



THE OFFICIAL SPONSOR OF BIRTHDAYS®

JOIN THE FIGHT AGAINST CANCER

[Donate](#)

## Cellular Phone Towers

Cellular (cell) phones first became widely available in the United States in the 1990s, but since then their use has increased dramatically. The widespread use of cell phones has led to cell phone towers being placed in many communities. These towers, also called *base stations*, have electronic equipment and antennas that receive and transmit radiofrequency (RF) signals.

### How do cellular phone towers work?

Cell phone base stations may be free-standing towers or mounted on existing structures, such as trees, water tanks, or tall buildings. The antennas need to be high enough so they can adequately cover the area. Base stations are usually from 50-200 feet high.

Cell phones communicate with nearby cell towers mainly through radiofrequency (RF) waves, a form of energy in the electromagnetic spectrum between FM radio waves and microwaves. Like FM radio waves, microwaves, visible light, and heat, they are forms of non-ionizing radiation. This means they cannot cause cancer by directly damaging DNA. RF waves are different from stronger types of radiation such as x-rays, gamma rays, and ultraviolet (UV) light, which can break the chemical bonds in DNA.

At very high levels, RF waves can heat up body tissues. (This is the basis for how microwave ovens work.) But the levels of energy used by cell phones and towers are much lower.

When a person makes a cell phone call, a signal is sent from the phone's antenna to the nearest base station antenna. The base station responds to this signal by assigning it an available radiofrequency channel. RF waves transfer the voice information to the base station. The voice signals are then sent to a switching center, which transfers the call to its destination. Voice signals are then relayed back and forth during the call.

### How are people exposed to the energy from cellular phone towers?

As people use cell phones to make calls, signals are transmitted back and forth to the base station. The RF waves produced at the base station are given off into the environment, where people can be exposed to them.

The energy from a cellular phone tower antenna, like that of other telecommunication antennas, is directed toward the horizon (parallel to the ground), with some downward scatter. Base station antennas use higher power levels than other types of land-mobile antennas, but much lower levels than those from radio and television broadcast stations. The amount of energy decreases rapidly with increasing distance from the antenna. As a result, the level of exposure to radio waves at ground level is very low compared to the level close to the antenna.

Public exposure to radio waves from cell phone tower antennas is slight for several reasons. The power levels are relatively low, the antennas are mounted high above ground level, and the signals are transmitted intermittently, rather than constantly.

At ground level near typical cellular base stations, the amount of RF energy is thousands of times less than the limits for safe exposure set by the US Federal Communication Commission (FCC) and other regulatory authorities. It is very unlikely that a person could be exposed to RF levels in excess of these limits just by being near a cell phone tower.

When a cellular antenna is mounted on a roof, it is possible that a person on the roof could be exposed to RF levels greater than those typically encountered on the ground. But even then, exposure levels approaching or exceeding the FCC safety guidelines are only likely to be found very close to and directly in front of the antennas. If this is the case, access to these areas should be limited.

The level of RF energy inside buildings where a base station is mounted is typically much lower than the level outside, depending on the construction materials of the building. Wood or cement block reduces the exposure level of RF radiation by a factor of about 10. The energy level *behind* an antenna is hundreds to thousands of times lower than in front. Therefore, if an antenna is mounted on the side of a building, the exposure level in the room directly behind the wall is typically well below the recommended exposure limits.

### **Do cellular phone towers cause cancer?**

Some people have expressed concern that living, working, or going to school near a cell phone tower might increase the risk of cancer or other health problems. At this time, there is very little evidence to support this idea. In theory, there are some important points that would argue against cellular phone towers being able to cause cancer.

First, the energy level of radiofrequency (RF) waves is relatively low, especially when compared with the types of radiation that are known to increase cancer risk, such as gamma rays, x-rays, and ultraviolet (UV) light. The energy of RF waves given off by cell phone towers is not enough to break chemical bonds in DNA molecules, which is how these stronger forms of radiation may lead to cancer.

A second issue has to do with wavelength. RF waves have long wavelengths, which can only be concentrated to about an inch or two in size. This makes it unlikely that the energy from RF waves could be concentrated enough to affect individual cells in the body.

Third, even if RF waves were somehow able to affect cells in the body at higher doses, the level of RF waves present at ground level is very low – well below the recommended limits. Levels of energy from RF waves near cell phone towers are not significantly different from the background levels of RF radiation in urban areas from other sources, such as radio and television broadcast stations.

For these reasons, most scientists agree that cell phone antennas or towers are unlikely to cause cancer.

### **Studies in people**

Very few human studies have focused specifically on cellular phone towers and cancer risk.

In one large study, British researchers compared a group of more than 1,000 families of young children with cancer against a similar group of families of children without cancer. They found no link between a mother's exposure to the towers during pregnancy (based on the distance from the home to the nearest tower and on the amount of energy given off by nearby towers) and the risk of early childhood cancer.

