

APPENDIX D-2

Comment Letter from a Private Organization



CALIFORNIA PUBLIC UTILITIES COMMISSION

Scoping Comments

Proposed El Casco System Project

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Please incorporate the enclosed material in my objection filed 8/1/07 at BANNING CITY COUNCIL OFFICE.

Material is related to the SCE proposal to upgrade Transmission Lines through an existing SCE Easement at S.L.C.C. (Banning, CA.)

I am also inviting the "ASPEN ENVIRONMENTAL GROUP" to evaluate my property at SLCC, and those of my immediate neighbors, that will be affected by the "increased" of EMF influence by those existing Pines to be "upgraded" by SCE.

Henry Tappata

 **Henry E. Tappata**
6328 W. Bardmoor Ave.
Banning, CA 92220

Banning Chamber of Commerce

Henry Tappata
Chairman
Transportation Committee



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info@banningchamber.org www.banningchamber.org

*Please print. Your name, address, and comments become public information and may be released to interested parties if requested.

Please either deposit this sheet at the sign-in table before you leave today, or fold, stamp, and mail. Insert additional sheets if needed. Comments must be postmarked by August 14, 2007. Comments may also be faxed to the project hotline at (877) 576-8342 or emailed to elcasco@aspene.com.

misc.activism.progressive

Power Transmission Lines

EMF SMOG - THE UGLY SECRET

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Mark Graffis [View prof](#) [More options](#) Mar 22 1998, 1:00 am

Posted to the web: Fri Mar 20 13:24:08 EST 1998

By Roy Beavers

LEBANON, Missouri, March 18, 1998 (ENS) - I learned a long time ago that anyone who has an electromagnetic frequency (EMF) problem of some sort is convinced that his or her problem is the most serious and the most threatening to humanity.

If a person lives in a neighborhood or community about to be deluged with cellular telephone antennas, that person believes the cell phone is the worst of all EMF hazard producers. If a new generating station or transmission line is to be constructed in someone's neighborhood, that is the worst threat.

Breast and prostate cancers are now suspected to be promoted, if not "caused," by exposure to EMFs. There are other known risk factors as well, of course. The same can be said of brain cancer or Alzheimer's or ALS or Parkinson's disease, brain neuron conditions which may be showing the strongest EMF associations of all. Childhood leukemia is consistently showing up in areas near power transmission or distribution lines and substations more frequently than in other

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areas.

It appears more and more likely that:

* EMF exposure from whatever source can be cell
damaging, and thus
health threatening, if sufficient in strength and
duration. This
effect probably occurs through the disruption of
normal hormone
activity resulting in an abnormal excess of free
radicals.

* it does not appear that the exposure to a particular
frequency or
range of frequencies is a defining factor in
determining these
harmful effects. Until we know more, it is perhaps
correct to say
that some frequencies may have a greater
propensity to cause cell
and tissue damage than others.

The exposure strength required to cause these
suspect illnesses is now
clearly conceded to be in the ranges of those
exposure conditions
which are, at least in certain situations, occurring in
our home and
work environments.

The emerging picture is one of potentially broad
overall health
impact, not just childhood leukemia or breast cancer
or brain cancer.
It is a picture of exposure and effect so broad and so
buried within
the historical process of worldwide electrification over
the past 100
years that it could easily have been missed for many
more years had
not a few prescient observers - like Robert Becker or
Nancy Wertheimer
- spoken out forcefully. These few have offered their
observations in
spite of condemnation that has been heaped upon
them by an
establishment medical and science community which
does not see the
forest for the trees.

EMF researchers have been reporting the results of their research efforts to their colleagues at the recent NIEHS (National Institute of Environmental Health Sciences) sponsored symposia at Durham, North Carolina in March of 1997 and most recently at San Antonio, Texas in January of 1998. They are saying that **EMF** induced biological damage is probably cumulative, and is subject to the natural cell healing processes which can work to overcome much of the cellular damage caused by free radicals.

The amount of free radical (potentially cell damaging) biological activity that is being induced within the human race by **EMF** exposure of all kinds and frequencies has been vastly multiplied since the introduction of electricity into our lives over a century ago. In the beginning, we simply did not see the effects of electric generation and **transmission** (or of radio, micro-wave and other higher frequency signals) in terms of health consequences.

In the same way that science once considered non-ionizing radiation to be biologically benign (at least at levels of exposure than being experienced by the human population), it is now virtually certain that not all of it is benign. It is far more active than was previously imagined.

THE UGLY SECRET: THE MYTH OF LOW RISK FACTORS

The principal method science has to track the existence and causes of such health conditions as cancer and leukemia is the branch of medical science known as epidemiology. In its simplest form, epidemiology compares groups of people who have been exposed

to a suspected risk
 with other groups who have not been exposed - the
 control groups. The
 result of this comparison provides the observed risk
 factor or odds
 ratio (O.R.)

Ideally, researchers want the two groups to be from
 the same
 population, the same socio-economic group, the same
 neighborhood and
 the same racial background (because of possible
 genetic determinants).

The goal is to match the two groups as perfectly as
 possible in every
 respect except one.

If this contrast between exposed and non-exposed
 cannot be based upon
 two groups that have genuinely different levels of
 exposure (though
 otherwise identical), the O.R. will tend to level out in
 the direction
 of 1 to 1. No contrast, or very little contrast, will be
 observable.

The problem for epidemiologists in **EMF** research is
 that
 electromagnetic radiation and **EMF** exposure is so
 widespread in modern
 electrified societies that it is becoming increasingly
 difficult to
 find control groups that have received no exposure or
 minimal exposure
 to EMFs.

The result is a tendency for the **EMF** study
 comparisons to level out at
 or near the 1 to 1 ratio.

In such studies there exists a built-in bias against
 obtaining results
 that would show the true adverse health effect of the
EMF exposure.

Much of the real effect is being lost in the leveling out
 that occurs
 when exposed groups are compared to so-called
 "non-exposed" groups. In
 fact, the people in the "non-exposed" groups have
 been exposed,

perhaps to substantial doses of EMFs, though we really cannot tell how much exposure they have experienced.

That is the ugly secret that is not being reported in the EMF epidemiology studies. The public is not being told about the many study results that contain this hidden bias.

The truth is that this EMF health threat is substantially greater than second hand smoke. State and local governments have been willing to pass laws to protect citizens from second hand smoke. Yet, many more people are being affected by EMF exposure than by second hand smoke.

At the San Antonio symposium, I asked a group of ten epidemiologists specifically about this built-in bias of exposure of the general population to EMFs. I got no answer. No denial. No argument. Every scientist who is working on this issue - certainly every epidemiologist - knows that this ugly reality is not being explained to the public. Why? Because it destroys the argument that EMF exposure to electro-magnetic radiation is a minor problem.

The weight of the evidence is telling us that we have a really big problem, and that it is quickly getting bigger as we saturate our environment in a technological/sales frenzy of cell phones (and their 140,000 retransmission antennas), space-based satellites, power lines, TV transmitters, not to mention all the electronics now in our homes and businesses.

The military of all nations has always been a major source of EMF pollution. There are some new military projects which dwarf past exposure levels. One of them is the HAARP (High-frequency Active

!!!

Auroral Research Program) underway in Alaska with a projected date of completion sometime in 1998. HAARP is considered non-conventional energy technology. Dr. Richard Williams of Princeton dubbed it the "super-powerful ionospheric heater."

In the introduction to their 1995 book "Angels Don't Play This HAARP," journalists Dr. Nick Begich and Jeane Manning write, "HAARP represents a technology which could lead to a new class of weapons that could change our world profoundly - an all-purpose military tool. If misused, the tool could mess up the weather. It could be used against humanity in a way that would change what people think, believe and feel. HAARP-type military experiments can manipulate the global weather, hurt ecosystems; knock out electronic communications; or change our moods and mental states."

This frenzied growth in EMF exposure, both commercial and military, which has no parallel in terms of other types of worldwide pollution, is giving us an electronic smog at more and more frequencies of the EMR spectrum and at higher and higher levels of **transmission** energy.

{Roy Beavers is a retired U.S. Navy officer with experience in nuclear weapons and political/military intelligence. He was a staff member for the United States during the Strategic Arms Limitations Talks I (SALT I). He spent 15 years in the electrical utility industry and is cited in Who's Who in the World, Who's Who in America, Who's Who in Science and Engineering, and Who's Who in Industry and Finance. Email him at [1]rbeav...@mail.llion.org or visit his Website: [2]<http://www.feb.se/EMF-L/EMF-L.html>}

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Environmental Protection Agency

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Environmental Protection Agency (EPA)

An agency of the federal government charged with a variety of responsibilities relating to protection of the quality of the natural environment, including research and monitoring, promulgation of standards for air and water quality, and control of the introduction of pesticides and other hazardous materials into the environment.

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Environmental Protection Agency (EPA)

An agency of the U.S. Government established to enforce federal pollution abatement laws and to implement various pollution prevention programs.

Example: The *Environmental Protection Agency* requires Permits for the siting of manufacturing facilities that may introduce pollution into the air or public waters. The *EPA* also provides grants to local governments to assist in construction of sewage treatment plants.

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Environmental Protection Agency

In December 1970, the U.S. Environmental Protection Agency (EPA) was established as an independent agency. Reorganization Plan 3 of 1970 consolidated fifteen components from five agencies for the purpose of grouping all environmental regulatory activities under a single agency. Most of these functions were housed in the Department of the Interior, Department of Agriculture, and the Department of Health, Education and Welfare.

The purpose of the EPA is to ensure that all Americans and the environment in

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Glossary

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Electric and Magnetic Fields (EMF) Radiation from Power Lines

Electric and magnetic fields (EMF) are invisible lines of force that surround any electrical device that is plugged in and turned on. EMF are made up of waves of electric and magnetic energy moving together (radiating) through space. Electric fields are produced by electric charges and magnetic fields are produced by the flow of current through wires or electrical devices.

EMF is commonly associated with power lines. A person standing directly under a high-voltage transmission line may feel a mild shock when touching something that conducts electricity. These sensations are caused by the strong electric fields from the high-voltage electricity in the lines. They occur only at close range because the

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electric fields rapidly become weaker as the distance from the line increases.

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Many people are concerned about potential adverse health effects. Much of the research about power lines and potential health effects is inconclusive. Despite more than two decades of research to determine whether elevated EMF exposure, principally to magnetic fields, is related to an increased risk of childhood leukemia, there is still no definitive answer. The general scientific consensus is that, thus far, the evidence available is weak and is not sufficient to establish a *definitive* cause-effect relationship.

In 1998, an expert working group, organized by the National Institute of Health's National Institute of Environmental Health Sciences (NIEHS), assessed the health effects of exposure to extremely low frequency EMF, the type found in homes near power lines. Based on studies about the incidence of childhood leukemia involving a large number of households, NIEHS found that power line magnetic fields are a possible cause of cancer. The working group also concluded that the results of EMF animal, cellular, and mechanistic (process) studies do not confirm or refute the finding of the human studies. The International Agency for Research on Cancer (WHO) reached a similar conclusion.

Who is protecting you

In the U.S., there are no federal standards limiting occupational or residential exposure to power line EMF.

About seven states set standards for the width of right-of-ways under high-voltage transmission lines because of potential for electric shock.

What you can do to protect yourself

People concerned about possible health risks

from power lines can reduce their exposure by:

- Increasing the distance between you and the source – The greater the distance between you and the power lines the more you reduce your exposure.
- Limiting the time spent around the source – Limit the time you spend near power lines to reduce your exposure.

Resources

California Electric and Magnetic Fields Program

EXIT Disclaimer

2006. California Department of Health Services.

This page is about find a rational and fair approach to dealing with the potential risks, if any, of exposure to EMF.

Electromagnetic Fields EXIT Disclaimer

2006. World Health Organization (WHO)

This page provides information about electromagnetic fields, answers to frequent questions, international research projects, and links to additional resources.

EMF Questions and Answers

2002. U.S. National Institutes of Health,
National Institute of Environmental Health
Sciences

This document provides basic information about electromagnetic fields, health effects research, existing national and international standards and recommendations, and answers to frequent questions, and related links.

