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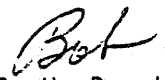
MINUTES OF IEEE-SSITADCOM MEETING  
HELD OF EMPIRE STATE COLLEGE  
IN NEW YORK CITY ON SEPTEMBER 9, 1989

- 0 President Balabanian reported that the SSIT Conferences in Los Angeles, scheduled for October 20-21 would cost about \$32K. The conference committee expected to raise the money from admissions and from the L.A. Council (a group of IEEE sections in L.A.)
- 0 TAB raised some questions about the Technology and Society (T and S) June issue that had an article on the history of electrical vibrators.
- 0 S. Unger (not present) is working a ballot for the next SSIT ADCOM meeting.
- 0 There was a discussion of the Paul Brodeur New Yorker series on <sup>electrostatic</sup> ~~r.f.~~ hazards.
- 0 There was no Treasurer's report, however; since the current IEEE cost report has not been received at the time of this writing, it is difficult to assess the exact current financial position.
- 0 R. Brook gave a liaison report on the forthcoming 1990 EMC Symposium.
- 0 P. Lubell gave a liaison report on the current "Hi-Tech" developments in the U.S. that are meant to compete with Japan for the Committee on Communications and Information Policy. This report will be an article in a forthcoming edition of T and S.
- 0 Arthur Goldsmith gave several reports, including one on the IEEE's official view of SSIT, which was quite positive from a need standpoint, but noted that the financial reserve of SSIT was \$9.70/member and the average IEEE society had \$63.49/member. This matter is being referred to TAB OPCON and the IEEE BOD.
- 0 TAB is to be restructured. It will have an administrative council consisting of 5 members and 5 Society presidents. This will probably not affect the various Societies operations.
- 0 There will be a restructuring of the volunteer organizations and a streamlining of the IEEE BOD and an effort to give a greater voice within each county and entity. USAB may become IEEE-USA. This would relieve the IEEE BOD of problems concerning local details.
- 0 The current IEEE positions on standards is in confusion because of the conflicts between the US standards versus worldwide standards. This will be discussed in a forthcoming issue of the INSTITUTE. This discussion is well received by countries with weak local engineering organizations, but not too well received by countries with strong organizations.

MINUTES OF IEEE-SSITADCOM MEETING  
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- 0 Awards Report - No current candidates .
- 0 Christine Specter reported that she is working on a special T and S issue for Dec. 1990 on the International Space Year (ISY).
- 0 An ISY conference that will be part of the International Geoscience and Remote Sensing Symposium to be held in May 1990.
- 0 G. Rabow gave the Publications report and said that the September T and S issue will be late; however, the December issue will be on time. There will be one or more issues in 1991 on the history of electro-technology.
- 0 Membership Report - Membership stabilized at 2419 active members, which shows some improvement, and 619 members in arrears.
- 0 Chapter Report - IEEE members in Toronto, Canada is setting up an SSIT chapter.
- 0 Senator Albert Gore is sponsoring a bill to establish a government sponsored computer network.
- 0 The IEEE is setting up a committee to look at EMAIL for TAB.
- 0 Next meetings are scheduled for: December 9, 1989, and March 10, 1990.

Respectfully Submitted

  
R. H. Brook  
EMC/S Liaison

7  
INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS  
SOCIETY ON SOCIAL IMPLICATIONS OF TECHNOLOGY  
OTHER SOCIETY LIAISON

6624 Kirby Court,  
Falls Church, VA  
22043  
Dec. 9, 1989

Norman Balabanian,  
President, SSIT-IEEE,  
Electrical Engineering Dept.,  
111 Link Hall,  
Syracuse University,  
Syracuse, NY  
13210

Subject: Other Society Liaison

Technology and Society Division, American  
Society of Mechanical Engineers:

On Monday, Sept. 11, 1989 I attended a meeting of the Executive Committee in Washington, D.C., and presented a page and a half report of the activities of SSIT. The committee showed an interest in the IEEE Code of Ethics and copies were Xeroxed and distributed at the meeting. At the request of the committee a short time later I submitted some examples of ethical judgements and dilemmas in recent IEEE literature.

Computer Professionals for Social Responsibility: (CPSR)

On Oct. 20 and 21, 1989 the ~~IEEE~~ CPSR hosted its fifth annual conference which was held in Washington, D.C., at the George Washington University. I did not attend because of a prior commitment to attend the national convention of The Tau Beta Pi Association at the same time in Columbia, SC, as a delegate for the local alumni chapter. Lance Hoffman, a member of the SSIT and a member of the faculty of George Washington University has been an active participant in the recent local SSIT-CPSR joint meetings. The workshop was entitled, "Local Organizing for Professionals."

National Association for Science, Technology and Society: (NASTS): As a member I receive their publication, NASTS NEWS. As mentioned in my report of Sept. 9, 1989 the Fifth Technological Literacy Conference and Annual Meeting will be held in Crystal City, Arlington, VA, on Feb. 2-4, 1990. The contact point is Franz Foltz, NASTS, 117 Willard Building, University Park, PA, 16802.

Section X, Societal Impacts of ~~Sci~~ Science and Engineering, American Association for the Advancement of Science (AAAS).

When I learn the results of the recent election I will establish liaison with our newly-elected counterparts. As a member of Section X, I am on the distribution list for their quarterly "Professional Ethics Report".

Note from the Chapters Report of this date that

Other society liaison continued:

the AAAS provided us with a speaker, Dr. Mark S. Frankel, for the SSIT NV/B/W Chapter meeting on Sept. 13, 1989.

American Engineers for Social Responsibility: A short time ago I received a copy of their latest newsletter. So far I have not been able to establish liaison with this organization.

Government Accountability Project: Back on Jan. 16, 1986 Louis Clark of this organization spoke to the NV/B/W Chapter of SSIT. I continue to be on the distribution list for their literature.

Respectfully submitted,

*Vernon E. (Veg) Gardner*  
Vernon E. (Veg) Gardner,  
AdCom Member, SSIT  
(703) 533-0999

cc:

J. Malvern Benjamin,  
Secretary, SSIT-IBEE,  
5446 Wayne Ave.,  
Philadelphia, PA  
19144

12/9/89 Mtg.

(1)

4. ~~report~~ <sup>Validator -</sup> 2 person subcommittee appointed to review TBS ~~to reviewing procedures~~ to "legitimacy" of the article. Reported article was legit & O.K. also. At latest TAB mtg. Nov 89 the motion to investigate SSIT was rescinded.
5. Magazine Monitoring Comm. - ad hoc. ~~has~~ become members. Will be looking at our TBS. ~~May~~ Patricia Walker is newly appointed IE<sup>3</sup> staff to work on this.
6. N.B. reported other members of TAB as well as Apter say we can get no useful info from H.G.
7. Gardner report ~~to Brooks EMC AERS~~ - Jathrow suggests TBS link. ASME 611T is sponsoring an ethics conf.
- 9.3 Brooks. Also O respchuck - Brooks discussion
- 9.1 ~~Barus~~ Barus. "Institute" reported an organization since 7/89

Whittleblower Award

2 possibilities: forest from Martin Thirkol

Whittleblowers - Comanche Peak Nuclear Reactor has several ~~to~~ she's investigating.

Jathrow suggests TBS interview <sup>SSIT member</sup> ~~anyone~~ who gets on award or is elected a fellow.

Cassedy suggested Wertheimer. N.B. against because she was not at risk. Jeff says heavy time and economic contrib. is qualifying. Steve thinks ~~this~~ her effort is too far afield. O respchuck says N.G. because her work is still in question.

- 9.1 or 9.11 Robbin moved Unger 2nd passed unanimously that ~~changes~~ in addition to awards definitions be accepted. (2nd vote)

9.2 Christine - Publication plans are progressing on schedule on disarmament. 3 prominent workers are going to ~~write~~ submit papers. ~~IE~~ Paper call is being published in several IE<sup>3</sup> journals. N.B. will see that Zelby ~~receives~~ <sup>contacts</sup> the 2 special editors of the 1<sup>st</sup> edition. IE<sup>3</sup> staff  
 Jeff: Sept issue should be out in Dec. ~~Dec issue~~ has nothing so far on Dec issue. ~~Actual~~ Publication process is in "rapid state of change" - but nothing is seen at the output yet. N.B. ~~says~~ <sup>reports</sup> Walschell assured him there is more than enough mtl for Dec issue

9.3 Christine - Intl Geoscience <sup>& Remote Sensing</sup> Symposium ~~to be in~~ <sup>Greenbelt MD</sup>  
 held in D.C. Many prominent intl speakers are lined up.  
 5/20-24/90 Social implications of ~~the~~ in 3<sup>rd</sup> World countries.  
 Expecting 700-800 attendees  
 Last mtg of Div IX members. Now present as  
 Chron. Conference Comm. - appointed by N.B. at this mtg.  
 Much discussion of their request for \$5K from us to hedge underwrite the Proceedings Pub. Voted that we ~~should~~ must 1<sup>st</sup> get ~~an~~ accounting of their expenditures and budget. Mal will find appropriate references in '88 minutes approving our contribution.  
 Deepchub moved & Barus seconds "N.B. is authorized to ~~spend~~ <sup>contribute</sup> up to 1.5K without further ADCOY discussions. Beyond this, it will be brought up at next ". Passed.  
 Christine suggests attending ~~a conference on the marketplace on~~ conferences organization.

