Powerlines & Cancer FAQs

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** Frequently Asked Questions (FAQs) on Power-Frequency Fields (EMF)
and Cancer

Summary

Questions and Answers on the connection between power lines, electrical occupations and cancer: discussion of the biophysics of interactions with EM sources, summaries of the laboratory and human studies, information on standards, and a bibliography.

Most of the concern about power lines ("EMF") and cancer stems from studies of people living near power lines (Question 12) and people working in "electrical" occupations (Question 15). Some of these studies appear to show a weak association between exposure to power-frequency magnetic fields and the incidence of cancer.

However, epidemiological studies done in recent years show little evidence that power lines are associated with an increase in cancer (Question 19), laboratory studies have shown essentially no evidence of a link between power-frequency fields and cancer (Question 16), and a connection between power line fields and cancer remains biophysically implausible (Question 18).

A 1996 review by the U.S. National Academy of Science concluded that:
  "No conclusive and consistent evidence shows that exposures to
   residential electric and magnetic fields produce cancer, adverse
   neurobehavioral effects, or reproductive and developmental
   effects."(Question 27E)

A 1999 review by the U.S. National Institutes of Health concluded that:
"The scientific evidence suggesting that [power-frequency electromagnetic field] exposures pose any health risk is weak."(Question 27G).

A 2001 review by the U.K. National Radiation Protection Board (NRPB) concluded that:
"Laboratory experiments have provided no good evidence that extremely low frequency electromagnetic fields are capable of producing cancer, nor do human epidemiological studies suggest that they cause cancer in general." (Question 27H)

A 2001 review of the epidemiological literature by the International Commission on Non-Ionizing Radiation Protection concludes that:
"In the absence of evidence from cellular or animal studies, and given the methodological uncertainties and in may cases inconsistencies of the existing epidemiologic literature, there is no chronic disease for which an etiological [causal] relation to [power-frequency fields] can be regarded as established."

The largest studies of childhood leukemia and power lines ever done reported in 1997-2000 that they could find no significant evidence for an association of power lines with childhood leukemia (Q19H through 19K). In contrast, two studies published in 2000 reported that if all the studies for which magnetic fields were measured (or could be calculated) were pooled, a statistically significant association could be found for childhood leukemia in the children with the highest average fields.

On the other hand, a series of studies have shown what life-time exposure of animals to intense power-frequency magnetic fields does not cause cancer or any other health problems. (Q16B)

Overall, most scientists consider the evidence that power line fields cause or contribute to cancer to be weak to nonexistent.

The full version of this FAQ is available on the web at:
http://www.mcw.edu/gcrc/cop/powerlines-cancer-faq/toc.html

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The USENET version contains only the Table of Contents and a list of recent revisions.

Preguntas y respuestas sobre líneas electricas y cancer esta disponible en espanol:
http://www.mcw.edu/gcrc/cop/lineas-electricas-cancer/toc.html

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There are two related FAQs:
FAQs about Cell Phone Base Antennas and Human Health
http://www.mcw.edu/gcrc/cop/cell-phone-health-faq/toc.html
Static Electromagnetic Fields and Cancer FAQs
http://www.mcw.edu/gcrc/cop/static-fields-cancer-faq/toc.html

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** Revisions Notes

(v7.9, May/June 2003):
- Blood cells were exposed to a 800 microT 60-Hz field for 24 hours and/or to a chemical mutagen; no evidence of genotoxic injury was found for the field alone, but exposure to the field enhanced the genotoxicity caused by the chemical [G118].
- Blood cells were exposed to a 230-700 microT 50-Hz fields for 12 hours and/or to gamma irradiation; no evidence of genotoxic injury

was found for the field alone, and exposure to the field did not enhance the chromosome injury caused by the ionizing radiation [G119].
- A study of men with both occupational and residential exposure to power-frequency fields found no effects of the exposure on melatonin levels [E43].
- Calculated residential magnetic field exposure was associated with melanoma in women, but not in men; estimated occupational magnetic field exposure was not associated with melanoma [C65].
- Occupational exposure to power-frequency magnetic fields was associated with prostate cancer [D52].
- Human cancer cells were exposed to 2000- 13000 microT fields at 50Hz for 2 or 4 days; above 6000 microT cell division was inhibited and cell death was increased [H70].
- Exposure of human white blood cells to 80 or 800 microT 50-Hz fields did not cause genotoxic injury, and did not significantly enhance genotoxic injury produced by a genotoxic drug; but the 800 microT exposure showed some evidence for enhancement of cell division [G117].
- Exposure of pregnant rats to 5-500 microT 60-Hz fields for 6-20 days had no effect on the mothers or on the offspring [J31].