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Dr. Joseph Mercola
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Are EMFs Hazardous to Our Health?

Can electromagnetic fields (EMF) from power lines, home wiring, airport and military radar, substations, transformers, computers and appliances cause brain tumors, leukemia, birth defects, miscarriages, chronic fatigue, headaches, cataracts, heart problems, stress, nausea, chest pain, forgetfulness, cancer and other health problems?

Numerous studies have produced contradictory results, yet some experts are convinced that the threat is real.

Dr. David Carpenter, Dean at the School of Public Health, State University of New York believes it is likely that up to 30% of all childhood cancers come from exposure to EMFs. The Environmental Protection Agency (EPA) warns "There is reason for concern" and advises prudent avoidance".

Martin Halper, the EPA's Director of Analysis and Support says "I have never seen a set of epidemiological studies that remotely approached the weight of evidence that we're seeing with EMFs. Clearly there is something here."

Concern over EMFs exploded after Paul Brodeur wrote a series of articles in the New Yorker Magazine in June 1989. Because of Paul Brodeur's reputation, his articles had a catalytic effect on scientists, reporters and concerned people throughout the world.

In November 1989, the Department of Energy reported that "It has now become generally accepted that there are, indeed, biological effects due to field exposure."

The EMF issue gained more publicity in 1990 when alarming reports appeared in Time, the Wall Street Journal, Business Week and popular computer publications. ABC's Ted Koppel and CBS's Dan Rather both aired special segments on EMFs.

In addition to the long-term health concerns, buying a house with high fields will be an economic disaster. In a few years, when power line radiation is as well known as asbestos and radon, a house with high fields will be practically impossible to sell. Already there are hundreds of lawsuits regarding EMFs and property devaluation.

EPA Says the Threat Is Real

By 1990, over one hundred studies had been conducted worldwide. Of these, at least two dozen epidemiological studies on humans indicated a link between EMFs and serious health problems. In response to public pressure, the Environmental Protection Agency (EPA) began reviewing and evaluating the available literature.

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Health Resources

In a draft report issued in March 1990, the EPA recommended that EMFs be classified as a Class B carcinogen -- a "probable human carcinogen and joined the ranks of formaldehyde, DDT, dioxins and PCBs.

After the EPA draft report was released, utility, military and computer lobbyists came down hard on the EPA. The EPA's final revision did NOT classify EMFs as a Class B carcinogen. Rather, the following explanation was added:"

At this time such a characterization regarding the link between cancer and exposure to EMFs is not appropriate because the basic nature of the interaction between EMFs and biological processes leading to cancer is not understood."

Curiously, this rather unusual logic appears on the same page as the following: "In conclusion, several studies showing leukemia, lymphoma and cancer of the nervous system in children exposed to supported by similar findings in adults in several occupational studies also involving electrical power frequency exposures, show a consistent pattern of response that suggest a causal link. "

When questioned about the contradictory nature of these statements, the EPA responded that it was "not appropriate" to use the probable carcinogen label until it could demonstrate how EMFs caused cancer and exactly how much EMF is harmful.

This explanation does not satisfy many critics who claim that the EPA's upper management was influenced by political and economic considerations exerted by utility, computer and military lobbyists.

How Do I Measure EMFs?

A Gauss is a common unit of measurement of magnetic field strength. A Gauss meter is an instrument which measures the strength of magnetic fields. Inside a Gauss meter there is a coil of thin wire, typically with hundreds of turns. As a magnetic field radiates through the coil, it induces a current, which is amplified by the circuitry inside the Gauss meter.

Gauss meters may vary in the strength of the magnetic field they are capable of measuring. A meter used for measuring EMFs from power lines, transformers, substations and appliances around the home, for example, should be able to measure as low as .1 mg.

Gauss meters vary widely in price and accuracy. Meters have either a single axis coil or a triple axis coil. Single axis meters are much simpler than triple axis meters to manufacture and thus, are less expensive.

To use a single axis meter you must point the meter's one sensor in three directions -- the x, y and z axis. Then, you combine the three readings in a mathematical equation to calculate the combined field strength. Obviously, its far easier and more accurate to use a 3-axis meter. Triple axis Gauss meters are quite accurate, but they are also more expensive.

Another thing to watch out for when purchasing or renting a Gauss meter is whether or not it is frequency weighted. Most meters will read the same EMF strength no matter what the frequency.

As the human body appears to be sensitive to both the field strength AND the frequency, Gauss meters used for biological purposes should be "frequency weighted".

Nutrition Plan
 Fewer
 Grains/Sugars
 More Omega-3
 More Water
 Effective Sleep
 Emotional Health
 Proper Exercise

Articles

Aspartame
 Cancer
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 Diet
 EMF - Electro
 Magnetic Fields
 Fluoride
 Hypertension
 Irradiated Foods

This means that if the field is different than 60 Hz the meter will consider the frequency and use it in calculating and displaying the EMF's strength. This feature is why frequency weighted meters will show a higher EMF reading than those meters typically used by electricians and engineers.

Power Lines

An enormous amount of electricity is created at power generating stations and sent across the country through wires that carry high voltages. All power lines radiate electromagnetic fields. The question is: how much are the

power lines near YOUR home radiating? The amount of EMFs coming from a power line depends on its particular configuration. Power companies know which power line configurations are best for reducing EMFs but most don't feel the evidence supports costly changes in the way they deliver electricity.

Substations

A substation is an assemblage of circuit breakers, disconnecting switches and transformers designed to substations have been blamed for causing cancer clusters among nearby residents. Paul Brodeur wrote about several such cancer clusters in the July 9, 1990 issue of the New Yorker Magazine.

Transformers

A key component of a utility's electrical distribution network depends upon numerous, small transformers mounted on power poles. A transformer looks like a small metal trash can, usually cylindrical.

Even when the electrical service is underground, you will often see a metal box (usually square) located on the ground near the street. Many people don't realize that when they see a transformer, the power line feeding the transformer is 4000 to 13,800 volts.

The transformer then reduces the voltage to the 120/240 volts needed by nearby homes. Since these transformers can be seen in almost every neighborhood, they are a source of concern.

EMFs near a transformer can be quite high, but due to its small structure, the field strength diminishes rapidly with distance, as it does from any point source. For this reason, having a transformer located near your home is usually not a major source of concern, although just to make sure, everyone should measure the field strength around it.

Home Wiring

If your home has high EMF readings, it is important to determine the sources of the EMF so that remedial action can be taken, if possible. Many times a particular room will have a higher EMF reading. Check to see if the electricity is coming into the house on the wall outside that room. When this is the case, it is usually a good idea to block off that room and only use it for storage purposes.

Sometimes, the source of a high magnetic field is incorrect wiring. If you suspect that your home is wired improperly, obtain the

Physics Explanation

Summary

EMFs produced a broad array of impacts on the nervous system, ranging from changes in the electrical activity of specific areas of the brain, to systematic changes such as clinical zoonosis, enzyme increases, and alterations in specific and diffuse behavior. The most important characteristic of the reported effects was that the energy imparted to the organism under study was far too low to have energetically driven the observed changes via passive or classical processes such as ionization, heating, or gross alteration in the resting potential of membranes in excitable tissue. It was the metabolism of the organism, therefore, which furnished the energy, and the applied EMFs functioned primarily as eliciting, triggering, or controlling factors for the observed biological changes. There have been no systematic studies with one type of EMF, one organism, and one experimental paradigm. Consequently, it is difficult to generalize regarding the direction or trend that will likely be exhibited by specific nervous system parameters when they are measured under conditions which differ from those already studied. In this sense the present studies are unsatisfactory. But this problem can be remedied by future studies and it does not detract from the fundamental conclusion that nonthermal EMFs can cause electrical, biochemical, functional, and histopathological changes in the nervous system.

The manner and location at which the EMFs were detected and the means by which their existence was first communicated to the central nervous system—a dear prerequisite for any of the reported effects—cannot be determined from the present studies. The site of reception may

were important parameters in bloodbrain barrier penetration, interresponse times, and the self-stimulation response. Sometimes, pulsed EMFs produced biological effects at much lower average incident energy levels than was obtained with continuouswave EMFs, and in some cases only the pulsed EMF elicited an effect. Exposure duration also was an important factor in the elaboration of some effects. Thus, in general, the bioeffects were relatively independent of frequency and field type, but other signal characteristics were important in the development of the observed responses.

Dose:effect relationships were not manifested within or between studies. For example, in one instance a ten-factor increase in the strength of the applied field did not produce a corresponding increase in the brain enzyme level (24), and in a second case it produced a change opposite to that found at the lower field strength (23). The general absence of dose:effect relationships suggests that the EMFs had a trigger effect which was relatively independent of their magnitude. The field-induced effects, moreover, were time-dependent phenomena and for this reason, from a dose:effect viewpoint, it is not possible to compare the results of studies which used different exposure periods (36, 37).

The physical characteristics of the applied EMFs partially determined the biological effects. Another important - perhaps, in some cases, principal - factor in the production of such effects was the physiological state of the subject. About half the rabbits in Kholodov's study, for example, exhibited the sustained delta pattern: in the remaining animals it did not appear or it appeared only briefly. Bychkov found elevated and depressed EEG activity, or no effect at all, depending on the particular animal. The behavioral studies involving reaction time and motor activity clearly suggest that the subject's state

example, it cannot be used to explain a specific observation recorded from a particular individual. In other words, if X is a stimulus, Y is a response, and Z is a particular subject, propositions of the form X caused Y in Z are meaningless within the physics thought-style because postdiction is impossible unless all conditions are known, and it is generally the case that the conditions that existed in the past are not known.

Conclusion

This analysis showed that whether or not powerline EMFs affect human health cannot be ascertained within the physics thought-style. This fact does not imply that powerline EMFs are not a health hazard. Rather, it indicates only that the question cannot be answered if one chooses to think solely as a physicist thinks.

Although the hazards question remains open within the physics thought-style, there is another way to establish scientific facts - the biological thought-style. It is possible, therefore, that the question could be answered affirmatively within that thought-style.

Powerline TOC

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City of Banning

Office of the Mayor

January 31, 2007

Mr. Michael Peevey
California Public Utilities Commission
505 Van Ness Avenue
San Francisco, Ca 94102

RE: Southern California Edison's El Casco System Project

Dear Mr. Peevey,

The City of Banning has been notified of, and attended, the recent Southern California Edison (SCE) Public Meetings regarding the El Casco System Project. We appreciate the information SCE has provided and look forward to working cooperatively toward the end goal of providing reliable power to this rapidly growing area. The project consists of reconstructing an existing single circuit 115kV line constructed on two wooden poles to a double circuit 115 kV line constructed on a single steel pole.

As you know, the City of Banning owns and operates its own municipal electric utility and is a participating member of Southern California Public Power Authority (SCPPA).

Approximately seven miles of the 115kV transmission line is located in an SCE right-of-way within the city limits of Banning. One mile of the existing 115kV line traverses a rather large 55+ community known as Sun Lakes. The Sun Lakes Development has 3300 homes with 2 golf courses and full amenities for all residents. The 115kV transmission line right-of-way is largely located within the golf course boundaries and is very close to many homes that border the golf course. All utilities, with the exception of the SCE 115kV transmission line are currently located under ground.

The City of Banning recognizes that it has no legal jurisdiction over the project but respectfully requests that SCE would underground the one mile of its proposed 115kV transmission line that traverses the Sun Lakes development.

Sincerely,

Brenda Salas
Mayor

CC: City Council
Lin Juniper, SCE

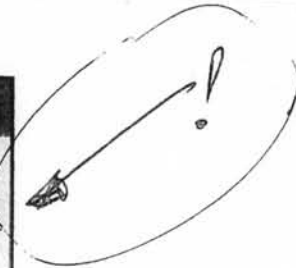
Damage that is being inflicted today is not even knowable. The EMF problem has been categorized as a new form of pollution as consequential as air and water pollution. It has also been likened to the newly-discovered hazards of asbestos and cigarette smoking. In terms of its cumulative health effects, it's been compared to the slow process of lead poisoning. The EMF problem will grow - and at a compounding rate. Fortunately, public awareness of EMF is also growing.

