

**Standard Operating Procedure
Heat Sources and Heating Baths**

1. Procedure/Hazardous Material:

Includes, but not limited to ovens, hot plates, heating mantles and tapes, oil baths, salt baths, sand baths, hot-air guns, and microwave ovens.

2. Department: Campus wide

3. Revision Date: February 2013

4. Special Notifications:

Unattended Operations

- Provide for containment of materials in the event of spills or failures.
- Label all containers and process equipment with the name of the material and special hazards.
- Post emergency numbers on the lab door.
- Keep lab lights on.

5. Hazard Description:

Hazards

- Personal injury and burns from hot surfaces, liquids, vapors or flames.
- Sources of ignition both from hot surfaces, liquids or flames and from electrical components.

Risks

- Contact burns are likely and may range from trivial to severe but most likely will affect only the user.
- Ignition or explosion is much less likely but may result in widespread injury to others.

6. Engineering Controls:

Required:

1. All unattended electrical heating equipment shall be equipped with a manual reset over-temperature shutoff switch, in addition to normal temperature controls.
 - Use a non-mercury thermometer, thermocouple or bimetallic temperature indicator, a temperature-control device, and a high-temperature shut-off device.
2. Heating equipment with circulation fans shall be equipped with an interlock arranged to disconnect current to the heating elements if the fan fails.
3. Heated Constant Temperature Baths:
 - NEVER heat a bath fluid above its flash point.
 - Electrically heated constant temperature baths shall be equipped with over-temperature shutoff switches in addition to normal temperature controls.

7. Personal Protective Equipment:

Appropriate gloves, safety glasses and lab coat must be worn when handling heating equipment.

8. Storage Requirements:

Store the oil or sand for reuse in a covered secondary container that is labeled with the name and maximum safe working temperature. Do not store on the floor.

9. Handling Precautions/Conditions:

Labeling:

All oil baths must be labeled with the name of the oil and its maximum safe working temperature:

"Hot Mineral (Silicone) Oil"
"Do not allow the temperature to exceed ____ deg C"

Use:

- When using hot oil or sand for heating, mount the baths in such a way that they cannot be overturned or that water cannot fall into an oil or sand bath causing hazardous splattering.
- Do not use a sand or oil bath unless it is equipped with a thermometer (non-mercury) or other temperature indicating device.
- Avoid overheating an oil bath. Watch for smoking of the oil. Oil that is smoking is too hot and may burst into flames. If an oil bath starts to produce smoke, turn off the heat immediately.
- Do not leave an operating sand or oil bath unattended unless it is equipped with a high-temperature shutoff and with a warning label.
- Baths should be mounted on a laboratory jack that can be lowered easily without danger of the bath tipping over to cool the bath in an emergency. Equipment should be clamped high enough above a hot plate or oil bath that if the reaction begins to overheat, the heater can be lowered immediately and replaced with a cooling bath without having to readjust the clamps holding the equipment setup.
- Do not overfill bath containers. Oil expands in volume when heated.
- Secondary containment for oil baths must be used to contain any possible spills.

- Check all glassware before using to ensure it's free of cracks and other imperfections. Do not use if in doubt.
- Burners, induction heaters, ovens, furnaces, and other heat-producing equipment must be located at least 10 feet from areas where temperature-sensitive and flammable materials and compressed gases are handled. Remove all flammable materials from the fume hood that are not used in this procedure.

10. Emergency Procedures:

- Know the flash point of the material when using oil baths. NEVER heat a bath fluid above its flash point.
- Discard oil if it has become contaminated. If oil bath is contaminated with a solvent, the flash point is unknown.
- Do not use a water bath with water reactive, moisture sensitive or pyrophoric reactions.
- Know where the emergency gas shut off is for your lab when using Bunsen burners,
- Always use the grounded three-prong plug when using a variable transformer. Some older models of Variacs will keep whatever is plugged into them electrically live even though the Variac is switched off. Touching this device and ground at the same time could complete a circuit with your body and lead to electrocution. Always disconnect a Variac from the outlet before working with the device plugged into it.
- Discard the heating mantle if the fiberglass is brittle or cracked.
- Do not use any electrical equipment if any wires are frayed or exposed.
- Know where the nearest Fire Alarm Pull Box is to your lab. Know how to use a fire extinguisher. Use only 1 fire extinguisher before evacuating the area. Always contact EH&S for any size fire.

11. Decontamination:

Clean up spills (solid or liquid) immediately. Discard bath if contaminated.

12. Waste Disposal:

Pour used oil into an appropriate container that has a cap. Label containers as "USED OIL" and include the name of the oil (e.g. mineral or silicone). Date label when container is full.

13. Laboratory Specific Procedures:

Lab Director:

Room:

Procedures for using heat sources and heating baths:

14. Additional References

- *Prudent Practices* http://www.nap.edu/catalog.php?record_id=12654 (read it online for free)
Prudent Practices for Safety in Laboratories provides step-by-step planning procedures for handling, storage, and disposal of chemicals. Organized around a recommended workflow protocol for experiments, the book offers prudent practices designed to promote safety and it includes practical information on assessing hazards, managing chemicals, disposing of wastes, and more.
- NFPA 45 *Standard on Fire Protection for Laboratories Using Chemicals*, 2011 edition
- *ILPI*: <http://www.ilpi.com/inorganic/glassware/heatsources.html>
- *ACS Laboratory Safety for Students & Faculty*
 - http://portal.acs.org/portal/acs/corg/content?_nfpb=true&_pageLabel=PP_ARTICLEMAIN&node_id=2228&content_id=CNBP_027854&use_sec=true&sec_url_var=region1&_uuid=e6662131-ab2a-4b10-b03b-deb11cee9033