

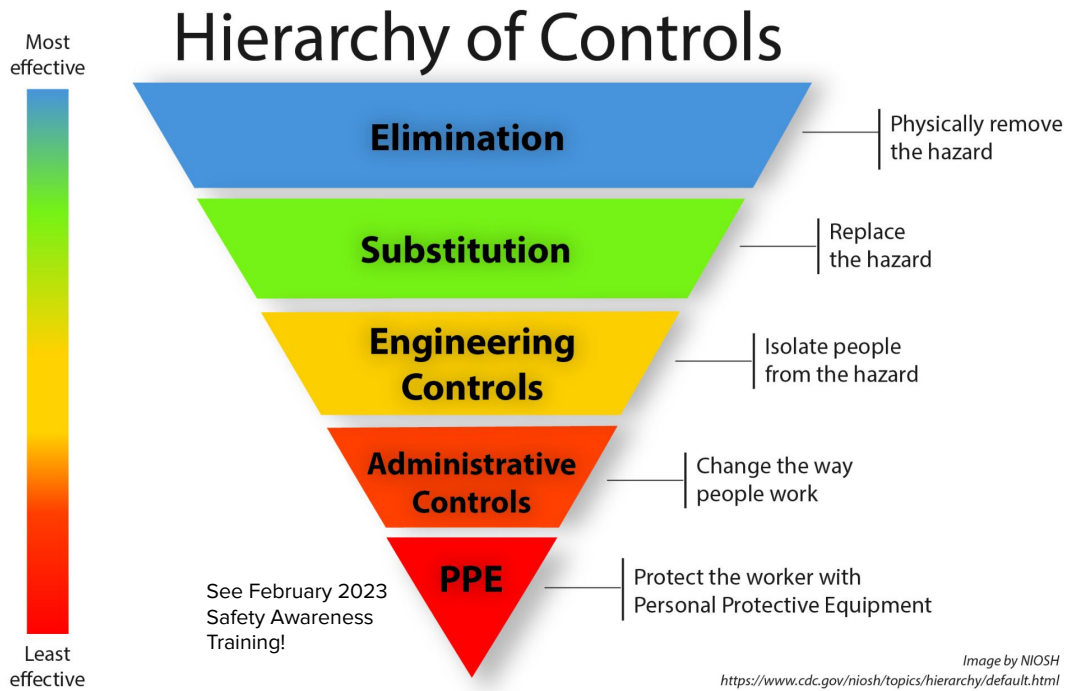
# Saint Louis University

## Engineering Controls

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# What are Engineering Controls?

If a hazardous material cannot be eliminated or substituted, engineering controls are the first line of defense to isolate people from the hazard.



# Chemical Fume Hoods

- Used to contain and exhaust hazardous fumes, gases, vapors, or dusts.
- Should be kept clean and clear of items that may impede proper air flow and normal operation.
- Tested by EHS annually to ensure they are working properly. This includes:
  - Linear face velocity measurements
  - Visual inspection for excessive clutter
- Chemical fume hoods used for volatile radioactive materials are tested quarterly.



# Downdraft Tables and Canopy/Portable Fume Exhausts

## Downdraft Tables:

- Provide ventilated work surfaces
- All stainless steel construction
- May include electrical receptacles and/or sink spray assembly



## Canopy Hoods:

- Designed to vent non-toxic materials such as heat, steam and nuisance odors.



## Portable Fume Exhaust:s

- Useful for laboratory benches when fume hoods are not an option.



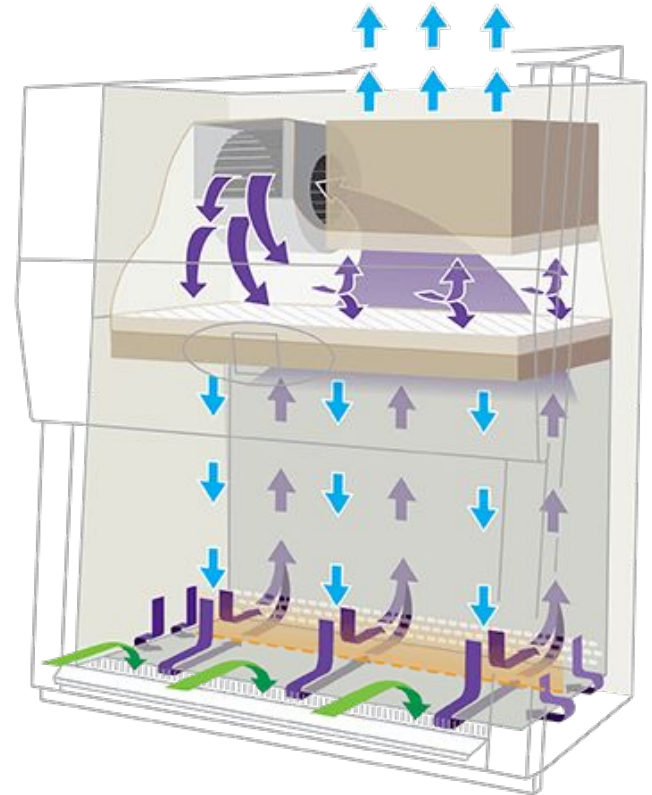
# Biological Safety Cabinets (BSC)

