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EH&S FACT SHEET
Environment, Health and Safety Information for the Berkeley Campus

Vacuum System Hazards and Precautions

Vacuum Systems

Many campus laboratories are supplied with a "house" vacuum system. The house vacuum system creates suction from a large vacuum pump in a mechanical room whose piping extends to laboratories throughout the building. These house vacuum pumps are maintained by campus maintenance staff, and it is important the systems not be contaminated with hazardous materials or organisms.

Laboratories that are not connected to a house vacuum system, or that need a stronger vacuum, commonly use stand-alone vacuum pumps such as rotary vane pumps, turbo pumps, diffusion pumps, and/or cryogenic vacuum pumps. These vacuum pumps are maintained by research groups, and can present hazards in the laboratory if not properly handled.

General Practices

Figure 1

- All connections to the house vacuum system must be suitably trapped to prevent liquids or hazardous materials from entering the system. All connections must be labeled with the sticker in Figure 1 (call 642-3073 to request stickers). Immediately inform your Department Safety Coordinator or the Office of Environment, Health & Safety (EH&S) if you are aware of any instance when a hazardous material was accidentally aspirated into a house vacuum system.
- A container under vacuum can implode and cause injury by violently spraying glass and hazardous materials. All glass containers must be strong enough to handle the pressure differential without failure. If the apparatus or glass lines are chipped or cracked, the container must be replaced immediately. It is a good idea to wrap glass vessels with tape and enclose the vacuum trap inside a rigid container, particularly if the trap is located on the floor.

Chemical Work

- If a stand-alone vacuum pump is used with volatile hazardous materials, it is important to trap the vapors so that they do not degrade the pump oil or pass through the pump and get emitted in the exhaust. Stand-alone vacuum pumps should exhaust to a fume hood or other building exhaust; they should not exhaust into the room.
- To capture most hazardous volatile liquids, a cold trap (e.g., a flask in a cold bath) using a slush of dry ice and either isopropanol or ethanol is sufficient (to -78 degrees C). A liquid nitrogen cooling bath may be used only with sealed or evacuated equipment, and then only with extreme caution. If the system is opened while

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the cooling bath is still in contact with the trap, oxygen may condense from the atmosphere and react vigorously with any organic material present.

- If a solvent distillation vacuum is not properly trapped, it can cause a flash fire. See this past "Lessons Learned": http://ehs.berkeley.edu/hs/129-lessons-learned-at-uc-berkeley/182.html.

Biological Material Work

- Use a liquid trap with an appropriate disinfectant (e.g. bleach, volume calculated for 10% final concentration). The trap should be labeled with the disinfectant used and any hazards. (see "A" in Figure 2.)
- A second overflow trap with a disinfection bubbler must also be installed (see "B" in Figure 2).
- To prevent research organisms from entering the house vacuum system, an air filter must be installed. Use only 0.3 um filters designed to protect vacuum lines (see "C" in Figure 2).

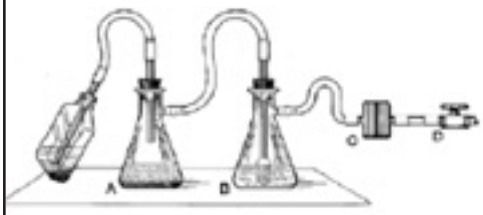

Figure 2 - Typical setup when working with biological materials.

A = Standard liquid trap flask
B = Overflow trap with disinfection bubbler
C = Hydrophobic Air filter for aqueous work, Hydrophilic Air Filter for non-aqueous work
D = Valve to house vacuum system

Flask A must contain a suitable disinfectant such as bleach (10% final concentration).

Additional Hazards and Precautions for Stand-alone Pumps

- Leaking or spilled oil can create slip hazards, so place vacuum pumps in a pan or tray.
- Exposed fan belts and pulleys can pose physical hazards, so vacuum pump belts and pulleys must be entirely enclosed with guards.
- Ensure that electrical cords and switches are not defective; check that cord insulation is intact.

Basic Liquid Trap

To make a liquid trap use a side-arm filtering flask. Properly size the flask so that liquids will not overflow and be drawn into the vacuum system. Into the neck of the flask, insert a one-hole stopper with glass tubing in it that extends below the sidearm. Use thick-walled tubing between the primary liquid trap flask and the overflow flask, and between the overflow flask and the house vacuum (regular tubing will collapse under vacuum).

With tape or pen, mark the maximum full line. Empty the trap before the liquid in the trap reaches the full line.

Basic Liquid Trap - Attach to Vacuum System

Disposal of Unwanted Hazardous Materials

Any unwanted hazardous materials that are generated must be assessed for proper disposal. If the process generates dilute, aqueous solutions, refer to the EH&S Drain Disposal Guidelines (http://ehs.berkeley.edu/images/ehs/pubs/draindisposal.pdf) to determine whether drain disposal is appropriate. If it is not suitable for drain disposal, submit a pick up request to EH&S. If the liquid contains biological organisms, follow the disposal guidelines in the EH&S Fact Sheet, "Biohazardous Waste and Recombinant DNA Waste Management in Biosafety Level 2 and 3 Laboratories." http://ehs.berkeley.edu/images/ehs/pubs/01biohazwaste.pdf.

When changing vacuum pump oil, drain the oil into a sealable container and go to the Hazardous Waste Program online at https://jwas.ehs.berkeley.edu/hwp to create labels and manage your hazardous waste.