

## INSIDE...

### EMF NEWS pp.2-7

#### Power Line Talk:

**Brodeur, Hersh Clash on NAS Report • U.S. Supreme Court Refuses To Hear NY Reiss Case • DOE Review—One Last Time**

#### Roundup of New Animal Studies

**No Increase in Lymphoma Seen in Australia  
Finns Find Mice Get Skin Cancer Faster  
In Sweden, No Link to Breast Cancer**

#### Taiwan Epi Study Finds Childhood Cancer Risk

#### EMFs Alter Key Enzyme Activity

#### Planning for the RAPID Risk Assessment Chapter Authors and Attendees

### HIGHLIGHTS pp.7-9

#### Wireless Notes:

**Repacholi: New Confidence in GSM Cancer Link • Congressional Doubts on Federal Preemption • Audubon Society Wants EIS on DTV Preemption • Cherry Tours U.S. • Irish Co. Report Dismisses Tower Hazard**

#### Finns Begin Probe of Cellular Health Risks

#### DTV Tests Interfere with Medical Telemetry

#### 1998 Conference Calendar (Part III)

### SPECIAL SECTION pp.10-13

#### Microwave News World Wide Web Directory

### FROM THE FIELD pp.14-15

#### ELF Magnetic Fields from Steel-Belted Tires: Implications for Epidemiological Studies

#### Clippings from All Over

#### Flashback: 5, 10, 15 Years Ago

### UPDATES pp.16-18

**MW Cooking Depletes Vitamin B<sub>12</sub> • EMI and TWA Flight 800 • Dad at EMF Work: The Kids Are Probably Alright • Senator To Test Melatonin in Space • Microwave Weapons on Missiles • Tower Hearing: True Fiction • Museum of Bogus Medical Devices**

### VIEWS ON THE NEWS p.19

#### EMF Animal Studies: What's Going On?

#### CTIA's WTR: Five Years and Counting

## “Equivocal” Cancer Finding in Two-Year EMF Animal Study

A two-year animal study has found a significant link between exposure to electromagnetic fields (EMFs) and thyroid cancer in male rats. But no such association was seen in mice or in female rats, and it is unclear whether the link represents a real biological effect.

A draft report from the National Toxicology Program (NTP) rates the thyroid result as “equivocal”—somewhere between “no evidence” and “some evidence” of an EMF–cancer connection. No increases were observed for brain tumors, breast cancer or leukemia in either rats or mice.

This study is the centerpiece of the NTP’s multimillion-dollar effort on the health effects of EMFs (see *MWN*, S/O90), and is one of many recently com-

### Microwave News’ EMF and EMR Internet Directory Addresses for More than 250 Sites on the World Wide Web See Special Section on pp.10-13

pleted studies that will be discussed at the National Institute of Environmental Health Sciences (NIEHS) review of *in vivo* research in Phoenix, April 6-9.

NTP scientists have had long discussions about whether EMF exposure caused the increase in thyroid cancer. “I don’t think it did,” said the NTP’s Dr. Gary Boorman. “But it’s a difficult issue. Almost every argument has two sides.”

(continued on p.4)

## Dueling Data on Breast Cancer: U.S. and German Results Do Not Agree

Researchers at the Battelle Pacific Northwest Labs in Richland, WA, have been unable to confirm German experiments linking EMFs to breast cancer.

“Our results showed no increase in breast cancer in rats due to EMF exposure,” Battelle’s Dr. Larry Anderson told *Microwave News*. The work at Battelle was an attempt to reproduce the findings of Drs. Wolfgang Löscher and Meike Mevissen at the School of Veterinary Medicine in Hannover. The Battelle studies were sponsored by the RAPID research program (see *MWN*, M/A96).

Meanwhile, Löscher and Mevissen have a new 26-week study to support their earlier findings. As in five previous experiments, they found that EMFs promoted the development of breast cancer initiated with the chemical carcinogen DMBA. The incidence of tumors (based on macroscopic examination) was greater among animals exposed to a 1 G magnetic field than among controls, a difference they termed “highly significant.” Löscher will present these results at the Bioelectromagnetics Society meeting in St. Petersburg, FL, this June.

