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Environmental Health & Safety

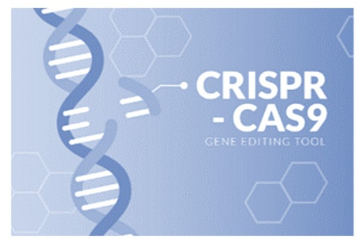
SafetyMatters

Revised Institutional Review of Gene Editing Experiments

by Christopher Aston, PhD, Associate Director, Biological Safety Programs

The term "gene editing" refers to a group of recombinant DNA technologies that give researchers the ability to change an organism's DNA. These technologies allow genetic material to be added, removed, or altered at particular locations in the genome. One new example of this technology is the utilization of CRISPR-Cas9 editing which has made gene editing simpler, rapid, and cheaper with higher throughput and broader application, including alterations to the human genome.

Over the past year, EH&S and the Institutional Biosafety Committee (IBC) has been developing an approach to review gene editing work that integrates both the NIH Guidelines and current best practices for safe and ethical use of this technology. This included consulting a working group of Columbia's gene editing researchers and surveying practices at other institutions. In short, Columbia will adopt the following criteria for when IBC review is required for gene editing experiments:



- IBC review **is not required** for any gene editing experiment that is exempt from the NIH Guidelines. This includes *in vitro* experiments in Risk Group 1 prokaryotes, eukaryotic cell lines, or embryonic stem cells or embryos that are not implanted (for stem cells/embryos, Stem Cell Committee approval is required). Invertebrate experiments e.g., *D. melanogaster* or *C. elegans* are also exempt.
- IBC review **is required** for any gene editing constructs introduced by Risk Group 2 viral vectors such as lentiviral vectors, whether *in vitro* or *in vivo*. Gene editing experiments in plants or invertebrate animals that are vectors of disease will require review by the IBC. Gene editing in vertebrate animals and human subjects will also require review.
- IBC review **is required** for any experiments involving gene drives in any sexually reproducing organisms, including animals, plants and fungi.

Registration of rDNA experiments is completed via submission of a Hazardous Materials Appendix A in Rascal (www.rascal.columbia.edu). PIs should check the applicable box on their Laboratory Assessment Tool and Chemical Hygiene Plan (LATCH) if they are performing any work with gene editing tools or gene drives, regardless of whether IBC review is required. Researchers should also review the University's policy "Recombinant DNA policy; requirements for submission approval and use" available on the EH&S website: https://research.columbia.edu/system/files/EHS/Policies/RecombinantDNA.pdf.

Gene editing is a new and evolving field; the Biosafety Program is available to work collaboratively with researchers to conduct comprehensive risk assessments and determination of the need for IBC review. For example, a researcher interested in developing gene drives (systems that can alter the traits of wild populations and associated ecosystems) should involve the Biosafety Program early in the study design as this work requires consultation with the NIH. Guidance on risk assessments, or completing and submitting an Appendix A can be requested by emailing biosafety@columbia.edu.

Inside this issue:

Environmental Health & Safety

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

Proper work attire (e.g., 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 odors from migrating into your laboratory.

Have you seen our website? https://research.columbia.edu/content/environmental-health-safety

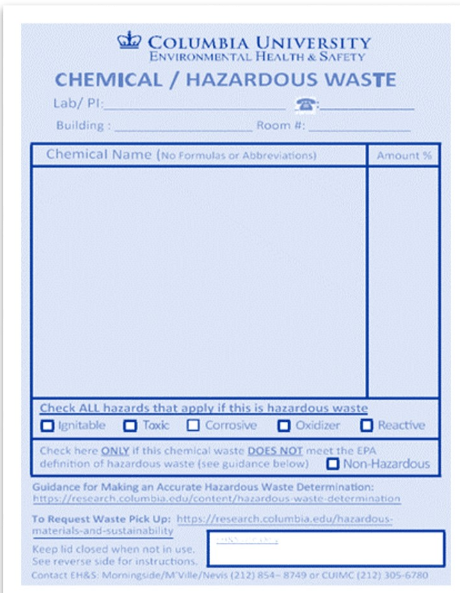
For Lab Fire Safety Prevention Tips, check out FDN(wh)Y Me https://research.columbia.edu/content/fdnwhy-me