9.4 Jock <sup>handwritten</sup> report . . . Discussed ~~report~~ updating our brochure.  
Will try to have it done gratis, otherwise will postpone.

~~9.5~~

9.5 Stephen - nominations have been turned ~~in~~, in.  
A lo reported on <sup>committee mtgs.</sup> further ~~work~~ on the Ethics Code  
BOD reviews with Emerson Pugh, Bertolli, and  
others. Some of his recommendations were accepted,  
but he lost the "First amendment" battle.  
The draft now goes back to the BOD.

Rabbi nominated and Unger seconded N. B. pres & Al Wall  
V.P. " by acclamation.

9.6, 9.7. Veg reports

9.10 ~~3/17/90~~ ~~3/3/90~~ 3/17/90, 5/19

9.14 3:30P

9.4

1

When Membership as of Nov 1987  
 is 2500 - this approximately  
 the same as in 1985. are  
 amount was needed to  
 maintain due to the IEEE  
 bookkeeping method.  
 The comparison must be  
 made against the same  
 month of the previous year  
 actually we are not doing  
 in membership  
 We must handle SSIT  
 to a greater extent by  
 distributing all brochures at  
 IEEE 8500th conference,  
 and at local meetings,  
 this must be done by individual  
 chapters.

2

Not Budget is illustrated by  
 letters from Austin, Biddle,  
 regarding distributions  
 of the 8500th brochure at  
 the SSIT conference in San  
 Angelo  
 read like  
 that, Bill Hunter, read  
 packages of the brochure  
 to each SSIT chapter during  
 they sought to procure  
 for our chapters claim to  
 provide the brochure  
 as appears in their local  
 and  
 additional copies of the  
 brochure may be obtained  
 from IEEE Handbook  
 Dept. 3000 Order -  
 or Call 1-800-577-IEEE

3

about 2 months ago  
 I received a phone call  
 from Al Cole. Div's representative  
 of the Membership Div. came  
 He was interested in our  
 Brochure - are we updating  
 it, and what we are  
 doing for membership. He  
 was planning a meeting  
 with Bill Hunter - IEEE  
 Membership Div. Come  
 I saw the following to  
 him  
 1. letters to members on dues  
 2. " from Tony Ruffe to  
 Society Editors  
 3. letters for use by editors  
 for promoting SSIT  
 membership  
 He offered to order some  
 Society editors for inclusion  
 our letters or parts of it as  
 I am aware of your letter,



**OVERVIEW OF 60 Hz EM FIELD SCARE**

by

**John M. Osepchuk  
Raytheon Research Division  
Lexington, Massachusetts**

## O U T L I N E

### I. PAST HISTORY

- A. Microwave Scares of 1968-1982
- B. The Zapping of America
- C. Radiophobia Syndrome Caused by Existence of Poor-Quality Research Which Feeds Media Misinformation Which Leads to Public Distrust and Confusion.
- D. Rebuttal by IEEE-COMAR, EEPA, and Individual Scientists cf. papers by Pickard, Foster and Guy, Foster and Pickard.

### II. RECENT RESEARCH ON 60 Hz BIOEFFECTS

- A. Review by Carstensen
- B. Mostly Negative Effects
- C. Epidemiology Suggesting Cancer Link; Wertheimer, Savitz, Milham.
- D. Laboratory Research Suggesting Low-Level Non-Thermal Effects; Adey, Blackman, Liboff.
- E. Rebuttals by Cole, Michaelson, and Others

### III. RECENT MEDIA EVENTS

- A. New Yorker Articles by Brodeur
- B. Educational Brochure by Granger Morgan
- C. OTA Report by G. Morgan et al.
- D. Currents of Death (Simon and Schuster 1989) by Brodeur

Brodeur alleges hazardous exposure near utility distribution lines, certain radars and VDTs—but exempts appliances other than electric blankets. Alleges cover-up and calls for field reduction from these sources.

Scare continues in various media, including warning on electric blankets in Consumer Reports. Writings of Morgan et al. suggest science on this subject is high-quality but complicated. Admits no definitive evidence of hazard but proposes policy of "prudent avoidance," just in case alarmists are correct.

Utilities accept Morgan's assessment of science but oppose policy of "prudent avoidance."

#### IV. APPLIANCE ITEMS

- A. Development of General AHAM Policy on this Issue
- B. New Proposals for Product Redesign for Reduced Field Exposure to Consumers
- C. Two Viewpoints to be Published in Appliance

#### V. CAMPAIGN FOR RATIONAL ACTIONS

##### A. Rebuttal of Brodeur; COMAR Review; EEPA Briefing Paper

1. Reference to historical disposition of past scares by Brodeur and others.
2. Reference to proposed safety limits by established groups like ANSI, NRPB, and IRPA.

Proposed safety limits are well above 1000 milligauss. Existing exposures typically are in the range of 0.1 to 10 milligauss even for electric blankets.

3. Basis for exposure parameters confused, especially if credence is given to concepts of "windows" and role of "intermittency."
4. Existing exposure sources not well understood by public. Brodeur and others selective in alleging hazards. Ignored sources include electric trains, and various special-purpose appliances, furniture, and electronic equipment.
5. Groups defending use of present 60 Hz technology include FDA, utilities, industry in general, EEPA, professional societies, and the military.
6. Costs to society of adopting "prudent avoidance" are not only monetary (product costs, utility rates, or taxes passed on to the consuming citizens), but also in mental health—that is, unnecessary fears which could cause tragic acts like abortions, etc. The moral and ethical position is to insist on science as the basis of public policy in this matter. This objective can be attained only by a patient refusal to accede to some modern "risk communicators" who suggest public perception as the basis for public policy.

## REFERENCES

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2. Foster, K. R. and Guy, A. W., "The Microwave Problem," Scientific American, 255, pp. 32-40, Sept. 1986.
3. Foster, K. R. and Pickard, W. F., "Microwaves: The Risks of Risk Research," Nature 330, pp. 531-532, Dec. 1987.
4. Carstensen, E. L., Biological Effects of Transmission-Line Fields (Elsevier, New York) 1987
5. EEPA, Proceedings of 1988 and 1989 Annual Meetings and Annual Short Course.
6. Brodeur, Paul, Currents of Death (Simon and Schuster, New York) 1989.
7. Morgan, M. G., Electric and Magnetic Fields From 60 Hertz Electric Power: What Do We Know About Possible Health Risks? (Department of Engineering and Public Policy, Carnegie-Mellon University, Pittsburgh, Pennsylvania) 1989.
8. Nair, I.; Morgan, M. G.; and Florig, H. K., Biological Effects of Power Frequency Electric and Magnetic Fields (Office of Technology Assessment, Washington, D.C.) 1989.

## ELF MAGNETIC FIELDS BIOEFFECTS: RESEARCH PRIORITIES

It has been suggested that magnetic fields comparable in magnitude to those which we experience in our normal domestic and industrial environment may cause, promote or enhance the development of cancer. The fear of such a possibility has already had a profound effect upon utilities and regulatory agencies. A rapid resolution of the question is essential. If true, the phenomena must be studied intensively to determine the best methods to protect the public health. If there is no basis to the suggestion, such measures need not be taken and our limited resources can be devoted to the solution of real problems.

To summarize the scientific information on the subject (1) Sufficient numbers of epidemiological studies have been reported to demonstrate that if magnetic fields do cause cancer, the effect is so subtle that epidemiology does not have the power or sensitivity to detect it with reasonable certainty. When Savitz and Calle (1987) combined all of the studies available to them on the relationship of leukemia to occupation, the results barely approached the level of statistical significance. Of some 9 studies which have investigated the relationship between magnetic fields and cancer in the domestic environment, all but three are clearly negative and the Savitz (1986), Tomenius (1986) and Wertheimer (1979, 1982) studies are of limited usefulness. The inherent problems of all epidemiological research, compounded here by the pervasive nature of magnetic fields, makes it nearly impossible to identify populations which have sufficiently different exposure levels to make further investigations worth the vast resources which would be needed for their design and execution; (2) Under more precisely controlled laboratory conditions, there is no clear evidence that a.c. magnetic fields comparable in level to those of transmission lines cause any effect in mammals; (3) Out of the whole body of literature which is relevant to this subject, a small collection of very recent, related reports demand special consideration. Although their claims appear to be conflicting, they bear on the fundamental question of whether magnetic fields have any effects on mammalian systems. This is a fundamental question which must be answered if we are to deal with the much more specialized question of cancer.

These studies are summarized in the attached Table. Both normal and malignant cells are involved. In contrast with much of the literature on biological effects of ELF electromagnetic fields (Carstensen, 1987), the magnitudes of many of the effects reported in the Table are large. A few of these studies have been replicated internally. Only one study has been subjected to independent confirmation. [M.M. Cohen (1987) was not able to find the effect claimed by Phillips *et al.* (1986) and Winters (1986).] In a general sense, the results of the group of studies appear to be conflicting. At this stage, it would be difficult to formulate a postulate which could unify the claims of all of the studies. Almost certainly some of the claimed effects are not real. However, if it turns out that even one of these reports can be substantiated, it puts a completely new perspective on the question of whether magnetic fields can cause biological effects at frequencies and levels commonly experienced in our homes and places of work.

