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Environmental Health & Safety

SafetyMatters

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Environmental Health & Safety

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Research Safety and... Paracelsus

by Laszlo Virag, Research Safety Specialist

Paracelsus was a 16th century Swiss-German physician, botanist, and philosopher who is credited as the founder of toxicology. As a medical professor he was one of the first to recognize the importance of academic knowledge in natural sciences, particularly chemistry, for physicians, and pioneered the use of chemicals in medicine. He also put forth the theory that chemical compounds that are poisonous in large doses may be curative in small ones: "the dose makes the poison." In other words, some toxic substances may be harmless in small doses, while ordinarily harmless ones can be deadly in large doses. We owe Paracelsus the "target organ toxicity" concept as well, rooted in his belief that diseases locate in a specific organ. Thus, there is a particular organ where the effect of a chemical will be the greatest.

So what does Paracelsus have to do with research safety? Recently, a research laboratory inquired about the safety of handling Tyrosol, also known as 2-(4-hydroxyphenyl) ethanol. Tyrosol is a phenolic antioxidant present in wine and in olive oil (as ester with fatty acids) that can protect cells against oxidative injury. In animal models, Tyrosol increases the expression of a longevity protein (SIRT 1) in the heart after myocardial infarction. Ironically, when searching the Safety Data Sheet one will find in red capital letters the warning: "If swallowed, refer for medical attention, where possible, without delay."

The list of chemicals with such seemingly contradictory properties can be endless. For example, potassium chloride (KCl) is used in the treatment of hypokalemia, a low potassium syndrome that leads to elevated blood pressure, abnormal heart rhythm, muscle weakness, myalgia, and tremor. However, overdoses of KCl have a lethal effect by inducing cardiac arrest. Another example, is the toxin arsenic. Arsenic trioxide, has long been used in traditional Chinese medicine to treat cancer. Marketed as Trisenox, arsenic trioxide was approved in 2000 by the US FDA for the treatment of refractory acute promyelocytic leukemia, being shown to induce apoptosis of cancer cells. However, this drug carries significant risk due to the toxicity of arsenic.

How should a researcher proceed in light of these seeming contradictions? Far from advocating disregard for information in chemical Safety Data Sheets, or complacency when working with hazardous substances, EH&S wants to emphasize that even highly toxic chemicals can be handled safely by minimizing our exposure through the use of appropriate engineering controls, personal protective equipment, and not least, administrative controls (safe work practices). It is essential that researchers develop a thorough knowledge of the chemicals used in their experiments. Cross-referencing several chemical safety information sources can provide a more complete picture of a chemical's safety properties before use. A detailed understanding of the experimental protocols is always important, and practicing a dry-run of the steps involved when highly toxic substances are used, is recommended. For additional assistance in evaluating the safe use of chemicals in your laboratory, contact the Research Safety Team at labsafety@columbia.edu.

EH&S website offers enhanced navigation http://ehs.columbia.edu

When working in the laboratory, eating, drinking or applying cosmetics is prohibited.

Proper work attire (long pants, closed toe shoes) and PPE (e.g., laboratory coat, gloves and eye protection) must be worn when working in the laboratory.

Remember to periodically flush your laboratory cup sinks and floor drains with water to prevent sewer gases from migrating into your laboratory.

[On-line Chemical Waste Pick-up Request](http://vesta.cumc.columbia.edu/) Form http://vesta.cumc.columbia.edu/

For Lab Fire Safety Prevention tips, check out FDN(wh)Y Me http://www.ehs.columbia.edu/FDNYMe.html

Chemical Fume Hood Safety

by Katie Bolger, Health & Safety Specialist

Chances are that if you have worked in a research laboratory at Columbia University you have used a chemical fume hood. A chemical fume hood is the primary laboratory engineering control device for minimizing exposure to airborne chemical hazards. However, exposure is only minimized if the chemical fume hood is properly used and maintained. While EH&S inspects all chemical fume hoods annually, there are several things you, the user, can do to properly use and maintain the fume hood.