“We now have three studies at Battelle, with a total of 1,300 animals, show-

(continued on p.5)

## « Power Line Talk »

When **Paul Brodeur's** book, *The Great Power-Line Cover-Up*, was published in 1993, jacket blurbs included this testimonial from fellow investigative reporter **Seymour Hersh**: "This book should be required reading for every parent in America, especially those with children in grade school. Paul Brodeur is as good a journalist as they come." Last December, Hersh was reminded of these words—and immediately disowned them. In a Washington bookstore where Hersh was promoting his JFK biography, *The Dark Side of Camelot*, a member of the audience complained that Brodeur had "cost the country a billion dollars a year and scared people to death" and asserted that the 1996 **National Academy of Sciences (NAS)** EMF report had proven Brodeur wrong. "So did you make a mistake?" the audience member asked. "Of course," Hersh answered, explaining his endorsement as "something for somebody I worked with at the *New Yorker*." This was just the way the publishing business works, he said, and "the bottom line is that if you believe everything you read on [a] jacket, I've got a bridge I wanna sell you." Hersh was obviously not expecting questions on magnetism or electricity—other than JFK's sexual kind—and he later admitted to New York City's *Village Voice* (February 17) that the query on EMFs left him "completely nonplussed." But when the exchange ended up on C-SPAN2, it did not leave Brodeur in a generous mood. In a January 30 letter, Brodeur told Hersh that his retreat "gives new meaning to the very concept of expediency." He wrote that, "If you had read [the NAS report], and not been so craven as to take what your interlocutor suggested about it as gospel, you might have known that the report did not exonerate power lines." Brodeur pointed out that the NAS panel called the data linking power lines and childhood leukemia "statistically reliable and robust." "Imagine having to point out to a smart truth sniffer like you that investigative journalists shouldn't always believe what they read in the newspapers!" commented Brodeur. He told Hersh that, "If you had not had your nose stuffed up Jack Kennedy's trousers for so long, you might have remembered how rigorously your and everyone else's manuscripts at the (old) *New Yorker* were scrutinized for factual accuracy." Brodeur concluded by saying, "As for me, I'm pleased to have cost the electric utility industry a billion dollars a year—a charge that sent you bravely scurrying for self-serving cover—and pleased to know that record numbers of Americans are refusing to buy homes near...high-current power lines." When Hersh spoke to the *Voice*, he insisted that the NAS report was "devastating" to Brodeur's viewpoint. But he is not about to get into a debate on the issue. "I consider it a crank letter," Hersh told the *Voice*. "I'm not going to respond to him."

«« »»

On February 23, the **U.S. Supreme Court** rejected a request from **Howard and Eve Reiss** to consider an appeal in their lawsuit against **Consolidated Edison**, the New York utility. Their action alleged that public fear of EMFs caused their home, near a Con Ed power line, to decline in value. The suit had been dismissed by a New York state court in December 1996 (see *MWN*, J/F97 and J/F98). An attorney for the Reisses, **Eric Bregman**

### **EMF Review Scheduled for September in Tucson**

There will be at least one more annual DOE review of EMF health research. But instead of being held in November, as in past years, the meeting will be in September, in Tucson, AZ.

The main reason for scheduling the review two months early is to allow for a review of the draft RAPID report. "We want to make sure that members of the EMF community give us their views and concerns," said NIEHS' Dr. Gary Boorman, who is in charge of completing the report by the end of October (see p.6).

The other reason is that federal agencies will likely have no EMF research budgets in fiscal year 1999, which begins on October 1, 1998. The review is being sponsored by the DOE, EPRI and the NIEHS.

"It's going to be a very different meeting this time," said Dr. Dan Driscoll of the New York State Department of Public Service in Albany. According to the proposed program, the draft RAPID report will be presented formally on Sunday, September 13, with Monday and Tuesday afternoons reserved for public discussion. Driscoll predicted that the meeting will probably end on Wednesday—one day earlier than in previous years—because fewer research papers will be submitted for presentation.

"I expect that this will be the last review," said Driscoll. Dr. William Wisecup, who is organizing the meeting, agrees. "I don't see any money coming down the pike," he said. For more details, see p.9.

of Sive, Paget & Riesel in New York City, said, "I'm convinced that we were right, but it's an area the courts just didn't want to wrestle with." Bregman told *Microwave News* that, "This appears to mean the end for EMF property litigation in New York state." The only exception, he said, would be when property is condemned by eminent domain, in which case New York's *Crisciola* decision still applies (see *MWN*, N/D93 and J/F94). The Reisses' claim was a test case for several similar EMF property lawsuits in New York (see *MWN*, J/A94), which are now likely to be withdrawn. Con Ed's Joseph Petta said in an interview that, "We're pleased with the U.S. Supreme Court's action. We feel that the New York courts were correct, and this action confirms that."

«« »»

A study of 32,000 Danish utility workers "does not support the hypothesis of an association between occupational exposure to EMFs and the risk of cancer," Drs. **Christoffer Johansen** and **Jørgen Olsen** of the **Danish Cancer Society** in Copenhagen report in the March 15 *American Journal of Epidemiology* (147, pp.548-555, 1998). A small but significant increase was seen in overall cancer risk, but much of this was due to asbestos-related lung cancer. There was no consistent association between EMF exposure and leukemia or breast or brain cancer.

---

## **New EMF Animal Research from Around the World**

### **Australia: No Link to Lymphoma**

Power frequency EMFs did not increase rates of lymphoma in mice, according to a new Australian study led by Drs. Antony Basten and Michael Repacholi.

