Center for Drug Design
Departmental Safety Training
Topics

- Proper Use of Fume Hoods
- Secondary Container Labeling Requirements
- Proper Lab Attire and PPE Requirements
- Radiation Safety – Non-User Training
- Biosafety – Incident Review & Biosafety Cabinets
Safe Fume Hood Use
Proper use of a Fume Hood
Proper Use of a Fume Hood

Ensure that the hood has a current inspection sticker (dated within the last year)

Velocity = _____ _____ _____ fpm

Date _____ / _______          Initials_________
Proper Use of a Fume Hood

Verify the hood is working before using

- Check the flow monitor (if present)
- Use a tissue to demonstrate flow into the hood
Proper Use of a Fume Hood

Conduct all work at least 6 inches inside the hood face

Bad

Better

Best
Proper Use of a Fume Hood

Close the sash(es) to the maximum position possible while still allowing comfortable working conditions.

Not Recommended

Recommended
Proper Use of a Fume Hood

DO NOT place equipment, materials or chemicals in the hood which block the slots or otherwise interfere with smooth hood airflow.
Proper Use of a Fume Hood

DO NOT remove sash panels or back baffles or modify the interior or exterior components of the hood.
Typical obstructed fume hood
Proper Use of a Fume Hood

- Move chemicals and waste into flammable storage
- Equipment should be elevated to allow for airflow underneath
Lab Jack
Elevating equipment

- Wooden or Styrofoam blocks
- Trays on blocks for smaller samples, equipment
Proper Use of a Fume Hood

Labconoco
http://www.youtube.com/watch?v=q2Pp3wge2j8

Dartmouth
http://www.youtube.com/watch?v=GRQkl-t-hSg

UC Berkley
http://www.youtube.com/watch?v=A4AHxLnByts
Proper Use of a Fume Hood

If your fume hood is not operating correctly, report the issue immediately to Facilities Management by calling 624-2900
Non-manufacturer Container Labeling Requirements at UMN
Recent Events – OSHA Citation

UMN Incident - In May of 2015, OSHA issued a $1,200 fine for two unlabeled bottles of EtOH. The fine was paid by the researcher.

A Safety Alert about this incident was sent to DSOs on 8/13/2015.
The Labeling Requirement

From the OSHA Labeling and Transfer of Chemicals Fact Sheet:

“This label must contain two key pieces of information: the identity of the hazardous chemical(s) in the container (e.g., chemical name) and the hazards present. There are many ways to communicate this hazard information. Employers should select a system that will work for each location.”

What Containers Need a Label

All containers must have a means of communicating their contents and the hazards of those contents.

Exemptions:
- Reagents that will be used within one work shift
- An apparatus of a reaction in progress for one work shift
Examples of Unacceptable Labeling

Above and below: These bottles include some initials, dates and reagent acronyms but no hazard information was posted

Above: One bottle with no label (left), other bottles with simple markings

Right: Unlabeled flasks that had been left for several days (more than one work shift)
Acceptable Labeling Methods

There are three methods of secondary container labeling accepted at the University of Minnesota:

1. Labels with the chemical contents AND hazards
2. Labels with acronyms or symbols AND a posted key
3. Labels with acronyms or symbols AND work-area labeling

Please note, the labeling methods above do not cover hazardous chemical waste
Method 1: Names AND Hazards

Label every secondary (non-manufacturer) container with the chemical identity (i.e. ethanol, ethyl alcohol or EtOH) and hazards of the chemical (i.e. flammable for ethanol)
Examples of Acceptable Labeling
Method 2: Acronyms or Symbols AND Key

Label every secondary container with standard acronyms (i.e. EtOH for ethanol), chemical formulas (i.e. C₂H₆O for ethanol) or a reasonable symbol (i.e. color coded stickers) AND post a highly visible key that lists the chemical name and hazard associated with that acronym, formula, or symbol.

![Chemical Abbreviation Key](image-url)
Acronym Key Example

Bottle of ethanol labeled with an acronym

Posted key listing acronym and name

Posted explanation (or lab training) of GHS symbols
Method 3: Acronyms and Area Labels

Label every secondary container with standard acronyms, chemical formulas, or symbols AND store the containers with chemicals of the same hazard class in an area or storage bin that is labeled with the hazards of the material. These containers MUST return to the storage area at the end of the work shift.