Label That Hazardous Waste

by Jon Paul Aponte, Safety Advisor II

Hazardous waste labelling is a key component to overall compliance in the laboratory. EH&S periodically surveys waste containers in laboratories to ensure overall waste compliance is upheld. During the last survey round in summer 2019, EH&S found that laboratories across all five campuses proved to be mostly compliant but that there is room for improvement.

Most importantly, the only waste labels that should be used are those exclusive to Columbia University. These EH&S-supplied labels have been updated over the years, but are most recognizable as rectangular, orange stickers as seen pictured on the right. The waste label must be attached to the waste container – whether by the adhesive provided on the labels or in a sleeve affixed to the container itself. Waste labels must also reflect all of the constituents of the container and the approximate percentages of each individual material. The contents should be written in a way that is universally understandable without the use of abbreviations, written structures or shorthand. The labels should be filled out as materials are added to the container, not once the container is full.


COLUMBIA UNIVERSITY
ENVIRONMENTAL HEALTH & SAFETY
CHEMICAL / HAZARDOUS WASTE
Lab/ PI: ____________ ☎: ____________
Building : ____________ Room #: ____________

Chemical Name (No Formulas or Abbreviations)	Amount %

Check ALL hazards that apply if this is hazardous waste
☐ Ignitable ☐ Toxic ☐ Corrosive ☐ Oxidizer ☐ Reactive

Check here ONLY if this chemical waste DOES NOT meet the EPA definition of hazardous waste (see guidance below) ☐ Non-Hazardous

Guidance for Making an Accurate Hazardous Waste Determination: https://research.columbia.edu/content/hazardous-waste-determination

To Request Waste Pick Up: https://research.columbia.edu/hazardous-materials-and-sustainability

Keep lid closed when not in use.
See reverse side for instructions.
Contact EH&S: Morningside/M'Ville/Nevis (212) 854–8749 or CUIMC (212) 305-6780

A newer requirement of hazardous waste labelling is to mark the **hazard characteristic(s)** of the waste. For instance, if the liquid has a flashpoint of <140 degrees Fahrenheit then the "Ignitable" box must also be checked. If the pH is <2 or >12 then the "Corrosive" box must be checked. Same must be applied if any toxic, oxidizing and/or reactive materials are present. The newest version of the waste label also has a separate box for "Non-Hazardous"; this is waste that does not fall under the same regulations as other waste streams deemed "hazardous" by the Environmental Protection Agency (EPA). Common examples of these materials are ethidium bromide gels and paraffin emulsifiers.

These instructions and more can be found on the reverse (paper) side of the hazardous waste labels. If there are any questions or concerns, reach out to labsafety@columbia.edu. If the laboratory requires additional waste labels, containers, and/or a hazardous waste pick up, please visit submit a request on the EH&S website: https://cumc.co1.qualtrics.com/jfe/form/SV_6gqSpJrYyxX5lul.

Fire Safety Minute

Daylight Savings Time is March 8th 2020 — Don't forget to check your Smoke Detectors!

Don't Get Hoodwinked: Chemical Fume Hoods vs. Biosafety Cabinets

by George Hercules, Safety Advisor

Engineering controls are a primary method of managing exposure to hazardous materials including chemicals and infectious biological agents. Within numerous research laboratories, available engineering controls may include either a chemical fume hood a Biosafety Cabinet (BSC), or both; it is important to recognize the differences between these two pieces of safety equipment and what can or cannot be used inside them.