(v7.8, Jan/Feb-2003):
- Occupational exposure to power-frequency fields was associated with brain cancer, but only if there was also exposure to lead, solvents or pesticide/herbicides [D51].
- Exposure to power line electric fields in the UK was not associated with the incidence of childhood cancer [C64].
- Residence near powerlines in Norway was not associated with an increased risk of birth defects [J30].
- Exposure to a 2000 microT field for 52 weeks did not promote skin cancer in rats [G116].
- Exposure of human volunteers to power-frequency fields had no effect on nighttime secretion of melatonin or other hormones [E35].
- Exposure of human immune system cells to 2-500 microT fields had no effects on their function [H69].
- Exposure of cultured cells to a 1000 microT field caused DNA stand breaks if the exposure was intermittent, but not if the exposure was continuous [G115].
- Two studies of electrical utility workers found no evidence that exposure to power-frequency fields was associated with heart disease [E37, E38].

** Table of Contents

14. How close do you have to be to a power line to be considered exposed to power-frequency magnetic fields?
15. What is known about the relationship between electrical occupations and cancer rates?
16. Do laboratory studies indicate that power-frequency fields can cause cancer?
    a. Do power-frequency fields show genotoxic activity in humans?
    b. Do power-frequency fields cause cancer in animals?
    c. Do power-frequency fields show genotoxic activity in cell culture?
    d. Do power-frequency magnetic fields cause or enhance neoplastic cell transformation?
    e. Are power-frequency magnetic fields cancer promoters?
    f. Do power-frequency magnetic fields enhance the effects of other genotoxic agents?
17. Do laboratory studies indicate that power-frequency fields have any biological effects that might be relevant to cancer?
    a. How do lab studies of the effects of power-frequency fields on cell and tumor growth relate to the question of cancer risk?
    b. How do lab studies of the effects of power-frequency fields on immune function relate to the question of cancer risk?
    c. How do lab studies of the effects of power-frequency fields on melatonin relate to the question of cancer risk?
18. Do power-frequency fields show any reproducible biological effects in laboratory studies?
    a. Do power-frequency fields of the intensity encountered in occupational and residential settings show reproducible biological effects?
    b. Are there known mechanisms by which power-frequency fields of the intensity encountered in occupational and residential settings could cause biological effects?
    c. Haven't some new mechanisms been proposed that could explain how power-frequency magnetic fields could cause biological effects?
    d. Could the presence of transients or harmonics in power-frequency fields provide a biophysical mechanism for biological effects?
19. What about the "new studies" showing a link between power-frequency fields and cancer?
    a. What about the European (Scandinavian) epidemiological studies showing a link between power lines and cancer?
    b. What about the studies showing a link between occupational exposure to power-frequency fields and cancer?
    c. What about the studies showing a link between electrical occupation and breast cancer?
    d. What about the studies showing a link between pulsed electric fields and lung cancer?
    e. What about the studies linking the use of electrical appliances with cancer?
    f. What about Sweden's/Denmark's decision to regulate fields power line fields?
    g. What about the study showing that it is the interaction between power- frequency fields and the Earth static field that causes cancer?
    h. What about the 1997 NCI study showing no link between power lines and childhood leukemia?
    j. What about the 1999 Canadian studies of power lines and childhood leukemia?
    k. What about the 1999-2000 UK studies of power lines and childhood leukemia?
    l. Could exposure to power-frequency electric rather than magnetic fields be linked with cancer?
20. What criteria do scientists use to evaluate all the laboratory and epidemiologic studies of power-frequency magnetic fields and cancer?
    a. Criterion One: How strong is the association between exposure to power-frequency fields and the risk of cancer?
    b. Criterion Two: How consistent are the studies of associations between exposure to power-frequency fields and the risk of cancer?

Related questions and answers

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