In the March 1998 *Radiation Research*, they write that groups of about 100 transgenic mice were exposed to continuous 50 Hz EMFs at strengths of 10 mG, 1 G or 10 G for 20 hours a day for 18 months. An additional group was exposed to intermittent 10 G fields, switched on or off every 15 minutes. The incidence of lymphoma in the EMF-exposed groups ranged from 26% to 35%, with a 29% rate among unexposed controls. No association was found between EMFs and either an increased risk of cancer or a faster onset of the disease.

“There was no difference between animals exposed to magnetic fields and the controls—but it must be noted that there were no harmonics or high-frequency transients,” Dr. Michael Repacholi told *Microwave News* (see p.19).

Basten and Repacholi used a strain of mouse that had been genetically altered to make it especially susceptible to lymphoma, so that detection of weak effects would be more likely. They calculated that this experiment had a 95% chance of detecting a doubling of the rate of lymphoma in the transgenic mice.

Many of the transgenic mice developed an unusual liver disease, which showed a significant increase in the 10 G continuous EMF exposure group. “This result is puzzling,” the researchers write, especially since it did not occur with the intermittent 10 G exposures. “The biological significance of [this] result must remain in doubt” until it is repeated elsewhere, they conclude.

Basten is executive director of the Centenary Institute of Cancer Medicine and Cell Biology in Sydney. Repacholi was at Australia’s Royal Adelaide Hospital before moving to Geneva, Switzerland, to head the World Health Organization’s EMF project.

### **Finland: Mice Get Skin Cancer Faster**

Mice regularly exposed to ultraviolet (UV) light developed skin cancer significantly faster if they were also exposed to power frequency EMFs, according to a study by Dr. Jukka Juutilainen of the University of Kuopio in Finland.

The EMF effect was not strong, reports Juutilainen, but “the consistency of the results suggests that the difference is a true [EMF] bioeffect rather than a chance finding.” Preliminary results from this study were presented in 1996 (see *MWN*, M/A96), and final conclusions appear in the January issue of the *International Journal of Radiation Biology*.

This promotional effect can be seen in two ways: More animals had tumors, and there were more tumors per animal. But the effect is apparent only if both malignant and nonmalignant skin tumors are considered together. When malignant tumors are examined separately, the number is “low and similar” whether or not the mice were exposed to EMFs.

Three groups of about 44 mice each were exposed to UV light three times a week for 35 minutes at a time. Two of these groups were also exposed to EMFs, one with continuous exposure at 1 G and the other with exposures that were both intermittent and

variable. The latter involved exposures of 20 minutes each at 13 mG, 130 mG and 1.3 G, followed by a two-hour pause, in an attempt to reflect the uneven character of actual human exposures.

Half the mice in Juutilainen’s recent study were from a strain that over-expresses the gene for the enzyme ODC. Other researchers have shown that ODC is involved in cancer promotion, and that EMFs can have an effect on ODC (see *MWN*, N/D87 and J/F98). Juutilainen found that the ODC-transgenic mice did in fact have more skin cancer than normal mice, but that EMF exposure did not influence the levels of ODC. Thus, Juutilainen concludes, EMFs “may have cocarcinogenic effects that are not dependent on increased ODC activity.”

“This study did not support the hypothesis that intermittent [and variable] magnetic fields would be biologically more active than continuous fields,” Juutilainen reports. But he adds that the low statistical power of comparisons among the EMF-exposed animals means that such a difference cannot be ruled out. While the design of the exposure system reduced the occurrence of transients when the fields were switched on and off, some transients were still observed.

### **Sweden: No Promotion of Breast Cancer**

A new Swedish study has found that EMFs did not promote the development of breast cancer in female rats.

Drs. Tomas Ekström, Kjell Hansson Mild and Bo Holmberg, of Sweden’s National Institute for Working Life (NIWL), applied a single 7 mg dose of the chemical carcinogen DMBA to 180 Sprague-Dawley rats. Two groups of 60 rats each were then exposed to “an intermittent...transient-associated magnetic field,” turned on or off every 15 seconds. Fifty Hz fields were used for both exposure groups, with one at 2.5 G and the other at 5 G. The third group served as a control.

Seventy percent of EMF-exposed rats developed breast cancer, as compared with 72% of controls. Writing in the January 16, 1998, *Cancer Letters*, the researchers report that, “The rate of tumor appearance in all groups was similar.”

“This result may seem to be in contrast to Löscher and Mevissen,” comments the Swedish team (see p.1). But they decline to draw such a firm conclusion, noting that “the magnetic field exposure scheme is different in our study.”

In a 1994 study by Holmberg, Ekström, Mild and colleagues, intermittent EMF exposure appeared to promote the growth of DMBA-induced skin cancers in mice (see also p.19 and *MWN*, M/A94). The new EMF study marks the last by this research group. Mild, based at the NIWL in Umeå, told *Microwave News* that Holmberg has retired from his lab in Solna, and that Ekström is no longer working on EMFs.