A chemical fume hood functions by drawing air from the laboratory across its face and into the work area of the hood, and then exhausting 100% of that air to the outside of the building. This air flow dynamic keeps contaminants generated inside the hood contained in the hood, and away from the user's breathing zone, prior to exhaust. This air current is most efficient when there is minimal disturbance in front of the fume hood (e.g., lab mates walking past), as well as minimal turbulence inside the fume hood from clutter and equipment. The fume hood sash, which is the glass window at the face of the hood used to separate the user from the hazard, should be positioned at the height indication mark that appears on the frame of every fume hood. The sash does double duty as it also helps protect the user from splashes or other accidents that may occur in the fume hood.

The University's Chemical Hygiene Plan (http://www.ehs.columbia.edu/Policy1.1.html) specifies avoiding storage of materials in the fume hood. While this is not always possible, any storage that does occur must be limited to materials that are in active use. Additionally, you can purchase portable fume hood shelves, such as those from TrippNT (www.trippnt.com), which help elevate materials and allow more adequate airflow in the fume hood. Figure 1 shows the air flow inside a fume hood without and with stored items and demonstrates how stored items can prevent proper air flow and allow contaminants to escape into the laboratory and reach the user's breathing zone.

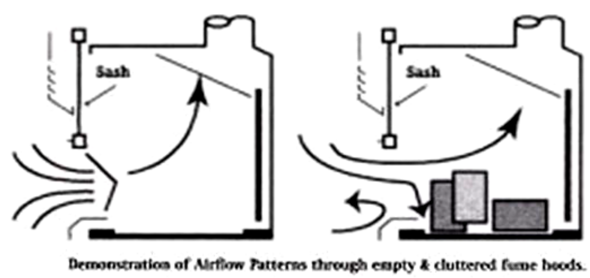


Figure 1.

Finally, while chemical fume hoods can serve as effective engineering controls when properly used and maintained, they do not eliminate the need for other protective measures, such as personal protective equipment. It is important, for example, to still use the appropriate gloves for the substance you are working with, as well as a lab coat and safety goggles to further protect your body and eyes from chemical splashes.

If you have any questions about the air flow in your fume hood or about ways to reduce clutter in the hood's work area, please reach out to occusafety@columbia.edu.

Are You FDNY Inspection Ready? by Andrew J. Patterson, Fire Safety Officer

The New York City Fire Department (FDNY) visits both of Columbia's New York City campuses on a weekly basis to perform annual inspections of all permitted laboratories. Here are a few tips to help ensure compliance with the FDNY Fire Code and NFPA 45, and more importantly, operate with the highest regard for safety:

- Housekeeping – Ensure aisle spaces are kept clear of rubbish, including combustible materials such as empty cardboard boxes. Also be mindful of storage too close to the ceiling. Maintain 18" of clearance in sprinklered laboratories, 24" in non-sprinklered laboratories.
- Chemical segregation – Do not store incompatible chemicals in the same cabinet or secondary containment bin. Also, do not store flammable liquids with acids or any oxidizing chemicals.
- Flammable liquid limits – Every laboratory has a flammable liquid limit established by FDNY and this quantity includes both reagents and waste. To find out what your laboratory's flammable storage limit is check the FDNY laboratory permit posted on or near your laboratory entrance door or contact fire-life@columbia.edu.
- Chemical Labeling – All containers of chemicals must be labeled at all times, even water! Please be sure to label all containers including, but not limited to, test tubes, bottles, and all waste containers. Need labels? The ChemWatch system can generate them for primary and secondary containers of all sizes - http://ehs.columbia.edu/Labels.html.
- Secure cylinders – All cylinders must be stored in the upright position by using a chain, strap, floor stand or bench clamp.
- Label Cylinders – Ensure that the cylinder contents are clearly visible at all times. This may require installing added labels on the top "shoulder" area of the cylinder in addition to the vendor applied label.
- Obstructions – Be mindful not to block safety and emergency equipment such as a fire extinguisher, eyewash/deluge hose or overhead emergency showers. Additionally, no electrical panel should be blocked or obstructed.
- Self-Closing Doors – No self-closing door should be propped or held in the open position by anything. Self-closing doors help confine fire and stop it from spreading into adjoining areas.
- C-14 – Every laboratory using chemicals must have at least one C-14 Certificate of Fitness holder present, whenever the laboratory is operation, including nights, weekends and holidays, as needed. The C-14 is an FDNY certification and classes are offered on campus. For more information about the requirements and class schedules please go to http://ehs.columbia.edu/cof.html.