**Note:** This also applies to flasks of reactions that are running beyond one work shift. They require a label (i.e. protocol or lab notebook number) AND an area label indicating hazards.
Area Label Example

Hazard and content identification **must** be present on the sample holder or shelf/cabinet area these where samples are stored but does not have to be on *individual* samples

**Examples:**
- Anything too numerous of the same hazard that labeling is impractical
- Anything too small to support a label
Resource Links

- OSHA quick cards
  - Labeling and Transfer of Chemicals: 
  - Hazard Communication Standard Pictogram: 
    https://www.osha.gov/Publications/HazComm_QuickCard_Pictogram.html
  - Hazard Communication Standard Labels: 
    https://www.osha.gov/Publications/HazComm_QuickCard_Labels.html

- Sample chemical abbreviation key
  - http://z.umn.edu/chemabbrev

- Sample container labels
  - http://z.umn.edu/averylabels
Proper Lab Attire and PPE
General Proper Attire in ALL UMN Labs

Required in all University labs where hazardous materials are present:

- Long pants or skirts that extend to the ankle
- Shoes that have closed toes and heels

Unacceptable Attire

Acceptable Attire (low hazard)

Figure 1: Short pants or skirts and sandals, open shoes, ballet flats or shoes with cut-outs.

Figure 2: Long pants (or skirts) as well shoes that have a closed toes and heels.

Lab Attire Fact Sheet:
http://www.dehs.umn.edu/PDFs/FSProperLabAttire.pdf
Additional PPE Requirements

Based on department policy or hazards of the task performed, additional base PPE may be required. Such as:

- Goggles or safety glasses
- Lab coats
- Gloves

Lab Attire Fact Sheet:
http://www.dehs.umn.edu/PDFs/FSProperLabAttire.pdf

Figure 3: Some departments require extra PPE, such as lab coats, to enter the lab. Also, some lab work may require the use of additional PPE.
Special Note: Safety Glasses/Goggles

Safety glasses with side shields or safety goggles should be required whenever working with splash or impact hazards.

Prescription glasses do not adequately protect against chemical splashes or impact hazards.

Berkeley Incident:
A researcher’s left cornea was lacerated when a diazonium perchlorate transfer detonated.

Berkeley Incident Details: http://cenblog.org/the-safety-zone/2015/09/more-on-the-uc-berkeley-dizaanionium-perchlorate-explosion/
Chemical Splash Demo – St. Olaf
Chemical Splash Demo – St. Olaf
Chemical Splash Demo – St. Olaf
Chemical Splash Demo – St. Olaf
Safety Glasses/Goggle Requirements

Ultimately, the lab supervisor should determine the risk of chemical splash and impact hazards in their lab when developing their lab-specific PPE requirements.

Strong recommendations:

- Safety glasses be worn in chemistry-heavy labs at all times
- Safety goggles or specialty safety glasses should be worn over or prescription glasses unless prescription safety glasses are worn
Questions?

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Radiation Safety
Annual Refresher Training

Radiation Protection Division
Department of Environmental Health & Safety
General Radiation Safety Information

Annual Background Radiation Dose
US Average: 300 mrem

- Radon – 2 mSv/yr
- Rocks & soil – 0.3 mSv/yr
- Human body – 0.4 mSv/yr
- Cosmic – 0.3 mSv/yr

U.S. Average: ~ 3 mSv/yr
Minnesota: ~ 3 mSv/yr
Colorado: ~ 4 mSv/yr
Dose Limits

Dose Limit to Individual Members of the Public

Whole body (TEDE)*……1 mSv/yr. The dose to an individual in any unrestricted area from external sources shall not exceed 20 μSv in any one hour.

Occupational Dose Limits

Whole body (TEDE……50 mSv/yr. Extremity………500 mSv/yr.