A.W. Harris et al., “A Test of Lymphoma Induction by Long-Term Exposure of Eμ-Pim1 Transgenic Mice to 50 Hz Magnetic Fields,” *Radiation Research*, 149, pp.300-307, 1998.

T. Kumlin et al., “Effects of 50 Hz Magnetic Fields on UV-induced Skin Tumorigenesis in ODC-Transgenic and Non-Transgenic Mice,” *International Journal of Radiation Biology*, 73, pp.113-121, 1998.

Tomas Ekström, Kjell Hansson Mild and Bo Holmberg, “Mammary Tumors in Sprague-Dawley Rats After Initiation with DMBA Followed by Exposure to 50 Hz EMFs in a Promotional Scheme,” *Cancer Letters*, 123, pp.107-111, 1998.

For example, Boorman told *Microwave News*, the specific type of thyroid cancer that showed an increase is very rare. “We almost never see cancer in thyroid C-cells,” he said, and to some this means the finding is probably just a fluke. “Others take the opposite view, that this means the finding of an increase is even more important.” Boorman also heads the RAPID EMF research program at the NIEHS in Research Triangle Park, NC, and has written on the pathology of the thyroid gland in laboratory rats.

In a study with this many comparisons, some associations would likely appear by chance alone. But for thyroid C-cell cancers, male rats showed an increase in every EMF exposure group—and in two groups (20 mG and 2 G) the increase is very significant ( $p < 0.01$ ). “That’s a more unusual event,” Dr. Joseph Haseman, a biostatistician at the NIEHS, told *Microwave News*. “Having two groups at that level of significance, my guess would be that the odds of a chance finding are about 9% or 10%.” In a third exposure group (10 G, continuous) the association was just short of statistical significance ( $p = 0.055$ ).

The NTP report downplays the likelihood that this finding represents a real biological effect. It cites the lack of either a dose-response relationship or increases in precancerous conditions, and points out that increased thyroid cancer has never been observed in epidemiological EMF studies. But the report also notes that EMFs can affect calcium flux *in vitro*, and that, “C-cells are sensitive to...changes in calcium concentrations.”

“Is there a real risk?” asked Haseman. “I just don’t know. It can’t be dismissed.” For this reason, Haseman said, he supports the conclusion that the evidence was “equivocal.”

One of the report’s peer reviewers, Dr. John Bailer of Miami University in Oxford, OH, suggested upgrading this finding to “some evidence” for an association. On the other hand, another reviewer, Dr. James Bus of Dow Chemical Co. in Midland, MI, urged that the report do more to emphasize that “the unexpected thyroid tumor finding seems unlikely to be attributable to [EMF] exposure.” But when the peer reviewers met on March 11 in Research Triangle Park, there was unanimous support for the “equivocal” designation, according to Boorman.

### **Did the Experiment End Too Soon?**

There is nothing equivocal about the letter that Drs. Cesare Maltoni and Morando Soffritti sent to the NTP on February 26: The two researchers question whether the experiment had been designed correctly in the first place. “It is our belief that the NTP bioassay was planned and conducted with a protocol that could only allow negative conclusions on 60 Hz [EMF] carcinogenicity,” they write. Both are at the Ramazzini Foundation for Oncology and Environmental Science in Bologna, Italy.

“The results of the NTP experiments are far from conclusive,” contend Maltoni and Soffritti. If this is not stressed, they warn, the negative findings for various cancers “could become an easy and dangerous alibi for all who wish to obscure and quickly conclude” the debate over EMFs and cancer.

Specifically, the Italian researchers state that, “The number of animals per group in the [NTP] experiment...may well be insufficient to expose the effects of a low-potency carcinogen.” This problem is aggravated, they argue, by the decision to end the experiment after two years, when most of the animals were

still alive: “Had we truncated our experiments on vinyl chloride after two years, we would never have exposed the carcinogenic effects of the compound at low doses, and the consequent regulations would not have taken place.”

“In some ways Maltoni is right, but in others it’s not quite so simple,” responded Boorman. “It’s true that [sometimes] you do not see an effect unless you do a lifetime study. On the other hand, the longer they live, the higher the incidence of cancer in the control animals, and that can cause problems for statistical power.” He added that when an experiment runs longer, “There’s more spontaneous death, and this may lead to loss of tissue. So you can say the study should go longer, but it’s difficult to continue the work at the highest level of quality.”

Maltoni is well known for his work linking vinyl chloride to cancer in the early 1970s. He plans to do his own rodent study on EMFs and cancer, which he outlines in the letter: “The size of our experimental groups will be much greater than those in the NTP study, the exposure will start during embryo life and will be continued for the whole life span, and the animals will be kept under observation until spontaneous death.”