- When used properly, BSCs help protect users from exposure to biological agents.
  - BSCs work by providing an air curtain (vertical laminar airflow) between the user and the work environment.
- ➔ Air is moved through a HEPA filter before recirculation within the cabinet or exhausted back into the room or into a permanently connected exhaust duct.



## Class II, Type A2

Air In-flow 70% Recirculated vs. 30% Exhausted



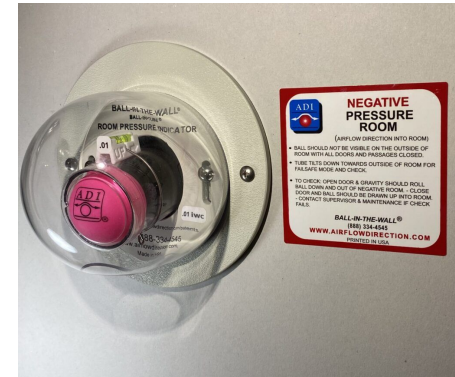
# Biological Safety Cabinets (BSC)

- BSCs must be tested and certified:
  - At the time of installation
  - Annually
  - Any time they are moved
- Do not use flammable gases in BSCs.
- Keep vents clear of tools, etc (prevents proper airflow).
- BSCs are not a storage location.
  - Remove items that are not necessary for the tasks of the day
- Use an appropriate disinfectant after each use.
- Contact EHS with any questions regarding purchase, testing, or use.



# HVAC Design - Doisy Research Center

- HVAC system is monitored using Metasys Building Automation Systems (BAS).
- BSL-2 labs are single-pass, non-recirculating with 100% supplied outside air.
- BSL-3 labs and ABSL3 facilities have negative directional airflow.
  - Fresh air enters and exits the A/BSL-3 spaces through air supply ducts and exhaust ducts.
  - Exhaust air passes through a HEPA filter bank and is dispersed from the roof via strobic fans.
  - Relative air pressures are displayed near entrances using:
    - Magnehelic gauges (measurement of directional airflow)
    - Ping pong ball system (visual indicator of directional airflow)
  - Red strobe lights are a visual indicator of an air handling failure.



# Centrifuge Rotors and Bucket Covers

- Safety centrifuge cups and rotors with O-Rings contain spills and prevent release of aerosols during centrifugation.
  - Check O-Rings and grease seals with vacuum grease.
  - Use an approved disinfectant to decontaminate rotors/buckets after use. Use mild detergents for cleaning.
  - Look for signs of corrosion. Metal fatigue will eventually cause any rotor to fail.
  - Always use rotor(s) specified by the manufacturer.
  - Ensure tubes are properly balanced in rotors.





# Shielding for Radioactive Materials

- Plexiglass shielding for strong (energetic) beta emitters
- Lead shielding for gamma emitters



# Self-Shielded X-Ray Cabinets with Door Interlocks

- These cabinets are manufactured with shielding materials built into them.
- Door interlocks are also built in to prevent personnel from being exposed to x-rays. If the door is opened, the unit stops emitting x-rays.



