



# Risk in Perspective

## EMF and Human Health — an Open Question

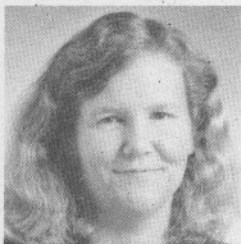
***"With such widespread exposure of humans to electric and magnetic fields, the potential impact of any adverse health effects associated with EMF could be profound."***

L. Green



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In 1979, Wertheimer and Leeper published an epidemiologic study suggesting a possible association between power lines and childhood leukemia in Denver, Colorado. This study, buttressed by later epidemiologic reports, stimulated public concern and scientific interest in the potential health effects of electric and magnetic fields (EMF). Although these fields are generally much weaker than the earth's natural magnetic fields, citizens worry about their exposure to EMF from high voltage transmission lines, electrical wiring in buildings, and household appliances, while scientists debate the biological plausibility of conflicting evidence on the potential dangers of EMF. With such widespread exposure of humans to electric and magnetic fields, the potential impact of any adverse health effects associated with EMF could be profound.

In response to both the significance of this issue and the uncertainty surrounding it, the Harvard Center for Risk Analysis (HCRA) has assembled a panel of distinguished scientists to provide an ongoing review of the emerging science on EMF. The goals of this new group, the Harvard Advisory Committee on EMF and Human Health, are to examine the new studies and issues arising in the EMF area, to interpret the state of the science for nontechnical audiences, and to recommend new research activities that are needed to clarify these issues.

This issue of *RISK IN PERSPECTIVE* examines several of the key issues involved in the public health debate over EMF. It also introduces the new Harvard Advisory Committee on EMF and Human Health.

### **Perplexing Science**

Over the past decade and a half, researchers from a broad array of scientific disciplines have published hundreds of studies on the potential health effects of human exposure to electromagnetic fields. The scientific results from these studies have been diverse and perplexing.

In epidemiologic research, for example, there have been many studies whose findings suggest a possible association between EMF and childhood leukemia. There have also been several studies that find no statistically consistent association. Similar conflicting results have emerged from epidemiologic studies exploring the relationship of EMF exposures in various residential and occupational settings to other adverse health outcomes, such as male breast cancer, cancers of the skin and central nervous system, and various forms of leukemia. Some of these studies suggest positive associations between EMF and one or more of these cancers; others indicate no association. One explanation for the inconsistent results may lie in the difficulties inherent in trying to measure residential and occupational exposures to EMF, particularly the difficulties in trying to reconstruct and estimate past EMF exposures in occupational settings. The studies may also be influenced by various confounding risk factors, such as the general health and socioeconomic status of residents living near power lines or electrical workers' exposure to chemicals or other potential toxicants.

There have also been numerous studies exploring a host of different factors in the effort to search for biological clues. Studies at the cellular level have investigated and found possible effects associated with EMF in 1) the flow of calcium ions across cell membranes, 2) DNA synthesis and RNA transcription and synthesis, and 3) the hormonal and immunological systems, such as inhibition of the secretion of melatonin from the pineal gland, which may play a role in suppressing the growth or preventing the initiation of breast, prostate, and possibly other cancer cells. Other potential effects of exposure to EMF currently being investigated include changes in cell signaling and cell proliferation. To date, there is a broad array of evidence suggesting that exposure to EMF affects cellular level activity. The mechanism of action and the dose-response relationship associated with EMF have not been defined,

however, nor have the implications of these cellular changes for human health.

### Media Interest

Accompanying the scientific interest in EMF has been a high level of public concern over the potential health impact of exposure to EMF. Much of this concern stems from pervasive media reports on the scientific studies investigating the potential dangers of human exposure to EMF. Numerous stories in the popular press, such as the series of articles written by Paul Brodeur for *The New Yorker* in the late 1980s, as well as those in the scientific literature, continually explore the safety of EMF. These reports have helped to elevate public concern, not only over the possible dangers of high voltage power lines near schools and residential areas, but also over the safety of electric blankets, video display terminals, hair dryers, wireless telephones, and other household appliances that citizens use every day.

