TEXAS A&M UNIVERSITY SAN ANTONIO
Research and Academic Environmental Health & Safety

Guidelines: Microwave Ovens

☐ Process ☐ Hazardous Chemical ☐ Hazardous Class ☒ Equipment ☐ Experiment

Using microwaves in a lab is very similar to using microwaves at home.

You have to be just as careful of the general hazards associated with heating or using a microwave. For example, the heat from steam which can cause serious burns and never placing metal objects in the microwave.

In a lab environment be very mindful of:

- Not everything is microwavable.
- Some substances react and become volatile when heated.
- Leaking microwaves.
- Burns from vessels (used to hold substances) and substances that become hot.
- Steam from substances or substances expanding and bubbling over.

Potential Hazards

The use of microwave ovens for simple heating or defrosting in laboratories can pose a number of hazards, including:

- Ignition of flammable vapors
- Exposure to microwave radiation from a faulty or modified unit
- Electric shock from ungrounded or faulty units
- Ignition of materials being heated
- Pressure build-up in sealed containers
- Sudden boiling of liquid in an open container following removal from an oven
- Contamination of food products with chemical residues

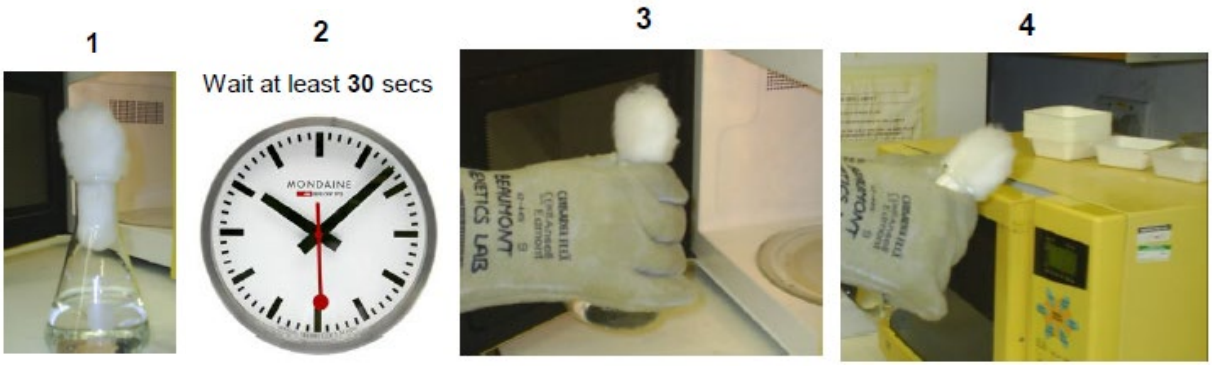
General Safety Procedures (best practice):

- Using unsuitable containers that lose their strength and then fail when handled.
- Using dirty containers that contain residues of another substance that react with your substance, causing an exothermic reaction.
- Reactions after heating e.g. placing a cold metal object in a boiling substance may cause an ejection of hot liquid.
- Confusing signals i.e. the container may be cold but the substance inside may be very hot.
- Toxic vapors from hot substances.

The steps below should ensure your health and safety when microwaving items in a lab:

1. **ALWAYS** refer to the Risk Assessments before heating any substance.
2. **NEVER** microwave flammable or toxic materials.
3. **BE CAREFUL** when microwaving water – the water may not appear to be boiling but can explode when removed from the microwave.
4. Use suitable (non-metallic), heat resistant containers.
5. Never overfill containers.
6. Use a suitable stopper (picture 1) that stops bubbling over but also stops pressure build-up.
7. Allow items to cool for at least 30 seconds (picture 2) before removing them.
8. Wear heat resistant gauntlets (picture 3) when removing items. Keep your lab coat sleeves tucked into the gauntlet so you don't get steam up the sleeve!
9. Point containers away from yourself and others (picture 4) when removing from the microwave.

10. Handle the container / substance carefully.
11. If you think it is *'too hot to handle'* wait for it to cool a bit more.