For more information about how to keep your laboratory FDNY inspection ready, contact fire-life@columbia.edu.

Spotlight on Safety – Protect Yourself by Kathy Somers, Sr. Research Safety Specialist

When it comes to laboratory safety, the phrase "protect yourself" can mean many things. It can mean a thoroughness in reviewing information about reagents and researching protocols, careful preparation before beginning an experiment, and even meeting sleep and nutritional requirements in the nights and days before working with hazardous materials. The last step in protecting yourself is to put on a lab coat, safety glasses and gloves before starting bench work with hazardous materials.

EH&S spoke with Yinglu Zhang, third-year graduate student in Biological Sciences, following a recent safety survey, and discussed her research and the decision-making process that led to buying new lab coats in the Liang Tong Laboratory.

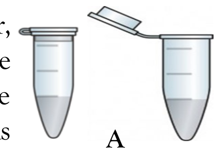
According to Yinglu, the lab's decision was motivated by safety and guidance from EH&S. The group's research includes protein crystallography, using bacteria to express proteins. The bacteria they use is *E. coli*, and although the strain is non-pathogenic, the team decided to reinforce the basics of biological safety along with standard precautions and review the differences between hazardous and nonhazardous materials at a recent laboratory meeting. "When we work with bacteria, we always wear a lab coat," Yinglu reports. The group also discusses safety weekly, with a special focus on sharing information on the status and operation of communal equipment.

EH&S applauds Yinglu and the laboratory of Dr. Liang Tong, for taking a "Safety Always" approach to their hazard recognition, communications, and PPE practices. Are you protecting yourself? Do you discuss safety in your laboratory? Find out more about personal protective equipment (PPE) here: http://ehs.columbia.edu/ppe.html.

Secure Your Microcentrifuge Tube Caps When Heating

by Tom Morgan, Chief Radiation Safety Officer

Microcentrifuge tubes are ubiquitous in laboratories. They are ideal for containing small quantities of liquids during sample preparation, chemical or enzymatic reactions or analysis. These tube are frequently exposed to extreme temperatures, from subzero freezing for sample preservation to heating for polymerase chain reactions (PCR) or DNA hybridizations. Often made of polypropylene, the tubes are able to withstand temperatures ranging from -200ºC to 100ºC, or greater. However, they are not unaffected by these extremes. Polypropylene expands slightly and softens when heated. This can cause the caps of some tubes to pop open (A) which can result in splattering or spillage of the contents about the immediate area. This can be particularly problematic when the contents contain radioactive materials, infectious agents, or hazardous chemicals.



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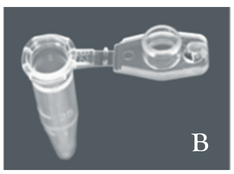

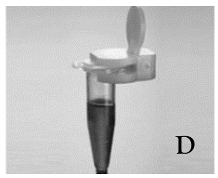

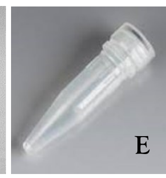

This problem can be solved by careful selection of a microcentrifuge tube appropriate to the task at hand. When extreme temperatures are called for in a research protocol, tubes with a special cap locking mechanism should be used. These are available in several types. A tube with an integral snap lid (B) provides extra resistance to leakage. Alternatively, special clamps can be used (C and D). Screw cap vials are also available (E).

Cooling of these tubes to liquid nitrogen temperatures may also create stress in the polypropylene that can result in leakage when thawed. Remember, storing tubes in the vapor phase of a liquid nitrogen dewar greatly reduces the possibility of leaks or of ampules exploding during removal.