In another study, researchers compared a group of more than 2,600 children with cancer to a group of similar children without cancer. They found that those who lived in a town that could have exposed them to higher than average RF radiation from cellular phone towers in the previous 5 years had a slightly higher risk of cancer, although not of any certain type of cancer (like leukemia or brain tumors). This study estimated the children's possible exposure based on the number of towers in their town and how strong the signals were from the towers. It did not look at actual exposure of any individual child based on how far their home or school was from a tower.

One study looked for signs of DNA and cell damage in blood cells as a possible indicator of cancer-causing potential. They found that the damage was no worse in people who lived near a cell phone tower as compared with those didn't.

The amount of exposure from living near a cell phone tower is typically many times lower than the exposure from using a cell phone. About 30 studies have looked at possible links between cell phone use and tumors in people. Most studies to date have not found a link between cell phone use and the development of tumors, although these studies have had some important limitations. This is an area of active research. For more information, see the document, [Cellular Phones](#).

### **Studies done in the lab**

Laboratory studies have looked at whether the types of RF waves used in cell phone communication can cause DNA damage. Most of these studies have supported the idea that the RF waves given off by cell phones and towers don't have enough energy to damage DNA directly.

Some scientists have reported that the RF waves may produce other effects in human cells (in lab dishes) that might possibly help tumors grow. However, these studies have not been verified, and these effects weren't seen in a study that looked at the blood cells from people living near a cellular phone tower.

Several studies in rats and mice have looked at whether RF energy might promote the development of tumors caused by other known carcinogens (cancer-causing agents). These studies did not find evidence of tumor promotion. Research in this area continues.

### **What expert agencies say**

#### **About cell phone towers**

The 3 expert agencies that usually classify cancer-causing exposures (carcinogens) – the International Agency for Research on Cancer (IARC), the National Toxicology Program (NTP), and the US Environmental Protection Agency (EPA) – have not classified cell phone towers as to their cancer-causing potential.

The **US Federal Communications Commission (FCC)** has said this about cell phone towers near homes or schools:

“Radiofrequency emissions from antennas used for cellular and PCS [personal communications service] transmissions result in exposure levels on the ground that are typically thousands of times below safety limits. These safety limits were adopted by the FCC based on the recommendations of expert organizations and endorsed by agencies of the Federal Government responsible for health and safety. Therefore, there is no reason to believe that such towers could constitute a potential health hazard to nearby residents or students.”

### **About RF radiation**

Some of the agencies that classify cancer-causing exposures have, however, made statements about radiofrequency radiation.

The **International Agency for Research on Cancer (IARC)** has classified RF fields as “possibly carcinogenic to humans,” based on limited evidence of a possible increase in risk for brain tumors among cell phone users, and inadequate evidence for other types of cancer. (For more information on the IARC classification system, see our document, [Known and Probable Human Carcinogens](#).) IARC also noted that exposure to the brain from RF fields from cell phone base stations (mounted on roofs or towers) is less than 1/100<sup>th</sup> the exposure to the brain from mobile devices such as cell phones.

The **Environmental Protection Agency (EPA)** states:

“Exposure to radio frequency (RF) radiation has climbed rapidly with the advent of cell phones and other wireless technologies. Studies of the link between exposure to RF and to electric and magnetic frequency (EMF) radiation have found RF and EMF to be ‘potential carcinogens,’ but the data linking RF and EMF to cancer is not conclusive. World wide, health physicists (scientists who study the biological effects of radiation) continue to study the issue.”

### **Do cellular phone towers cause any other health problems?**

High levels of RF waves can cause a warming of body tissues, but the energy levels on the ground near a cell phone tower are far below the levels needed to cause this effect. So far, there is no evidence in published scientific reports that cell phone towers cause any other health problems.

### **Can I limit my exposure?**

Cell phone towers are not known to cause any health effects. But if you are concerned about possible exposure from a cell phone tower near your home or office, you can ask a government agency or private

firm to measure the RF field strength near the tower (where a person could be exposed) to ensure that it is within the acceptable range.

### **What should I do if I've been exposed to cellular phone towers?**

There is no test to measure whether you have been exposed to RF radiation from cellular phone towers. But as noted above, most researchers and regulatory authorities do not believe that cell phone towers pose health risks under ordinary conditions. If you have additional health concerns, you might want to talk with your doctor.

### **Additional resources**

#### **More information from your American Cancer Society**

The following related information may also be helpful to you. These materials may be viewed on our Web site or ordered from our toll-free number, at 1-800-227-2345.