Each of the studies in the Table should be replicated by at least two independent laboratories. If any replicate shows a statistically significant effect, standard procedures should be followed to make certain that the effects are real and related to the field exposure: (1) Additional replicates should be performed, (2) Biological response as a function of magnitude of exposure should be determined, (3) The relevant physical characteristics of the exposure should be elucidated [e.g., determine whether the effect depends directly upon the magnetic field effect or only indirectly through the induced electric field; determine the frequency dependence] and (4) The biological and biochemical conditions necessary to produce the effect should be determined. Determining whether an effect is real requires learning the biophysical mechanism of the action of the exposure at least at a rudimentary level. These replicate studies should be undertaken in parallel. In any event, a minimum of two replicates should be performed on most of the reports in the Table.

Edwin L. Carstensen

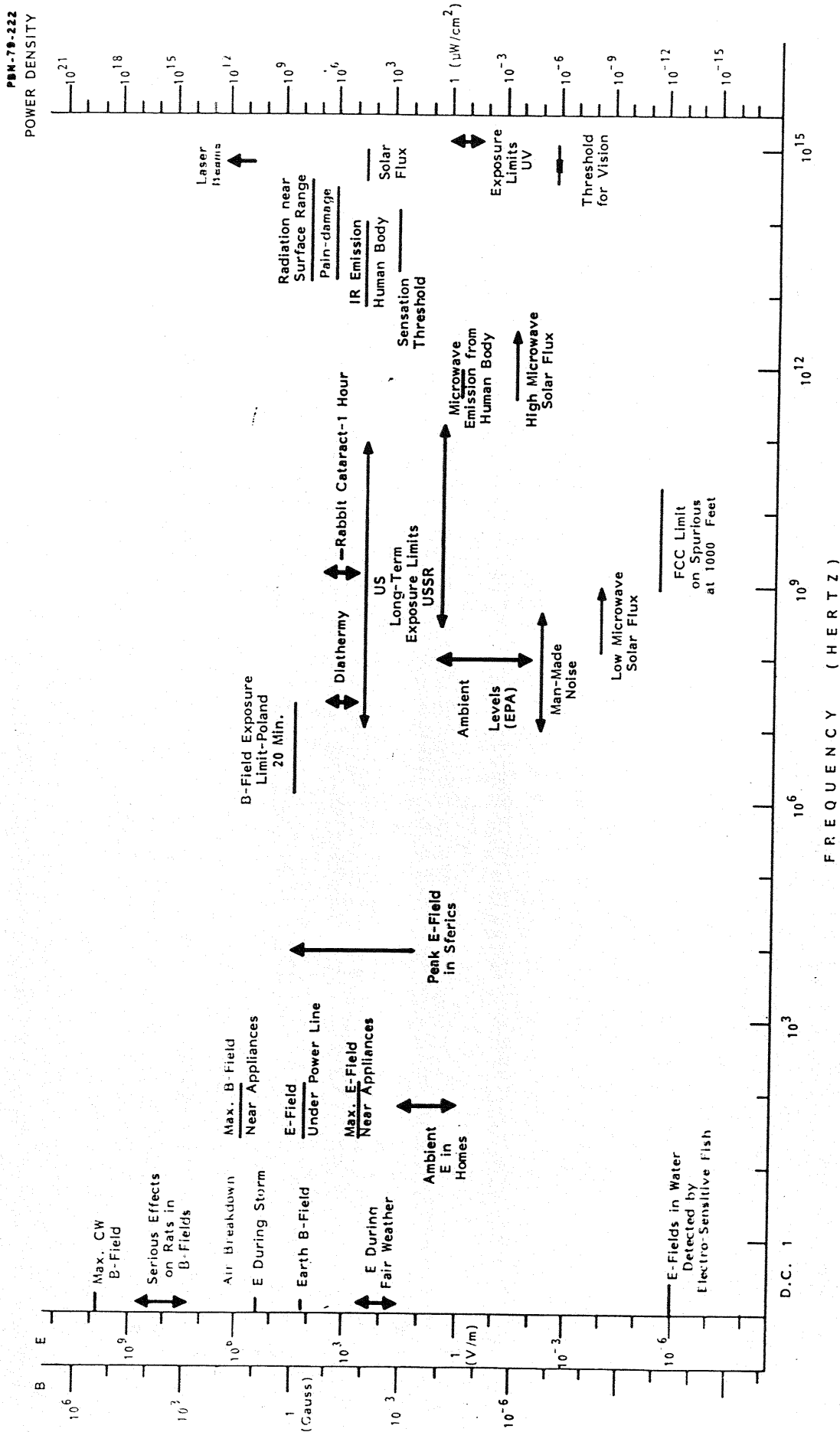
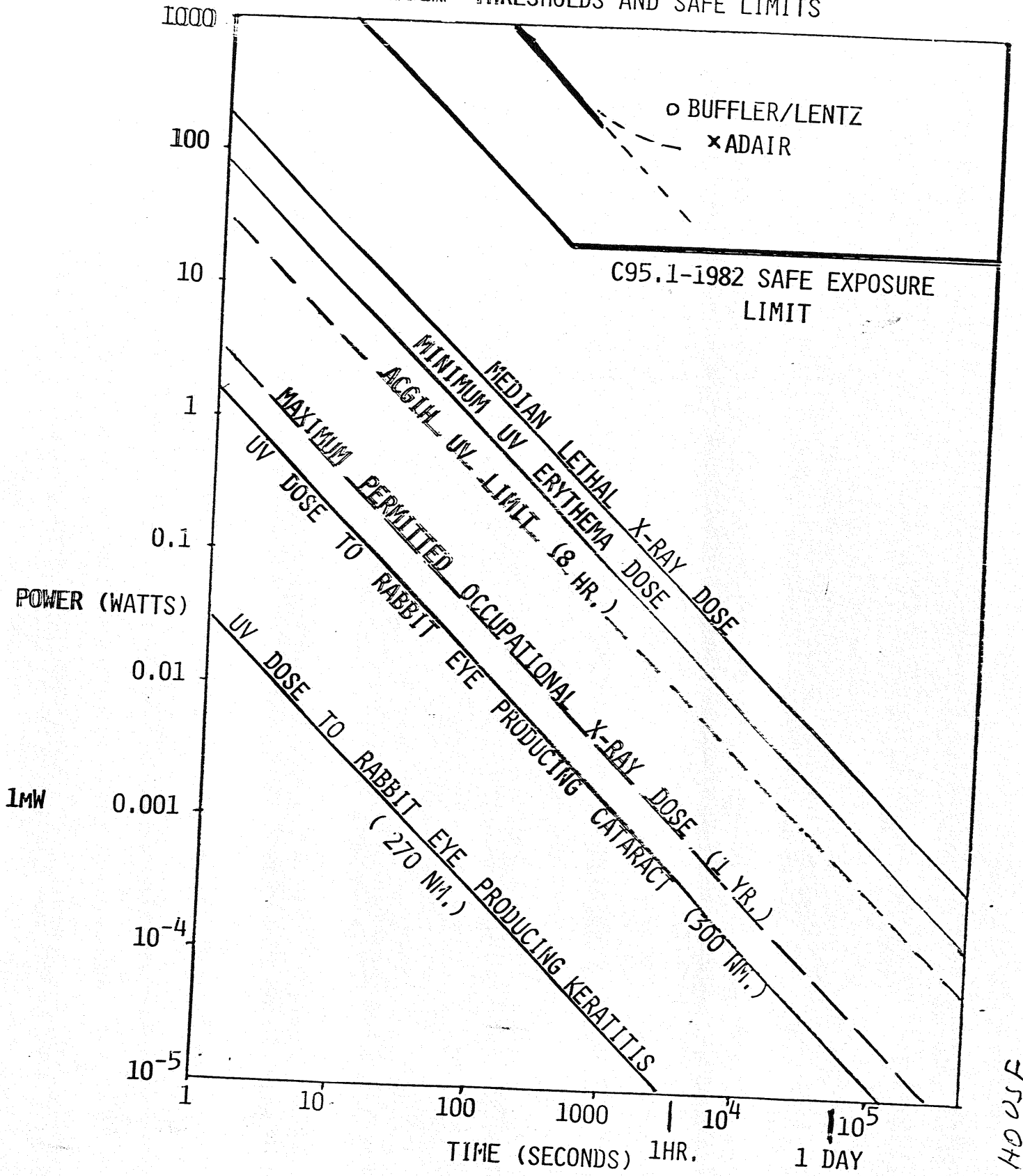