In summary, select a microcentrifuge tube appropriate to the task at hand. These tubes are designed for single use only, and should never be reused.

Inspection Readiness – Laboratory Hazardous Waste Management

by Shane Son, Hazardous Materials Specialist

Over the past several years, state and federal regulatory agencies such as the New York State Department of Environmental Protection and the United States Environmental Protection Agency have, on average, inspected Columbia University annually; there have been no inspections so far in 2016, so a regulatory inspector could arrive at any time. Regulatory inspections are unannounced and generally include visits to laboratory spaces, as well as hazardous waste storage areas. In laboratories, along with proper personal protective equipment and general chemical hygiene (i.e., proper chemical labeling, segregation, and storage), an inspector will look for any deficiencies in hazardous waste management at the satellite accumulation area(s). A satellite accumulation area (SAA) is the space in the laboratory, designated by the laboratory, where chemical waste is accumulated prior to removal by EH&S to a central accumulation area (hazardous waste storage area). To ensure compliance with state and federal regulations, the University policy for hazardous waste management requires laboratories to follow "The 5 Ls." The 5 Ls are co**LL**ect, **L**abel, **L**id, **L**ocate, and **L**eaks. To remain inspection ready, please ensure you:

1. Co**LL**ect all of your chemical wastes into proper waste containers.
2. **L**abel the waste container with an orange Hazardous Waste label provided by EH&S and complete the label in its entirety (no chemical abbreviations or chemical formulas, please).
3. Keep a tight fitting **L**id on the container at all times, except when actively adding waste, of course.
4. **L**ocate hazardous waste containers at/near the point of generation and never move your waste container to another laboratory or anywhere outside of your laboratory.
5. Visually inspect hazardous waste containers for **L**eaks periodically.

For more information on hazardous waste management, refer to the peel-off instructions on the back of the orange hazardous waste label issued by EH&S or visit http://www.ehs.columbia.edu/HazardousWaste.html.

The Summer 2016 Laboratory Safety Attire Challenge!

by Janice Clarke, Research Safety Specialist

This past winter, the Research Safety program visited hundreds of research laboratories throughout Columbia University's campuses and completed a series of Personal Protective Equipment (PPE) field surveys. During the surveys, Research Safety Specialists observed more than 1,000 research personnel working near or with hazardous materials in the laboratory, and thus necessitating the use of safe laboratory attire and PPE. The good news is that nearly everyone observed during the field visits wore long pants, or the equivalent, and closed toe shoes. Laboratory appropriate attire, by its very nature, complements the use of PPE, such as a lab coat, and offers an additional layer of protection from inadvertent contact with hazardous materials.

The results, while very positive, were expected for a survey conducted during the winter months, given the need to stay warm and protected from the elements. The greater challenge will be maintaining the consistent use of proper laboratory appropriate attire during the summer months when the desire to stay cool drives us to wear shorts, sandals, flip-flops, and other summer attire that leaves a lot of exposed skin on the legs and feet. Not only is this inconsistent with Columbia University's *Policy for Personal Protective Equipment in Research Laboratories*, but it puts laboratory personnel at risk of increased exposure if something hazardous were to be splashed, spilled or sprayed. While incidents are infrequent, they can occur and could have serious consequences. Recently, a bottle of acetic anhydride fell to the floor and shattered, splashing its corrosive contents onto a researcher's feet when it impacted the floor. The researcher was wearing closed toe shoes at the time, which were contaminated with the corrosive material. The researcher removed their shoes, and out of caution, rinsed their feet off and walked away from the incident unscathed. An individual wearing sandals or flip-flops may not have been so fortunate.

Dressing comfortably is important, and understandably, researchers do not spend all day in the laboratory. EH&S recommends keeping an extra pair of pants or scrubs and closed toe shoes available to change into when working in the laboratory. At the end of the day, shed the extra layer and go on about your summer activities. Remember that proper laboratory attire always includes a lab coat, safety glasses/goggles, and appropriate gloves. These basic items of PPE will provide an extra barrier between you and the substances that you work with, and with careful planning, you will stay cool and stay safe.

