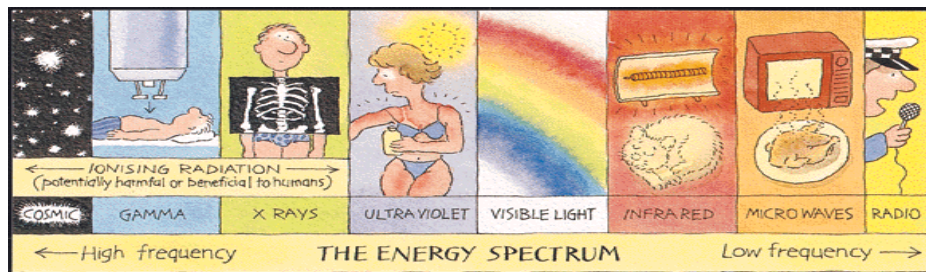


MICROWAVE OVEN RADIATION SAFETY

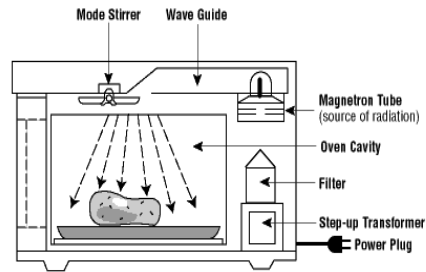
What is microwave radiation ?

Microwaves, like visible light are a part of the electromagnetic spectrum and are extremely high frequency radio waves. Microwaves travel in straight lines and may be reflected, transmitted or absorbed by matter in their path. Metallic materials totally reflect microwaves. Non-metallic materials such as glass and plastics are partially transparent to microwaves. Materials containing moisture such as foods absorb microwave energy and produce heat.



Some of the more common uses of microwaves include satellite communications, radar, car phones, air and navigational aids. Other applications include use in industry for thawing and drying materials and in medicine in diathermy treatment as well as household use for the preparation of food.

How do microwave ovens work ?



In the microwave oven an electronic tube called a magnetron is used to produce the microwaves. The magnetron, basically converts 60 Hz power line electric current to electromagnetic radiation at 2450 MHz. The high voltage (typically 3000 to 4000 volts) which powers the magnetron tube is produced by a step-up transformer rectifier, and filter which converts 120 V AC to 4 kV DC. The microwave then pass through a wave guide into the metal oven cavity where they are reflected around the oven walls. Uneven reflections may cause localized hot and cold spots in food. This is minimized by the use of a mode stirring fan and rotating carousel. The microwaves penetrate food and cause water molecules within the food to vibrate at a frequency of the microwaves (2450 MHz). The vibration causes considerable molecular friction which produces heat and results in a rapid rise in temperature. The rate of heating depends on moisture content, shape, volume and mass of food present. This can produce uneven heating with some foods where the outside may be only warm while the inside may be close to boiling (jam filled donuts, for example). The oven walls and cooking utensils are not directly heated by microwaves because they do not absorb microwave energy. However, they frequently get very warm from direct contact with the hot food.

Can microwaves leak radiation ?

Old or faulty door seals are the most common causes of microwave radiation leakage. Mechanical abuse, a build up of dirt, or simple wear and tear of continued use can cause door seals to be less effective.

How is microwave radiation measured ?

Microwave energy is measured as power density in units of milliwatts per square centimetre (mW/cm^2) which is essentially the rate of energy flow per unit area. Typical levels of radiation leakage from microwave ovens is about $0.2 \text{ mW}/\text{cm}^2$ which is far below the limit set by the national safety standard **Safety Code 6: Limits of Exposure to Radiofrequency Fields at Frequencies from 10 kHz - 300 Ghz.**

How safe are microwave ovens ?

Microwaves generated in microwave ovens, like visible light from light bulbs, cease to exist once the electrical power to the magnetron is turned off. They do not remain in the food when the power is turned off and they cannot make food or the oven radioactive. Therefore, food cooked in a microwave presents no radiation hazard.

Microwave ovens have at least two safety interlock switches which stop the generation of microwaves immediately if the door is opened. The design of microwave ovens is such that the microwaves are contained within the oven, though it is possible for some leakage to occur around the door.

What are the health effects to be considered in the use of microwave ovens ?