*TEDE: Total Effective Dose equivalent
Topics in Radiation Safety

- **General requirements (posting, training, security)**
  - Food and beverage prohibition
  - Proper attire, PPE
  - Contamination surveys and instrumentation
  - Radioisotope spills and emergencies
  - ALARA considerations
  - Other ___

- Permit holder responsibilities
- Radioisotope Purchasing and Transfer
- Radioactive waste management & disposal
- GM operation and survey protocol
- Record keeping
- Personnel monitoring
- Prenatal exposure guide
General Requirements

- Posted rooms are restricted areas.
- Training of staff is required.
  - Visitors must be escorted at all times.
- Material must be secured from unauthorized removal or access while in storage.
- Material must be kept under constant surveillance when not in storage.
Topics in Radiation Safety

- General requirements (posting, training, security)
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- Personnel monitoring
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Topics in Radiation Safety

☑ General requirements (posting, training, security)
☑ Food and beverage prohibition

❖ Proper attire, PPE
   (Lab Safety Plan)

☐ Contamination surveys and instrumentation
☐ Radioisotope spills and emergencies
☐ ALARA considerations
☐ Other ___

☒ Permit holder responsibilities
☒ Radioisotope Purchasing and Transfer
☒ Radioactive waste management & disposal
☒ GM operation and survey protocol
☒ Record keeping
☒ Personnel monitoring
☒ Prenatal exposure guide

University of Minnesota
Topics in Radiation Safety

- General requirements (posting, training, security)
- Food and beverage prohibition
- Proper attire, PPE
- **Contamination surveys and instrumentation**
  - Radioisotope spills and emergencies
  - ALARA considerations
  - Other ___
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- Prenatal exposure guide
Contamination Surveys

Lab staff are required to monitor and survey their own work stations, storage locations, etc., at specified frequencies.

The Radiation Protection Division periodically surveys all radioisotope laboratories.

Laboratory equipment must be free of contamination before being removed from the lab for disposal or repair.
Topics in Radiation Safety

- General requirements (posting, training, security)
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- Contamination surveys and instrumentation

- Radioisotope spills and emergencies
- ALARA considerations
- Other __

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Spills and Emergencies
What is an emergency?

- Contamination on skin or clothes.
- Ingestion, absorption/puncture or inhalation of radioactive material.
- Spread of contamination outside the immediate workstation (floor, benchtop, fume hood, etc.).
- Contained spills that you are not comfortable assessing or cleaning alone.
- Unknown or unidentifiable liquid or residue near storage areas or radioactive waste containers.
Spills and Emergencies
What should you do?

Remain calm.

Let everyone know that you may have an incident.

Contact the Radiation Protection Division (RPD).

Everyone must remain in the area until RPD arrives to survey them.
Spills and Emergencies
How to contact the RPD

Monday – Friday, 8:00AM – 4:30PM:

612-626-6002

24 Hours A Day:

911

Remain in the area and wait for help to arrive.
Topics in Radiation Safety

- General requirements (posting, training, security)
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- Prenatal exposure guide

Other ___
Radiation Exposure Control

ALARA:
- As Low As Reasonably Achievable

Exposure control, both internal & external

Internal
- Food and beverage prohibition
- Inhalation protection

External
- Time, distance & shielding
- Safe handling procedures
Topics in Radiation Safety

- General requirements (posting, training, security)
- Food and beverage prohibition
- Proper attire, PPE
- Contamination surveys and instrumentation
- Radioisotope spills and emergencies
- ALARA considerations

Other

- Permit holder responsibilities
- Radioisotope Purchasing and Transfer
- Radioactive waste management & disposal
- GM operation and survey protocol
- Record keeping
- Personnel monitoring
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Topics in Radiation Safety

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- Proper attire, PPE
- Contamination surveys and instrumentation
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- ALARA considerations
- Other ___

- Permit holder responsibilities
  - Radioisotope Purchasing and Transfer
  - Radioactive waste management & disposal
  - GM operation and survey protocol
  - Record keeping
  - Personnel monitoring
  - Prenatal exposure guide
Permit Holder Responsibilities

- Training of staff who have access to radioactive material labs or storage areas.
- Security of radioactive materials.
- Control of radioactive contamination.
Topics in Radiation Safety

- General requirements (posting, training, security)
- Food and beverage prohibition
- Proper attire, PPE
- Contamination surveys and instrumentation
- Radioisotope spills and emergencies
- ALARA considerations
- Permit holder responsibilities
  - Radioisotope Purchasing & Transfer
- Radioactive waste management & disposal
- GM operation and survey protocol
- Record keeping
- Personnel monitoring
- Prenatal exposure guide
- Other ___
Radioisotope purchasing and transfer