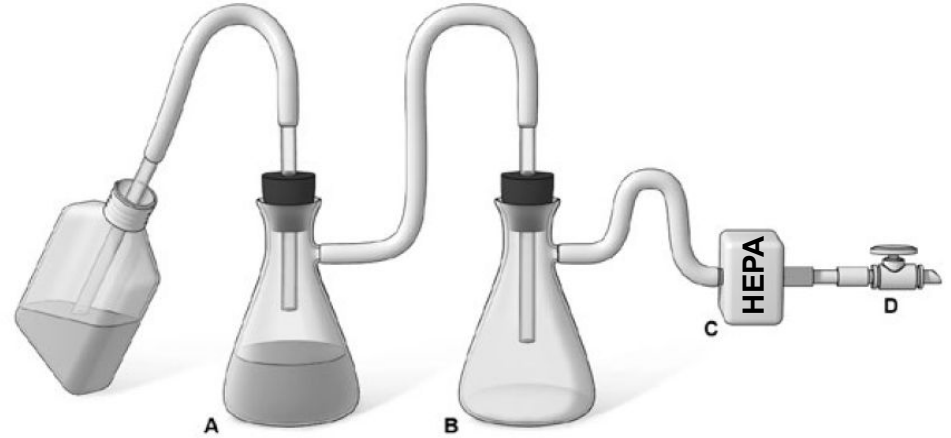
# Safety Needles

- Use self-sheathing needles and/or self-blunting needles,
  - Eliminate or minimize employee exposure
- Dispose of all sharps in leak-proof and puncture-resistant Sharps Disposal Containers.



# Vacuum Systems

- If using with biological agents, the primary flask should contain sufficient volume of disinfectant (e.g. bleach) to decontaminate the final amount of liquid.
- An in-line HEPA filter must be used between the final flask and the vacuum source to protect the vacuum from contamination!



## Protection of a house vacuum

Example method to protect a house vacuum system during aspiration of infectious fluids. The suction flask (A) is used to collect the contaminated fluids into a suitable decontamination solution; the right flask (B) serves as a fluid overflow collection vessel. An in-line HEPA filter (C) is used to protect the vacuum system (D) from aerosolized microorganisms.

(Adapted image/text from Biosafety in Microbiological and Biomedical Laboratories (BMBL) 6th Edition)

# Hot Plates and Stirring Devices

## Hot Plates:

- Use in place of an open flame
- Do not operate near volatile or flammable materials
- Do not use with a metal vessel
- Must be used within a fume hood if potentially hazardous vapors will be generated

## Stirring Devices:

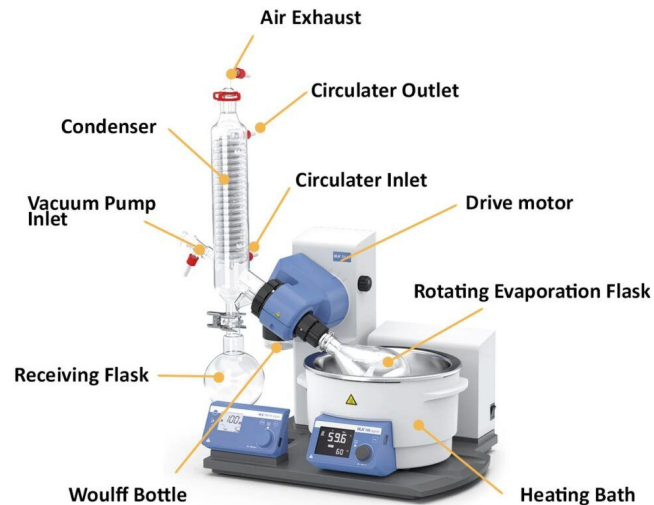
- Operate in a biological safety cabinet whenever possible
- Use spark-free induction motors in power stirring and mixing devices