### **No Prenatal or Postnatal Exposures**

In his written peer review, Dow Chemical’s Bus noted that the NTP study “did not include pre- or early postnatal exposures. Thus, the findings of this study may not be particularly relevant to implications of human childhood leukemias.” This point was raised by another reviewer, Dr. John Cullen of the College of Veterinary Medicine at North Carolina State University in Raleigh: “The period of greatest relative growth is completed by rats and mice by [age 6-8 weeks, when the EMF exposures began]....Human neonates may be more sensitive to exposure in their earliest weeks of life.”

The NTP study was carried out at the IIT Research Institute (IITRI) in Chicago, under the direction of Dr. David McCormick. Groups of 100 male and 100 female F344 rats were exposed to 60 Hz EMFs for 18.5 hours a day for a two-year period. Three groups were exposed to continuous fields of 20 mG, 2 G or 10 G. Another group was exposed to a 10 G intermittent field, switched on or off every hour, while an additional group served as a control. The same procedure was followed with male and female B6C3F<sub>1</sub> mice. Great care was taken to avoid high-frequency transients in the EMF exposures, and to keep harmonic distortion to a minimum.

There were scattered significant findings for other cancers. For example, in female mice, the rate of malignant lymphoma was significantly lower among those exposed to the 10 G intermittent fields than among the controls. Other significant results included a positive trend for some skin cancer in male rats, and a negative association for some lung cancer in male and female mice. But none of these were as consistent as the thyroid finding in male rats.

Last year, NTP researchers reported on a smaller, eight-week experiment with a similar design, which found no evidence that EMFs increase the risk of cancer (see *MWN*, J/F98).

G.A. Boorman et al., *Toxicology and Carcinogenesis Studies of 60-Hz Magnetic Fields in F344/N Rats and B6C3F<sub>1</sub> Mice*, draft, NTP Technical Report No.488, NIH Publication No.98-3978, 160 pp., March 1998.

ing similar results,” said NIEHS’ Dr. Gary Boorman. “We think that’s a significant body of data.”

In an interview, Mevissen was critical of the Battelle work. “In two of their three experiments,” she said, “the tumor rates in the controls were over 90%. Under these conditions, comparisons with the EMF-exposed groups are not very useful.”

“I’ve been amazed at the differences between the Löscher and the Battelle studies,” said Dr. Christopher Portier of the NIEHS in Research Triangle Park, NC, who is coordinating RAPID’s EMF risk assessment (see p.6). “I have no good explanations,” he added. “Like everyone else, I have only questions.”

Both Boorman and Anderson said that the differing results in the Battelle and Hannover labs would be a major topic at the NIEHS symposium on *in vivo* studies in early April, and they hope the discussion will start to clarify the issue.

### **Differences in Genetics, Food and DMBA**

Anderson said he has some “candidate ideas” on the reasons for the difference, “but right now no firm conclusions.” He cited possible differences in the DMBA, the animals or the food used by each lab, or subtle differences in some aspect of the exposure environment.

“I think genetic differences between the Battelle rats and our rats are the most likely explanation for the differences in tumor and EMF outcomes,” Löscher said in an interview. Sprague-Dawley rats “show marked genetic variability among different breeders,” he explained, citing diet and the EMF exposure protocols as other possible factors.

Löscher noted that in every one of his experiments, “tumor incidence of the EMF-exposed group always stayed above the sham-exposed controls, although all studies were done blind.” Löscher’s six studies to date, with exposures from less than 10 mG to 1 G, have involved over 1,000 animals.

At Battelle, rats were exposed to EMFs for 18.5 hours a day, while in Löscher’s lab, exposures went on around the clock. Dr. Susan Fischer of the MD Anderson Cancer Center at the University of Texas, Smithville, a peer reviewer of the Battelle draft report, urged that it address this disparity—and its possible effects. When *Microwave News* asked Löscher if the difference in exposure times could have changed the results, he answered, “I simply don’t know.” But he noted that his rats had 500 hours of additional exposure over the course of a 13-week study, or the equivalent of three extra weeks. Boorman responded that, “Certainly, in our 26-week study, the total exposures would exceed those in Löscher’s 13-week studies.”

Battelle did two 13-week studies and one that lasted 26 weeks. Each used exposure groups of 100 female Sprague-Dawley rats. In the first 13-week study, 20 mg of the carcinogen DMBA was applied to the rats in four weekly doses of 5 mg. Different groups were exposed to 1G 50Hz, 5G 50Hz or 1G 60Hz EMFs, while a control group was treated with DMBA only.

Both U.S. and German labs took great pains to avoid harmonics and transients in the animals’ EMF exposures.

In Löscher’s work, the breast tumor rate among controls was about 40%. But in Battelle’s first 13-week study, the rate in the controls reached 92%, which left little possibility for contrast with the EMF-exposed animals (see *MWN*, M/A97).

