

Safe use of microwave ovens in laboratories

Hazards

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

- Ignition of flammable vapours
- 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

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:

- Attempt to heat flammable liquids or solids, hazardous substances or radioactive materials in any type of microwave oven, whether domestic or laboratory-grade.
- Attempt to defeat the interlock switches that prevent a microwave oven from operating with the door open.
- Place any wires, cables, tubing etc between the door and the seal.
- Modify in any way the mechanical or electrical systems of a microwave oven.
- Carry out unauthorised 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 awaiting repair or disposal. Any irreparable or redundant microwave oven should be rendered inoperable by removal of the plug and cord, before disposal.
- Use a microwave oven in a laboratory for food preparation (or vice versa)
- 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 seat upward against the threads and containers can explode either in the oven or shortly after removal.
- Use bottles with a restricted neck opening [e.g. medical flats]
- Place metal objects of any kind in a microwave oven. This includes aluminium foil and plastic coated magnetic stirrer bars.
- 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 in the microwave.
- Use appropriate protective equipment when removing heated liquids from the oven.

Specialised microwave usage– additional measures

1. 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. 250ml) 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 vapourisation in solid agar where vapour 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.

2. The use of microwave heating as a reaction accelerator in the chemical

research field is to be treated with extreme caution. While techniques have been developed, these usually involve the use of dedicated laboratory-grade equipment rather than domestic ovens. Should a need be identified for this application of microwave heating, the researcher(s) concerned must **carry out a full risk assessment**. The Safety Office should be consulted for guidance.