APPENDIX 14

POLICY FOR THE USE OF MICROWAVE OVENS IN LABORATORIES

SAFE USE AND SELECTION OF MICROWAVE OVENS IN LABORATORIES

The following information is for laboratories that use microwave ovens. These requirements must be followed to comply with applicable New Jersey Uniform Fire Code (NJUFC) and Public Employees' Occupational Safety and Health (PEOSH) regulations and to ensure the safe usage of the equipment.

- All microwave ovens must be approved for laboratory use and for the material placed in the microwave.
- Approval can be obtained by the manufactuer of the microwave oven or by REHS after a hazard assessment has been conducted.
- Microwave ovens specifically designed as "Laboratory Grade" or manufactured for laboratory research activities to control or minimize potential hazards are considered to be approved laboratory equipment and will not require additional hazard assessments as long as they are utilized according to the manufacturers' recommendations and established standard operating procedures.
- Under NO CIRCUMSTANCES are residential, household type microwave ovens permitted to be used in laboratories.
- Users of such equipment must be thoroughly familiar of operation procedures, safety devices and protocols before beginning experiments, especially when there is a possibility of fire (flammable solvents), over-pressurization, arcing or when hazardous vapors are produced.

PRE-APPROVED LABORATORY PROCEDURES

REHS conducted hazard assessments for the following materials commonly used in laboratory microwave ovens. These materials are permitted to be used as long as they are used in a microwave oven listed for commercial use and are in accordance with written experimental procedures (quantity, heat setting, time, etc.)

Material	Process
Agar	Melting/Heating
Agarose	Melting/Heating
Buffer Solution	Heating
Water	Melting/Heating
Slide	Drying
Sample preparation (nontoxic)	Drying
Staining (nontoxic)	Heating/Drying

1) **SPECIALIZED MICROWAVE USAGE – AGAR/AGAROSE -** The use of a microwave to melt agar/agarose can be particularly dangerous. The following precautions must be followed when performing this task to minimize the risk:

   a) Set the power level to the lowest level and heat for the minimum amount of time required to melt the agar/agarose. This should be pre-determined for the volumes normally used in the lab and displayed in a prominent position next to the microwave.
   b) 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. Failure to chop up the agar may result in an explosive vaporization.
   c) The lid on the bottles must be completely removed before heating. Use loose fitting sterile foam plugs or loose 'Kimwipe' plugs, rather than just relying on a loosely placed cap.
   d) Ensure adequate amount of headspace is available in the container above the substance being heated. Do not overfill containers (no more than two thirds full).
   e) Thermal gloves and a face shield must be worn when removing a bottle from the microwave or wait until the agar is sufficiently cooled before removing and handling (as a guide wait a minimum of five minutes).
   f) 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.

ADDITIONAL HAZARD ASSESSMENTS

The use of microwave heating as a reaction accelerator or with hazardous (flammable, corrosive, toxic, etc.) materials must be treated with extreme caution. While techniques exist, they usually involve the use of dedicated laboratory-grade specialized microwave oven rather than just commercially listed unit.

Prior to the use of a microwave oven for these procedures or for any other procedure not pre-approved as identified above, the researcher(s) must request a hazard assessment be performed by REHS.

HAZARD AWARENESS AND CONTROL MEASURES

- The uses of microwave ovens for heating, melting or drying in laboratories create various hazards, including: Significant and rapid temperature/pressure rise
- Ignition of flammable vapors
- Exposure to microwave radiation from a faulty or modified unit
- Electric shock from ungrounded, improperly wired or faulty units
- Ignition of materials being heated
- Integrity of containers holding materials
- 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

To assist the research community, REHS assessed the utilization of typical microwave oven processes to establish procedures for the safe operation of commercially listed microwaves at university laboratories consistent with the microwave's intended use.

The use of flammable materials, corrosive materials, hazardous substances, and radioactive materials is STRICTLY PROHIBTED.

The following hazard control measures must be implemented:

- 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 directly into an outlet without overloading the circuit. The use of an extension cord or outlet strip are prohibited.
- 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.
- DO NOT perform the following:
    - Defeat the interlock switch that prevents 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.
    - Perform unauthorized repairs on a microwave oven. When a unit is suspected to be faulty it should be disconnected from the power supply, removed from service and labeled with an appropriate tag while awaiting repair, surplus or disposal.
    - Use a microwave oven in a laboratory for food preparation.
    - Heat closed or sealed containers in a microwave oven. Even a loosened cap or lid poses a significant risk.
    - Use bottles with a restricted neck opening [e.g. medical flat bottles]
    - Place metal objects of any kind in a microwave oven. This includes aluminum foil and plastic coated magnetic stirrer bars.
    - Overheat liquids. 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.
    - Use chemicals that can potentially produce harmful byproducts or odors.