It is known that microwave radiation can heat body tissue in the same way it heats food. Exposure to very high levels of microwave radiation (**well in excess of those measured around microwave ovens**), can cause a painful burn. The lens of the eye is particularly sensitive to intense heat, and exposure to high levels of microwaves can cause cataracts. Likewise, the testes are very sensitive to changes in temperature. Accidental exposure to high levels of microwave energy can alter or kill sperm, causing temporary sterility. *These types of injuries can only occur if exposed to large amounts of microwave radiation*, much more than a leak from a microwave oven.

Injuries from microwave oven use are the same as those related to conventional ovens or cooking surfaces. Persons are burned by handling hot items or from spattering of hot grease or other liquids. Steam generated from items heated in microwave ovens can cause serious and painful burns. Explosions may occur in microwave ovens, from pressure built up in sealed containers or from ignition of volatile materials.

Microwave ovens that are modified or constructed for special purposes such as drying ovens in research laboratories may not have proper protective shielding surrounding the cavity. Vent openings, disabling of interlocks or removal of doors and sides may result in dangerous levels of leakage of microwave radiation.

In the past, there were some problems resulting from the microwave radiation interfering with the signal from pacemakers. Because pacemakers are electronic devices, interference from other electrical sources can cause the pacemaker to malfunction and thus send incorrect information to the heart muscles. Although properly maintained and operated microwave ovens are unlikely to cause interference, the electromagnetic shields have been put into new pacemakers as an added precaution. Patients with pacemakers should consult with their doctor if they believe that they may have a problem related to microwave or radiofrequency radiation.

Plastic containers considered safe for holding foods at room temperature may not necessarily be suitable for use in a microwave oven. The high cooking temperatures may cause the plastic's chemistry to break down and thereby contaminate food in the container. It is recommended that only plastic containers or wraps clearly designated for microwave oven use by the manufacturer be used. Dishes with metallic glazes should not be used. Do not allow fast food foil containers or aluminum foil touch the sides of the oven as this may cause sparking.

Microwave Do's and Don'ts

Do's

- L Do follow the manufacturer's instruction manual for recommended operating procedures and safety precautions for your oven model.
- L Do read recipes ahead of time. If you plan to use frozen food as an ingredient, the recipe may call for a thawed product.
- L Do be aware of whether your microwave oven has a longer or shorter cooking time than average.
- L Do teach children who cook how to correctly and confidently use the microwave oven. Keep in mind that although containers are not heated by microwaves, they will absorb heat from hot foods.
- L Do keep your microwave oven clean, since any drippings affect the efficient operation of microwave energy. A messy microwave oven will cook more slowly and unevenly.
- L Do ensure that all food prepared in a microwave oven is at the correct temperature to allow it to be consumed safely. Cases have been reported where babies have received severe burns from boiling milk heated in a microwave oven.
- L Do check with your doctor if you have a pacemaker. Though modern pacemakers are shielded against interference, some older pacemakers may still be adversely affected by proximity to a microwave oven.

Don't's

- L Don't add an extension cord to the microwave's own cord. Microwave ovens should use a separate 110 grounded circuit.
- L Don't operate a microwave oven empty. In some ovens the magnetron tube can be damaged by unabsorbed energy.
- L Don't connect other appliances to the same circuit. Reduced electrical energy affects and may harm the microwave.
- L Don't use a microwave oven if an object is caught in the door or if the door doesn't close firmly or is otherwise damaged.
- L Don't tamper with or inactivate the interlocking devices.
- L Don't poke any object, particularly a metal object into the oven.
- L Don't use scouring pads, steel wool, or other abrasives to clean the oven.
- L Don't allow children to use microwave ovens unsupervised.
- L Don't use microwave ovens for sterilizing baby bottles or other food utensils. This application does not allow adequate temperature for safe results.
- L Don't dry or disinfect clothing or other articles in the microwave oven because of the risk of fire.
- L Don't use plastic wrappings from purchased foods in a microwave oven, since they may melt.
- L Don't use unsafe/non-microwaveable containers. Either the containers or the microwave may be damaged.

Did you know ?

Warming cooked foods is the primary use of microwave ovens.

- L Heating/warming previously cooked food - 79%
- L Defrosting - 30%
- L Cooking prepackaged convenience foods - 29%
- L Boiling/heating water or other liquids - 21%
- L Cooking other foods - 19 %

Source: Family Circle Magazine Consumer Panel Survey, 1994

Who in the family uses a microwave oven ?

- L Children (2 - 6 yrs) - 20%
- L Children (6 - 8 yrs) - 50%
- L Children (8 - 11 yrs) - 83%
- L Children (12 - 18 yrs) - 91%
- L Spouse - 94%
- L Self - 100%

Source: MFTA Survey, September 1995