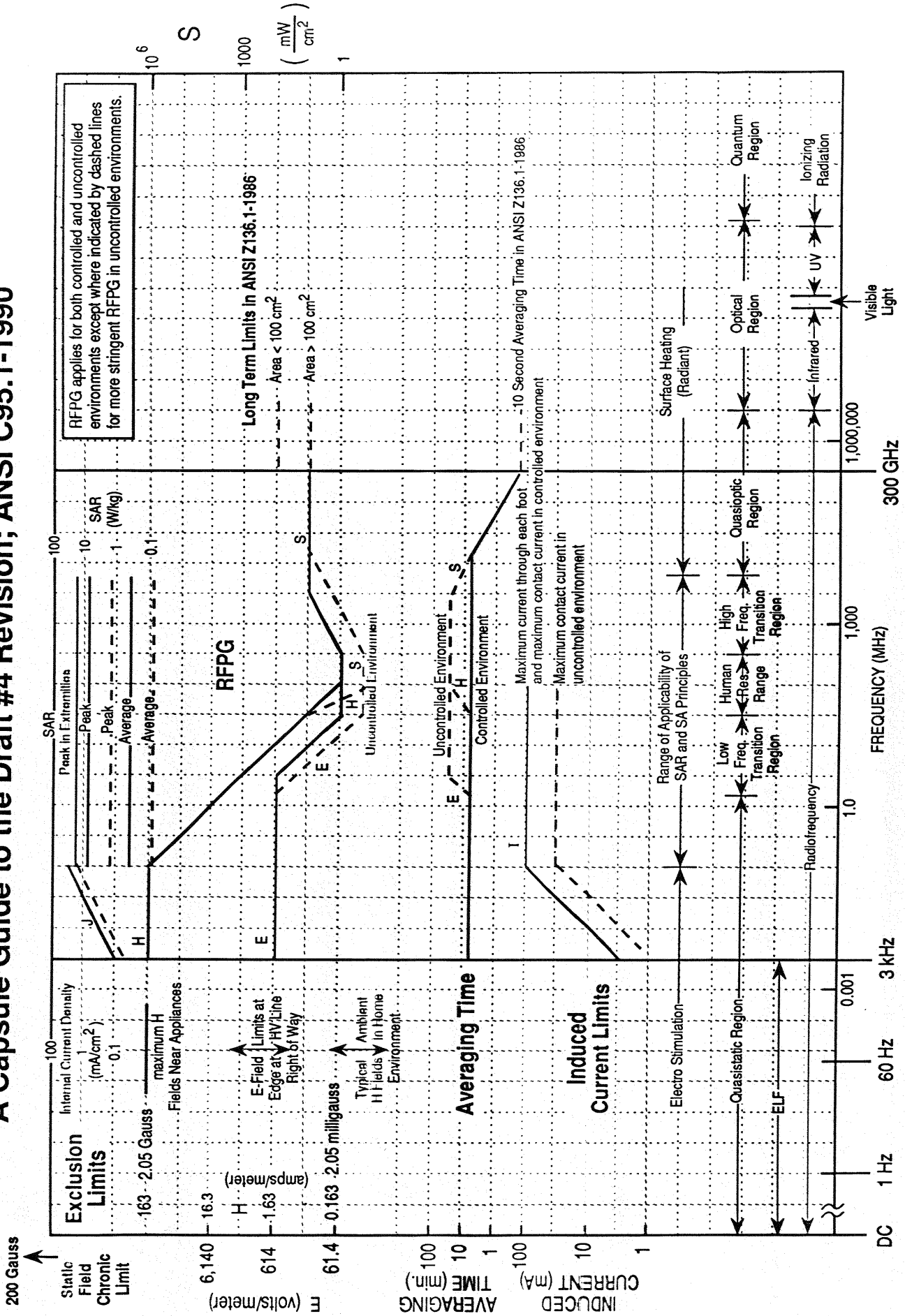
Fig. 10. A map of intensity benchmarks across the nonionizing radiation spectrum. The E and B scales are adjusted to correspond to the far-field values for radiation at power density shown on the right scale.

# RADIATION THRESHOLDS AND SAFE LIMITS



THEN HOUSE

# A Capsule Guide to the Draft #4 Revision; ANSI C95.1-1990





Panoramic photography, Lawson said, is a "paradoxical sport."

"It creates a cohesive image that a viewer can perceive as being peripheral," he said. "The viewer of my photograph sees not only what is in front of him or her but what lies on

Cities are savable when you look at them from this perspective. We're not going to desert our cities.

"When you look at it like this, I suppose I'm a documentarian more than anything else. I'm recording living history."

# A disturbing study of power lines and cancer

By Ray Murphy  
GLOBE STAFF

Something new to scare you. Paul Brodeur is rattling the chains here as he uncovers environmental threats to the bodies of our children, and to us. This time out it is low-level radiation flowing through us via electric power lines, electrical transformers and video display terminals, as well as various household appliances, including electric blankets, toasters and dial-face plug-in electric clocks.

Brodeur, an environmental reporter for The New Yorker, has previously wielded his sharp-edged pen against environmental hazards posed by asbestos and ozone depletion. Here he's after something ubiquitous that's never been considered much of a problem. Brodeur shows us it should have been so considered.

His reports on the increased incidence of cancer in children include a Colorado study that appeared to show that children in houses near overhead electrical lines died of cancer at twice the rate of children in houses only a short distance away. This study is the most dramatic one cited.

The study was done in Colorado by Nancy Wertheimer, a particularly persistent epidemiologist and a contender as our next great environmental heroine. In her independent study she found an inordinate number of leukemia cases in houses near electrical transformers. The transformers are the cylinders, attached to power poles, that reduce the amount of current coming into your house, and into your body.

Wertheimer argues that magnetic field exposure, caused by the transformers, was associated with the higher incidence of childhood cancer. To support her contention she cited a 1950 study that showed that telephone linemen, subway operators, electricians and welders developed cancer at a higher rate than the general population.

There are some bright spots here. Brodeur cites a grass-roots movement in South Seattle, Wash., that stared down a power company's attempt to build a pair of high-voltage lines on either side of a street.

A protest group led by a retired Teamster made the point that the radiation from the lines would put persons near the wires in danger of

**Brodeur, an environmental reporter for The New Yorker, is after something ubiquitous that's never been considered much of a problem.**

## CURRENTS OF DEATH

Power Lines, Computer Terminals and the Attempt to Cover Up Their Threat to Your Health

By Paul Brodeur

Simon and Schuster, 333 pp., \$14.95.

a steady bombardment of current and electromagnetism. The groups also threatened lawsuits in the case of the physical damages they expected would occur. The company dropped the idea.

Brodeur also brings disturbing tidings about the video display terminals that are dominating offices throughout the country. He faults manufacturers who have been remiss, he says, in failing to measure or to give information about the magnetic fields emanating from the machines. The average office terminal, Brodeur says, gives off X-rays, most of them absorbed by the machine, and also ultraviolet, visible light, radio waves, microwaves, Very Low Frequency and Extremely Low Frequency waves, and a static electrical field. He also cites the incidence of miscarriages and abnormal births suffered by VDT operators.

Much of the book is devoted to Brodeur's righteous anger against those agencies that should be defending us - the various government regulatory agencies, as well as scientific research groups aided by government grants that all too often appear to be toadies for the military, big contractors and politicians. In an age of political mendacity and moral poltroonery, Brodeur maintains his indignation.

Critics of Brodeur claim he has yet to make an incontrovertible case about the dangers of electromagnetism. That may be true. But he has certainly thrown up some reasonable causes for alarm and given citizens occasion for indignation and anger.

## 11 THE BOSTON GLOBE BRINGS TEACHERS

# WHALES!

Parents understand what huge means? at extinction means forever?

16-page, mini-newspaper for kids in grades 4 to 6. The Boston Globe Newspaper in Education Program's answer. Look at the watery world of whales written by Sylvia Orlin, a regular contributor to The Globe's Health & Science section. This mini-newspaper will explore whale family life, and how they have changed from hunters to conservers.

It includes information on how interested children can help protect the right whale, the Commonwealth's officially designated whale, through the New England Aquarium program.

With drawings and photographs, WHALES also includes classroom activities and fascinating whale facts that will interest parents and kids.

How to order: The Boston Globe through the Education Program at the rate of 20¢ per copy, (mini-newspaper) and we'll deliver an equal number of WHALES free of charge. Order by December 11.

Place your prepaid order by December 1. So make it out to "The Boston Globe," with your home and school address and send it to: The Boston Globe, Box 2378, Boston, MA 02107-2378. Or call 617-264-2646 between the hours of 9 a.m. and 5 p.m.

## The Boston Globe

Boston, MA 02107

12/1/89

Wash Post

ism or any of the other isms so routinely filed these days by occupants of the ivory tower.

The result is not merely that *Satisfaction Guaranteed* is mercifully free of cant but that Strasser's careful research and her usually careful interpretation of it are objectively presented; it may speak volumes about the current state of American social history and criticism that readers should be grateful for this, but grateful we certainly must be. The clarity, equanimity and good humor of *Satisfaction Guaranteed* are, collectively, a cool breeze in a time of hot air.

Strasser has taken on, in the relatively brief space she has allotted herself in this book, a large and complex subject: the transformation of the American economy, and thus the American culture, from individual to mass production; the creation of an expanding market that was not defined by supply and demand but shaped by energetic manufacturers who understood that markets could be developed; the ever-changing relationship between manufacturers, wholesalers and retailers; the development of three genuinely new merchandising forms: the department store, the mail-order house and the chain store; and, ultimately connected to all of these developments, the transformation of advertising

motif—its many illustrations include ample, and revealing, reproductions of late-19th- and early-20th-century newspaper and magazine advertisements—she shows how we have evolved into a consumer culture in which the creation of demand is central. As a speaker told the Nashville Ad Club in 1916: "It is all very well to get the sales of things that people want to buy, but that is too small in volume. We must make people want many other things, in order to get a big increase in business." Or, as Strasser puts it elsewhere:

"The new marketing principles concerned broad cultural issues. They involved conceptualizing the market as dynamic and malleable, constantly changing as new products were incorporated into people's daily lives. The demand for candles, Ralph Starr Butler pointed out in a 1914 textbook, 'is not keeping up with the increase in population, because newer methods of illumination are driving candles from the field.' Nearly all such new technologies, Butler explained four years later, started as luxuries. At the beginning, there was not much demand for automobiles, phonographs, tractors or typewriters. The far-seeing manufacturer, he declared, will refuse to limit his vision to the expressed demand for his product, and will find in the field that he wishes to cover,

modern America: the transformation of supply into demand. In fascinating detail, Strasser shows how clever marketing and advertising turned radically new inventions into staples of the marketplace. Gillette razors, Kodak cameras, Crisco shortening, Waterman fountain pens, Ivory soap, Wrigley gum, Kellogg cereals—at the time of their introduction all of these products were new, unfamiliar, even alien, so it was the job of the manufacturers and their advertising agents to create a market for them. This they did, and in so doing established the principle of the ever-expanding market that is the bedrock upon which the entire consumer culture, not to mention the entire American economy, ultimately rests.