Figure 1 Fume Hood

A chemical fume hood (see Figure 1) is connected to the building's heating, ventilation and air conditioning (HVAC) system to ensure that any toxic, carcinogenic, flammable, and reactive vapors produced within them are exhausted away from the user's breathing zone. 100% of this air is vented to the outside using dedicated exhaust fans. Fume hoods should be utilized only for handling chemicals with significant inhalation hazards such as those that produce toxic gases, toxic chemical vapors, volatile anesthetics (e.g., isoflurane), volatile radioactive material, and respirable toxic powders. Fume hoods are annually certified by EH&S.

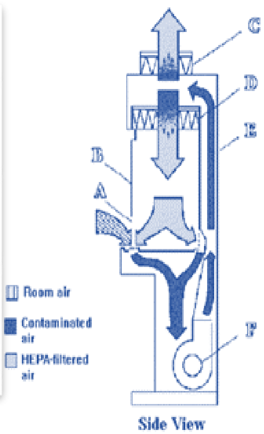
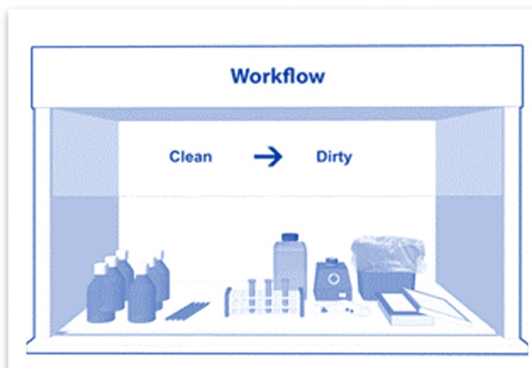


Figure 2 Biosafety Cabinet

BSCs (see Figure 2) utilize **H**igh **E**fficiency **P**articulate **A**ir (**HEPA**) filters to ensure that the user and their samples are protected. Aerosols generated within the cabinet are filtered out with up to 99.99% efficiency against airborne particles 0.3 microns in size (typical sizes of bacteria and viruses). This efficiency increases with aerosol sizes greater or smaller than 0.3 microns. A BSC will **<u>not</u>** protect against hazardous fumes and vapors. All open manipulation of Biosafety Level 2 and above organisms that have the potential to splash or generate aerosols, must be performed in a BSC. Laboratories are responsible for ensuring BSCs are annually certified by an outside vendor.

Don't get hoodwinked. Just because your biological sample has a small chemical component does not necessarily mean that it should be handled in a fume hood. Conversely, a biological agent that is mixed with a chemical that emits vapors should **not** be handled in a BSC (fumes may concentrate to dangerous levels). A risk assessment should be performed to determine the best engineering control or work practices for each situation. If uncertain about whether to use a fume hood or BSC for certain mixed samples, always consult your Standard Operating Procedure, your laboratory manager or Principal Investigator, or consult with EH&S.



While fume hoods and BSCs serve as effective hazard controls, they do not eliminate the need for other protective measures, such as personal protective equipment (PPE). Researchers should still use the appropriate gloves, safety glasses/ goggles and laboratory coats appropriate for the work. In addition to PPE usage, when working in either a fume hood or BSC, researchers should arrange their workflow so that one section is assigned as a clean space and the other end for contaminated materials (see diagram to the left).

If there are any questions about the appropriate use of fume hoods, please reach out to occusafety@columbia.edu. For questions relating to BSCs, please reach out to biosafety@columbia.edu.

Historical Artifacts and Safety: Surveying the Papers and Possessions of Marie Curie

by Peter Caracappa, PhD, Executive Director & Chief Radiation Safety Officer

When individuals want to handle historical items such as those that may be displayed or stored in a museum or archive, they are often asked to wear gloves or other protective clothing. In most cases, this is meant to protect the items from harm by the people handling them. However, in a few cases, it might be the other way around. A historical item can be associated with hazardous work of a chemical, radiological, or biological nature from a time when these hazards were less known, understood, or controlled.