DANGER ZONES

Here are measurements of EMF from common sources. Remember, EMF exposure depends not just on strength of the fields, but on proximity and duration of contact.

EMF in Milligauss

Source	Up to 4 Inches	At 3 feet
Blender	50 to 220	0.3 to 3
Clothes washer	8 to 200	0.1 to 4
Coffee maker	6 to 29	0.1
Computer	4 to 20	2 to 5
Fluorescent lamp	400 to 4,000	0.1 to 5
Hair dryer	60 to 20,000	0.1 to 6
Microwave oven	100 to 500	1.0 to 25
Television	5 to 100	0.1 to 6
Vacuum cleaner	230 to 1300	3 to 40
Airplane	50 mG avg. in a 747	



Recommended safety levels range from 0.5 mG to 2.5 mG as the maximum exposure - with 1.0 mG as a preferred standard. Adverse biological effects have been found at 2.5 mG.

Strengthen Yourself Against EMF

Your body possesses a remarkable ability to adapt to rapidly changing environments. But when your body is chronically bombarded by man-made EMF (electromagnetic fields), its innate intelligence and energy can become weakened. When your body's ability to cope is impaired, it's more difficult for your body to shield itself from negative influences. EMF, in effect, can knock your innate intelligence and energy "out of phase."

You know why the airline captain tells you to turn off your electronic devices during take off and landing? The EMF generated by your cell phone and laptop wreak havoc on the plane's navigational system. And they wreak havoc on yours as well.

Some scientists estimate that you are now daily exposed to 100 million times the EMF radiation of your grandparents. Research shows that these fields have a significant disruptive effect on the natural energy levels of your body. Your body's energy, as well as your cellular communication system, are altered by the high frequencies of EMF. Man-made radiation magnifies your body's "fight or flight" responses, compounding your adrenal loads



Colgate University First Year Seminar 39: Earth Resources

Term papers

Midwest Power Line Expansion & the EMF Debate

Abbie Webb

NOTE: When reading this paper replace the December, 2000 NSP reference to EDISON, and Minnesota (Sun Fish Lakes) Residents by Sun Lakes C.C. residents

Midwest Power Line Expansion & the EMF Debate

The Mid-Continent Area Power Pool (MAPP) predicts that by the year 2006, the Midwest will be experiencing an extreme power deficit. This will cause blackouts and brownouts throughout the area, especially during the summer months (North American Reliability Council, 1998). In an attempt to prevent this power crisis, the Northern States Power Company (NSP) has announced plans to construct 35 new transmission lines in Minnesota by the year 2008 (Dangers, 2000).

Because the new transmission lines will provide the Midwest with a more reliable source of power, most people support the NSP's proposal. However, the route that the NSP is currently proposing for the expansion goes directly through several communities, in some areas passing less than fifty feet from houses (Dangers, 2000). These communities are fighting the proposal.

The main concern of the angry Minnesota residents is that the new transmission lines could pose health hazards. Several studies have shown that the electromagnetic fields (EMF) associated with high-energy transmission lines might be linked to health problems such as cancer, heart diseases, Alzheimer's Disease, Lou Gehrig's Disease, depression, miscarriages, stunted growth, and birth defects (Dangers, 2000). Home owners also worry that the lines will have negative effects on their area aesthetically, leading to decreased property values. They have suggested that the NSP bury the lines, or take a different route through the area, but the NSP has ignored their request, arguing that it would be too expensive, and that there is no proof that EMF is dangerous.

The History of the EMF Debate

For decades, scientists have known that high-energy power lines are surrounded by electromagnetic fields. However, they believed that the energy emitted was of such a low frequency that it couldn't have any biological effects. It wasn't until the 1960's that people began to suspect that EMF could be harmful. The debate began when studies in the Soviet Union showed that utility workers at high voltage substations had an unusually high occurrence of sleeplessness and headaches (Sagan, 1996). Then in the 1970's, U.S. ambassador, Walter Stoessel, developed leukemia after working in the U.S. embassy in Moscow. The high-energy surveillance system maintained by the Soviets was blamed for causing his cancer (Sagan, 1996). The EMF issue was brought to the attention of the public by the Wertheimer-Leeper study of 1979, which was the first to suggest that EMF was linked to childhood cancer (Sagan, 1996). From that point on, many EMF studies were done. Although the vast majority of these studies found no significant link between EMF and health problems, the few studies that did find a link have been enough to keep scientists wondering if maybe EMF really could be dangerous.

STUDIES CONNECTING EMF AND HEALTH PROBLEMS

For years, scientists have believed that the electromagnetic fields associated with power lines had no biological effects, positive or negative. But some recent studies contradict this belief. For example, the migration paths of certain birds that use geomagnetic fields to navigate have been known to be altered by power lines (Avery, 1978). Also, according to a study by James D. Hays and Neil D. Opdyke of the Lamont and Doherty Geological Observatory, an incredibly large number of organisms died during periods in history when the earth's magnetic fields switched directions (Becker, 1978). Another study, by Rutger Wever of the Max Planck Institute, found that the electromagnetic environment of the atmosphere can affect the circadian rhythms of humans (Becker, 1978). Finally, a scientist by the name of Andrew Bassett found that human bone tissue healed faster when an electrical current was induced at the site of a fracture. (Becker, 1978). While none of these studies prove that EMF is dangerous for humans, they do suggest that these fields can have biological effects.

In recent years, some scientists have been able to find links between EMF and health problems in the laboratory. James H. McElhaney of West Virginia University found that low frequency electric fields, like those emitted from power lines, can cause bone tumors in rats (Becker, 1978). Gordon Marsh of the University of Iowa found that even lower frequency fields can affect the growth of flatworms (Becker, 1978). R.O. Becker and A.A. Marino found that after a month of exposure to a 60 hertz electric field, rats exhibited hormonal and biochemical changes similar to those caused by stress. They note that chronic stress can cause a wide variety of health problems. Also, after continuously exposing three generations of rats to this same electric field, Becker and Marino observed high levels of infant mortality and severely stunted growth (Becker, 1978). All of these studies found that EMF can be detrimental to the health of animals in the lab. While this still doesn't prove that power lines can be harmful to nearby humans, it suggests that it is possible.

Possible Mechanisms

In order to prove that EMF is dangerous, scientists must determine what EMF does at the cellular level to cause the negative effects they have noticed in the laboratory and in epidemiological studies. One theory, the induced-current theory, says that EMF creates electrical charges within our tissues, and this disturbs the cells. However, many scientists argue that the increase in electrical activity associated with exposure to EMF is only a tiny fraction of the amount of electrical activity that takes place in our bodies naturally and is too minute to affect us (Sagan, 1996). This can be seen in Figure 1.

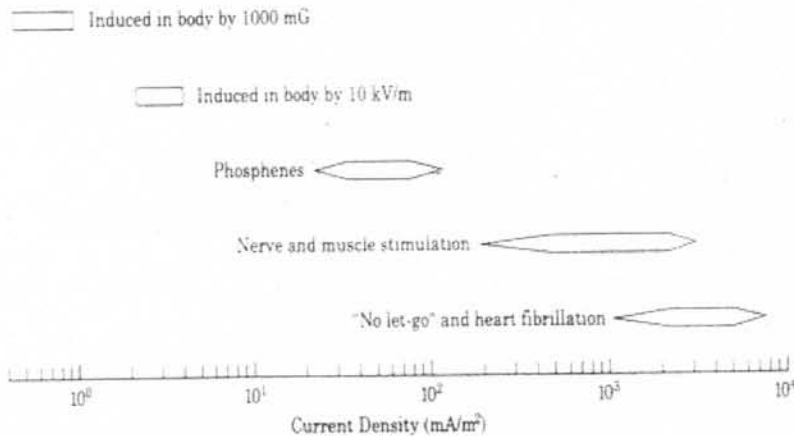


Figure 4.1 Approximate Current Density Thresholds For Various Responses

Figure 1: Currents induced in the body by EMF as compared to the body's naturally occurring currents. (Sagan, 1996)

Another theory, the transient theory, argues that, although the current that EMF induces in body tissue is relatively small compared to the body's natural charges, it can still affect the body if the changes in current are sudden. Russel Reiter of the University of Texas has done studies showing that rats exhibit more drastic hormonal changes when exposed to electrical fields that change rapidly rather than gradually (Sagan, 1996). Figure 2 shows the sudden magnetic field changes experienced by an eight year old girl on an average day. According to the transient theory, the abrupt increases and decreases apparent in the graph are the cause of health problems associated with EMF. The transient theory is being examined more closely, but physicists argue it has some "serious theoretical limitations" (Sagan, 1996).

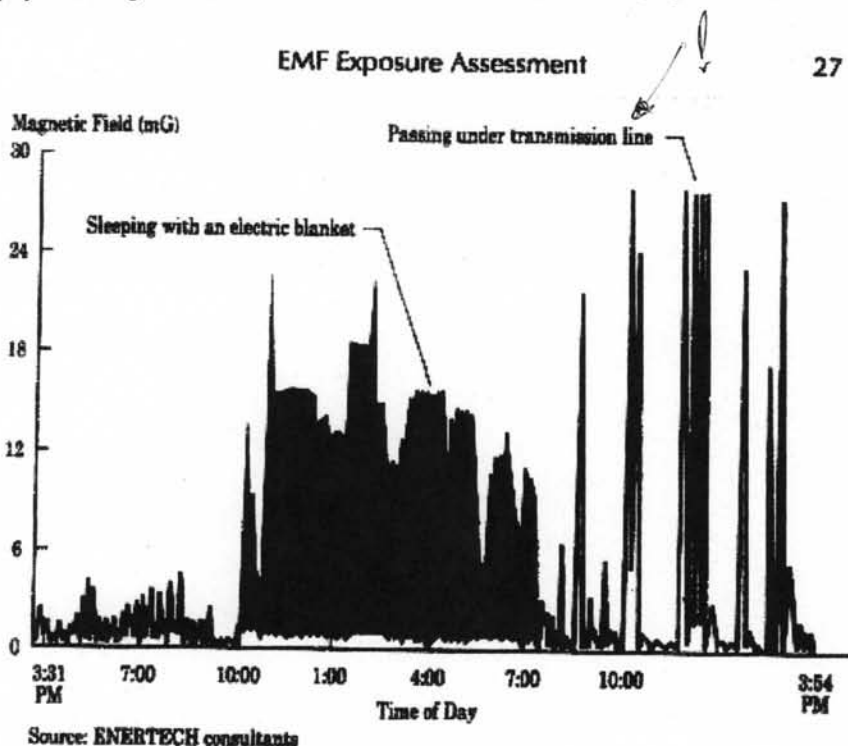


Figure 2: The magnetic fields experienced by an eight year old girl on an average day (Sagan, 1996).

A third theory is the resonance theory. This theory suggests that EMF accelerates the movement of ions across cell membranes. Physicist Abraham Liboff of Oakland University in Michigan supports this theory, citing his observation that calcium ions cross cell membranes more quickly when influenced by electric fields. This could have profound effects on the body because calcium ions are important chemical messengers that trigger several cell functions (Sagan, 1996).

Another possible mechanism has been proposed in one of the most recent EMF studies, entitled "Increased Exposure to Pollutant Aerosols Under High Voltage Power Lines." In this study, Denis Henshaw and his colleagues from the University of Bristol suggest that power lines cause cancer by magnifying the negative effects of exhaust pollution released by cars. Between 1989 and 1991, several studies found leukemia to be associated with high traffic density, suggesting that exhaust pollution is a carcinogen. In his study, Henshaw measured the deposition of pollutant aerosols on objects below power lines and compared them to objects 100 meters away from the lines. He found that the objects under the lines were covered with nearly twice as many aerosol pollutants. This would be enough to cause a measurable increase in instances of cancer near power lines (Henshaw, 1999).