"The creation of modern American consumer culture," Strasser writes, "involved not only introducing new products and establishing market demand for them, but also creating new domestic habits and activities, performed at home, away from stores and outside the marketing process." It is no exaggeration to say that in order to remake the marketplace, we had to remake America. Whether we did so for better or worse is a question that will be debated until, and no doubt beyond, the millennium, but by and large Strasser refrains from judgments either positive or negative. She knows that it

systemic level," she writes, "economic growth through marketing-driven production is fueled by waste: extravagant packaging, disposables, planned obsolescence and styling changes that create markets for replacement products," and she adds:

"The significance of the historical process of market creation, described in this book lies in its location at the intersection of public and private life. The ecological consequences of unlimited market creation demand a public discourse about matters generally considered private: the things people buy and use every day, the ways they spend their time, the ways they perceive their needs. Although personal, our buying habits are not wholly private: they have public sources and public consequences."

The strategies for dealing with this complex, pervasive problem "must come, not from the sum of individual choices in the marketplace, but from a political process that addresses inherent conflicts and competing interests." In other words, we're all in this mess together and we all should have a voice in how, if at all, we are to resolve it. In saying this Susan Strasser is making no political statement: she is merely asking us, as she does throughout this excellent book, to face reality.

# High Tension, High Anxiety

on dying lakes and forests; the ocean is regurgitating the filth from our cities; toxic fumes percolate up from forgotten waste dumps beneath our homes; lead is in our water and Alar on our apples; we are being smothered by a thickening blanket of carbon dioxide, while chlorofluorocarbons are eating a hole in the ozone.

Now, in *Currents of Death*, Paul Brodeur warns that the fields produced by ordinary 60-Hertz electric currents, perhaps the most ubiquitous of all our environmental alterations, may be adding our brains and inducing leukemia in our children. If we have learned anything in recent years, it is that we cannot take such warnings lightly, or accept uncritically the soothing reassurances of authorities.

But, before you switch to candles, you might want to get a second opinion. Industrialization, after all, has not shortened the average life. On the contrary, life expectancy has just about doubled since the industrial revolution began—and the increase has been most rapid since the advent of electrification.

Brodeur, a longtime staff writer for the New Yorker, begins his expose in 1976, when a "free-lance epidemiologist" in Denver concluded that childhood victims of leukemia often lived near power transformers. Such studies can be the first step in identifying risk factors: the relationship between smoking and lung cancer, for example, or between dietary sodium and hypertension. The epidemiologist looks for patterns in the incidence of a disease that would indicate a link with

environmental factors.

At times, however, people imagine patterns where none exist, much as we see familiar shapes in Rorschach blots. Scientists try to guard against attributing significance to chance occurrences by repeating their measurements and by designing controls that minimize unintentional bias. But even eminent scientists have had their careers tarnished by having had the misfortune to observe some coincidence that was so compelling that they were thereafter unable to free themselves of the conviction that it was significant. Moreover, because people tend to see what they expect to see, a false report by a respected colleague often carries other scientists along on the road to ignominy.

Following the news—Continued on page 13.

**IRRENTS OF DEATH**  
Power Lines, Computer Terminals,  
and the Attempt to Cover Up  
their Threat to Your Health

Paul Brodeur  
Non and Schuster. 333 pp. \$19.95

**Robert L. Park**

IF PEOPLE are paranoid today, it could be because each time we look over our shoulder something seems to be stalking us. The sky, we are told, is raining acid

Robert L. Park is professor of physics at the University of Maryland and director of the Washington office of the American Physical Society.

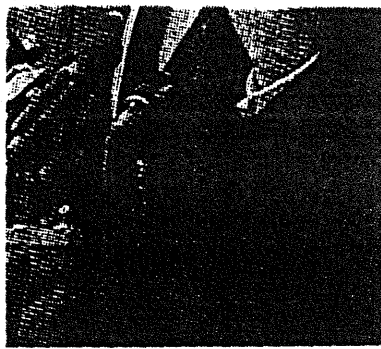
same: Get a "game plan" to "handle it-PR-wise."

He spent hours every day with aides developing strategy to improve his image, "studying the press, manipulating the press." Although he had great luck with the press (753 of 806 dailies endorsed him in 1972), he hated it.

**I**T'S EERIE to read the many devious ways Nixon sought to have others love him, and yet how he hated just about everyone. This is what made him and Henry Kissinger soulmates. "They were alike in their utter cynicism," Ambrose writes, "and in their contempt for everyone else, including each other..." All Nixon's top aides were selected for their vindictiveness. "Nixon, except for the ceremonial functions, seemed to take little pleasure in being President. To the contrary, he seemed to be always angry," constantly scribbling orders to his aides as to how they should seek vengeance for him "... step on them hard and twist... crush them, show no mercy").

The only long-range program he mapped for his second term was to make "the most comprehensive notes on all of those that have tried to do us in... they are asking for it, and they are going to get it."

This mental violence created the



UPI/BETTSMANN NEWSPHOTOS

Richard M. Nixon in 1962

aura that prompted many businessmen to tell Daniel Patrick Moynihan they felt "Fascism is here." In fact, nothing happening at that time could compare with the truly frightening Americanism-Fascism of Nixon's early campaigns in California, particularly his triumph over Helen Gahagan Douglas to win a seat in the U.S. Senate. Many biographers have given an account of it, but none so vividly as Morris. He brings to life a society and a candidacy that will scare the hell out of you, even 39 years after the event. Here are hordes of patriots making anonymous calls: "Hello, did you know that Helen Douglas is a communist?" "Hello, did you know Helen Gahagan Douglas is married to a man whose real name is Hesselberg?"

Even more frightening was the

was distributed after mass. Panicked, most of the leading Democrats turned their backs on her. President Truman and Jack Kennedy betrayed her. (Hubert Humphrey was true blue.)

Morris's account of the Nixon-Douglas campaign shows that under properly poisoned conditions, it can happen here. Six out of 10 Californians voted to send Nixon to the U.S. Senate in 1950, just as six out of 10 Americans voted to re-elect him president in 1972. Morris recalls that when Nixon was Ike's running mate in 1952 and disgruntled Republicans leaked details of his \$16,000 slush fund, Nixon counter-attacked by claiming the leak had come from communists and that the fund was set up to save taxpayers money. This was the message he shoveled from the back of a train going up the West Coast, and, Morris tells us, "Nowhere, from the hot Central Valley through the neat, cloudy, small cities of Oregon, would he face an audience that did not cheer his claim of smears and savings, did not accept his distorting view of public morality and political motives, did not scorn and when the chance came even punish his opponents..."

That's the baffling thing that our biographers have to keep coming back to: An awful lot of people like Tricky Dick. ■

## Currents of Death

Continued from page 3

from Denver, there were reports that women who sleep under electric blankets were having miscarriages, that people living near voltage lines were prone to suicide and that workers who sit all day in front of video display terminals are often disoriented. Other scientists might be less skeptical of these statistical studies if some identifiable damage from low frequency fields were found. Known cancer-producing agents—ionizing radiation, chemical irritants, certain viruses, asbestos—all produce damage at the cellular level that can be directly observed.

**T**HERE IS, however, virtually no laboratory evidence of harmful effects from alternating electric or magnetic fields and no known biological response to such fields that would lead one to expect harmful effects. At most, AC fields have

been shown to induce weak biological responses. By contrast, a rather strong physiological response is observed in humans exposed to the smell of freshly baked bread, but no one suggests it is harmful.

In fact, the evidence for biological responses to low-frequency fields, harmful or not, is not very convincing. Brodeur tells us, for example, that two groups of researchers observed changes in calcium efflux from chick-brain tissue exposed to alternating magnetic fields. In one case, however, the efflux increased, whereas in the other case it decreased. The essential fact, Brodeur says, is that both groups saw a change. It's as though your broker tells you to expect a rise in the market just before it crashes—and afterwards boasts of having correctly predicted it would change.

The overwhelming consensus of the scientific community, that no significant hazard exists, becomes

for Brodeur evidence of a massive coverup. We have seen the tobacco industry suppress its own studies linking smoking to disease; the nuclear industry, chemical companies, car makers, drug manufacturers, have all at times engaged in cover ups. Is there any reason to expect the electrical industry to behave in a more principled fashion?

Perhaps not, but there is no need to rely on the electrical industry to examine the environmental consequences of alternating fields; Brodeur is right about that. Better designed and more extensive studies of the biological effects of low-frequency fields should be undertaken by independent organizations, with no connections to the electrical industry—or the fearmongers. If even a slight hazard can be demonstrated, it would make sense to design new appliances and power distribution systems to minimize stray fields. In the meantime, save your candles for a black-out. ■

city may motor the book, as the previous one, onto the bestseller list.