Any list of the most famous and influential scientists in history must include Marie Curie, the two-time Nobel Prize winner for contributions to the understanding of radiation and radioactivity, particularly the discovery and study of radium and polonium. Numerous items associated with Curie are of historical interest. While she was at the forefront of radioactivity research, she had not yet developed the kinds of controls that we use today, and much of her effects, equipment, scientific notebooks, and even her home and cookbooks, remain contaminated with significant quantities of radium.

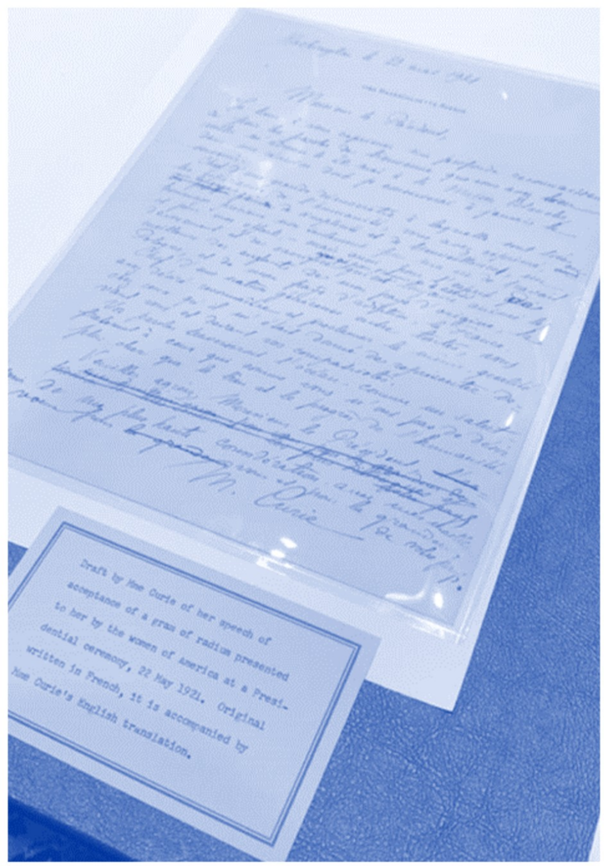


Figure 1 A Speech Handwritten by Marie Curie

In 1921 and again in 1929, journalist Marie Mattingly Meloney invited Marie Curie to tour the US in order to raise money for the purchase of radium so Curie could continue her research. Many of Mrs. Meloney's papers and artifacts have found their way to the Columbia University Libraries Archival Collections including a number of Curie's personal items given to Mrs. Meloney: notes from speeches, correspondences, an academic cap worn by Curie when receiving honorary degrees, and a watch that first belonged to Pierre Curie when the two Curies began their groundbreaking work.

When these artifacts were being re-archived, the Libraries staff reached out to Radiation Safety to investigate whether there were any safety issues with some of these items. Although radiation is undetectable by sight or smell, with the right equipment, it is easy to determine if any contamination is present. Luckily, the materials in the archives were far enough removed from Curie's radium research that they showed no signs of contamination. As safety professionals, EH&S was thrilled to have a close encounter with such an important figure in our field. The staff of the Archival Collections were extremely generous with their time in sharing some of the most interesting artifacts with our staff.

EH&S is available not only for the typical research concerns, but for any unusual or unique inquiries. If you find yourself with a concern about a hazard, even far removed from a research laboratory, do not hesitate to reach out to our group at (212) 305-6780 or (212) 854-8749. One never knows what new and interesting questions arise at an institution like Columbia University!

Expansion of Animal Biosafety Level-2 (ABSL-2) Facilities

by Christopher Aston, PhD, Associate Director, Biological Safety Programs

Animal Biosafety Level -2 (ABSL-2) facilities are used to house animals treated with infectious agents that may pose a risk to humans or other animals. Animals treated with replicative and non-replicative viral vectors administered non-stereotaxically are also typically housed at this containment level. Hallmarks of ABSL-2 housing include handling of animals in a biological safety cabinet and autoclaving of dirty cages and carcasses.