“It would have been useful if they had done a preliminary experiment first, using small groups to assess the dose-dependent effects of DMBA in their strain of rats,” said Mevissen, calling this a “fairly standard” approach. In the recent breast cancer study by Drs. Ekström, Mild and Holmberg (see p.3), a dose-finding experiment at the outset led them to use 7 mg—instead of 10 mg—of DMBA.

The high background tumor rate at Battelle “was not entirely unanticipated,” according to the draft report on the study. “When we began,” Boorman explained, “the people we consulted with who had used DMBA said that with 20 mg you’ll get 90%-95% tumors with American rats. But we felt that if you’re going to replicate a study, you can’t choose to use a different dose.”

The report states that “in light of [the] findings” of Battelle’s first 13-week experiment, the Department of Energy (DOE) decided to sponsor a DMBA dose-response study. Based on these results, the Battelle group then carried out a second 13-week experiment with less DMBA: four weekly doses of 2 mg, for a total of 8 mg. This cut the breast cancer rate among controls to 43%. For EMF-exposed rats, the rates ranged from 38% to 48%.

Battelle’s 26-week study, which was under way before the DOE dose-response study was done, used a DMBA dose of 10 mg in a single application. In this case, the cancer rate among controls was 96%. Among EMF-exposed animals, the rates ranged from 85% to 95%.

In all three Battelle experiments, “No promotional effect by magnetic fields was found on any of the tumor parameters,” according to the report. To the extent that there was any trend, the EMF-exposed animals actually had fewer tumors. In the 26-week study, this gap was statistically significant for rats in the 1 G 50 Hz exposure group ( $p < 0.01$ ).

Although EMF-exposed animals at Battelle tended to have fewer mammary tumors, those tumors tended to be larger. But this trend was not significant, and Boorman noted that there was no increase in overall tumor mass per animal. An animal with fewer tumors might have larger ones “simply due to competition for nutrients,” he observed.

Löscher has shown EMF-related changes in levels of the hormone melatonin and the growth enzyme ODC. While the Battelle team did not look at ODC activity, no consistent effect of EMFs on melatonin levels was found. Anderson’s report notes, however, that the melatonin “data were highly variable within each [exposure] group,” making interpretation difficult.

A recent paper by Löscher raises another important issue: a seasonal variation in the tumor burden of Sprague-Dawley rats. Löscher suggests that this may be due to known seasonal variations in melatonin production and immune function.

G.A. Boorman et al., *Studies of Magnetic Field Promotion in Sprague-Dawley Rats*, draft, NTP Technical Report No.489, NIH Publication No.98-3979, 168 pp., March 1998.

W. Löscher, M. Mevissen and M. Häußler, “Seasonal Influence on 7,12-DMBA-Induced Mammary Carcinogenesis in Sprague-Dawley Rats under Controlled Laboratory Conditions,” *Pharmacology & Toxicology*, 81, pp.265-270, 1997. For more on Löscher and Mevissen’s work, see *MWN*, J/A93, S/O94, J/F95 and J/A95.

W. Löscher, M. Mevissen and S. Thun-Battersby, “Magnetic Field Exposure for 26 Weeks Enhances Tumor Development and Growth in a Rat Breast Cancer Model,” Abstract No.A-9-1, *20th Annual Meeting of the Bioelectromagnetics Society*, St. Petersburg, FL, June 7-11, 1998.

## Taiwan Study Links Childhood Leukemia, Transmission Lines

An elevated risk of leukemia has been found among children living near high-voltage transmission lines in metropolitan Taipei, Taiwan. The study drew on data from Taiwan's National Cancer Registry for the years from 1987 to 1992.

Children living in areas within 100 meters of a transmission line had a leukemia rate 2.7 times higher than did children in the nation as a whole, a significant increase. Their cancer risk was

2.4 times higher than that of other children in the same neighborhoods, a finding just short of statistical significance.

Dr. Chung-Yi Li of the College of Medicine at Fu-Jen Catholic University, Taipei, and Drs. Wei-Chin Lee and Ruey Shiung Lin of National Taiwan University, Taipei, report these results in the February *Journal of Occupational and Environmental Medicine* (40, pp.144-147, 1998). Formerly with the Maryland Department of Health, Lin was the first epidemiologist to link brain cancer to occupational EMF exposure (see *MWN*, O84 and J/A85).

"I tend to think that EMFs are responsible for what we observed in the study," Li told *Microwave News*. But he added that

## EMF RAPID Program Ending; Report Due in Late October

The National Institute of Environmental Health Sciences (NIEHS) is gearing up for the completion of the EMF Research and Public Information Dissemination Program, known as EMF RAPID.

The RAPID program has funded a variety of research projects (see *MWN*, S/O94, M/A95 and J/F97). The NIEHS will summarize the findings and put them into the context of the overall EMF health literature. In the Energy Policy Act of 1992, which mandated RAPID, Congress asked the NIEHS to determine whether exposure to EMFs produced by the generation, transmission and use of electricity affects human health.