—Kirkus

## THE SOUND OF

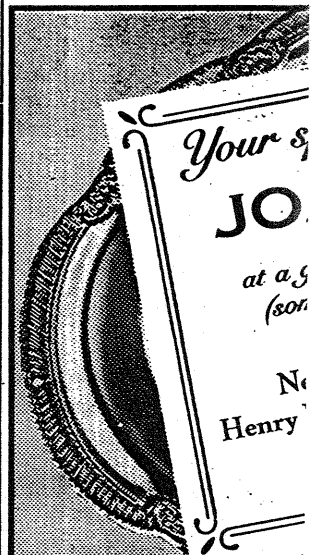
The Life of

### AMELIA EARHART

By the author of the intro-

## MARY

S. T. M.



JOAN BRADEN

*Just Enough Rope*

AN INTIMATE MEMOIR

Coming Sunday,

## Taking t Out of L

The chairman of the F  
gone respectable. Mar  
The Washington Post

Newsday, November 19, 1989  
HEADLINE: The Trouble With Physicists  
BYLINE: Randolph Riddle. Manhattan  
(Full text)

Robert Park ["Does 60 Hertz Hurt?" Ideas, Oct. 29] abused readers with a striking display of fallacious argument and intellectual arrogance so regrettably common among physicists.

Park begins with name-calling, saying that investigative reporter Paul Brodeur is in "the fear business." He does not mention that Brodeur blew the whistle on the asbestos tragedy at a time when mainstream science was looking the other way, just as Park hopes we will ignore the startling evidence of serious health hazards from low-frequency electromagnetic fields. "Most scientists remain skeptical," he says, a quasi-argument know to logicians as the appeal to authority.

Park goes on to say that epidemiological evidence never proves cause and effect. Quite right, but as in the epidemiological case associating smoking and lung cancer, strong correlations between electromagnetic radiation and a wide range of neurological and biological injuries properly invite our suspicion and interest - not Park's attitude of "what, me worry?"

Holding no apparent credentials in medicine or microbiology, Park clearly figures that if physics doesn't find something, it just ain't there. In his essay, we find the same bumptious faith that told us DDT was safe.

(452)

# Fusion defender in tenure fight

By Anthony Flint  
CONTRIBUTING REPORTER

Peter L. Hagelstein, the noted physicist who helped develop lasers for the "star wars" system and then quit for a job at the Massachusetts Institute of Technology three years ago, is being opposed for tenure by factions who believe he embarrassed the institute by defending cold fusion in the spring.

But Hagelstein is putting his MIT tenure and his scientific reputation on the line next week when he presents a paper that is said to contain a revised and quantified version of his controversial fusion theory - a paper that may do little to resuscitate the idea of cold fusion as a source of limitless energy but could vindicate his positions as a point of science.

For these reasons, the paper, which is on MIT, Page 24

THE BOSTON GLOBE • WEDNESDAY, DECEMBER 6, 1989

## Cold-fusion defender faces MIT tenure fight

MIT  
Continued from Page 1

the agenda of next week's annual meeting of the Society of Mechanical Engineers in San Francisco, promises to be watched closely both as a development in Hagelstein's effort for tenure and as a new contribution in the near-dead campaign to prove that cold fusion, or some form of it, actually exists.

Hagelstein, 34, came to MIT three years ago from the Lawrence Livermore Laboratories in Berkeley, Calif., where he did "star wars" research before leaving because of misgivings over weapons work. He is up for consideration for tenure this spring, but sources say that lingering unhappiness over his much-publicized cold-fusion positions are a potential snag.

Hagelstein declined to be interviewed, but according to sources at MIT, his paper will contain new quantitative evidence to support his theory that a hitherto unknown nuclear phenomenon is at work in cold fusion.

"He's doing his best to justify his early intuition," said MIT professor Hermann Haus, who was Hagelstein's thesis adviser when he stud-

ied at MIT. "He's struggling to come up with a quantifiable answer. Something is going on, and we need a good theory for it."

"He's trying to account for the unaccountable," said another MIT colleague, who asked not to be named. "He's got the numbers, and what's different now is other theorists are getting on board. There's another kind of interaction at work."

Cold fusion made headlines last spring when Utah researchers B. Stanley Pons and Martin Fleischmann said they produced heat by immersing a palladium electrode in a test tube of heavy water containing deuterium, a form of hydrogen.

The experiment was initially viewed as revolutionary because Fleischmann and Pons said it brought about fusion, the process by which hydrogen atoms are merged and release energy, without the high temperatures previously thought necessary for such a reaction. Cold fusion would also be cheaper and less dangerous than bringing about a nuclear reaction through fission, the splitting of atoms that occurs daily in the nation's nuclear power plants.

The Pons-Fleischmann experiment could not be repeated with the same results in other laboratories. Soon after the Utah announcement, scientists challenged the findings, and the cold fusion revolution fizzled almost as soon as it started.

### MIT scientists assailed cold fusion

Scientists at MIT, primarily hot fusion advocates who have spent millions researching the more conventional, high-temperature fusion process, were at the forefront of assailing cold fusion - except for Hagelstein.

In a news conference April 14, he defended the Pons-Fleischmann experiment and floated his unknown-phenomenon theory. MIT rushed to file a patent on the potential applications of Hagelstein's ideas.

Fellow MIT physicists, following the conventional belief that all reactions are already known, scoffed at the idea of a new phenomenon. Chemists such as MIT's Keith Johnson said Hagelstein failed to understand that a chemical reaction involving physical reaction might be occurring.

In the end, Hagelstein was roundly criticized for publicizing his theory without sufficient quantitative evidence. Critics say it was not so much Hagelstein's ideas as the way they were presented - through the news media in an atmosphere of heightened expectations about cold fusion, rather than in the confines of peer review among scientists.

"It just smacked of a lot of grandstanding," said Ronald Parker of the Plasma Fusion Center at MIT, an active opponent of cold fusion. "It became a media phenomenon. And the issue of the ability of a scientist to become self-questioning became a question."

### Tenure decided at highest levels

Sources at MIT said that despite support for Hagelstein in his own department of electrical engineering, the way he drew MIT into the "hysteria" surrounding cold fusion became an issue in his bid for tenure. The decision to award tenure is made at the highest levels at MIT, but individual faculty members can comment in the tenure process.

"He loves MIT. The thing he wants most in life is academic recognition and respect," said a former colleague from Lawrence Livermore, adding that not getting tenure would be a "big blow" to the shy, pi-an-playing researcher who is uncomfortable with media attention.

Although others at MIT said the cold-fusion flap would not work against Hagelstein's tenure bid, supporters hope the presentation scheduled for the San Francisco conference will go a long way toward silencing his critics.

According to sources, Hagelstein will discuss quantified evidence that shows the varying degrees of energy released in cold-fusion experiments - the presence of fired-off neutron particles - is due to a previously unknown phenomenon.

Hagelstein's model, they said, will show exactly how the deuterium atoms are "absorbed" into the crystal lattice of the palladium electrode, thereby hiding most evidence of energy from scientific measurements. Most cold-fusion experiments after Pons-Fleischmann's have yielded only small measurements of energy.

Globe reporter Daniel Golden contributed to this story.

*To those who worry about the health hazards of electricity: Meet the late James Thurber's grandma; she was convinced that wall sockets leaked dangerous stuff.*

# ELECTROPHOBIA

By Peter Huber



McCaw Cellular can't put an antenna on a building in Seattle because workers on the top floors are worried about radiation. A nation of hypochondriacs, we are developing a phobia toward technology worthy of a primitive tribe. I am reminded of an earlier time:

"This room is equipped with Edison Electric Light. Do not attempt to light with match. The use of electricity for lighting is in no way harmful to health, nor does it affect the soundness of sleep." In 1892 these signs started appearing in hotels and public buildings newly equipped with electricity. It took a few decades to overcome the public's fears.

Now comes a *New Yorker* journalist, Paul Brodeur, to declare that the early phobiacs were right. His pen is itself a remarkable generator, of publicity at least. Extra-low-frequency (ELF) electromagnetic fields from transmission lines, video display terminals, and yes, electric lights have all become today's fashionable environmental terrors.

One strand of research suggests that low-level fields can affect cells in carefully contrived laboratory

conditions. But the effects come and go, apparent at one frequency, disappearing at the next, pointing in different directions in different laboratories, altered by (among other things) the local orientation of the earth's magnetic field. Effects don't rise with field intensity.

Then there's the epidemiological work. It all started when an extremely green researcher drove around Denver hunting for an environmental factor to explain childhood leukemia. Many of the victims seemed to live near power line transformers, she decided. She published a paper on the correlation. But she didn't systematically measure the fields themselves. Others did and found little relationship between her wiring observations and actual field intensities.

More recently, epidemiologist David Savitz explored 52 correlations between childhood cancer, measured electric and magnetic fields, and wiring codes. He found no association with electric field levels, and none that were statistically significant with magnetic fields, though here he did claim to see some suggestive trends. There was a slightly stronger correlation with wiring codes. Only one data group (consisting of eight cancer cases and two controls) stood out as distinctly unusual. Savitz, as translated by Brodeur, sounds almost apocalyptic. But "it would be erroneous to interpret the literature as a series of replicated positive results," says Savitz himself. Epidemiological studies, he might have added, uncover weak correlations of this kind all the time. Almost all are eventually discarded as spurious.

This we know. ELF fields of ordi-

nary intensity don't disrupt chemical bonds, as ionizing radiation does, nor do they heat tissues. Living cells naturally maintain electric fields thousands of times stronger than man-made fields in the everyday environment. The strength of a typical man-made magnetic field in the home is vastly lower than the earth's, by factors of 100 or more.

