards to human health and the environment resulting from fires, explosions or any unplanned or sudden release of

hazardous waste to air, soil or surface water. As part of Columbia's on-going preparedness and response efforts, EH&S, in partnership with the Department of Public Safety and the Radiation Safety Office, hosted emergency response site familiarization tours on the CUMC and Morningside campuses for NYPD on February 20<sup>th</sup>. More than 20 of New York City's Finest, from local precincts, Special Operations Division, Emergency Services Unit-Hazardous Materials/WMD Response Team and

Counter Terrorism Division, had an opportunity to meet and familiarize themselves with members of Columbia's Emergency Management Operations Team and its response capabilities, as well as gain a greater appreciation for Columbia University's chemical response coordination. Columbia also regularly conducts similar drills with FDNY, in order to familiarize firefighters with the complex geography and operations of the many CU campuses.

For Lab Fire Safety Prevention tips, check out:

FDN(wh)Y Me @

<http://>

[www.ehs.columbia.edu/](http://www.ehs.columbia.edu/)

[FDNYMe.html](http://www.ehs.columbia.edu/FDNYMe.html)



### FLUSH YOUR LAB'S EYE WASH WEEKLY.

AN EMERGENCY IS NOT THE TIME TO DISCOVER THAT IS NOT WORKING. REPORT ANY PROBLEMS WITH THE UNIT TO YOUR CAMPUS FACILITIES DEPARTMENT.

## Ergonomics: Top Warning Signs of Back Pain

Back pain that is worse at certain times of day or week (such as after a long day in front of a computer); pain that starts in the neck and moves downward into the upper back, lower back and extremities; pain that goes away after switching positions while sitting or standing; sudden back pain that is experienced with a new job, a new chair, a new car; and/or back pain that comes and goes for months.

Over time, poor posture such as slouching, looking at the computer screen at a wrong angle, or standing for long periods of time, may cause back, neck and shoulder pain. However, factors affecting posture and ergonomics are mostly within one's ability to control and are not difficult to change.

The following tips could help to improve posture and resolve ergonomic issues, especially for people sitting most of the day in an office chair.

- ◆ **Get up and move:** As muscles tire, slouching, slumping, and other poor postures become more likely; this in turn puts extra pressure on the neck and back. To maintain a relaxed yet supportive posture, change positions frequently. One way is to take a break from sitting every hour or so for a few minutes in order to stretch, stand, or walk.
- ◆ **Keep the body in alignment while sitting or standing:** Distribute body weight evenly

to the front, back, and sides of the feet while standing. Sit up straight and align the ears, shoulders, and hips in one vertical line. Any single position, even a good one, will be tiring. Leaning forward with a straight back can alternate with sitting back, using the back support of the chair to ease the work of back muscles. Also be aware of and avoid unbalanced postures such as crossing legs unevenly while sitting, leaning to one side, hunching the shoulders forward or tilting the head.

- ◆ **Use posture-friendly props and ergonomic office chairs when sitting:** Supportive ergonomic "props" can help to take the strain and load off of the spine. Chairs with an adjustable back support should be used. Footrests, portable lumbar back supports, and a towel or small pillow can be used while sitting in an office chair or while driving. Using devices designed to minimize back strain can also promote good posture. Proper corrective eyewear and positioning computer screens to your natural, resting eye position help to avoid straining the neck.
- ◆ **Increase awareness of posture and ergonomics in everyday settings:** Being aware of posture and ergonomics at work, home, and play is a vital step toward instilling good posture and ergonomic techniques. This includes making conscious

connections between episodes of back pain and specific situations where poor posture or ergonomics may be the root cause of the pain.

- ◆ **Use exercise to help prevent injury and promote good posture:** Regular exercise such as walking, swimming, or bicycling will help the body stay aerobically conditioned, while specific strengthening exercises will help the muscles surrounding the back to stay strong. Exercise promotes good posture, which will, in turn, further help to condition muscles and prevent injury. There are also specific exercises that will help maintain good posture.
- ◆ **Wear supportive footwear when standing:** Avoid wearing high-heeled shoes regularly, which can affect the body's center of gravity and change the alignment of the entire body, negatively affecting back support and posture. When standing for long periods of time, placing a rubber mat on the floor can improve comfort.
- ◆ **Remember good posture and ergonomics when in motion:** Walking, lifting heavy materials, holding a telephone, and typing are all moving activities that

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## Ergonomics: Top Warning Signs of Back Pain continued

require attention to ergonomics and posture. It is important to maintain good posture even while moving to avoid injury. Back injuries are especially common while twisting and/or lifting and often occur because of awkward movement and

control of the upper body weight alone.

- ♦ **Create ergonomically positive environments and workspaces:** A small investment of time is required to personalize the workspace, home, and car, but the payoff will be well

worth it. Undue strain will be placed on the structures of the spine unless the chair, desk, keyboard, and computer screen, etc. are properly positioned.

## Uranium: the Magic Element

Uranium has the highest atomic weight of all the naturally occurring elements. In nature, most uranium atoms exist as U-238 (99.3%), U-235 (0.7 %) and a very small amount of U-234. Uranium decays slowly (1/2 life of 4.47 billion years for U-238 and 704 million years for U-235) by emitting an alpha particle; Geiger counters easily detect uranium's beta and gamma decay products.

Uranium has been used since antiquity to color glass yellow (hence the yellow color of radiation signage). A more modern use of Uranium stems from U-235's ability to fission by neutron capture with a large amount of energy release. This ability to fission was confirmed by Columbia University scientists in the late 1930's using the Pupin Cyclotron, a discovery that was instrumental in developing the atomic bomb and harnessing nuclear energy. In order for most nuclear reactors to function, the percentage of U-235 must be raised from 0.7% to at least 3%, a

process known as enrichment (for weapon grade uranium, U-235 must be enriched above 95%). Several methods are used to accomplish this; an early such method, gaseous diffusion, was also developed in the late 1930's at Columbia University. In the early 1970's Columbia University built a small research nuclear reactor which for political and economic reasons was never fueled or operated. In the late 1990's Columbia University returned 5 tons of natural uranium (unrelated to the above mentioned nuclear reactor) to the Department of Energy.

Currently uranium (as uranyl acetate) is used at Morningside campus for its density rather than its radioactivity for preparing samples for electron microscopes. Its use causes a dilemma for some colleges because purchasing the compound does not require a license; however it must be disposed as radioactive waste, which does require a license.

URANIUM 238 (U238) RADIOACTIVE DECAY		
type of radiation	nuclide	half-life
	uranium—238	$4.5 \times 10^9$ years
α	thorium—234	24.5 days
β	protactinium—234	1.14 minutes
β	uranium—234	$2.33 \times 10^5$ years
α	thorium—230	$8.3 \times 10^4$ years
α	radium—226	1590 years
α	radon—222	3.825 days
α	polonium—218	3.05 minutes
α	lead—214	26.8 minutes
β	bismuth—214	19.7 minutes
β	polonium—214	$1.5 \times 10^{-4}$ seconds
α	lead—210	22 years
β	bismuth—210	5 days
β	polonium—210	140 days
α	lead—206	stable

The New York City Fire Department Code requires combustible materials (e.g., wood, paper, cardboard, and plastics) be stored at least 18" (457mm) below ceilings in areas protected by sprinklers. Materials stored on shelves against a wall are not subject to this requirement because they do not impede the overlap of spray from multiple sprinkler heads. In rooms or areas not protected by sprinklers, combustible storage shall be maintained at least 2 feet (610mm) below the ceiling.