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Environmental Health & Safety

# SafetyMatters

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## Safety Culture and Accountability: Who is Looking Out for You?

by Jessica Phippard, Senior Research Safety Specialist

What is it that really makes a laboratory safe? Surely, a strong safety culture is built through a collaborative network of dedicated departments and institutional committees, exemplary supervisory staff and conscientious individuals. But who, specifically, plays the single greatest role in *your* personal safety? *You* do. While Environmental Health and Safety (EH&S) plays an integral part in the foundation of Columbia's safety culture, through policy development and implementation, training programs and laboratory surveys, ultimately, Columbia's safety culture flourishes when individuals take accountability for safety within and around their laboratories and work places.

Principal investigators (PI), too, play a fundamental role in setting the safety tone in their laboratories. This is evident in the various manners through which administrative controls are executed. Safety culture is strong in a laboratory group when the PI establishes a firm and transparent commitment to safety through the development of written Standard Operating Procedures (SOPs), requires strict adherence to University safety training requirements and supplements required training with task-specific benchtop training, and establishes a consistent expectation regarding the importance of routinized use of personal protective equipment (PPE) and proper laboratory attire. Still, individual decisions, despite the best guidance, can make or break a safety culture.

While teamwork and collaboration are essential in the pursuit of scientific research, personal accountability for safety is the only way to ensure a robust safety culture for the greater University community. The resources that have been put in place to help establish a safe working environment fall short when underutilized. It is imperative for all members of the research community to actively engage in safety matters – to discuss concerns or incidents, including near miss incidents, to encourage one another to do better in prioritizing safety and to reach out when help is needed. At the center of individual accountability for safety is the familiarization with the types, locations, and functionality of safety and emergency equipment in the laboratory. Quick: what is the location of your spill kit, emergency eye wash, overhead emergency shower, and portable fire extinguisher? Do you know how to use them? All too often, the knowledge of this information is siloed within the memory bank of a laboratory manager or supervisor. All individuals need to empower themselves with this knowledge, as accidents and emergencies tend to occur at the most inconvenient times. By the same token, laboratory managers, supervisors and PIs must regularly share their safety knowledge with all laboratory members.

Participate actively in making your laboratory a safe place for yourself and your colleagues, because when it comes to safety, the whole is truly greater than the sum of its parts.

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 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

# Spotlight on Safety – Isoflurane Exposure Control

by Katie Bolger, Health and Safety Specialist

Isoflurane, a commonly used anesthetic, is not an easy substance to control when it comes to exposure. Small procedural mistakes or improper work practices can lead to unnecessary exposure. In this edition of Spotlight on Safety, Samuel Clark, a research scientist with Dr. David Sulzer, shares some of the lab's decisions and practices that have led to significant safety gains and improvements in research applications.

**Katie: What made the lab begin searching for ways to control potential exposure to isoflurane gas?**
Samuel: After learning that continuous isoflurane exposure had been associated with a higher risk of spontaneous abortion and liver damage as well as potential negative effects on the developing brain, I decided to see what solutions we could implement in the lab. With the help of my Principal Investigator, Dr. David Sulzer, we were able to set up a surgery room that kept our exposure as low as possible.

**Katie: How did you decide on which engineering controls to use and how to set them up?**
Samuel: While doing stereotaxic surgery, the researcher has to have their breathing zone very close to the mouse. We already had an elephant trunk hood in the surgery room, but it was not in use. With the help of Dr. Sulzer, we made sure that all lab members were using isoflurane under the elephant trunk only. We also found that a digital vaporizer with a small bench top hood, would be our best option when we later added a second surgery station.

**Katie: What made you choose to purchase this vaporizing system versus a more traditional system?**
Samuel: My own experience with the traditional vaporizer is that a lot of isoflurane can leak from the system and cause exposure. It is also not as accurate when it comes to the dose amount and requires constant adjusting. While the digital vaporizer is more expensive, the return on investment comes through reduced use of isoflurane as well as fewer purchases of isoflurane bottles (in 6 months, 1 bottle was purchased with the digital vaporizer rather than 6 bottles with the traditional vaporizer) and charcoal canisters. In spite of the cost, because of Dr. Sulzer's commitment to safety, the lab was able to purchase it and install the local exhaust hood to capture any escaping vapors.