Basic physics and common sense notwithstanding, claims of magical healing powers from ELF fields have been floated over the years about as often as claims of pernicious hazard. Over 200 effects have been reported. Most have been at the borderline of experimental detectability. The claims shift quickly, always one step ahead of the good science. It's what Nobel physicist Richard Feynman called cargo-cult science. After World War II, South Sea islanders set up dummy airbases, complete with hangars and flares, to attract back the military planes that had once brought comfort and plenty. Bad scientists go through similar rituals and motions of the scientific inquiry. But the planes never land.

In recent years, the health effects of ELF fields have been reviewed by the National Academy of Sciences, the World Health Organization and commissions in Florida, New York, Australia and England. None concludes that any human health hazard has been proved. The evidence of hazard is "not close to meeting established standards of scientific acceptance," says Robert K. Adair, Sterling Professor of Physics at Yale. "The results are about as believable as claims of perpetual motion." Or cold fusion.

The electrophobiacs will nonetheless be fortified in their fears by a report recently published by Congress' Office of Technology Assessment, which somberly concludes that "there are legitimate reasons for concern," and counsels "prudent avoidance" of ELF fields. James Thurber's grandmother must be smiling in her grave. She "lived the latter years of her life in the horrible suspicion that electricity was dripping invisibly all over the house," her grandson wrote in a 1933 essay. She spent her days turning off the wall switches that led to empty sockets, "happy in the satisfaction that she had stopped not only a costly but a dangerous leakage." Paul Brodeur: Meet Thurber's grandma. ■

*Peter Huber, a senior fellow of the Manhattan Institute, is the author of Liability: The Legal Revolution and Its Consequences.*

# I WVO VIEWS: Possible danger in electric, magnetic fields

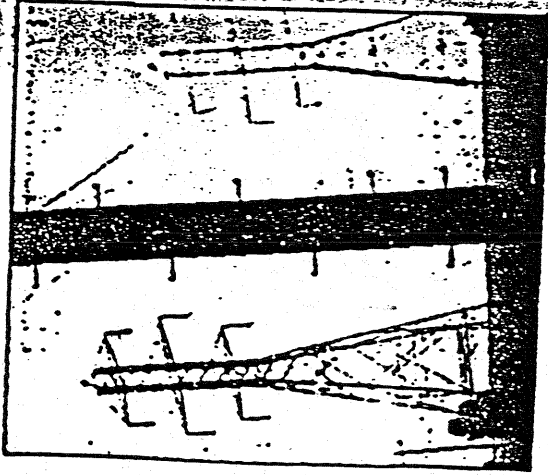
## Scientific data are contradictory

**M. Granger Morgan**  
For Scripps Howard News Service

**W**HETHER there is electricity there are electric and magnetic fields. High-voltage power lines on steel towers, low-voltage power lines on wooden poles, wiring in our homes and offices, electric blankets and other appliances. They all make power-frequency, or electric and magnetic fields.

Until recently, nobody gave these fields a second thought. But scientific studies, using various kinds of animal cells, have shown that power-frequency fields can produce changes in the chemicals that cells make and the way cells communicate with one another.

Studies with animals and people show that fields can produce hormonal and other changes. Could these things lead to health risks? Scientists cannot say. They have done studies that have them concerned about things such as cancer (not starting, but making existing cancer grow faster), birth defects, and various nervous-system effects. But the evidence on health effects is still contradictory.



High-voltage lines on Seattle's Beacon Hill.

Usually when there is uncertainty like this about a possible risk from some environmental agent, such as a toxic chemical, it's because there

hasn't been very much good research. That's not true in this case. There has been a lot of very good research. But the results are complicated.

Responsible scientists do not yet agree on whether power-frequency fields pose a risk to health, and if they do, how serious that risk might be.

A considerable amount of additional research is likely to be necessary before clearer answers are possible. If fields do turn out to pose health risks, the fields from large power lines may not be the greatest concern. Exposure from smaller lines, and appliances such as electric heating pads and blankets, may be much more significant.

What should we do when there is a basis for concern but no clear evidence of risk? We can't begin to make a list of things to do. We can't begin to make a list of things to avoid. We can't begin to make a list of things to do more of. We can't begin to make a list of things to do less of.

In our private lives, when we face an uncertain situation like this, we exercise prudence. Consider the many people concerned about cancer who have made changes in their diet. They eat little charred, broiled food and lots of fiber because, while there is no proof, these changes are thought to reduce the risk.

Yet prudent people do not go without breakfast when all that is available on the menu is regular low-fiber cereal. Nor do they order lobster for their children because it is the only food on the menu not charbroiled. Prudence means you take steps to control possible risks, but at reasonable cost and

inconvenience. You keep some sense of proportion. In public life, we find it hard to exercise prudence about risks. We generally force our decision makers, regulators, and courts to treat everything as either safe or unsafe.

The world isn't like that. We do not know if power-frequency fields are safe or risky. It will take a lot more research, and probably quite a few years, before we will know.

In the meantime, we need to chart new ground. We need to figure out how to prudently keep people out of fields without going off the deep end. We need to be able to design new power lines with lower fields, and locate them in places that avoid most people — without also forcing utilities to replace lots of old lines.

We need to be able to figure out how to let appliance manufacturers design and introduce new field or no-field appliances into the market without opening themselves up for product-liability suits on older appliances.

These things will certainly require thoughtful, responsible government officials, citizens, and journalists who take time to learn the complicated facts before they act.

**M. Granger Morgan** is head of the Department of Engineering and Public Policy at Carnegie Mellon University, Pittsburgh. He recently wrote a brochure for general readers on electric and magnetic fields.

## Electric industry needs more facts

**WILLIAM McCOMBEN JR.**  
For Scripps Howard News Service

**B**ATTLE'S Pacific Northwest Laboratory; Carnegie Mellon University; Yale University; John Hopkins University; University of Rochester — these are just a few of the many facilities conducting research on electric and magnetic fields. Yet that doesn't begin to represent the hundreds of studies that have been conducted to assess whether these fields can harm human health.

The authors of a study recently commissioned by the Congressional Office of Technology Assessment concluded: "In our view, the emerging evidence no longer allows one to categorically assert that there are no risks associated with electric and magnetic fields but it does not provide a basis for asserting that there is a significant risk."

So what should the public and the electric-utility industry do?

Because the scientific understanding is incomplete, the utility industry is committed to spending a tremendous amount of money and time investigating the issue, working with independent laboratories, universities and scientists to determine what, if any, adverse effects are caused by high-voltage transmission lines, local distribution lines, and electric appliances.

We have been conducting such research for almost 20 years. The Electric Power Research Institute is the largest single source of funding for electric-power frequency research in the world. A total of \$25 million has been spent by the institute on such research since the program's inception in the mid-1970s. An additional \$20 million will be spent over the next three years.

Results of the many studies so far are mixed and for the most part inconclusive. While some scientists have identified some biological responses from electric and magnetic fields exposure in laboratory experiments, they cannot link these responses to any adverse effects on human health.

Public concern has been generated by the widely reported epidemiology studies, some of which report

weak associations to health effects.

But many of those studies make no attempt to disassociate other environmental considerations affecting human health, such as exposure to known carcinogens. Therefore the conclusions can be questionable.

The bottom line is that electric and magnetic fields are a complicated phenomenon. The OTA report points out that in some research, "windows" in frequency and intensity levels are identified. While they can find a biological response at one frequency or intensity level, those responses are not observed at higher or lower levels.

So unlike the situation with environmental pollutants, in which the more there is, the worse the effect, increasing the frequency or intensity of electric and magnetic fields may not necessarily be worse.

There is also uncertainty about how people are actually exposed to electric and magnetic fields daily. EMF is not limited to electric power lines. The wiring inside the home, household appliances, electric blankets, and even video display terminals all produce electric and magnetic fields.

In fact, field levels near some appliances are often higher than the EMF levels found directly beneath high-voltage power lines. Thus there are

still no answers telling us, what, if any, EMF exposure poses a health risk.

As the supplier of the most critical energy source, electric utilities must balance objective reviews of scientific research against attempts to sensationalize a potentially dramatic and confusing issue.

While the pressure to react can be intense, the scientific evidence to determine the best course of action is just not there. Some would have us busy with new standards, and regulate appliances with new standards in an attempt to reduce exposures to EMF.

But if we can't identify what EMF exposure may or may not do, how can we take steps to remedy it without knowing if we are solving or only exacerbating the situation?

The utility industry is providing the necessary research that will prove to be sound and with results that will stand the test of the most rigorous scientific and public review. It is only after we see these results that we will be able to determine what the next steps should be.

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**William McComben Jr.** is president of the Edison Electric Institute.



NOV 3 '89 FRI 10:54 CT PUBLIC BDCST HTFD P.02

# The electromagnetic scare: Are

By ROBERT L. PARK

**L**ately, the Environmental Protection Agency has been getting calls from people who want to know if the level of 60-hertz (cycles per second) magnetic fields in their homes is dangerous. These are the alternating current fields that emanate from ordinary household electric wiring and appliances as well as from power-lines outside the home. We are bathed in these fields for most of every day. There is no escape; they penetrate the walls of our homes as easily as they penetrate our bodies. Yet there are no public agencies or private companies to which we can turn to measure the level of 60-hertz magnetic fields, and no government standards for exposure if we could.