Arguments Against the EMF - Cancer Link

It is important to remember that, while the studies mentioned above may seem to prove that EMF is linked to health problems, there are still many arguments against this belief. For every study showing a link between EMF and health problems, there are several others that found no such results. Furthermore, as mentioned above, no mechanism has been proven. While some communities near power lines have an unusually high occurrence of cancer and other health problems, other communities near power lines have seen no such trends. It is possible that the high-cancer rate seen in some of the communities near power lines is nothing more than a matter of chance (Sagan, 1996).

EMF Regulations

It is obvious that this issue will not be resolved for several years, until enough studies are done to explain the trends we have noticed over the years. In the mean time, many feel that it is better to be safe than sorry. This is the stance that has been taken in many European countries. For example, legislation in Norway forbids the construction or expansion of power lines near places of human habitation. Similar restrictions exist in the United Kingdom, Sweden, Spain, and Australia (Sagan, 1996). The Soviet Union has very specific regulations involving electromagnetic fields. There, the occupational exposure standard is 10 microwatts per square centimeter. In the U.S. the occupational exposure standard is 10,000 microwatts per square centimeter (Becker, 1978).

One is compelled to ask why European countries are so much stricter than North America when it comes to regulating EMF. Investigative Journalist Paul Brodeur believes that the big power companies and several U.S. government agencies know that EMF causes cancer and other health problems, but they are suppressing this information in order to protect their business interests (Sagan, 1996). Whether Brodeur's conspiracy theory is valid or not, there has been more pressure on the U.S. government in recent years to rethink its EMF regulations. In 1998, the National Institute of Environmental Health Sciences warned that the EMF associated with power lines should be regarded as a possible carcinogen (NIEHS, 1998). In June 1999, the same organization released its "EMF-RAPID" study in which it "suggests that the power industry continue its current practice of siting power lines to reduce exposures." (NIEHS, 1999). The U.S. government is hesitant to pass any drastic legislation until the relationship between EMF and human health problems becomes more clear. In the mean time, it will provide funding for studies that will help to cast more light on the issue.

The Red-Rock Wilson Line

While the government's stance on the EMF issue may seem acceptable for those of us who don't live near high-voltage power lines, for those that do live near these lines, and are exposed to high levels of EMF every day, the issue seems a bit more urgent. Unless legislation is passed, people will have no way to protect themselves if a power company decides to disregard the NIEHS' advisory and build in residential areas in order to keep costs down. This is the position in which the people of the Sunfish Lake community have recently found themselves.

A few years ago, the NSP (Northern States Power Company) decided to run a new transmission line through the area in order to provide more power for the expansion of high-tech industry in Bloomington, MN. The proposed route would pass within 30 meters of approximately ninety houses along the entire stretch of the line. Eighteen of these houses are in the town of Sunfish Lake (Dangers, 2000). Some of these homes are less than 15 meters from the line. This alarms the area's residents for several reasons. First of all, if the proposed expansion were to occur, they would be the only people in the entire country to live so close to such a high-energy power line. Secondly, the recently published Henshaw study discussed above found that the effects of EMF can be harmful up to 500 meters away from a high-voltage power line. This would mean that more than 100 homes along the Red Rock-Wilson Line would be in danger (Dangers, 2000). The residents are surprised that the power companies would even consider building so close to houses after the National Institute of Health advised them to site their lines as far from residential areas as possible.

The Sunfish Lake residents have also expressed other concerns. They worry that the lines will hurt the area aesthetically and thereby decrease property value. They feel that the NSP should also take environmental issues into account. In April of 1995, the town of Sunfish Lake hired an independent arborist to take inventory of the trees that lie on the proposed power line's path. The results found that the area contains an impressive variety of species, including one butternut tree, which is an endangered species in Minnesota (Mussel, 1999). All of these trees would be cut down during the construction process. The people's final concern is that the NSP has failed to keep them informed on the issue and in some cases has withheld information from them or even lied to them. Some of the issues that the NSP has been less than honest about are the cost of the project and the possibility of alternative routes (Power Line Task Force, 2000).

The residents of Sunfish Lake have proposed a few alternatives to the NSP. They have suggested that the line be built along nearby Interstate 494, rather than through their backyards. As can be seen in Figure 3, the two routes are about the same distance.

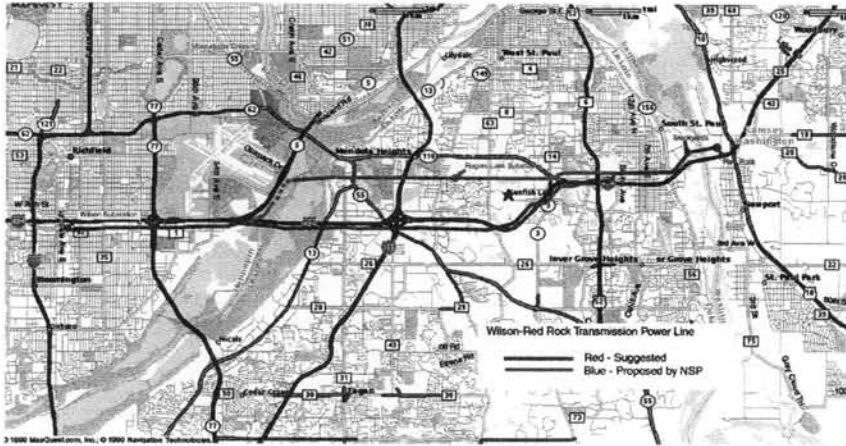


Figure 3: Map of the Red Rock-Wilson Line as proposed by the NSP (blue) and as suggested by the Residents of Sunfish Lake, Minnesota (Dangers, 2000)

A third alternative would be to bury the lines. This would eliminate the EMF problem as well as the property value issue because the underground lines wouldn't give off dangerous radiation and they wouldn't hurt the area aesthetically. However, the NSP wants to keep costs to an absolute minimum and therefore has refused to alter its plans. !!!

The residents of Sunfish Lake have taken the NSP to court and are currently awaiting the court's decision. They hope that the NSP will be ordered to use an alternate route or bury the lines. It could be several months before the decision is made.

Conclusion

The EMF issue is far from being resolved. While there is some evidence that the electromagnetic fields associated with power lines may cause health problems in humans, the vast majority of the evidence says that no such relationship exists. Nonetheless, the small amount of data that does suggest that EMF is dangerous keeps the issue open for debate. Therefore, the U.S. government has advised power companies to avoid building near residential areas. As of yet, no legislation has been passed to enforce this advice, because the lawmakers want to avoid making any drastic decisions until further study makes the issue more clear. Unfortunately, this leaves many people, including the residents of Sunfish Lake, in potential danger. If further study reveals that power lines are in fact linked to cancer, miscarriages, or other health problems, it may already be too late to help those people who have already been exposed. !!

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Edison seeks approval to cancel rate increase

BY LESLIE BERKMAN
THE PRESS-ENTERPRISE

In an effort to return a \$500 million revenue surplus to ratepayers, Southern California Edison said Wednesday it wants to skip a 6 percent rate increase scheduled Jan. 1 and slightly lower existing rates for some residential customers.

The utility said it has asked the California Public Utilities Commission for approval to cancel the rate increase intended to fund the utility's stepped-up infrastructure replacement and expansion program. The rate increase already had been deferred from August.

With new proposed rates, Edison's average residential customer in the Inland Empire, who uses 840 kilowatt hours of electricity in the summer and 555 kilowatt hours in the winter, next year will see his monthly summer bills drop from \$128.05 to \$125.79 and his monthly winter bills drop from \$78.92 to \$77.98.

Akbar Jazayeri, Edison's vice president of revenue and tariff, said state law mandates that the utility reimburse ratepayers for revenues that are greater than forecast. He said that without the rate increase, Edison will have sufficient funds for the

proposed system upgrade.

Jazayeri said the cost of natural gas used to fuel power plants today is about 20 percent less than was forecast last winter. Soaring natural gas prices in late 2005 prompted Edison to raise residential rates by 15 percent in early 2006.

In addition, he said, the utility's sales of electricity during the heat wave of July and August were about 30 percent higher than anticipated.

Residential customers were the group who provided the majority of Edison's surplus collections during the heat wave, he said.

And among all households the biggest power users were hit hardest by the higher rates. That is because residential rates are structured in escalating tiers, so that households a higher rate for power the more they use.

Jazayeri said the biggest cuts next year are proposed for the higher-rate tiers so larger electricity users will benefit the most, receiving rate reductions of up to 11 percent in Riverside and San Bernardino counties. But households who use the least power will see no benefit since by state law rates in the lowest two tiers are frozen.

BUSINESS P.E. 12/21/06 ←

Edison says that putting new lines underground is expensive. If they are going to double up the present power lines along Bardmoor Ave, my personal priorities are:

- 1) Put them underground
- 2) Re-route them away from residential areas
- 3) Prove to me by EPA written statement that no harm will (cause health wise or to existing home appliances (TV, radio, etc) Receivers)

Berry >

P.S.: Get ready to argue this case during the EDISON-S LCC meeting 1/23/07 at South Club House.

From Edison Bringing to S.H.A.C.

El Casco System Project

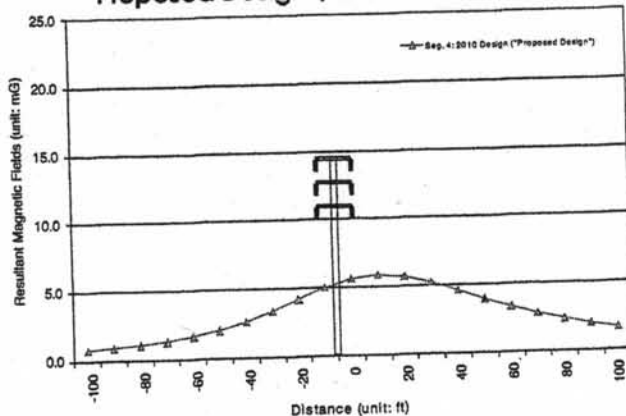
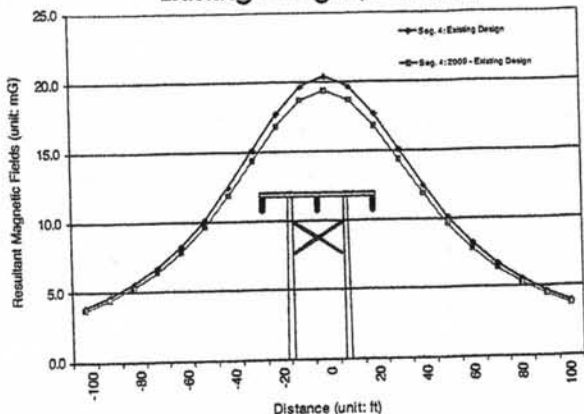
COMPARISON OF MAGNETIC FIELDS

El Casco Substation to Maraschino Substation Areas

Existing Design (H-Frame)

vs.

Proposed Design (Double-Circuit)

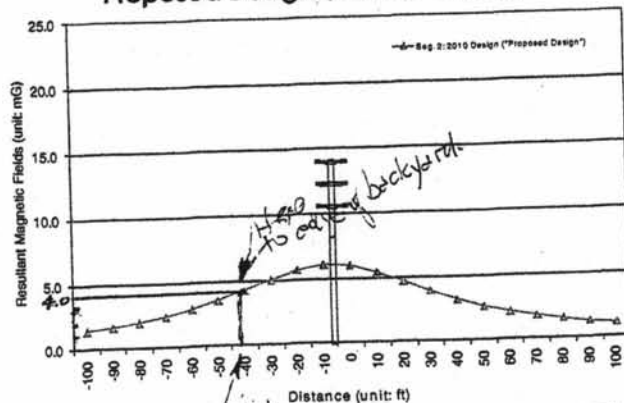
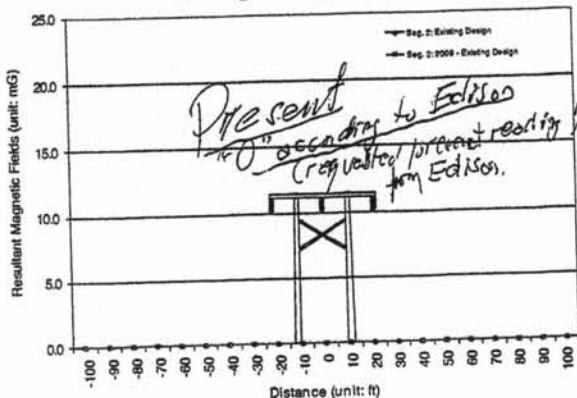


Maraschino Substation to Banning Substation Areas

Existing Design (H-Frame)

vs.