All radioactive material must be acquired through the Radiation Protection Division

- Regular Orders
- Free or trial offers
- External transfer
- Internal transfers
Topics in Radiation Safety

☑ General requirements (posting, training, security)
☑ Food and beverage prohibition
☑ Proper attire, PPE
☑ Contamination surveys and instrumentation
☑ Radioisotope spills and emergencies
☑ ALARA considerations
☑ Other ___

☑ Permit holder responsibilities
☑ Radioisotope Purchasing and Transfer

➤ Radioactive waste management & disposal

☑ GM operation and survey protocol
☑ Record keeping
☑ Personnel monitoring
☑ Prenatal exposure guide
Radioactive Waste

All radioactive waste must be returned to RPD for proper disposal.

Keep your inventory records up to date.

Place all radioactive waste in the proper containers.
Topics in Radiation Safety

☑ General requirements (posting, training, security)
☑ Food and beverage prohibition
☑ Proper attire, PPE
☑ Contamination surveys and instrumentation
☑ Radioisotope spills and emergencies
☑ ALARA considerations
☑ Permit holder responsibilities
☑ Radioisotope Purchasing and Transfer
☑ Radioactive waste management & disposal

- GM operation and survey protocol
  - Record keeping
  - Personnel monitoring
  - Prenatal exposure guide
Surveys and Instruments

Reference Reading
Surveys
Topics in Radiation Safety

☑ General requirements (posting, training, security)
☑ Food and beverage prohibition
☑ Proper attire, PPE
☑ Contamination surveys and instrumentation
☑ Radioisotope spills and emergencies
☑ ALARA considerations
☑ Other ___

☑ Permit holder responsibilities
☑ Radioisotope Purchasing and Transfer
☑ Radioactive waste management & disposal
☑ GM operation and survey protocol

➢ Record keeping
☐ Personnel monitoring
☐ Prenatal exposure guide
Record Keeping Requirements

- **Training documentation**
  - New employee - on-line/lab
  - Annual refresher training

- **Inventory of all material**
  - New stock vials
  - Ongoing use of material
  - Radioactive waste inventory

- **Contamination surveys**
  - Routine surveys
  - Quarterly reports
  - Counter printouts
Topics in Radiation Safety

- General requirements (posting, training, security)
- Food and beverage prohibition
- Proper attire, PPE
- Contamination surveys and instrumentation
- Radioisotope spills and emergencies
- ALARA considerations
- Permit holder responsibilities
- Radioisotope Purchasing and Transfer
- Radioactive waste management & disposal
- GM operation and survey protocol
- Record keeping
- Personnel monitoring & Dosimetry

- Prenatal exposure guide
Dosimetry

Requirements are in your radiation safety manual and at www.dehs.umn.edu.

No external dosimeters are necessary (or even effective) for users of H-3, C-14, P-33, S-35 or Ca-45.

The only fee associated with the program is if badges or rings are not returned on time.
Topics in Radiation Safety

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- Radioisotope spills and emergencies
- ALARA considerations
- ALARA considerations
- Permit holder responsibilities
- Radioisotope Purchasing and Transfer
- Radioactive waste management & disposal
- GM operation and survey protocol
- Record keeping
- Personnel monitoring

Prenatal exposure guide
If a woman chooses to declare her pregnancy, then certain conditions & requirements apply.

Training Session

Dosimetry service

Separate Dose limit
Questions? Comments?

Don’t hesitate to call

6-6002

Radiation Protection Division
Department of Environmental Health & Safety

University of Minnesota
Biosafety Refresher – Center for Drug Design

Incident Review & Biosafety Cabinets

Robin Tobias
Biosafety Specialist – DEHS

November 3, 2015
**Important Biosafety Reminders**

- Any laboratory work with recombinant or synthetic DNA, biologically-derived toxins or infectious agents (viruses, bacteria, parasites, fungi, prions – human, plant or animal) must be conducted with approval from the Institutional Biosafety Committee (IBC).

- Any incident that occurs while conducting work on an IBC protocol, must be reported to the IBC as soon as possible.