Hot plate



Stir plate

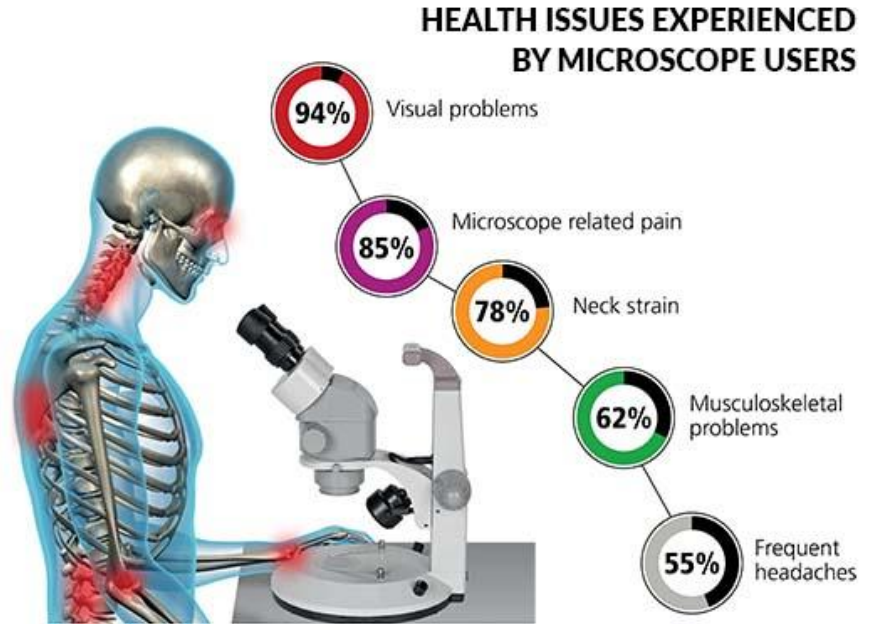


Rotary Evaporator

# Ergonomics

## Microscopes

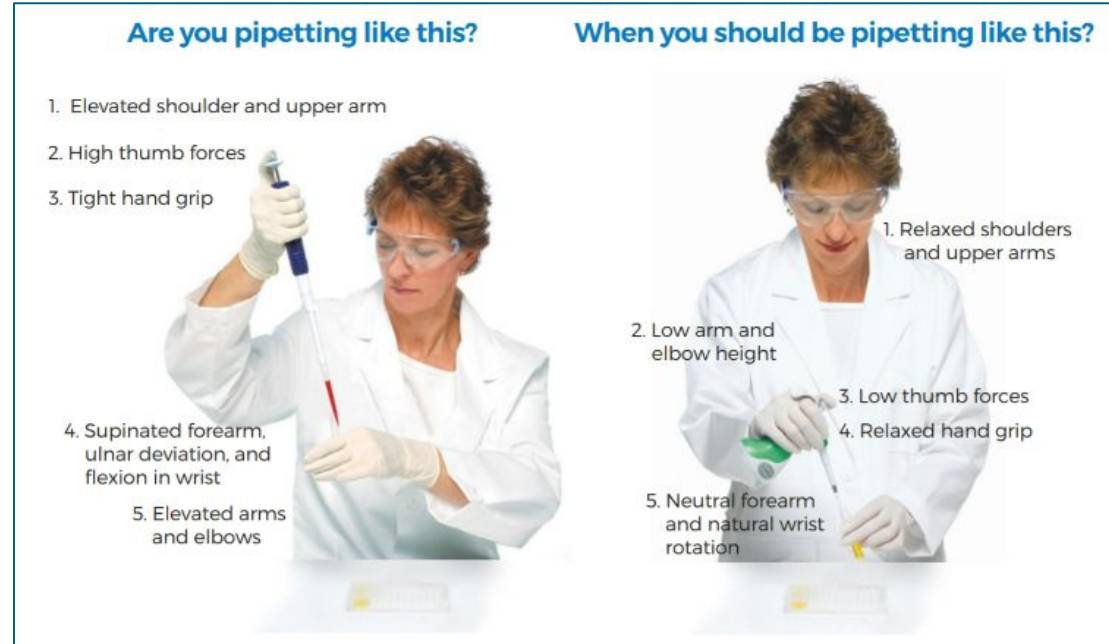
- Position microscope near the edge of the table
- Use a height adjustable chair
- Eyepiece should be at eye level



# Ergonomics

## Pipettes

- Maintain straight wrists. Do not twist or rotate your wrists while using the pipette.
- Keep elbow and body close to your work.
- Select the lightest pipette that can fit in your hand comfortably.
- Use multi-channel or electronic pipette to reduce repetitions.



<https://vistalab.com/ergonomics-is-a-science-not-a-slogan/>

# Ergonomics

## Biological Safety Cabinet

- Avoid repetitive movements whenever possible. Utilize ergonomic accessories.
- Keep head bent forward at 30° angle or lower.
- Rest elbows or forearms on elevated pads. Take care to not block front air grill or rest arms directly on work surface.
- Avoid clutter and reaching across the work zone. Work from “clean to dirty”.
- Keep wrists in-line with forearms - straight, non-locked position. Sit upright at 90° angle while working in the cabinet.
- Take frequent breaks with periodic stretching.
- Keep upper arms & shoulders relaxed whenever possible.





# Summary

- Please complete the [Safety Awareness Quiz](#) on Engineering Controls by May 31, 2023.
- Please contact [ehs@slu.edu](mailto:ehs@slu.edu) for any questions.