Proposed Design (Double-Circuit)



Notes About The Magnetic Field Graphs

- The magnetic field graphs are only intended to show relative differences in magnetic field levels between the existing design and proposed subtransmission design under a specific set of modeling assumptions.
- The magnetic field graphs are not intended to predict actual magnetic field levels at any given time or at any specific location because magnetic fields vary with time. The magnetic fields will continuously vary with customer electricity usage, load growth and other factors beyond SCE's control.
- By implementing appropriate no-cost and low-cost magnetic field reduction measures, SCE attempts to reduce magnetic fields to levels lower than they would be if SCE had not considered various magnetic field reduction measures.

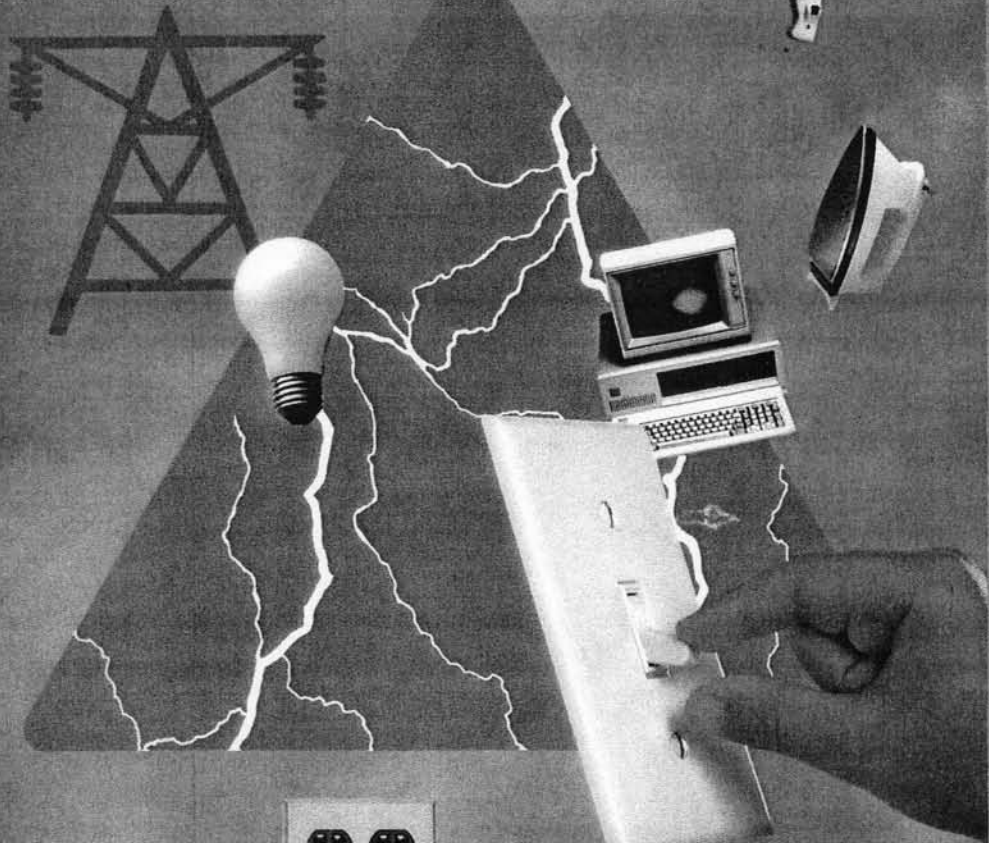
SCE Resident exposure → 4.0 mG to the edge of properties along Banning Ave. is S.H.A.C. (Constant exposure if new lines are built.)

NY
T

WARNING:

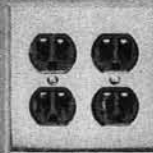
**The Electricity Around You
May Be Hazardous to Your Health**

How to Protect Yourself from Electromagnetic Fields



363.189
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SUGARMAN

- Information on:**
- Reducing your EMF exposure — simply and safely
 - Testing your home, workplace, and school for EMFs
 - Determining the safety zone for appliances
 - Measuring your EMF exposure

...minimizing exposure times, task redesign; work-station redesign; use of robotics.

- Design of lower EMF appliances.
- Modification of circuit design in equipment to reduce the generation of transient fields.
- Development of better protective equipment.
- Training and education of workers to reduce exposure.

CHAPTER 8

EMF Litigation

We think the juries, the mothers of America, aren't going to allow this to continue.

MICHAEL WITHEY of Seattle's
Schroeter, Goldmark and
Bender

Not unlike what has occurred in many other environmental scenarios where a public health concern has collided with powerful economic interests, our decision makers have all but defaulted on the health hazards of EMF radiation. The government's unwillingness to fund necessary research, coupled with its reluctance to initiate any sort of clear regulatory action to protect the general public from exposure to 60-Hz fields, has left the battle squarely in the hands of the people themselves. The battle is going to be fought from the bottom up, community by community, or, where attorneys are involved, case by case.

While public officials and special interests continue to argue that there's no proof that EMFs are dangerous, and our decision makers continue to drag their heels, attorneys around the country are arming themselves for what they have identified as a burgeoning new area of litigation: EMF case law. According to one attorney who has already been involved in a number of EMF lawsuits, this is one of

the fastest-growing areas of litigation in the country today. Others seem to agree. Late last summer, the American Bar Association sponsored a teleconference on EMF litigation and reported the highest response it has ever had to such a conference. And more than 100 EMF lawsuits have been filed since 1985.

The clear advantage of taking a critical social issue like the health hazards of EMFs into the court system is that something will be done about it. A judge's rulings are called *orders*, and with good reason—they tell people what they must do. So far, in case after case, the courts have directed utilities to do something about their offending power lines. As long as the courts continue to so rule, the situation with involuntary EMF exposure in this country should be undergoing some significant changes in the next few years. By now, a spate of court cases has put the utilities on notice.

San Diego Gas and Electric in California is a good example of how legal action works to change a utility's attitude about EMFs. After losing a number of major lawsuits involving EMF exposures, along with the shadow of one of the first personal liability EMF cases in the country looming over them (the Zuidema suit, which will be covered a little later in the chapter), San Diego Gas and Electric purchased a hundred gaussmeters and, at the advice of its attorneys, has undertaken an active campaign of measuring EMFs around its lines and informing the public about the level of the fields.

Houston Lighting and Power, in Texas, is another case in point. In winter 1987, the parents of Michael Scott sued HL&P over a 345-kv line that they claimed had caused their son's brain cancer death. The basis of the complaint, according to attorney John McDowell, of Bankston and McDowell, was that when the utility purchased the easement from the Scotts, it failed to warn them about the possible dangers from the line's magnetic field. The utility settled out of court on the condemnation part of the lawsuit and the personal injury case is still pending. Two points about the settlement are typical of such cases: (1) that there is a gag order on the amount that the utility paid, and (2) that after the lawsuit was settled, HL&P began to send out prudent avoidance notices to all its customers warning them about EMF hazards of their power lines.

Despite the fact that a growing number of attorneys are taking EMF cases to court and prevailing, there are still some major problems in doing this, the most obvious one being the cost of litigation. Because of the expense, not everyone with a legitimate concern can avail themselves of the legal option. In fact, because of the cost, the legal approach may be best suited to groups of plaintiffs—as in class-action suits like the Filipowski case in New York State—or to municipalities themselves, like the Middletown township suit in New Jersey. That action cost \$300,000.

H. Dickson Montague, an attorney with Vinson and Elkins of Houston, Texas, warns, "One of the main problems is money to go into court and hire an attorney, then hire experts who'll be able to prove a case to the jury. It is extremely expensive to fund a case such as this." Speaking of his clients in a ground-breaking EMF lawsuit that he won in 1987, he added, "It was fortunate that Klein Independent School District had the financial wherewithal to stand up to the utility company and present a full and complete picture to the jury on the potential adverse health consequences of prolonged exposure to electromagnetic fields. It is rare that a person is given this opportunity. However, when one is given this opportunity, the results are obvious."

Montague successfully defended the Klein Independent School District in *Houston Lighting and Power Company v. Klein Independent School District*. This suit involved a dispute over the proposed siting of a 345-kv transmission line next to three schools. In what was a standard siting procedure, HL&P petitioned the state Public Utilities Commission to condemn a portion of the Klein School District's land for an easement. The school district filed objections to the taking of the land. Eventually, the parties went to court over the dispute. In the course of the litigation, the line was built and energized. Klein won the lawsuit. The judge ruled that the utility had to remove the line and the jury awarded the school district \$350,000 in punitive damages. The utility appealed the case. In November 1987, the Texas Court of Appeals upheld the ruling about the line, but not the punitive damages.

This case is important because it demonstrates the earliest instance of a jury's acceptance of the "possibility of cancerous effects of

WARNING: *The Electricity Around You May Be Hazardous to Your Health*

least counsel a prudent avoidance approach, meaning that people should do what they can to limit their exposure without spending a lot of money or greatly changing their lifestyle. Clyde Murley, from the San Francisco Public Utilities Commission, believes the time has come for EMF regulatory action. Stating that he's "very concerned about 8,000 more kids dying of cancer every year," he went on to explain some of the problems with regulating EMF exposures:

Typically, what society does is regulate what is easy to study. But, if someone loses his keys at night, that doesn't mean they'll find them under the street light. I think difficulty of testability should be factored in along with the usual problem-times-numbers-equals-risk equation. We should consider how difficult it is to study a particular scenario when we're making decisions about regulating it. For instance, it is very difficult to study EMFs and cancer in the lab, but far easier to study it epidemiologically. This kind of resistance to testability really hampers regulation.

CHAPTER 5

EMFs in Your Community

Our utility concerns are concerns about being able to manage magnetic fields from our lines if that should be proved to be necessary. At present, there's no interest throughout the industry in putting these techniques into effect. We'll leave that up to the decision makers, society at large, who will have to decide in the end whether the gain is worth the expense or the inconvenience.

LUCIANO ZAFANELLA, *manager
of the EPRI High-Voltage
Transmission Research Facility*

The possible health risks of electromagnetic fields are fast becoming an urgent social issue. Numerous public meetings and forums around the country have been called to discuss EMFs to help people better understand the subject of electromagnetic fields in general and EMF health risks in particular, or to cope with specific EMF problems in their communities, like the siting of a new power line or the discovery of a cancer cluster in the vicinity of an electric substation. Despite the complexity of the topic, however, public meetings about EMFs tend to be remarkably similar.

The people who come to them are worried and usually confused. They want to hear what the panel of experts has to say about EMF health risks. They expect the experts to clarify the issue for them.

Unfortunately, these panels are usually made up of such a mixed bag of "experts"—skeptics, believers, scientists, environmentalists, special-interest group spokespeople—that they often add to the confusion. Each panelist will proceed to give his or her side of the issue, which usually conflicts with someone else's views. Somehow, the public has to sort it out.

During the latter part of the program, people in the audience are invited to get up and address questions to the panelists. Wherever the meeting is, whatever the audience's agenda may be, people always seem to ask the same questions. Because of the similarity of these meetings, a public information meeting on electromagnetic fields called by the EPA and the City of New York early last fall will serve as an example.

The meeting was held at New York University. The panel of experts included David Carpenter (dean of the SUNY School of Public Health), Louis Slesin (editor of *Microwave News*) Indira Nair (Carnegie Mellon University), Herb Kaufman (ESEERCO—Empire State Electric Energy Research Corporation), John Wilson (Consolidated Edison), Stan Sussman (EPRI—Electric Power Research Institute), Martin Blank (Columbia University), Michael Buccigrossi (U.S. EPA), and Robert Kulikowski (Bureau of Radiation Control, New York City Department of Public Health).

