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Are they safe? Good question

- The technology is hard to fathom, and long-term effects of exposure are undetermined

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DANIELLE CENTONI

In any discussion about microwaving, one big question usually comes up: Are they safe? It's a tough question to answer. First, the technology behind microwave ovens isn't always easy to understand. Second, the government hasn't yet been able to determine if there are any detrimental effects from low levels of microwave exposure over a long period of time.

What we do know is that microwaves are essentially very high frequency radio waves. Radio waves are a form of electromagnetic radiation. Although this sounds very scary, electromagnetic radiation is simply a term for waves of electrical and magnetic energy that move together through space. In fact, many of our household objects operate through this kind of radiation all the time -- radios, cell phones, TVs.

Some electromagnetic waves move at a higher frequency than others. There are the low-frequency waves used for broadcasting radio and TV, and very powerful, high-frequency waves used for X-rays. At about 2,400 megahertz, the frequency used for microwave ovens falls in the non-ionizing (i.e. non-molecule-damaging) spectrum used for broadcasting and cell phones, and well below the 30 to 30,000 petahertz frequency used for X-rays.

The microwaves cook food by making molecules move, which causes friction. The friction causes heat, and the heat cooks the food. Generally, the outer layers of foods are heated and cooked by microwaves while the inner layers are cooked by the conduction of heat from the outer layers.

According to the FDA's consumer Web site (www.fda.gov/cdrh/consumer/microwave.html), there's no need to be concerned about food being contaminated by radiation:

"There is no residual radiation remaining after microwave production has stopped. In this regard a microwave oven is much like an electric light that stops glowing when it is turned off."

What can still be a concern is the amount of microwaves the ovens leak while in use.

The Web site states, "A Federal standard limits the amount of microwaves that can leak from an oven throughout its lifetime to 5 milliwatts of microwave radiation per square centimeter at approximately 2 inches from the oven surface. This limit is far below the level known to harm people. Microwave energy also decreases dramatically as you move away from the source of radiation."

Although the FDA says most ovens they tested showed little or no detectable microwave leakage, a good rule of thumb is to stay at least an arm's length away from the oven while it's in use. And make sure the door, latch or seal on your oven isn't damaged in any way. There are inexpensive testing devices you can buy to measure the amount of radiation outside your oven, but the FDA cautions against them:

"FDA has tested a number of these devices and found them generally inaccurate and unreliable. If used, they should be relied on only for a very approximate reading. The sophisticated testing devices used by public health authorities to measure oven leakage are far more accurate and are periodically tested and calibrated."

If you have any doubts about how well your oven is sealed, have a repairman look at it.

As for the possible dangers of microwaving with plastic, the FDA says the dangers of chemicals leaching into foods is minimal as long as you use containers and wraps that are labeled as microwave safe. Even so, they recommend keeping plastic wrap from touching food. For more on using plastic in the microwave, visit www.fda.gov/fdac/features/2002/602_plastic.html.

Here are a few other useful Web sites on how microwave ovens work:

www.fda.gov/cdrh/consumer/microwave.html

www.gallawa.com/microtech/mwfaq.html

<http://home.howstuffworks.com/microwave.htm>

http://rabi.phys.virginia.edu/HTW/microwave_ovens.html