- More information can be found on the IBC website.
**Important Biosafety Reminders**

- Be sure to clean out old equipment and furniture before moving, sending to ReUse or disposing.
- If items contained biological samples or potentially infectious material, they must be decontaminated with a suitable disinfectant.
- Equipment Decontamination Fact Sheet
An employee became ill with a suspected Salmonella laboratory acquired infection. This has yet to be confirmed through additional medical testing. The work on this project took place in 3 different spaces including the laboratory, an animal holding room, and a necropsy room. An accident investigation was conducted, but DEHS was unable to determine the exact route of the potential exposure.
Incident Review – Observations

- The laboratory did not have an approved IBC protocol for animal work with Salmonella.
- Outer surfaces of Salmonella culture tubes and other equipment were not sprayed down with disinfectant prior to removal from the biological safety cabinet (BSC).
- The disinfectant bottle was not kept inside the BSC at all times.
- A lab coat was not worn at all times when handling Salmonella cultures.
- Animals were inoculated with Salmonella cultures outside of a BSC or isolator cage using a throat gavage. Throat inoculation can make the animals cough out infectious droplets. Staff were not wearing faceshields during this procedure, only surgical masks.
- Necropsy of infected animals was also done without a faceshield.
Lessons Learned – Potential Exposure Routes

- Improper technique working in the BSC
  - Contaminated disinfectant bottles and tubes were brought outside of the cabinet’s containment. Surfaces outside the cabinet might have been contaminated then touched or handled without gloves.

- Inappropriate PPE
  - Failure to wear a lab coat or a faceshield during procedures with salmonella exposed larger surface areas of skin to contamination, which may have been accidently touched later on and ingested.

- Working without IBC approval
  - If the lab had submitted an IBC protocol, SOPs would have been reviewed. It is highly possible that improper techniques and PPE would have been flagged in the SOPs before research even started.
Intro to Biosafety Cabinets

- **Laminar Flow Cabinets**
  - Not a BSC, for product protection only and actually blow air at the user

- **Chemical Fume Hoods**
  - Used for exhaust of chemical fumes and do not provide filtration to protect the environment from potentially infectious material

- **BSCs** – primary engineering control for risk group 2 and 3 agents
  - provide both protection to the worker and the environment
  - Class II cabinets also provide product protection
Laminar Flow or Clean Bench

Biosafety Cabinet (BSC)
Classes and Types of BSCs

- BSC's are manufactured and divided into classes
  - Class I: protects the worker and the environment, but not the product
  - Class II: provide personnel, product and environmental protection
- All BSCs use high efficiency particulate air (HEPA) filters.
  - can remove particles down to 0.3 microns with 99.97% efficiency and will trap most bacteria and viruses.
  - vapors (from ethanol, formalin, etc.) and gases will not be captured and removed by the HEPA filter.
General Rules for Biosafety Cabinets

- **Certification**: must be done at installation, annually thereafter, or anytime the cabinet is moved or relocated
- **A Decontamination protocol must be in place**
  - UV light should be used as a backup method only
- The use of open flames and natural gas inside the BSC is strongly discouraged
  - Use disposable loops, an electronic or bead sterilizer
- 1 user at a time
Safely and Effectively working in a BSC

- **Plan for experiment:**
  - Place all items needed for procedures, waste collection, & disinfection inside the cabinet

- **During experiment:**
  - Enter the air curtain straight on
  - Spray down with disinfectant
  - Minimize movement
  - Do not block grilles
  - Work as far back in the cabinet as possible
  - HEPA filtered house-supplied vacuum lines
  - Keep your disinfectant bottle inside the cabinet at all times.
  - Failure to do so, can lead to contamination outside the BSC
Safely and Effectively working in a BSC

- Work from “clean to dirty”
- Keep grilles clear and work as far back as possible
Safely and Effectively working in a BSC

- When procedures are finished:
  - Tightly cap any tubes and cultures that will be coming out of the cabinet
  - Tie off biohazard waste bag & close off sharps bin
  - Wipe down all items inside the BSC with an appropriate disinfectant, including items that you will be taking out.
  - Remove all items from the BSC
  - Spray down the cabinet surfaces with disinfectant
  - Liquid in aspiration flasks must be soaked in 10% bleach for a minimum of 30 minutes before sewering
Biosafety Cabinet Resources

- BMBL – 5th Edition
- BSC Training Module – DEHS
- Biosafety Cabinet Fact Sheet
Questions or Concerns?

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