Incident Response

- If materials inside the oven ignite, **KEEP THE DOOR CLOSED**. If safe to do so, turn the oven off, disconnect the power cord and follow Fire Emergency Procedures.
- If you think something is wrong with the microwave, **STOP** using it, place a sign on it to ensure others don't use it and report it immediately to your Supervisor / Line Manager.

NEVER use lab microwaves to heat your food!

References and Additional Resources

Risk management & control measures

To minimize the risk of these hazards, an appropriate combination of the following control measures should be implemented to ensure that the risk to health and safety from the use of microwaves will be low. These must be documented in a risk assessment for the process.

DO NOT:

1 Attempt to heat flammable liquids or solids, hazardous substances or radioactive materials in any type of microwave oven, whether domestic or laboratory-grade.
2 Attempt to defeat the interlock switches that prevent a microwave oven from operating with the door open.
3 Place any wires, cables, tubing etc. between the door and the seal.
4 Modify in any way the mechanical or electrical systems of a microwave oven.

Carry out unauthorized repairs on a microwave oven. Where a unit is suspected to be faulty it should be disconnected from the power supply, removed from service and labelled with an appropriate tag while

5 Awaiting repair or disposal. Any irreparable or redundant microwave oven should be rendered inoperable by removal of the plug and cord before disposal.
6 Use a microwave oven in a laboratory for food preparation (or vice versa)
7 Heat sealed containers in a microwave oven. Even a loosened cap or lid poses a significant risk since microwave ovens can heat material so quickly that the lid can sit upward against the threads and containers can explode either in the oven or shortly after removal.
8 Use bottles with a restricted neck opening [e.g. medical flats]

9 Place metal objects of any kind in a microwave oven. This includes aluminum foil and plastic coated magnetic stirrer bars.

10 Overheat liquids in a microwave oven. It is possible to raise water to a temperature greater than the normal boiling point; when this occurs, any disturbance to the liquid can trigger violent boiling that could result in severe burns.

DO:

- Ensure that the oven cavity is adequately ventilated. The unit should be located on a clear open bench and not in a location where the vents could be obstructed by books or equipment.
- Conduct regular inspections to ensure that the sealing surfaces are clean and do not show any sign of damage. The presence of arcing or burn marks may be indicative of microwave leakage.
- Ensure that microwave ovens are electrically grounded and connected using a properly rated three-pin cord and plug. As with all new laboratory equipment, microwave ovens should be inspected in accordance with the University's policy for electrical equipment to ensure compliance with this requirement.
- Report defects in equipment or difficulties in operation with a microwave oven promptly to the laboratory manager or supervisor.
- Where possible use microwave grade plastic vessels with a pressure relief valve. Where glass vessels are used, check these for cracks and flaws before using them in the microwave.
- Use appropriate protective equipment when removing heated liquids from the oven.

Specialized microwave usage– additional measures

The use of a microwave to melt agar.

Agar can be particularly dangerous and great care must be taken to use the minimum power level only heat for the minimum time. The following precautions must be observed: To minimize the risk of these hazards, users need to adopt the following rules

- Large amounts (e.g. 250 ml) of solidified agar should not be warmed in a microwave oven unless the agar is first chopped up with a sterile spatula or other suitable instrument. Not doing this can cause explosive vaporization in solid agar where vapor cannot escape.
- Use loose fitting sterile foam plugs or loose 'Kimwipe' plugs, rather than just relying on a loosely placed cap.
- Ensure a good amount of headspace is available in the container above the substance being heated.
- Set the power and timings correctly. These should have been pre-determined for the volumes normally used in the lab, by controlled experiment and should then be displayed in a prominent position next to the microwave.
- Thermal gloves and a face visor must be worn when removing a bottle from the microwave.
- Care should be taken when placing the bottle on the bench so as not to cause unnecessary disturbance of the agar, which may cause the agar to boil over.

For more information, contact RAEHS at vpantusa@tamusa.edu or 210-784-2822.