**Katie: Do you see a decrease in the amount of isoflurane used with the digital vaporizer versus the traditional vaporizer?**
Samuel: Yes, for sure. Especially when compared to the traditional vaporizer. This device allows the researcher to use the right amount for each individual mouse and thus improves safety for the mouse, also.

**Katie: Do you plan to expand on this approach with other chemicals in the lab?**
Samuel: We already have. In our lab we work with dental glues that give off strong odors, as well as formaldehyde. All work with these substances is done under a chemical fume hood or the local exhaust, and we prevent exposures by purchasing pre-made solutions whenever possible. We really have our Principal Investigator, Dr. Sulzer, to thank for all of this. Without his help our lab would not be able to maintain the safety culture it has currently.

## Think Outside the Pipette Tip Box

by Keith Bottum, Senior Hazardous Materials Specialist & Laboratory Sustainability Coordinator

In the Fall 2014 edition of Safety Matters, EH&S published the article " Give Me 5" announcing that New York City had begun accepting #5 plastics for recycling. For the University this meant capturing a common waste stream, pipette tip boxes, for recycling rather than as trash for landfill, which was its usual fate. The article also highlighted other common numbered plastics at the University that could be recycled.

Since that time, EH&S has worked with multiple departments to introduce and expand the University's laboratory recycling program, with a focus on capturing recyclable materials that laboratories traditionally disposed of as trash or placed in regulated medical waste (red bag) containers, even though they were not contaminated. At present, there are 28 laboratories actively engaged in recycling laboratory-wide. These model laboratories have been impressed by the amount of waste they have been able to divert from trash and red bag streams, both of which ultimately end up in landfills, to recycling, where it typically meets a much more environmentally-sustainable fate.

In addition to the conscious choice to manage their waste in a new way, participating laboratories commit to the placement of small color-coded receptacles for metal, glass, plastic materials, as well as for paper/cardboard materials, in an area convenient for the laboratory's use. Working closely with these laboratories to identify what can and should be recycled has given all stakeholders a clear direction for their individual role in the University's sustainability program. While there are many waste items generated by laboratories that may be chemically or biologically contaminated, and thus must be disposed of accordingly as either hazardous or regulated medical waste, there are many more items that are easily recyclable. For questions regarding laboratory recycling, please contact hazmat@columbia.edu.

## Institutional Review of CRISPR/Cas9 Gene Editing Experiments

by Christopher Aston, Manager of Biological Safety Programs

Molecular biologists have used recombinant DNA (rDNA) technology to perform gene editing experiments since the 1970s. Compliance requirements are thus well-established, and researchers are generally aware that many types of rDNA experiments must undergo review by the University's Institutional Biosafety Committee (IBC) in order to meet the NIH guidelines for rDNA research (http://osp.od.nih.gov/sites/default/files/resources/NIH_Guidelines.pdf).

Enter, CRISPR/Cas9, a new gene editing technology that is faster, less expensive, and more precise than previous methods and that has already been used in more than three dozen organisms. Its ease of use has enabled other scientists such as chemists, biomedical engineers, and computer scientists to enter the gene editing field. Do these investigators also need institutional review of their CRISPR/Cas9 gene editing experiments, even if the work is performed *in vitro*? The answer is most likely "yes".

For CRISPR/Cas9 work that takes place at Biosafety Level 1 (BSL-1; for example introducing CRISPR/Cas9 plasmids into a cell line), the NIH guidelines require that the work is registered with the IBC before, or at the time the experiment is initiated. For work at BSL-2 (for example introducing CRISPR/Cas9 using a lentiviral or adenoviral vector) the work must be reviewed by the IBC before initiation. Investigators using viral vectors should identify controls that would mitigate the risk of accidental exposure to a virus that could then edit genes in their own body. EH&S's Biosafety Officers can help investigators perform risk assessments of their work.

For *in vitro* work, the IBC will want to know if whether the guide RNA sequence and the Cas9 gene are physically linked on the same piece of DNA and if there is similarity between human and animal guide sequences. For gene editing experiments in animals (*in vivo*), the IBC will also want to know if heritable changes are being created, whether there any known off-target effects or mutations, and how investigators will determine (or quantify) unknown off-target effects.

