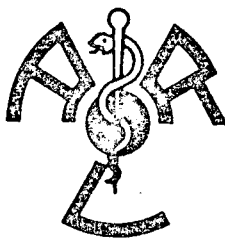


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AUSTRALIAN RADIATION LABORATORY

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THE DOMESTIC MICROWAVE OVEN

The Australian Radiation Laboratory of the Commonwealth Department of Health has a responsibility to maintain a close watch over potential radiation hazards arising from technical and consumer products and to evaluate any possible public health risk arising from them.

Standards of safety for radiation leakage from microwave ovens have been recommended by the National Health and Medical Research Council. Over the years the Laboratory has surveyed, and assessed in terms of the safety standard, many microwave ovens which are in use in restaurants, food catering establishments, hospitals and homes. These surveys have demonstrated that many microwave ovens can, in time (and especially with lack of care) exceed the recommended level for microwave leakage. Where an inspection suggests that the microwave oven is damaged or does not meet the requirements outlined in the National Health and Medical Research Council recommendations (which are listed on page 3 of this information sheet), then a serviceman should inspect the oven before it is used.

In Australia, all States require a sample of every model of a microwave oven to be tested for microwave leakage and no oven may be offered for sale unless it achieves the standards recommended by the National Health and Medical Research Council.

MICROWAVE RADIATION

Microwaves, like X rays, gamma rays and visible light, are a part of the electromagnetic spectrum. The microwave region of the spectrum lies, between, and in some areas overlaps, the radio-wave and infra-red ray regions of the spectrum. The frequency range of microwaves is between 100 and 300,000 mega hertz (MHz) which corresponds to a wavelength range of 3 metres down to 1 millimetre.

The properties which microwave radiation possesses in common with light are reflection, refraction, diffraction and absorption. These properties enable microwaves to be harnessed for domestic and industrial uses. Some of the industrial and commercial uses of microwave radiation are:— air and sea navigation, weather mapping, curing of rubber, kiln drying timber, sealing plastics and the transmission of radio and television programs.

In the domestic microwave oven an electronic tube called a magnetron is used to produce the microwaves. The microwaves then pass through a wave guide into the metal oven cavity where they are reflected around the oven walls.

Microwave radiation heats materials by an electrical interaction with components of the material. For example, in food, microwaves interact with the water and protein molecules present in the food and these molecules attempt to orientate themselves in the direction of the electric field within the microwave. As the direction of this field changes with the frequency of the microwave radiation, a considerable amount of molecular friction is produced which creates a temperature rise and results in the food being cooked.

The amount of heating available depends on the time spent in the microwave field and on the power density of the microwave radiation, which is usually measured in milliwatts per square centimetre.

BIOLOGICAL EFFECTS

For the human body or other animal bodies this heating from microwaves may take place on the skin, near the surface, or deep within the body. The depth of penetration is related to the frequency of the microwave and for the frequency used in Australia for the domestic microwave oven, 2450 MHz, the microwave radiation can penetrate tissue underlying the skin. The depth of penetration depends on skin thickness, thickness of fatty tissue, tissue composition and the part of the body exposed to the microwave radiation.

The human body has various mechanisms by which it can compensate for a certain amount of heating; perspiration and circulating blood acting as coolants are good examples of these mechanisms. Consequently an over-exposure to microwave radiation may be somewhat less hazardous in cool weather than on an extremely hot day when the body's cooling mechanism is already working at full capacity.

The human eyes are susceptible to 2450 MHz microwave radiation and when exposed excessively to microwave radiation of this frequency, small opacities will develop within the lens of the eye. This process is irreversible and in time may lead to the development of cataracts. In the early stages of cataract development small opacities may only be detectable by detailed eye examination.

As the surface of the human body is more generously supplied with sensory nerves than the interior, a feeling of warmth may give a warning in case of over exposure to surface heating from microwaves. However, in the case of localized heating within the body, it is less likely that any warning sensations would be noted before damage occurred. Hence it is important to use precautions in the use of microwave generating apparatus and to establish limits for microwave oven leakage radiation.

PRECAUTIONS AND LIMITS

The National Health and Medical Research Council at its 75th Session issued the following precautions in the use of microwave ovens:—

A microwave oven should only be used if an inspection confirms all the following items:

- The grille is not damaged or broken.
- The door fits squarely and securely and opens and closes smoothly.
- The door hinges are in good condition.
- The door does not open more than a small fraction of an inch (more than a few millimetres) without the user hearing the safety switches operate.
- The metal plates of a metal seal on the door are not buckled nor deformed.
- The door seals are not covered with food nor have large burn marks.

Microwave radiation from microwave ovens can cause harmful effects unless the following precautions are taken:

- Never tamper with or inactivate the interlocking devices on the door.
- Never poke an object, particularly a metal object, through the grille or between the door and the oven while the oven is operating.
- Never open the door while the oven is on.
- Never place metal objects inside the oven. These include saucepans, trays or any other metal utensils or metal-rimmed or metal decorated utensils.
- Clean the oven cavity, the door and the seals with water and a mild detergent at regular intervals. Never use any form of abrasive cleaner that may scratch or scour surfaces around the door.
- Never use the oven without the trays provided by the manufacturer.
- Never operate the oven without a load (i.e. an absorbing material such as food or water) in the oven cavity unless specifically allowed in the manufacturer's literature.
- Never rest heavy objects such as food containers on the door while it is open.

AUSTRALIAN STANDARDS

The National Health and Medical Research Council recognises that some microwaves will escape from ovens and in the 71st Session of October 1971 they laid down a standard of safety for leakage radiation. They believe that compliance with this standard will ensure that public health is not affected from the use of microwave ovens. This standard of safety states that the power density of microwave radiation emerging from any microwave oven, shall not exceed 5 milliwatts per square centimetre at any point 5 centimetres or more from the external surface of the oven.

Although some States do maintain their own independent test function, prototypes of many microwave ovens are tested by the Australian Radiation Laboratory. Since the development of the standard, the Australian Radiation Laboratory has tested numerous prototypes of many models of microwave ovens and all which have been marketed have complied with the prescribed standards.

The Australian Radiation Laboratory has tested a number of microwave ovens in the field, particularly in commercial use, and during these surveys have encountered from time to time ovens which have deteriorated and shown leakage in excess of the prescribed standard. Any faults which are likely to occur in microwave ovens will normally occur earlier in a commercially used oven than an oven used domestically because of the more frequent use of the commercial unit.

These surveys emphasise the importance of servicing and maintenance of microwave ovens in accordance with the precautions issued by the National Health and Medical Research Council which are reprinted on page 3 of this information bulletin.

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