A draft of the institute's final report is scheduled to be available by July 15.

Dr. Kenneth Olden, the director of the NIEHS, will send the report to Secretary of Health and Human Services Donna Shalala at the end of October. Shalala will then transmit the final report to Congress (see *MWN*, J/F98).

The NIEHS report will be the first evaluation of EMF health risks to be completed by a federal agency. The Environmental Protection Agency worked on such a review for more than ten years—and released a draft report in 1990—but has refused to publish a final version, which would have pointed to an EMF cancer risk (see *MWN*, M/J90 and J/F98).

Eleven chapters of the NIEHS report are currently under preparation (see table at right). They will be revised by a working group assembled by Drs. Christopher Portier and Mary Wolfe of the NIEHS in Research Triangle Park, NC. The report's summary chapter, with conclusions, will be written by the working group, which will meet in Minneapolis June 15-24.

"We hope to have the report written for the Minneapolis meeting," said Dr. Gary Boorman, who heads the RAPID effort at the institute. "It is an ambitious schedule."

The completed draft will be distributed to the public at no charge, Wolfe told *Microwave News*. Interested parties will have approximately six weeks to file comments.

The Energy Policy Act also set up the National EMF Advisory Committee and the EMF Interagency Committee to watch over the RAPID program. In September, both will review the draft report. The interagency committee, made up of representatives of federal agencies, must send its own report to Congress.

Congress had originally asked the NIEHS to complete its report by March 31, 1997, but granted an extension after the program got off to a slow start due to funding delays.

### EMF RAPID Final Report: Chapter Authors and Working Group

Chapter	Author	Affiliation
<i>In Vivo</i> Cancer Studies	Dr. Larry Anderson	Battelle PNL, Richland, WA
Occupational Epidemiology	Dr. Joseph Bowman	NIOSH, Cincinnati
Adult Residential Epi	Dr. Elisabeth Cardis	IARC Lyon, France
Clinical Human Lab Studies	Dr. Charles Graham	MRI, Kansas City, MO
<i>In Vitro</i> Studies	Dr. Richard Luben	University of California, Riverside
Molecular Biology	Dr. Mats-Olof Mattsson	Umeå University, Umeå, Sweden
<i>In Vitro</i> Cell Differentiation	Dr. Kenneth McLeod	State Univ. of New York, Stony Brook
Theoretical Mechanisms	Dr. Charles Polk	Univ. of Rhode Island, Kingston
<i>In Vivo</i> Non- Cancer Studies	Dr. Walter Rogers	Consultant, San Antonio
Childhood Residential Epi	Dr. Claire Sherman	University of California, Davis
Exposure Characterization	Dr. Michael Yost	University of Washington, Seattle

Attendees as of March 31: Drs. Arnold Brown, University of Wisconsin, Madison (emeritus); Mary Cook, Midwest Research Institute (MRI), Kansas City, MO; Sir Richard Doll, Oxford University, U.K.; Margarita Dubocovich, Northwestern University, Evanston, IL; James Felton, Lawrence Livermore National Lab, Livermore, CA; Maria Feychting, Karolinska Institute, Stockholm, Sweden; Paul Gailey, Oak Ridge National Lab, Oak Ridge, TN; Jean Harry, NIEHS, Research Triangle Park, NC; Leeka Kheifets, Electric Power Research Institute, Palo Alto, CA; Curtis Klaassen, University of Kansas, Lawrence; Genevieve Matanoski, Johns Hopkins University, Baltimore; Martin Misakian, National Institute of Standards and Technology, Gaithersburg, MD; Indira Nair, Carnegie-Mellon University, Pittsburgh; Louis Slesin, *Microwave News*, New York City; Richard Stevens, Battelle Pacific Northwest Labs, Richland, WA; Lorenzo Tomatis, Istituto per l'Infanzia, Trieste, Italy; Hiroshi Yamasaki, International Agency for Research on Cancer (IARC), Lyon, France; Paul Zweicker, TU Services, Dallas.

Coordinator: Dr. Christopher Portier, NIEHS; Facilitator: Dr. Michael Gallo, University Medical and Dental New Jersey, Piscataway.

epidemiological methods could not do much more to clarify the EMF–cancer link. Li believes that epidemiologists should now turn their attention away from power lines and try to discover if there are any as-yet-unknown risk factors for leukemia. If a new one is found, researchers could then examine whether it is associated with power lines. “After all,” he commented, “there must be something responsible for the association.” If no other factors can be identified, it would strengthen the argument that EMFs are to blame.

The Taiwan team did not measure the distance of each house from the line. Instead, they based the study on areas where most of the land lies within 100 meters of a high-voltage transmission line. While acknowledging that this is a “crude” measure, they argue that any exposure misclassification would likely underestimate the risk.