Registration of rDNA experiments is through submission of a Hazardous Materials Appendix A in RASCAL. Guidance on risk assessment, or completing and submitting an Appendix A can be requested by contacting biosafety@columbia.edu.

# Flat Guidance for 3D Printing

by Rob Velez, Health & Safety Specialist

3D printing technology has grown substantially in popularity and application over the past few years. With smaller and more affordable units now available, 3D printers have become increasingly common in laboratories, shops, libraries and classrooms. The greater availability of these devices does not necessarily imply greater safety, however. Specifically, purchasers and operators of 3D printers must consider and control the creation of airborne, ultrafine particle (UFP) emissions to ensure the health and safety of users and others in the general vicinity.

UFPs encompass all particulate matter in the nanoscale size (less than 100 nanometers in diameter). While scientific research into the health hazards of UFPs is ongoing, there are no officially established airborne exposure limits. To fill this void, EH&S has taken a proactive approach to evaluating the airborne exposure concentrations of UFPs generated by these devices.

In collaboration with 3D printer users, EH&S has performed assessments on various types of printers comparing background airborne UFP concentrations to airborne UFP concentrations during printer use. Based on results and observations from this initial set of assessments, EH&S has formulated a set of general recommendations and considerations for 3D printer purchase and usage.

- **Style matters:** Some printers are closed to maintain optimal temperature – a feature which also offers a protective barrier between the emission source, the room air and the operator's breathing zone. With closed units, observations showed that waiting 10 to 15 minutes before opening the door after a print job resulted in lower UFP levels than those observed when opening the door immediately. With open printers, UFP concentrations were observed to build up in the room. Closed units are ideal for use in conjunction with local exhaust ventilation. In general, closed printers should be the first consideration.

- **Ventilation is critical:** Assessment results are consistent with existing literature in showing that local exhaust, where feasible, is highly effective in reducing airborne UFP concentrations in the room. Chemical fume hoods or other forms of local exhaust should be used to remove UFP emissions from 3D printing areas. Additionally, consideration should be given to where a 3D printer will be placed. Optimally, a printer should be placed near local ventilation exhaust and away from doors and other high traffic areas where air can be disturbed, allowing turbulence to disperse UFPs.

- **Choose materials wisely:** Emissions are generated by the heating and extrusion of plastic feedstock in layers to form a 3D object. Of the two commonly used types, polylactic acid (PLA) has been shown to have a lower UFP emission rate than acrylonitrile butadiene styrene (ABS) filament. EH&S's measurements confirmed that PLA produces lower concentrations of UFPs than ABS.

- **Housekeeping is important:** Regular cleaning of printing spaces with a HEPA vacuum, where possible, or even wet wiping, is recommended to keep dispersible particles to a minimum.

3D printer UFP emission assessments will continue as new printers arrive. Additionally, upcoming phases if this effort include further testing of engineering controls and volatile organic compound (VOC) emissions. If you are interested in having an assessment for your 3D printer set-up or would like some advice on where to best situate your printer, please reach out to Occupational Safety at occusafety@columbia.edu.

## Near Misses: Communicate and Adapt

by Kathy Somers, Senior Research Safety Specialist

On March 16, 2016, an explosion occurred at the University of Hawaii at Manoa. A post-doctoral researcher was conducting an experiment on the use of biofuels when a compressed gas tank containing an explosive concentration of oxygen, hydrogen and carbon dioxide was ignited by a static electricity discharge. The researcher lost the lower half of one arm in the explosion. Experts are weighing in on a host of contributing factors: the proper gauge on the tank, the exact ratio of gases used, and the lack of anti-sparking tools, among others.

It is easy to pass judgment and second guess the relevant circumstances. Heightened safety considerations, which are sometimes portrayed as being "overcautious" or "getting in the way of productivity," are seldom argued against in the aftermath of a serious accident. But the day before this accident, the post-doctoral researcher had a near miss under similar circumstances, but on a smaller scale, where the explosion was minor and contained. This near miss was reported to the PI, but research continued the next day without adjustment. In fact, the research was scaled up with more gas and larger equipment.