Biological Materials Safety Training Update

by Remi Dosunmu, Biological Safety Officer

Do you work with biological materials such as cell lines, bacteria, viruses, recombinant DNA, or blood specimens? Then you will have taken one or more of EH&S' training courses in RASCAL. These courses are designed to not only be informative but to maintain and promote a safe work environment as you perform your research. Occasionally courses are reevaluated to make improvements based on the research community's needs. The most recent round of updates addresses new regulatory requirements and improves course content, including the following enhancements:

- TC0508 *Recombinant DNA Training*, is now required solely for Principal Investigators, and is required to be refreshed every three years. This course was previously required for all staff on protocols where rDNA technology is used.
- TC0509 *Biosafety and Bloodborne Pathogen Training* and TC1150 *Viral Vector Training* have been updated and streamlined, and includes improved quiz questions.
- TC3550 *Biological Safety Cabinet Training* is a new breakout course. It contains instruction on the safe and effective use of the Biological Safety Cabinet (BSC) and answers many of the questions commonly received by the Biosafety Program about the BSC and look-alike engineering controls. This course will only be required for researchers performing infectious agent work at Biosafety Level 2 (BSL-2) and above, and is required to be refreshed every two years.

Are you an administrator with staff that may need to take one of these courses, based on their research? As always, these and other courses in the RASCAL system can be assigned to personnel using the Testing Center's "Department Administration" module. For additional information or questions about these course changes contact biosafety@columbia.edu.

Dosimetry Frequently Asked Questions for Research Radiation Users

by Daniela Nicoletti, Training & Development Coordinator

Many research and clinical activities at Columbia University involve the use of radioactive materials and equipment. The following are a few frequently asked questions that may be of interest to those who wear radiation dosimeter badges.

Q: What is a radiation dosimeter, and why do I need to wear one?
A: A dosimeter is a passive device that records exposure to ionizing radiation. Personnel who work with certain types and volumes of radiation need to wear a dosimeter in order have a record of their estimated radiation dose while at work.

Q: How often do I need to wear my dosimeter? Does it expire?
A: Dosimeters need to be worn whenever working with radiation. A dosimeter does not expire but the time frame in which it needs to be returned for analysis does expire. A wear date is printed on the face of each dosimeter and it needs to be returned at the end of the wear period.

Q: Where on my body do I wear my dosimeter while I am working?
A: If you were assigned one dosimeter, please wear it at the chest level on your lab coat by clipping it to the pocket or lapel. If you were assigned two dosimeters and you wear a lead apron, please wear the chest dosimeter (the black figure on the front of your dosimeter) underneath the lead apron and your collar dosimeter (the red figure on the front of your dosimeter) on the outside of your lead apron at the collar level. When in doubt, look at the figure on the face of your dosimeter for guidance on correct placement.

Q: Where should I store my dosimeter after work hours? Can I take it home with me?
A: Please do not take your dosimeter home with you. Your dosimeter can be stored in your workplace in a secure location away from any radiation sources, such as a desk drawer or locker.

Q: Where do I return my dosimeter? How do I get a new one?
A: Check with your lab manager or the individual in your lab who handles the dosimeters for your group. Typically each lab/department should have a central location where old dosimeters are returned and new ones are picked up. If you are unsure, you can ask your PI or lab manager or reach out to badges@columbia.edu.

Q: If an employee leaves the lab and no longer needs a dosimeter, how do I remove it from the lab's list?
A: Every dosimeter package includes a packing slip. This packing slip can be utilized as a way to communicate dosimeter changes or modifications. Dosimeters to be removed can be noted on the slip and returned with old dosimeters. You can also communicate these changes with your lab manager and/or by emailing badges@columbia.edu.

Have additional dosimetry questions not covered above? Please contact badges@columbia.edu.

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Please share questions or comments with us at **newsfeedback@columbia.edu**

Vision Statement

Environmental Health & Safety (EH&S) provides expert guidance and timely service to the University Community through our commitment to health and safety. Employing best practices and collaboration, and by building long term relationships, we promote a productive and safety conscious work environment.