

## Power Lines and Cancer

### Origin of the myth

“*Radiation causes cancer.*” It is no surprise that radiation has a bad reputation. High-energy radiation (ionising radiation) - such as x-rays, and (gamma)  $\gamma$ -rays (which are emitted by nuclear explosions) - has been shown to cause cancer, genetic defects and weaken the immune system.

It makes sense therefore that the media, and public perception, has extended this bad reputation to low-energy radiation (non-ionising radiation) – such as extremely-low-frequency (ELF) radiation (electricity), radiofrequency (RF) radiation and microwaves. Major sources of public concern have been powerlines, mobile phones and their base stations.<sup>1</sup>

High-energy radiation (ionising radiation) alters (ionises) chemical and molecular bonds and can cause damage to molecules such as DNA (genetic material in cells). This is the cause of cancers and genetic defects. Low-energy radiation (non-ionising radiation) does not have the right frequency or sufficient energy to ionise molecules. There is little basis for the theory that it can damage DNA.<sup>1</sup>

### Current evidence

Electric and magnetic fields exist wherever electricity is conducted through transmission lines or used in appliances. These fields have a frequency (wavelength) of 50 to 60 Hertz (Hz) which is relatively low. Hence, these fields are called extremely-low-frequency (ELF) fields.<sup>2</sup>

In 2002, The International Agency for Research on Cancer (IARC), an agency of the World Health Organization (WHO), classified ELF electric and magnetic fields and radiofrequency as ‘possibly carcinogenic [cancer-causing] to humans’ – the lowest of three levels of carcinogenicity.<sup>2,3</sup>

This classification means that there is:

- Limited evidence of carcinogenicity in humans; and
- Less than sufficient evidence of carcinogenicity in experimental animals.

IARC’s review concluded that there is limited evidence for the carcinogenicity of ELF magnetic fields in relation to childhood leukaemia, but inadequate evidence for all other cancers. Adult studies do not provide enough information or are inconsistent on the effects of ELF on cancer.<sup>2,3</sup>

The WHO undertook a further review in 2007 that took into account new human, animal and in vitro (laboratory) studies published since IARC’s 2002 monograph. WHO confirmed that although there is limited evidence of a link between ELF magnetic fields and childhood leukaemia, the evidence remains inadequate for all other childhood and adult cancers.<sup>4</sup>



The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) asserts that although numerous studies have been done, there is no conclusive evidence that ELF causes cancer. Studies show either weak or no association with adverse health effects.<sup>4</sup>

The US Report on Carcinogens (ROC) is a list of known or reasonably anticipated human carcinogens. ELF fields and ELF radiation are not included in this list.<sup>6</sup>

## Summary

There is limited evidence for a weak link between intense and prolonged exposure to magnetic fields and childhood leukaemia. To date a definitive link has not been demonstrated, but it remains an active area of research internationally. There is inadequate evidence to support an association between exposure to ELF electric and magnetic fields and other types of other cancer in adults or children.

## References

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2. World Health Organization (WHO). What are electromagnetic fields? 2014 [cited 13/08/2014]; Available from: <http://www.who.int/peh-emf/about/WhatisEMF/en/#>
3. International Agency for Research on Cancer (IARC), *Non-ionizing radiation, part 1: Static and extremely low-frequency (ELF) electric and magnetic fields*, IARC, Editor. Volume 80, 2002, IARC: Lyon, France.
4. World Health Organization (WHO) Environmental Health Criteria 238. Extremely Low Frequency Fields. 2007.
5. Australian Radiation Protection and Nuclear Safety Agency (ARPANSA). Electricity and Health - Fact Sheet 19. 2011 [cited 13/08/2014]; Available from: [http://www.arpansa.gov.au/radiationprotection/Factsheets/is\\_electricity.cfm](http://www.arpansa.gov.au/radiationprotection/Factsheets/is_electricity.cfm)
5. U.S. Department of Health and Human Services, *12th Report on Carcinogens*. 2011, Public Health Service - National Toxicology Program