This example may seem extreme, but it did happen and could happen elsewhere. Recently, one of our own graduate students was sprayed in the face by a solution of hazardous chemicals when a chemical reaction went awry. Thankfully, the student was not severely injured. Previously, in the same laboratory, this same reaction nearly resulted in similar outcomes while being performed by several other members of the laboratory. Over time, some laboratory members adjusted the experiment to account for the potential danger, yet there was no laboratory-wide discussion nor broad change in protocol until after the more serious incident occurred.

A near miss is a lucky warning. Think of a near miss as an alternate reality in which the worst case scenario that could have been your future did not occur. Your challenge is to (a) understand the most severe accident that could have happened; (b) grant your near miss the gravitas of that accident such that you change behavior; and finally (c) talk about this with your group and your Principal Investigator. Help make others aware of your discovery so that you do not watch it happen to someone else.

For more information about the UH laboratory accident, please see the full report: http://www.hawaii.edu/news/2016/07/01/independent-investigation-of-lab-accident-complete/.

## Are You FDNY Inspection Ready?

by Harry J. Oster, Manager of Fire/Life Safety Programs

Columbia University's permitted research laboratories are subject to unannounced inspection by the Fire Department of the City of New York (FDNY). Based on the number of FDNY permitted laboratories at Morningside and Medical Center campuses, an FDNY inspector is at each campus on a weekly basis performing inspections. EH&S accompanies the FDNY during the inspection to help ensure that all findings are clearly communicated to the laboratory's PI and/or supervisor so corrective action can be quickly taken.

Laboratories have the ability to remain "Inspection Ready" for FDNY inspections at all times by simply following some helpful tips available on EH&S's website @ http://ehs.columbia.edu/NOV-preventions-final.pdf. The items presented in the GUIDELINES FOR PREVENTING FDNY LABORATORY SAFETY VIOLATIONS are known to be priority for FDNY during inspections. For assistance with your laboratory's inspection readiness, please contact an EH&S Safety Specialist at fire-life@columbia.edu or labsafety@columbia.edu.

# Radiation Survey Instrument Calibration Services at Columbia University

by Samuel Dindayal, Associate Health Physicist

Radiation survey meters are an essential tool in the safe practice of laboratory research with certain radioisotopes. These instruments provide real-time feedback about the cleanliness of work surfaces, laboratory devices and even skin and clothing. With the help of information that a survey meter provides, researchers can effectively remove radiation from areas that have been contaminated during research activities; surveys to detect contamination must be performed before, during and after experiments for this very reason. To ensure that your meter is accurately detecting "hot" areas, it must be calibrated annually. What really happens when a meter is sent for calibration? Usually after the instrument is checked for proper operation, efficiencies are recalculated and the survey meter is adjusted accordingly.

EH&S Radiation Safety provides all calibration services free of charge and only requires individual departments or laboratories to pay for repairs if they are warranted. Beginning in November, 2015 EH&S instituted an onsite calibration service. Meters expiring within a calendar quarter are collected for calibration from laboratories and returned fully calibrated, usually within three business days. The new process has proven efficient and cost-effective.

The next onsite calibration service is scheduled in November; individual labs must make their survey meters available for pick-up to participate. While most meters can be accepted for calibration, at this time, we are unable to calibrate ion chambers or survey meters that readout in mR/hr scale. Complete and drop off a Survey Meter Calibration Request form, available @ http://ehs.columbia.edu/CalibrationRequest2.pdf, along with the meter, during package processing hours, to arrange for calibration of these types of meters.

Please remember to request EH&S Radiation Safety approval when purchasing a survey meter. Upon approval, the meter will be entered in EH&S's database to track it for annual calibration. Between calibrations, it is the responsibility of the laboratory to ensure that the survey meter is operational with good batteries. Please contact EH&S Radiation Safety Office for assistance with a survey meter calibration or repair requests. Medical Center: rsotechcumc@columbi.edu or Morningside, Lamont and Nevis: rso-ehrs@columbia.edu.

# Fire Prevention Week is October 9-15, 2016



November 6, 2016

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