Recently, the sole ABSL-2 facility for all campuses was in the Irving Cancer Research Center vivarium. Demand for ABSL-2 space continued to outpace availability, leading to wait times to begin experiments. We are pleased to announce that the Institute for Comparative Medicine (ICM) will open two additional facilities, firstly at the Jerome L. Greene Science Center on the Manhattanville campus and secondly, in a newly renovated vivarium in the Hammer Health Sciences Center.

Figuring out whether your research requires this type of housing requires a risk assessment for the infectious agents that are being employed, and a space requirements conversation with an ICM veterinarian. Guidance on risk assessment, or completing and submitting a Hazardous Materials Appendix A that describes infectious agent work can be requested by emailing biosafety@columbia.edu. Another helpful source of information is a matrix that cross references experiment type with containment level and is available on the EH&S website at: https://research.columbia.edu/sites/default/files/content/EHS/BioSafety/AnimalHousingRequirements.pdf.

Spring is Here: Keep Cool with Proper Laboratory Attire

Yes
Long pants
Closed toe shoes
+
Lab Coat
Gloves
Eye Protection

No
Shorts
Sandals/Flip Flops

Safety — A Core Value of the American Chemical Society

by Sunipa Pramanik, PhD, Senior Safety Advisor

The American Chemical Society (ACS) has defined safety as one of their core values in the "ACS Strategic Plan." ACS is cultivating RAMP as a principle to encourage professors, instructors, researchers and students to build a strong and positive laboratory safety culture by keeping science safety at the forefront of their work in a laboratory environment. RAMP is an acronym that stands for:

- **R**ecognize the hazard
- **A**ssess the risk
- **M**inimize the risk
- **P**repare for emergencies

Safety education should be an integral part of a chemist's career at all stages. Incorporating chemical safety as part of the chemistry curriculum helps both the instructor and the student focus on the underlying chemical principles of a potential hazard and take appropriate actions to either avoid or minimize the risks of exposure to that hazard. RAMP can provide the framework on which safety education and safety preparedness is built.

ACS is also promoting correct safety practices through multiple resources such as webinars, workshops at national meetings, safety videos, and publications. Many of the following are of interest and use to the Columbia research community:

- **Publications:** ACS has recently introduced a new journal in their portfolio named ACS Chemical Health & Safety that will focus on publishing articles relevant to the chemical safety discipline. ACS has also implemented a new requirement stipulating that all authors submitting scientific work to any ACS journal must include information about safety needs associated with their methods. This ensures accurate propagation of safety information to researchers who would follow the procedures published in ACS literature. Information regarding the best way to communicate safety information can be found in the ACS Guide to Scholarly Communication under the Scientific Communication section: https://pubs.acs.org/page/styleguide.

- **Webinars:** ACS is organizing webinars on research and chemical safety topics, inviting speakers with varied backgrounds and laboratory safety experiences as part of academia, chemical industry and/or the safety enterprise. This will help ACS in connecting researchers with subject matter experts in the field of chemical and laboratory safety, and new researchers can learn from the knowledge and experience of seasoned professionals. Webinars developed by ACS can be found on their website: https://www.acs.org/content/acs/en/acs-webinars.html.

- **Workshops:** ACS and ACS Division of Chemical Health & Safety (DCHAS) are organizing workshops, both online and at their national meetings, to educate safety professionals as well as graduate students and researchers on research safety leadership in the academic laboratory setting. Information on upcoming laboratory safety workshops can be found on the DCHAS website: https://dchas.org/2019/11/21/workshop-registration-page-2020/.

- **Videos:** ACS has created a collection of videos focusing on common laboratory safety issues in a manner that is clear and easy to understand. They address topics such as risk assessment, safety demonstrations, or working alone in the laboratory. These videos can be accessed through the ACS chemical safety website under the safety resources section: https://www.acs.org/content/acs/en/chemical-safety/resources.html.

Any chemists or researchers working with hazardous chemicals, should explore the wealth of information available on the ACS website (https://www.acs.org/content/acs/en/chemical-safety.html), and the DCHAS website (https://dchas.org/2015/10/15/about-us/).

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