The public, some 150 strong, looked remarkably like a cross section of middle America. When it came time for the people to have their say, it was apparent that they had done their homework: They understood the subject well enough to ask some very specific questions and they had no trouble at all articulating their concerns.

First, each of the panelists gave a brief presentation on the EMF/health issue. Then the people got to query the experts. Questions from people seeking general information were fielded by various members of the panel, according to their bias. Often, other panelists representing a differing perspective would then respond.

But many of the queries that night went beyond the level of general information. Whereas the scientific community might still be withholding their opinion, the majority of the people who are informed about magnetic fields seem to be convinced there is a problem. This was clear at the New York meeting. People wanted to know two

things: how to reduce their exposure and who had the responsibility to protect them from EMFs. When panelists informed the audience that no one agency or utility currently has that responsibility—an official from Consolidated Edison told a speaker "you're on your own"—the crowd broke out in boos and hisses. About halfway into the question and answer period, the crowd seemed to lose patience and the evening took on an adversarial air. As scenario after scenario was presented, it became apparent that the Con Ed man was right: No agency or utility was willing to even come out and measure the strength of magnetic fields, much less suggest some amelioration. For the most part, the government agencies and the utility spokespeople denied there was any danger at all.

Carpenter, Slesin, and Indira Nair, however, were advocates on behalf of the public. At the start of the meeting, Carpenter gave an impassioned plea for people to "speak out" and demand some protection. His comments were seconded by Slesin, who spends half his time at meetings like this trying to keep the record straight.

Dr. Indira Nair is a world-acclaimed physicist in Carnegie Mellon's Department of Engineering and Public Policy and is co-author of the 1989 Office of Technology Assessment paper that redirected the scientific community's attitude about EMF bioeffects with the statement, "The emerging evidence no longer allows one to categorically assert that there are no risks." Eventually, Dr. Nair became quietly vociferous as she picked up on the public's frustrations. At one point, she produced a slide that she had held back during her initial statement, introducing it by saying,

These are my concerns [about EMF exposures], not Carnegie Mellon's: (1) We're changing the evolutionary environment. (2) Certain types of cancer have shown an increase. (3) Worries about the central nervous system effects. . . . The preponderance of the evidence tells me something is there I should worry about.

Dr. Nair is one of the team who coined the term *prudent avoidance*: People should do whatever they can to avoid exposure to magnetic fields if they can do so without great cost or great inconvenience. This has become a device the experts have used to pass

FROM EDISON
to

BACKGROUND

Mr. Marvin Friedman presented SCE with the following questions at the El Casco System Project Open House held on January 23, 2007 at the Sun Lakes Country Club. SCE committed to provide written responses to these questions to the residents of Sun Lakes located within 300 feet of the proposed El Casco System Project.

Although the Open House was intended for the purpose of informing the Sun Lakes community specifically about the El Casco System Project, some of the questions received appear to pertain to the existing Devers-Valley No. 1 transmission line and the proposed Devers-Valley No. 2 transmission line. To avoid confusion, SCE has answered each of Mr. Friedman's questions as it pertains to each project or line.

El Casco System Project

There are two existing electric lines in the Sun Lakes area. The line which is part of the proposed El Casco System Project is a 115 kilovolt (kV) subtransmission line which runs through the golf course in Sun Lakes. This line was originally built in 1939 though most of the poles through Sun Lakes were replaced in 1971. At present, the line is used primarily as a backup subtransmission line to serve the area when the main subtransmission line is out of service. Under normal conditions, the backup line is energized, but no electrical current flows through it. The line is continually energized so that, if the main line goes out of service, the line going through Sun Lakes is instantly ready to carry the local area loads.

→ where is it?

The El Casco System Project includes rebuilding the existing line on new double-circuit poles and adding a second 115 kV line onto those poles. The two lines will deliver power from the proposed El Casco Substation to both Maraschino and Banning Substations.

!!!

When the El Casco System Project is completed, both the existing line and the new line will have current flowing through them at all times.

Devers-Valley No. 2 500 kV Transmission Line

no objection?

The line south of the Sun Lakes community is a 500 kV transmission line called the Devers-Valley No. 1 line. This line was put into service in 1985. Recently, the California Public Utilities Commission (CPUC) approved the construction of a second 500 kV line between the Devers and Valley Substations, to be called the Devers-Valley No. 2 500 kV transmission line. The Devers-Valley No. 2 line will be constructed south of the existing 500 kV line within SCE's existing right-of-way (ROW) (further away from Sun Lakes' residences). SCE is in the process of obtaining additional approvals

El Casco System Project

Though the existing 115 kV line is energized, no electrical current normally flows through the line. Therefore, the existing line does not typically produce any magnetic fields. When this project is completed however, electrical current will flow through both the new and the existing 115 kV lines producing magnetic fields. Therefore the lines will produce magnetic fields. SCE proposes to implement the following measures to reduce public exposure to EMF. → from future project!

it will though on new project!
MITIGATION No

- Use taller poles.
- Use a double-circuit pole-head configuration for the double circuit design.
- Optimally phase the proposed 115 kV subtransmission line with respect to the existing 115 kV subtransmission lines.

See attached graph (Figure 1).

Devers-Valley No. 2

Since the existing Devers-Valley No. 1 line does have electrical current normally flowing through it, the line already produces magnetic fields. Since the future Devers-Valley No. 2 line will be built south of the existing line, SCE's calculations indicate that there would actually be a noticeable magnetic field **reduction** (i.e. greater than 15% magnetic field reduction) on the north side of the existing right-of way (nearer to Sun Lakes' residences), while there would be a noticeable magnetic field **increase** on the south side of the right-of-way (farther away from Sun Lakes' residences). See attached graph (Figure 2).

Q. 3. What is the exact ROW location along the golf course and the southern edge of Sun Lakes Country Club, and other populated areas in Banning?

El Casco System Project

The existing 115 kV subtransmission line is centered within a 50-foot ROW originally established in 1939.

~~attached~~

Devers-Valley No. 1 Line

The portion of the existing 500 kV transmission line south of Sun Lakes is located within a 290-foot ROW granted by the Bureau of Land Management in the early 1980's. The edges of the ROW are approximately 80 feet north and 210 feet south of the centerline of the existing towers.

Q. 4. Where in the ROW are the new transmission lines to be placed?

El Casco System Project

The new steel poles for the 115 kV subtransmission lines will be located approximately 15 feet south of the northern edge of the ROW.

Important!
Total Exemption is 100 Ft. wide

Devers-Valley Project

The new lattice steel towers for the 500 kV transmission line will be placed approximately 130 feet south (centerline to centerline) of the existing steel towers.

Q. 5. Could you provide graphs of the magnetic field profile produced by the sum of the existing and proposed transmission lines?

See attached graphs (Figure 1 and Figure 2).

Q. 6. With regard to the proposed pole supports for the wires on the golf course:

- a: how tall will they be?**
- b: how far apart will they be?**
- c: how many total will there be?**
- d: how does this compare to the number of supports presently on the course?**
- e: how many wires will they support?**

El Casco System Project

- a: The new poles through the golf course will be approximately 75-85 feet tall. (The current poles are approximately 60-65 feet tall.)
- b: The new poles will be approximately 400 to 800 feet apart. This spacing will be approximately the same as it is currently.
- c: There will be 10 poles between Highland Springs Road and Highland Home Road.
- d: There are currently 10 pole locations between Highland Springs Road and Highland Home Road.
- e: The new steel poles will each support six wires. (The current poles support three wires.)

Q. 7. With regard to the support towers for the southern edge of the Sun Lakes Country Club:

a: where will the additional support towers be placed with respect to the towers already existing?

b: how far apart will they be?

c: how tall will they be compared to the towers already existing?

d: how many wires will they support?

Devers-Valley No. 2 Project

a: The new towers will be constructed approximately 130 feet south of the existing towers.

b: The new towers will be approximately the same distance apart as are the existing towers.

c: The new towers will be approximately the same height as the existing towers. There may be some variation due to geographical and topographical conditions.

d: The new towers will carry three wires (same as the existing towers).

Q. 8. What are the environmental consequences of this proposed project?

El Casco Project

When SCE proposes to construct a new project such as the El Casco System Project, SCE must file an application with the CPUC. The application must include a "Proponent's Environmental Assessment" (PEA) that describes the environmental impacts of the proposed project. The CPUC conducts an environmental review of the proposed project pursuant to the California Environmental Quality Act (CEQA). CEQA is a California law that requires state and local agencies to consider the potential environmental effects of a project and to impose mitigation measures to avoid or mitigate significant impacts whenever feasible prior to approving the proposed project.

SCE's PEA for this project has analyzed numerous environmental resource categories, including Air Quality, Aesthetics, Biology, Geology, Hydrology, Visual Impact, and Cultural Resources. With the exception of temporary construction impacts related to Air Quality, SCE's PEA concludes that the project will have no significant environmental impacts. SCE has proposed mitigation measures to address any potential impacts. These potential impacts will be more fully examined when the CPUC conducts its environmental review under CEQA.

As a courtesy to the residents of Sun Lakes, SCE has provided a copy of the El Casco System Project application and PEA to the Sun Lakes Home Owners Association. A copy is also expected to be available on the CPUC's website at www.cpuc.ca.gov.

! ! ! ! !
relative to future lines (not existing as it is "10" per EDISON)
CONFLICT OF INTEREST
to future lines!
when? will it be public?

Q. 9. What are the safeguards Edison has developed to eliminate the dangers of:

- a. radiation level increases**
- b. earthquake damage to the system**
- c. high wind loads**
- d. icing conditions**
- e. downed power lines**
- f. brush fires**

a. SCE's lines do not emit ionizing radiation. (?)

b. SCE's design standards for poles and towers incorporate lateral wind loading requirements that exceed seismic loading forces. Consequently, SCE's overhead lines are designed to withstand impacts from potential seismic ground shaking.

How much?

c. SCE designs overhead electric lines to meet or exceed the CPUC's General Order 95 wind loading criteria. CPUC General Order 95 has established uniform requirements for overhead electrical line construction in the State of California, the application of which will provide adequate service and secure safety to persons engaged in the construction, maintenance, operation, or use of overhead electrical lines and to the public in general. (OK)

d. Icing conditions are also covered in General Order 95 design requirements. Meteorological studies are performed during preliminary engineering of projects like these to ensure that design parameters include expected weather conditions for the area. (OK)

e. SCE incorporates high-speed relaying to sense any fault conditions on the lines, including downed wires, and relies on high-speed circuit breakers to isolate any faults. This results in the lines being de-energized within one-half second of the beginning of the fault. (OK)

f. The Pass Area section of Riverside County's General Plan depicts the Sun Lakes community as within a low fire probability zone for wildfires. Risks related to wildfires caused by construction or operation of the electric lines in the Sun Lakes community are expected to be low. (OK)

Q. 10. Will you provide a complete set of construction plans for the part of the project passing through and adjacent to the City of Banning (including Sun Lakes Country Club?)

SCE does not provide construction plans to third parties. However, SCE will be glad to meet with any interested parties to discuss the construction plans for this project.

SCE understands that construction may be disruptive to daily activities. SCE is committed to ensuring the community's safety and, to the extent possible, minimizing any inconvenience to residents and area businesses. SCE will work with local officials, residents, golf course operators, and other businesses to minimize the construction impacts of this project. Specifically, SCE will develop a construction notification procedure to notify property owners and businesses along the project of when SCE will be performing work in their vicinity.

Q. 11. Would you consider relocating the proposed and existing power lines further away from the populated areas of Banning?

To build the El Casco System Project, SCE must construct an additional 115 kV subtransmission line between the Banning and El Casco substations. There is no direct route between these two substations which does not, at some point, traverse populated or developed areas in Banning. Since the existing line is already within a long-established ROW, use of this line route is considered to be the most environmentally responsible option.

