WorkSafe Bulletin

Working around microwave radiation from rooftop antennas

What is microwave (MW) radiation?

More than 24 million Canadians use cellphones. And with the growth of wireless technology, more cellphone antennas are being installed. Cellphones rely on MW radiation to transmit and receive signals.

MW radiation is "non-ionizing," which means it does not have enough energy to break chemical bonds. For this reason, MW radiation is unable to break DNA bonds in the human body and is unlikely to cause cancer. However, if the energy level is high enough, there may be other effects on human health.

MW radiation can be described by its frequency, which is measured in hertz. One hertz (1 Hz) equals one wave or cycle per second. The MW radiation range is between 300 megahertz (300×10^6 Hz) and 300 gigahertz (300×10^9 Hz).

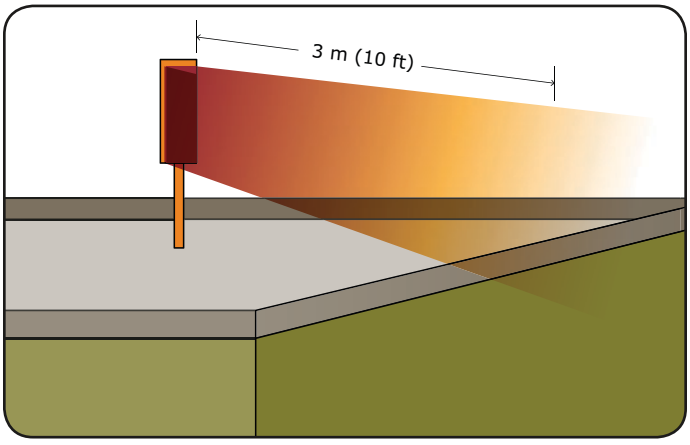

Figure 1. Path of one radiating antenna

Cellphone antennas use frequencies in part of the microwave range. These antennas operate between 900 megahertz (900×10^6 Hz) and 2,200 megahertz ($2{,}200 \times 10^6$ Hz).

A cellphone antenna radiates a signal forward, slightly angled (about three degrees) toward the ground, as shown in Figure 1. Cellphone antennas that are arranged in a group (as shown in Figure 2 on the next page) radiate a signal in the shape of an ever-expanding doughnut. As the signal moves farther from the antenna, the MW radiation decreases to almost non-measurable values. There are areas (for example, directly beneath the antenna) where the antenna emits no MW radiation.

Who is at risk from exposure to MW radiation from antennas?

Antennas are installed on many tall structures, including building rooftops and water tanks. Many workers may be unaware of the risks of exposure to MW radiation, and they may not know about the proper controls. These workers may include the following:

- Roofers
- Painters
- Building maintenance workers
- Building inspectors
- Window washers

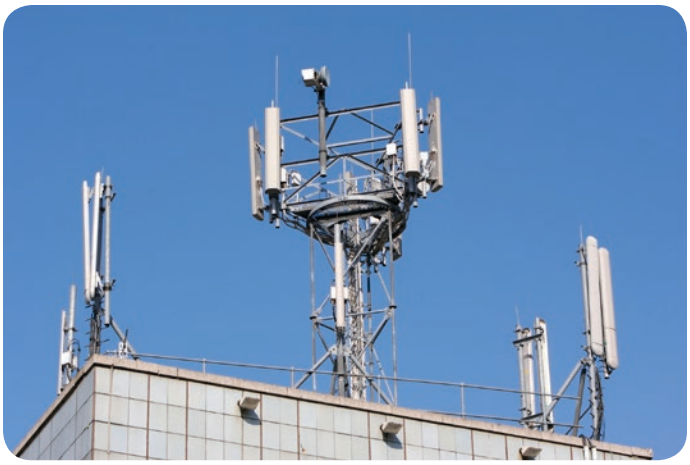

Figure 2. Typical cellphone antennas on a building rooftop

How is MW radiation measured?

MW radiation is made up of both electric and magnetic fields. The strengths of these fields can be measured separately using an electric field meter (units in volts per metre, V/m) and a magnetic field meter (units in amperes per metre, A/m).

At frequencies above 100 MHz, a single measurement called power density (units in watts per square metre, W/m^2) is possible — a combination of both electric and magnetic field strengths.

Are there exposure limits for MW radiation?

Health Canada publishes safety codes that list exposure limits for many types of electromagnetic radiation, including MW radiation.

MW radiation exposure limits can be found in Health Canada's Safety Code 6. (The full title is *Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz — Safety Code 6*.)

WorkSafeBC's Occupational Health and Safety Regulation mandates that employers keep worker exposure to MW radiation below the values listed in Safety Code 6.

What are the health effects of MW radiation?

The main health effect is body heating. As the body absorbs energy from the MW radiation, workers may start to feel warm. This warming may occur if workers spend more than a few minutes within about 3 m (10 ft.) of an antenna.

How do I reduce the risk of exposure to MW radiation?

Employers must ensure that their workers and others, including contractors, are not overexposed to MW radiation while working near antennas. Property owners and managers are also responsible for ensuring that rooftops are safe to access. Options that may be used to control MW radiation include the following.

Engineering controls

- Use physical guards or barriers to restrict access to areas near the antennas.
- Raise the antennas above the working level of the roof. The lowest level of MW radiation is directly beneath the antennas.

Administrative controls

- Property owners or managers should notify and consult with contractors if cellphone antennas are present. Turn off power to the antennas, if possible, while workers are in the area.
- Use signs and/or caution tape to indicate high MW radiation areas.
- Maintain at least a 3 m (10 ft.) distance from an antenna.
- Limit the amount of time spent near antennas. Do not remain for more than a few minutes within two metres directly in front of an antenna.
- Avoid physical contact with any of an antenna's radiating parts.

- Conduct a MW survey. See the Health Canada publication *Technical Guide for Interpretation and Compliance Assessment of Health Canada's Radiofrequency Exposure Guidelines*. To request an electronic copy of the guide, contact publications@hc-sc.gc.ca.

For more information

BC Centre for Disease Control: Electro-magnetic exposures
http://www.bccdc.ca/healthenv/ElectromagFields/default.htm

Health Canada: Safety codes
http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/index-eng.php#codes

Industry Canada: Guidelines for the measurement of radio frequency fields at frequencies from 3 kHz to 300 GHz
http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf08511.html

International Commission on Non-Ionizing Radiation Protection (ICNIRP): About ICNIRP
http://www.icnirp.de/what.htm

Occupational Safety and Health Administration (OSHA): Non-ionizing radiation
https://www.osha.gov/SLTC/radiation_nonionizing

Ontario Ministry of Labour: Radiofrequency and microwave radiation in the workplace
http://www.labour.gov.on.ca/english/hs/pubs/radiation/index.php

Victorian WorkCover Authority (Australia): Radiofrequency (RF) radiation — dangers of exposure
http://www.vwa.vic.gov.au/forms-and-publications/forms-and-publications/radiofrequency-rf-radiation-dangers-of-exposure

WorkSafeBC: Health effects of non-ionizing electromagnetic radiation in the workplace
http://www2.worksafebc.com/i/posters/pdfs/2014/ws_2014_07.pdf