In fact, five years ago EPA abandoned its research on the biological effects of so-called extreme low-frequency fields, or ELF for short. The program had turned up no evidence of harm to living organisms from ELF. Besides, the indifference of the Reagan administration to environmental concerns had led to cuts in the agency's research budget, and the decision was made to concentrate on what seemed to be more serious concerns, such as radon exposure. Now, faced with an epidemic of public concern, EPA is re-examining its decision.

The public's anxiety attack over electromagnetic fields is, in part, because of a series of articles this

*Robert L. Park is Washington director of the American Physical Society, an organization of professional people involved in physics and related fields. He wrote this article for Newsday.*

past summer in The New Yorker by Paul Brodeur. A longtime staff writer for the magazine, Brodeur is not new to the fear business. A dozen years ago he wrote another series for The New Yorker, sensationalizing the dangers of microwaves and charging a cover-up. It later appeared in book form as "The Zapping of America." Now he sounds the alarm over the pernicious effects of low frequency magnetic fields and warns darkly of another cover-up.

The market for fear has never been better. The sky rains acid on dying lakes and forests; the ocean regurgitates the filth from our cities; toxic fumes percolate up from forgotten waste dumps beneath our homes; lead is in our water and Alar on our apples; we are being smothered by a thickening blanket of carbon dioxide, while chlorofluorocarbons are eating a hole in the ozone. And now we are told that the fields produced by ordinary household electricity may be adding our brains and inducing leukemia in our children.

If we have learned anything in recent years, it is that we cannot take such warnings lightly or accept uncritically the soothing reassurances of authorities. We have seen the tobacco industry suppress its own studies linking smoking to disease; the nuclear industry, chemical companies, drug manufacturers, car makers all at times have engaged in cover-ups. Even the federal government has conspired with civilian contractors to withhold information about the spread of radioactive contamination around nuclear weapons production facilities. Is there any reason to expect the electrical industry to behave in a more principled fashion?

Perhaps not. But before fleeing to

Antarctica, you might want to take a closer look. Ten years ago no one worried about the feeble magnetic fields that are produced by normal electric currents; such fields are far weaker than the magnetic field of the Earth itself. In 1979, however, there was a report from Denver that the incidence of childhood leukemia in homes located near high-current power lines was double the rate elsewhere. This was followed by reports of frequent miscarriages among women who sleep under electric blankets, increased suicides by people living near high-voltage power lines, and mental disorientation of people who sit all day in front of video display terminals — all attributed to low-frequency magnetic fields. Most scientists remain skeptical.

The evidence that exposure to 60-hertz magnetic fields is hazardous is based almost entirely on epidemiological studies. The epidemiologist looks for patterns in the incidence of a disease that would indicate a link with environmental factors; the relationship between smoking and lung cancer, for example, or between dietary sodium and hypertension, or exposure to the sun's rays and skin cancer. Such studies can be the first step in identifying risk factors, but by themselves they are often misleading.

In the first place, epidemiological studies cannot establish cause and effect; at best they establish a relationship. An epidemiologist, for example, would find that death is often preceded by pronounced weight loss — but it would be a serious mistake

TV- 3-89 FRI 10:55 CT PUBLIC BDCST H.T.F.D. P. 03

Sunday, October 29, 1989 B5

# household appliances safe?

to conclude that losing weight is bad for your health. Similarly, I do not doubt that people who spend several hours each day seated in front of a computer terminal suffer stress; but, as one who spends countless hours in such a position, I find it bizarre that anyone would find it necessary to resort to the ELF fields emanating from the video display to account for stress.

In the second place, what seems to be a relationship may be no more than coincidence. A lot of foolishness can be traced to a failure to account properly for chance occurrences. It is not uncommon for otherwise intelligent human beings to refuse to play a game of golf without their "lucky hat." And even eminent scientists have had their careers tarnished by having the misfortune to observe some coincidence that was so compelling that they were thereafter unable to free themselves of the conviction that it was significant.

Moreover, people tend to see what they expect to see and fail to notice what they believe should not be there. Thus, a false report by a respected colleague often carries other scientists along on the road to ignominy. "Confirmations" are usually reported soon after every important scientific claim; refutation usually comes only after long study.

A classic example occurred in just the past few months. Two scientists at the University of Utah claimed to have produced "cold fusion" in a bottle. Within days, excited reports of confirmations were coming in from laboratories all over the world, and theorists were presenting de-

tailed explanations of the phenomenon. But, one by one, the hasty confirmations were withdrawn as errors were uncovered. "Cold fusion" was revealed to be nothing more than wishful interpretations of sloppy and incomplete experiments. The history of science, unfortunately, contains many such examples of self-deception.

Finally, epidemiological evidence is statistical, and its significance depends on the size of the sample.

The occurrence of childhood leukemia is sufficiently uncommon that it is difficult to obtain a significant sample. We are all familiar with "risk factors" that disappeared when more extensive studies were undertaken.

Because of the uncertainties inherent in epidemiological studies, scientists insist that the findings be backed up by laboratory demonstration of a mechanism. Known cancer-producing agents — ionizing radiation, chemical irritants, certain viruses, asbestos — all produce damage at the cellular level that can be directly observed. For example, because the mechanism is firmly understood, scientists are confident of the hazard of radon gas, even in cases where the increased incidence of cancer is too small to show up in statistical studies.

There is, however, virtually no laboratory evidence of harmful effects from ELF and no known biological response to such fields that would lead one to expect harmful effects. By contrast, ionizing radiation, such as X-rays, are capable of severing chemical bonds, micro-

waves, though less serious, can induce heating in the body. But for ELF fields, there are at most a few contradictory reports of weak biological responses.

Living organisms are, however, responsive to all sorts of stimuli. It is possible to measure a rather strong physiological response in humans to the smell of freshly baked bread, but no one suggests it is harmful.

What remains are some very preliminary reports suggesting a statistical correlation between exposure to extreme low-frequency fields and certain human ailments. In response to growing public concern, better designed and more extensive studies of the biological effects of ELF are needed — studies free of any taint by the electrical industry or the fear-mongers. If even a slight hazard can be demonstrated, it would make sense to design new appliances and power distribution systems to minimize stray fields, but any hazard that is found is unlikely to justify the staggering cost of rebuilding the nation's power-distribution system.

There is, after all, another piece of epidemiological evidence we should keep in mind: In spite of the growing list of manmade environmental hazards, industrialization has not, on the average, shortened our lives. On the contrary, life expectancy in the United States has nearly doubled since the Industrial Revolution began — and the increase has been most rapid since the advent of electrification. So whatever the truth, we are not dealing with The Black Death.

# Biological Effects of Power Frequency Electric and Magnetic Fields

*OR*  
*How to React to Insignificant Risk*

## Background Paper

This background paper was performed as part of OTA's assessment of  
**Electric Power Wheeling and Dealing:  
Technological Considerations for Increasing Competition**

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**NOTE:** OTA makes this background paper available for the use of readers desiring a more detailed or technical discussion of the issue than can be accommodated in OTA's final report. As an OTA background paper, it has not been reviewed or approved by the Technology Assessment Board. The findings and conclusions expressed in this report are those of the authors and do not necessarily reflect the views of OTA, the electric power project advisory panel, or the Technology Assessment Board.



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exposure leads to health risks, exposure to stronger fields or exposure for longer periods is worse than exposure to weaker fields or brief periods.

In addition to cellular studies, whole animal and human experiments have examined five general categories of effects:

1. General effects such as detection, avoidance and behavior response and development and learning of animals, and moods of humans;
2. Effects on externally measured physical parameters such as growth and birthweight, respiration, heartbeat rate, and temperature rhythms;
3. Effects on specific biochemicals such as hormones that are responsible for the maintenance, regulation and control of general physiological and psychological functions; for response to environmental stressors; for growth and development; and, for triggering special responses such as sexual function, and fetal and newborn nourishment;
4. Effects on circadian rhythms of animals and humans; and,
5. Effects in the epidemiology of cancer, particularly leukemia and brain cancer.

Several authors and scientific advisory panels have reviewed the effects literature. [Adey 86, Adey 87, AIBS 85, Carstensen 87, Florida 85, Grandolfo 86, Lee 86, NYSPLP 87, Sheppard 83, West 86, WHO 84]. In summary, the results are complex and inconclusive. There have been many "negative" experiments, that is, experiments that have looked for effects but not found any difference between biological systems that have been exposed to fields and those that have not. However, the growing number of positive findings have now clearly demonstrated that under specific circumstances even weak low-frequency electromagnetic fields can produce substantial changes at the cellular level, and in a few experimental settings, effects have also been demonstrated at the level of the whole animal. Epidemiological evidence, while controversial and subject to a variety of criticisms, is beginning to provide a basis for concern about risks from chronic exposure. Some observers find this epidemiological evidence more persuasive in light of the clear evidence of effects that is available at the cellular level, but others insist on treating the evidence from these two areas as separate.

As recently as a few years ago, scientists were making categorical statements that on the basis of all available evidence there are no health risks from human exposure to power-frequency fields. In our view, the emerging evidence no longer allows one to categorically assert that there are no risks. But it does not provide a basis for asserting that there is a significant risk.

If exposure to fields does turn out to pose a health risk, it is unlikely that high voltage transmission lines will be the only sources of concern. Power-frequency fields are also produced by distribution lines, wall wiring, appliances, and lighting fixtures. These non-transmission sources are much more common than transmission lines and could play a far greater role than transmission lines in any public health problem.

① risk > 0

② risk < significant

∴ risk = insignificant or "de minimus"