!
 ROW should be wider for the future power lines (350 for 500 kV line)
 Boney!

The original ROW was established in 1939 for the current transmission lines without constant flow of electricity!

CURRENT ROW SHOULD NOT ALLOW THE PLANNED INCREASE OF CONSTANT EMF CREATED BY THE NEW LINES! (going through residential areas adjacent to transmission lines)

Q. 12. Would you consider placing the proposed and existing power lines within and adjacent to populated areas of Banning below ground?

Typically, electric lines with voltages greater than 50 kV are constructed overhead. Overhead lines usually create less construction and long-term environmental impacts, are easier to maintain and cost substantially less than lines constructed underground.

*NOT TRUE!
(Yes for rest)*

SCE applies engineering criteria and CEQA guidelines to determine whether it will propose to construct an electric line with voltages greater than 50 kV overhead or underground.

- SCE's engineering analysis concluded that there are no technical advantages to constructing the El Casco System Project lines underground.
- SCE's analysis of the potential visual impacts of the proposed project indicated, in accordance with CEQA Guidelines, that constructing the new lines overhead would result in a less than significant visual impact on the community because they would not substantially degrade the existing visual character or quality of the site and its surroundings.
- While the replacement of the existing 115 kV structures within the existing right-of-way would result in some change in views from the neighboring properties, the visual character would remain essentially unchanged.
- The 115 kV right-of-way was established in 1939 and the existing structures have been in place since 1971.

*TRUE BECAUSE
IT COST MORE!*

Acceptable!

*under what rules?
(Banning Public Utilities?)*

Therefore, SCE has proposed overhead construction in its application to the CPUC.

Because of this experience and our ability to deliver quality products, Enertech has become a recognized leader in power frequency EMF research, engineering, instrumentation (meters), and software.

state that workers with cardiac pacemakers should not be exposed to a 60-Hz magnetic field greater than 1 gauss (1000 mG) or an electric field greater than 1 kilovolt (1000 volts) per meter (see previous table). Workers with pacemakers or implantable defibrillators should consult their doctors and their industrial hygienists if they think their workplace contains sources of high electric or magnetic fields.

The FDA MedWatch program is collecting information about medical device problems thought to be associated with exposure to, or interference from, electromagnetic energy. Anyone experiencing a problem that might be due to such interference is encouraged to call and report it: (800) FDA-1088.

What about products that are advertised as producing or emitting low or reduced magnetic fields?

This question must be answered product by product, depending on the claims of the manufacturer. Beware of advertisements claiming the federal government has certified that the advertised equipment produces little or no EMF. The federal government has no such certification program, guidelines or standards. The U.S. Food and Drug Administration (FDA) Center for Devices and Radiological Health is responsible for protecting the public from radiation generated by electronic products. If you have questions about a specific product, contact the FDA at (301) 443-3840.

*copy of
Danger*

If workers and employers want to reduce EMF exposure at work, what can they do?

Personal exposure to EMFs depends on three things: the strength of the magnetic field sources in your work environment, your distance from those sources, and the time you spend in the magnetic field.

If you are concerned about EMF exposure at work, your first step should be to find out where the major EMF sources are in your work area and move away from them or limit the time you spend near them. Magnetic fields often drop off dramatically about an arm's length away from the source (see the chapter, Your EMF Environment for information on measuring EMFs). Another way to reduce EMF exposure is to use equipment designed to have relatively low EMF emissions. Sometimes electrical wiring in a building can be the source of strong magnetic field exposure. Rearranging the work area to increase your distance from the electrical panel or wiring can reduce your EMF exposure in some cases.

We are not sure which aspect of the magnetic field exposure, if any, to reduce. (See discussion in the chapter, EMF Basics of the complexity of EMF exposure.) Future research may reveal that EMF reduction measures based on today's limited understanding are inadequate or irrelevant. No action should be taken to reduce EMF exposure if it increases the risk of a known health or safety hazard, such as electrocution.

While research continues, concerned workers and employers might consider the following simple, inexpensive measures for reducing EMF exposures:

- Provide information to employers and employees about the possibility of risk from EMF exposure.
- Find out where major EMF sources are in your work area.
- Increase the distance between the worker and the EMF source.
- Reduce the time spent near EMF sources.
- Use equipment designed to have low EMF emissions, if available.

For More Information

This section lists sources of additional information including toll-free telephone hotlines, an Internet listing, and publications written for a general audience.

Telephone Hotlines

Information on Workplace Hazards Hotline (800) 35 NIOSH (356-4674)

Run by the National Institute for Occupational Safety and Health (NIOSH), this hotline answers questions about safety and health in the workplace.

On the Internet: EMF Rapid Home Page

Information about the federal government's EMF research effort, including public information materials developed by the EMF

The electrician repaired a large air-conditioning motor at 9:10 am and 11:45 am.	The government worker was at the copy machine at 8:00 am, at the computer from 11:00 am to 1:00 pm and also from 2:30 pm to 4:30 pm.
--	--

*See "Means and Medians" for an explanation of mean and median.
Source: NIOSH, DOE

The figures above are examples of magnetic field exposures determined with exposure meters worn by four workers in different occupations. These measurements demonstrate how surprising and varied an individual worker's EMF exposure can be. These exposure plots do not necessarily represent typical EMF exposures for workers in these occupations.

Is there something significant about the 2-mG magnetic field level?

A typical U.S. home has a background magnetic field level (away from any appliances and averaged over time) that ranges from 0.5 mG to 4 mG, with an average value of 0.6 mG. This estimate is based on the Electric Power Research Institute study (see related discussion at beginning of this chapter; Zaffanella et al., 1993). Most ordinary electrical equipment produces higher magnetic fields close to the source. (for examples of fields from various EMF sources are given later in this chapter.)

Following standard epidemiologic practices, several EMF human health studies have used average exposures of 2 or 3 mG as an arbitrary cutoff point to define broad categories of exposure. Below this level, subjects were considered "unexposed," and above this level, they were considered "exposed." In some studies, a higher cancer risk was found within the exposed group. Two milligauss was significant in one influential Swedish study in that it was used as the boundary to define the exposed group, not because it identified a safety threshold. Laboratory experiments with cells have reported effects at field levels as low as 12 mG, but there is no peer-reviewed research reporting effects at 2 mG during an *in vitro* (test tube) study.

To conclude from current research results that 2 mG constitutes a safety threshold is to read far too much into the data. Several expert review panels, as well as the Swedish government, have so far concluded that current knowledge does not provide sufficient basis for setting exposure limits to magnetic fields of such low intensity.

How can I find out how strong the EMFs are where I work?

The tables on the following pages can give you a general idea about magnetic field levels for different jobs and around various kinds of electrical equipment. It is important to remember that EMF levels depend on the actual equipment used in the workplace. Different brands or models of the same type of equipment can have different magnetic field strengths. It is also important to keep in mind that the strength of a magnetic field drops off quickly with distance. A spot measurement is most useful in estimating a worker's personal exposure if it is taken at a location that approximates the worker's location and at a time when the exposure is typical of the workday. When spot readings are taken, they should be noted on paper along with notes showing the meter location, time, and what equipment is operating.

Some electric utilities will conduct EMF measurements for customers at no charge. You can make your own measurements if you have a magnetic field meter. Different meter models are now available, and many are advertised in the EMF periodicals listed in References.

A booklet that describes and rates currently available meters can be purchased from the Electrical Power Research Center in Ames, Iowa for \$25 by calling (515) 294-8057. Independent environmental firms can also be hired to conduct EMF measurements. In some cities they are listed in the yellow pages of the telephone book under headings such as "Engineers, Environmental;" "Environmental Services;" and "Industrial Hygiene Consultants." You should investigate the experience and qualifications of commercial firms, since governments do not standardize EMF measurements or certify measurement contractors.

Your plant safety officer, industrial hygienist, or other local safety official can be a good source of information. The National Institute for Occupational Safety and Health (NIOSH) is asked occasionally to conduct health hazard evaluations in workplaces where EMF is a suspected cause for concern. For further technical assistance, contact NIOSH at (800) 356-4674.

This table shows the range of magnetic field exposures averaged over a workday for workers in selected occupations. These personal exposure measurements reflect the average magnitude of the magnetic field produced by the various EMF sources and the amount of time the worker spent in the fields. Measurements were also obtained in nonoccupational locations and situations, for the purpose of comparison. The data summarized in this table came from various studies, all of which are listed in the Reference section.

Studies are now being conducted as part of the U.S. EMF RAPID Program to find out more about EMF exposures in various occupational environments including schools, shopping malls, grocery stores, and hospitals. (For a description of the program,

reason to exercise a certain amount of caution.' The Swedish government recommends against locating new homes and schools near existing electricity-generating plants and proposes that high magnetic fields in homes, schools, and workplaces be limited.

The state of California has initiated a statewide research and education program to inform decision makers about EMFs. Meanwhile, California electric utilities are taking no-cost and low-cost steps to reduce magnetic fields from new facilities.

What have nongovernmental organizations concluded about EMFs and cancer?

A number of organizations have issued public statements about the possibility of an association between EMF exposure and cancer.

The Harvard Center for Risk Analysis, in an April 1995 analysis, assessed current research findings linking occupational EMF exposure and cancer. About leukemia, the report found that while the data are too inconsistent to establish a cause-and-effect relationship, "there is enough evidence of association to raise concern." Evidence on EMFs and brain cancer was "sketchy," but the report noted that "the results of the Savitz study are likely to fuel greater interest in the hypothesis that EMFs can cause brain cancer."

The American Physical Society, an association of physicists, issued a statement in April 1995 on the overall scientific evidence relating to EMFs and public health. The statement read in part: "The scientific literature and the reports of reviews by other panels show no consistent, significant link between cancer and power line fields ... From this standpoint, the conjectures relating cancer to power line fields have not been scientifically substantiated."

The American Medical Association (AMA) issued a report in December 1994 stating that "no scientifically documented health risk has been associated with the usually occurring levels of electromagnetic fields." The AMA recommends "continued investigation of basic effects ... studies of people's average exposures, and the developing of national exposure standards, if such are recommended by an authoritative advisory panel." Until more is known, the AMA suggests: "Physicians may advise that patients themselves can control some of their exposures to electric and magnetic fields."

In a 1993 position statement on EMF, the American Industrial Hygiene Association (AIHA) said the following: "At present, the AIHA finds that the lack of replicated studies, an accepted interaction mechanism in the laboratory studies, and an absence of significant associations with measured fields in the epidemiological studies, make it impossible to come to a definite decision regarding the magnitude of health effects associated with exposure to extremely low frequencies. Good industrial hygiene and public health practice suggests that when there are conflicting data ... a cautious approach is recommended. The AIHA also supports the need for more research to close the current knowledge gaps."

Ongoing Research

Most authorities agree that more research is needed before we will have solid answers about whether EMF exposure affects our health. This chapter summarizes the current U.S. government EMF research effort.

Are more EMF studies being done?

Yes. Worldwide, about 200 studies are under way or planned involving EMFs. These include epidemiologic, laboratory, environmental, and engineering studies. Many of these involve some aspect of cancer development.

EMF RAPID Program

In the United States, the federal Energy Policy Act established a 5-year program (begun in 1994) to expand ongoing EMF research and to provide accurate public information about EMFs. The EMF Research and Public Information Dissemination Program, known as the EMF RAPID Program, is being managed by the U.S. Department of Energy and the National Institute of Environmental Health Sciences. The EMF RAPID Program is supported by federal and nonfederal funds.

Laboratory research is being conducted to explore the potential relevance of EMF exposure to possible health effects, including cancer and effects on reproduction and the nervous system. Work is also under way on exposure assessment and on risk assessment. This booklet is a product of the public information component of the EMF RAPID Program.

How might EMFs cause these biological effects?

Much of the debate about EMFs centers on this question. Researchers are trying to determine the biophysical mechanisms by which EMFs could cause the biological effects reported in some experiments. One such mechanism may be the weak electric currents generated in the body by oscillating electric and magnetic fields. However, some scientists argue that because these currents are much smaller than natural body currents, they are unlikely to have any effect on health. Others propose that currents from EMF exposure can have a steady frequency and a regular wave shape that is very different from the body's own electricity and that cells may somehow "sense" these currents, even though they are small.