#### **National organizations and Web sites\***

In addition to the American Cancer Society, other sources of information and support include:

#### **Environmental Protection Agency**

Home page: [www.epa.gov](http://www.epa.gov)

Understanding radiation: [www.epa.gov/radiation/understanding-radiation-overview.html](http://www.epa.gov/radiation/understanding-radiation-overview.html)

#### **Federal Communications Commission**

RF Safety Program, Office of Engineering and Technology

Web site: [www.fcc.gov/oet/rfsafety](http://www.fcc.gov/oet/rfsafety)

#### **Food and Drug Administration**

Home page: [www.fda.gov](http://www.fda.gov)

Radiation-emitting products: Cell phones: [www.fda.gov/Radiation-EmittingProducts/RadiationEmittingProductsandProcedures/HomeBusinessandEntertainment/CellPhones/default.htm](http://www.fda.gov/Radiation-EmittingProducts/RadiationEmittingProductsandProcedures/HomeBusinessandEntertainment/CellPhones/default.htm)

#### **National Cancer Institute**

Toll-free number: 1-800-422-6237 (1-800-4-CANCER)

Home page: [www.cancer.gov](http://www.cancer.gov)

Cellular telephone use and cancer risk: [www.cancer.gov/cancertopics/factsheet/Risk/cellphones](http://www.cancer.gov/cancertopics/factsheet/Risk/cellphones)

#### **National Institute of Environmental Health Sciences**

Home page: [www.niehs.nih.gov](http://www.niehs.nih.gov)

Electric and magnetic fields: [www.niehs.nih.gov/health/topics/agents/emf/index.cfm](http://www.niehs.nih.gov/health/topics/agents/emf/index.cfm)

## World Health Organization

Electromagnetic fields and public health: base stations and wireless technologies

Web site: [www.who.int/mediacentre/factsheets/fs304/en/index.html](http://www.who.int/mediacentre/factsheets/fs304/en/index.html)

*\* Inclusion on this list does not imply endorsement by the American Cancer Society*

No matter who you are, we can help. Contact us anytime, day or night, for information and support. Call us at 1-800-227-2345 or visit [www.cancer.org](http://www.cancer.org).

## References

ANSI-C95.1, 1982, American National Standards Institute. American national standard safety levels with respect to human exposure to radiofrequency electromagnetic fields, 300 kHz to 100 Ghz. New York: IEEE.

Baan R, Grosse Y, Lauby-Secretan B, El Ghissassi F, Bouvard V, Benbrahim-Tallaa L, Guha N, Islami F, Galichet L, Straif K; WHO International Agency for Research on Cancer Monograph Working Group. Carcinogenicity of radiofrequency electromagnetic fields. *Lancet Oncol*. 2011 Jul;12(7):624-626.

Elliott P, Toledano MB, Bennett J, et al. Mobile phone base stations and early childhood cancers: case-control study. *BMJ*. 2010;340:c3077. [Epub]

Federal Communications Commission, Office of Engineering and Technology. Radio Frequency Safety. 6/25/2012. Accessed at [www.fcc.gov/oet/rfsafety/rf-faqs.html](http://www.fcc.gov/oet/rfsafety/rf-faqs.html) on January 16, 2013.

IEEE-C95.1, 1991, Institute of Electrical and Electronics Engineers, Inc. Safety levels with respect to human exposure to radio frequency electromagnetic fields, 3 kHz to 300 Ghz. Piscataway, NJ: IEEE.

IEEE: Institute of Electrical and Electronics Engineers, Inc. Human exposure to RF emissions from cellular radio base station antennas; Washington, DC: 1992.

ICNIRP: International Commission on Non-Ionizing Radiation Protection. Health Issues related to the use of hand-held radiotelephones and base transmitters. *Health Physics*. 1996;70:587-593.

IRPA, 1988, International Radiation Protection Association. Guidelines on limits of exposure to radio frequency electromagnetic fields. IEEE United States Activities, COMAR, Washington, DC.

Li CY, Liu CC, Chang YH, Chou LP, Ko MC. A population-based case-control study of radiofrequency exposure in relation to childhood neoplasm. *Sci Total Environ*. 2012 Oct 1;435-436:472-478.

NCRP, 1986, National Council on Radiation Protection. Biological effects and exposure criteria for radiofrequency electromagnetic fields. Report 86, (Bethesda, MD: National Council on Radiation Protection and Measurements) pp. 1-382.

Röösli M, Frei P, Mohler E, Hug K. Systematic review on the health effects of exposure to radiofrequency electromagnetic fields from mobile phone base stations. *Bull World Health Organ*. 2010 Dec 1;88(12):887-896F.

Rothman KJ, Chung-Kwang C, Morgan R, et al. Assessment of cellular telephone and other radio frequency exposure for epidemiologic research. *Epidemiology*. 1996;7:291-298.

United States Environmental Protection Agency. RadTown USA: Basic Information. Accessed at <http://www.epa.gov/radtown/basic.html> on January 18, 2013.

Valberg PA. Radio frequency radiation (RFR): the nature of exposure and carcinogenic potential. *Cancer Causes Control*. 1997;8:323-332.

Wolf R, Wolf D. Increased incidence of cancer near a cell-phone transmitter station. *Int J Cancer Prevention* 2004;1:123-128.

Yildirim MS, Yildirim A, Zamani AG, Okudan N. Effect of mobile phone station on micronucleus frequency and chromosomal aberrations in human blood cells. *Genet Couns*. 2010;21(2):243-51.

Last Medical Review: 01/31/2013

Last Revised: 01/31/2013