### Economic Impact

The potential economic costs of mitigating the possible health effects associated with EMF are substantial. For example, concern over high voltage power lines has led to delays and cancellations of new projects constructing these lines. Not only can this lead to higher costs from having to find alternative sites for the lines, but it also may increase the frequency of brownouts and power outages to consumers. Concern over power lines may also decrease property values along transmission routes or induce power companies to move or redesign existing lines at considerable expense to the public. The cost to the average consumer of changes such as these may be significant, not only in the size of citizens' electric bills, but also in the potential availability of electricity for heat, air conditioning, and other household necessities.

### HCRA's Panel

The high level of current scientific and public concern over EMF, coupled with the uncertainties in the available data, has led the Harvard Center for Risk Analysis to convene a panel of distinguished scientists to track this issue. Composed of independent scientists from a range of disciplines, the Harvard Advisory Committee on EMF and Human Health will meet periodically to peer review major new studies on the potential health effects of EMF. The group will evaluate the new science in the context of the existing body of knowledge and explore emerging issues. Given the wealth of research underway on EMF, there is a need to provide continuous review of the issues, to examine where the field is headed, to identify significant gaps in knowledge and major research needs, to communicate with lay audiences, and to consider the implications for both scientific research and risk management. The panel is currently funded from unrestricted HCRA funds, and

it is seeking additional monies from both public and private funding sources.

One of the major goals of the new Harvard Advisory Committee on EMF and Human Health is that of risk communication. While there is much science being conducted on EMF, there is a critical need to explore new ways to communicate this emerging information to policy makers, opinion leaders, and the public. As yet, there is a dearth of knowledge on how best to transmit the emerging biologic and epidemiologic information to inform the public concerning EMF. The technical expertise of the panel will help HCRA to assess and assimilate the science on EMF and then to develop innovative approaches to disseminating the new information. Furthermore, with its diverse membership, the committee will also serve to introduce the EMF issues to scientists who may enter the group with less familiarity with the issues. The panel will serve not only as a vehicle to communicate information on EMF to opinion leaders and the public, but it will also strive to draw some fresh scientific perspectives into this critical area of study.

The initial members of the Harvard Advisory Committee on EMF and Human Health are as follows: **Dr. Raymond Greenberg**, Chair, Professor of Epidemiology and Dean, Emory School of Public Health; **Dr. John Bailar**, Professor and Chair, Department of Epidemiology and Biostatistics, McGill University; **Dr. Harvey Checkoway**, Professor of Environmental Health and Epidemiology, University of Washington School of Public Health and Community Medicine; **Dr. Philip Enterline**, Professor Emeritus of Biostatistics, Graduate School of Public Health, University of Pittsburgh; **Dr. Reba Goodman**, Professor of Pathology, Columbia University, Colleges of Physicians and Surgeons; **Dr. Stephanie London**, Assistant Professor, Department of Preventive Medicine, USC School of Medicine; **Dr. Genevieve Matanoski**, Professor of Epidemiology, Johns Hopkins School of Hygiene and Public Health; **Dr. Richard Monson**, Professor of Epidemiology, Harvard School of Public Health; **Dr. Indira Nair**, Associate Professor, Department of Engineering and Public Policy, Carnegie Mellon University; **Dr. Russel Reiter**, Professor of Neuroendocrinology, University of Texas Health Science Center; **Dr. Richard Setlow**, Associate Director for Life Sciences, Brookhaven National Laboratory; **Dr. Betty Siskin**, Research Professor, Center for Biomedical Engineering, University of Kentucky; **Dr. Paul Slovic**, President, Design Research, Professor of Psychology, University of Oregon; **Dr. Thomas Tenforde**, Chief Scientist, Life Sciences Center, Battelle Pacific Northwest Laboratories.

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### Further Reading:

Indira Nair, M. Granger Morgan, and H. Keith Florig, "Biological Effects of Power Frequency Electric and Magnetic Fields," Washington, DC: Office of Technology Assessment, 1989.

H. Keith Florig, "Containing the Costs of the EMF Problem," *Science*, Vol. 257, July, 1992, 468-492.

David A. Savitz, "Overview of Epidemiologic Research on Electric and Magnetic Fields and Cancer," *American Industrial Hygiene Association Journal*, Vol. 54, No. 4, 1993, 197-204.