Laboratory studies have not shown that EMFs cause the gene mutations that initiate the cancer process. Some studies suggest, however, that EMFs may promote cancerous activity in cells that are already precancerous.

Several recent studies have tried to find out whether exposure to EMFs can contribute to the promotion of cancer. In these studies, researchers first exposed a group of laboratory animals to chemicals that initiate skin or breast cancers. Then, they exposed some of the animals in the group to magnetic fields or to magnetic fields plus another chemical known to promote tumors. Several studies report no evidence for tumor promotion. However, some research has indicated that under certain circumstances EMF exposure may promote tumor development in animals.

For such research results to be widely accepted by scientists as valid, they must be replicated—that is, scientists in other laboratories should be able to repeat the experiment and come up with similar results. The U.S. government is currently sponsoring research that attempts to replicate some of these animal studies.

What about effects of EMFs on the hormone melatonin?

Melatonin is a hormone secreted mainly at night by the pineal gland, a small gland attached to the brain. Scientists have reported results of laboratory experiments showing that melatonin can slow the growth of some cancer cells, including breast cancer cells. If melatonin helps prevent cancer growth and if EMFs decrease melatonin, then this might help explain the results of studies showing increased cancer risk with EMF exposure.

The Midwest Research Institute (MRI) in Kansas City, Missouri, has studied the effect of EMF exposure on human melatonin levels in men. In 1993, MRI reported that although subjects showed no effect on the average, those individuals with naturally lower levels of melatonin did show a small additional decrease when exposed intermittently to 60-Hz magnetic fields of 200 mG. However, in 1994, MRI reported that a second study, designed to produce the same results as the earlier study, found no such effect. In 1995, MRI evaluated the effects of continuous exposure to magnetic fields at the same intensity; again, no effects on melatonin were found.

Some laboratory experiments have reported that EMF exposure alters melatonin levels in hamsters and rats. Results of the experiments have not been replicated consistently, however.

Summaries and Opinions

This chapter gives a sampling of opinions from individuals who have studied the EMF issue and from various organizations. Not everyone reaches the same conclusion.

What do EMF researchers have to say about possible health effects of occupational EMF exposure?

After nearly 20 years of research, experts are still unable to tell us for sure whether EMF exposure is safe or unsafe. Although opinions vary regarding the possible risk, most agree that more research is needed. Here is what several prominent scientists have concluded so far about the possibility that workplace EMF exposure may affect our health.

- *"The possibility of a risk exists, but it cannot be regarded as established, and it is not biologically plausible."*
Sir Richard Doll
Oxford University
May 22, 1995
- *"There are sufficient data for there to be real concern. The concern is not imaginary, (but) there's a lot to be done to understand whether certain types of exposure are more important than other types. Until we have a handle on the exposure metric and the significant exposures, we will be very much in the dark about the possible effects."*
Dr. David Bates

occupations. Floderus reported an association between estimated EMF exposure and increased risk for chronic lymphocytic leukemia. An increased risk for brain tumors was reported for men under the age of 40 whose work involved an average magnetic field exposure of more than 2 mG.

Another Swedish study by Alfredsson and colleagues (1996) found an excess risk of lymphocytic leukemia among railway engine drivers and conductors. The total cancer incidence (all tumors included) among these workers was lower than in the general Swedish population. In 1994, Floderus reported a similar finding in a study of Swedish railway workers. However, a 1994 study of Norwegian railway workers found no evidence for an association between EMF exposure and leukemia or brain cancer. Preliminary studies in Europe and the United States suggest that railway workers are exposed to comparatively strong magnetic fields at work. (See the chapter, Your EMF Environment regarding exposure assessment studies of transportation workers.)

Is there evidence that EMF exposure increases the risk of breast cancer?

Breast cancer in men

(in SLCC: Ben Franks & Larry Knowles)

The first epidemiologic evidence for an association between EMF exposure and breast cancer was for male breast cancer. In 1991, Dr. Genevieve Matanoski of Johns Hopkins University reported finding two cases of breast cancer among 900 men who worked in a central switching station of a New York telephone company. Since male breast cancer is a very rare disease (one in 100,000 men per year in the United States develop breast cancer), finding two cases in a group this small was unusual.

Norwegian researchers (Tynes and Andersen, 1990) reported that breast cancer occurred more frequently among men who worked in electrical occupations in Norway. The number of cases was small (12) but more than might be expected by chance alone. Other studies of breast cancer and electrical work have provided conflicting results. A subsequent study of men who had breast cancer (Demers et al., 1991) reported that they were more likely than a comparison group without breast cancer to have had jobs in "electrical" occupations.

In 1992, Dr. Dana Loomis at the University of North Carolina, reported that after studying death records of men in 24 states he found, in general, no excess number of deaths from breast cancer among those who had worked in electrical occupations. However, a higher than expected proportion of these breast cancer cases among electrical workers involved men who were less than 65 years old at death. In a 1993 study of cancer incidence among Danish workers, Dr. Pascal Guénel reported that in occupations with presumed intermittent or continuous EMF exposure, breast cancer developed more frequently than expected in men, but less frequently than expected in women. The results of these studies are limited because they include no workplace measurements and the investigators were unable to assess the role of known risk factors, such as family history of breast cancer, that can confound the analysis.

The three major studies of electric utility workers (described earlier in this chapter) estimated the workers' occupational exposures to EMF during the course of their careers with the electric companies. None of these studies reported an association between male breast cancer and jobs involving exposure to magnetic fields.

Breast cancer in women

Although breast cancer in men is rare, in women it is unfortunately common. The incidence rate for female breast cancer in the United States per year is more than one in 1000 (110 in 100,000).

A 1994 study by researchers at the University of North Carolina examined death records of female workers in the United States and found that women employed in electrical occupations were slightly more likely to have died of breast cancer than were other working women. However, this study did not control for confounding factors such as age at birth of first child, diet, fertility, and family history, all of which are known to affect breast cancer risk. Without this background information about the women in the study, it is impossible to know whether the apparent association with EMF exposure is being "confounded" with another risk factor that may also be common among women in electrical occupations.

In the study of Danish workers mentioned earlier, Guénel and colleagues estimated the exposure of all working women in the country by grouping jobs into high and low categories of EMF exposure. Women whose jobs were ranked in the highest exposure category did not have more breast cancer than did women who had jobs in the lowest exposure category.

Several large-scale studies are now under way in the United States and in other countries to see if women living in homes with higher EMF exposures have an increased risk of developing breast cancer. Biological studies are under way as well, examining the potential role of EMFs and melatonin in the development and suppression of breast cancer (see the chapter, Biological Studies).

Dalene's?

Could EMF be linked to other illnesses?

Conflict of interest!

California study

The California researchers, led by Dr. Jack Sahl at Southern California Edison Company (1993), studied 36,000 electric utility workers and reported no strong, consistent evidence of an association between magnetic fields and any type of cancer. Because there were relatively few cases of leukemia and lymphoma, the study was not capable of detecting very small risks, if present.

Canada/France study

The Canadian and French researchers, led by Dr. Gilles Thériault at McGill University in Montreal (1994), conducted a study of 223,292 workers at two large utilities in Canada and the national utility in France. They reported that workers with acute myeloid leukemia were about three times more likely to be in the half of the workforce with higher cumulative exposure to magnetic fields. In the analysis of median cumulative magnetic field exposure, no significant elevated risks were found for the other 29 types of cancer studied.

There were inconsistencies in the results from the three individual utilities involved in this study and no clear sign that the risk of cancer increased as the level of exposure increased. Based on their results, the researchers concluded that the study did not provide clear-cut evidence that magnetic fields caused the elevated risks found for leukemia and brain cancer. However, they observed as "noteworthy" the fact that the leukemia and brain cancer results did agree with results from certain previous studies. In a later analysis, the authors reported an association between exposure to short bursts or spikes in the magnetic field that were not in the ELF power-frequency range and increased risk of lung cancer. No other data support this finding, however, and the researchers are uncertain about the exposure data on which it is based.

North Carolina study

In another major study involving more than 138,000 utility workers at five electric utilities in the United States (Savitz et al., 1995), the authors concluded that the results "do not support an association between occupational magnetic field exposure and leukemia, but do suggest a link to brain cancer."

Do electrical workers have higher EMF exposures than other workers?

It is difficult to compare electrical workers' EMF exposures with those of other workers because there is less information about EMF exposures in work environments other than electric utilities. The early studies did not include actual measurements of EMF exposure on the job. Instead, they used job titles as an estimate of assumed EMF exposure among electrical workers. Recent studies, however, have included extensive EMF exposure assessments.

A report published in 1994 by Dr. Stephanie London and colleagues provided some information about estimated EMF exposures of workers in a number of electrical jobs in electric utilities and other industries. The study showed that in Los Angeles, electrical workers did have higher EMF exposures than workers in other jobs. For this study, the category "electrical workers" included electrical engineering technicians, electrical engineers, electricians, power line workers, power station operators, telephone line workers, TV repairers, and welders.

EMF Exposures of Workers in Los Angeles		
Job Type	Electric Field*	Magnetic Field*
Electrical	19.0 V/m	9.6 mG
Nonelectrical	5.5 V/M	1.7 mG

* The table displays the mean measurements (the sum of all measurements in a sample divided by the number of measurements taken).

Source: London et al., 1994

The study showed that in Los Angeles, electrical workers had higher EMF exposures than workers in other jobs.

Have studies suggested a link between EMFs and cancer in other industries?

One of the largest studies to report an association between cancer and magnetic field exposure in a broad range of industries was conducted by Dr. Birgitta Floderus, a researcher at the Swedish National Institute of Working Life. The study included an assessment of EMF exposure in 1015 different workplaces in Sweden and involved over 1600 people in 169 different

What happens when I am exposed to EMFs?

Electric fields

A person standing directly under a high-voltage transmission line may feel a mild shock when touching something that conducts electricity. These sensations are caused by the strong electric fields from the high-voltage electricity in the lines. They only occur at close range because electric fields are easily shielded or weakened by buildings, trees, and other objects that conduct electricity.

Magnetic fields

Alternating magnetic fields produced by AC electricity can induce weak electric current flow in the body. However, these currents are typically much smaller than those produced naturally by the brain, nerves, and heart.

How do we define EMF exposure?

No one knows which aspect of EMF exposure, if any, affects human health. Many questions must be asked when gathering information about EMF exposures:

How strong is the EMF?

Field strength (or magnitude) may be an important aspect of EMF exposure to consider, but it may not be the only one.

How long does the exposure last?

Does the EMF source operate continuously? How long are you near that source?

When does the EMF exposure occur?

The time of day, point in a person's sleep/wake cycle, or even stage of life may be important.

What is the frequency?

The frequency measured in hertz (Hz) tells us how many times the current changes direction or cycles in 1 second. A mixture of different electromagnetic frequencies is often present in work environments.

How consistent is the exposure?

It may be important to measure the intermittency of the exposure-how often or how much your exposure changes over time. Our bodies adapt to continued exposure but may need a certain amount of time at a steady exposure to respond or adjust.

Are there any short bursts or spikes in the field?

During our workday, most of us experience very brief bursts of EMF exposure when electrical equipment is turned on or off (see the chapter, Your EMF Environment). Research is under way to see if such transient exposures are important.

What is the average field strength?

With cancer-causing chemicals, a person's average exposure over many years can be a good way to predict their chances of getting the disease. So, in occupational EMF studies, the information reported most often has been a worker's EMF exposure averaged over time. This may not, however, be the only or the most important aspect of EMF exposure to consider (see the chapter, Your EMF Environment).

There are different ways to calculate average magnetic field exposures. One method for determining an individual's average exposure involves having the person wear a small monitor that takes many measurements over a shift, a day, or longer. Then the average of those measurements is calculated. Sometimes averages are calculated for people with the same occupation, working in similar environments, or using several brands of the same type of equipment.