A measurement study in the same part of Taiwan by Li, Lin and Dr. Gilles Thériault of McGill University in Montreal, Canada, found that high-voltage transmission lines produced fields of about 2 mG inside houses 100 meters away, with higher fields in houses that were closer. The same group also found a link between adult leukemia and calculated historical EMF levels in the home (see *MWN*, M/J97).

## **EMFs Alter Key Enzyme Activity**

Dr. Fatih Uckun of the Wayne Hughes Institute in St. Paul, MN, has found new evidence that EMFs can alter the activity of protein kinases, enzymes that are involved in both normal cell function and cancer promotion.

Writing in the prestigious *Journal of Biological Chemistry* (273, pp.4,035-4,039, February 13, 1998), Uckun reports that EMFs can disrupt the “growth regulatory balance” in cancer cells. In a second paper, which will appear in the same journal this April, Uckun reports similar EMF-induced activity in a different, but related, enzyme system.

“This is another piece of evidence, which we first began to see in the 1980s, pointing to the importance of protein kinases as a key intracellular communication system that is sensitive to both ELF and modulated RF fields,” Dr. Ross Adey of the University of California, Riverside, told *Microwave News*.

Uckun exposed lymphoma B cells to 60 Hz 1 G magnetic fields. His work was supported under a grant from the RAPID research program. Uckun did not respond to repeated requests for an interview (see also p.15).

## **HIGHLIGHTS**

### **« Wireless Notes »**

Dr. **Michael Repacholi**, who heads the EMF project at the **World Health Organization** (WHO), caused a stir last year when he reported elevated cancer rates among mice exposed to GSM digital cellular phone radiation (see *MWN*, M/J97). Now he has published a new study that he believes bolsters this finding. The second study had the same experimental design, but exposed the mice instead to 50 Hz EMFs and found no cancer risk (see p.3). Repacholi told *Microwave News* that the new data have implications for his cellular phone study: “The control groups for both our RF and 50 Hz field studies showed no statistical differences, which lessens the possibility that the RF study result was a chance event or due to errors in methodology.”

«« »»

Dr. **Neil Cherry** toured the U.S. in March to address communities concerned about the proliferation of telecom towers. Cherry, of Lincoln University in Canterbury, **New Zealand**, has long advocated strict RF/MW exposure standards—0.1  $\mu\text{W}/\text{cm}^2$  for cancer risks and 10  $\text{nW}/\text{cm}^2$  to protect against miscarriages and neurological problems (see *MWN*, M/A97). He spoke at town meetings in California, Colorado and Massachusetts on possible health threats from broadcast, cellular and PCS radiation. The trip was arranged by **Christopher Beaver**, a filmmaker in San Francisco who last year successfully opposed a cell tower on a church steeple near his home; it was paid for by contributions from activists across the U.S. “I firmly believe that there is now sufficient evidence to establish that chronic exposure of large populations to extremely low levels of RF/MW radiation produces significant adverse health effects,” Cherry said in an interview. “I am not an expert,” he continued, “but I am a teacher,

and as I look at the scientific papers, I can see a pattern. The mindset that keeps asking for more and more data before taking steps to protect public health is a fundamental part of the problem.” While in San Francisco, Cherry debated former FCC Commissioner **Rochelle Chong** and Dr. **Martin Meltz** of the University of Texas Health Science Center in San Antonio on a local television station. Asked whether his trip was a success, Cherry answered, “People are thirsty for information, and I am able to confirm that their fears are based on science, not mere innuendo.”

«« »»

In February, the Irish telecom firm **Eircell** released a glossy report declaring that families living near mobile telephone **base stations** have nothing to fear. There is “no evidence for any detrimental effect” of RF/MW radiation from wireless antennas, conclude the authors, Drs. **Maurice Hurley** of the Cork University Hospital, **Michael Maher** of Mater Private Hospital in Dublin, **Anthony Staines** of University College, Dublin, and **Philip Walton** of University College, Galway. At Eircell’s request, the four had looked at a number of recent lab studies; they found none that “definitively demonstrated a ‘cause and effect’ relationship” between RF/MW exposure and cancer. They note, however, that no studies of the health effects of living near base stations are under way. Their conclusion that no health hazard exists is based on the fact that average power densities near Eircell’s base stations are hundreds of times lower than both international limits and head exposure from a hand-held phone. The safety of wireless handsets is not addressed in the report: “We were asked to examine the masts [antennas] issue only,” Maher told the *Irish Independent* (February 2). Some members of the public were

## HIGHLIGHTS

---

skeptical of the all clear. Dr. **Dawn Payne**, a physician who works for the **Irish Countrywomen's Association**, contended that "four experts were not enough" to reflect the diversity of scientific opinion on the subject, according to the February 4 *Irish Times*. Since the World Health Organization's program of cellular phone safety research is still under way, Payne asked, "Why not shelve the erection of masts until these results are published?"

«« »»

Thirty-one members of Congress have asked FCC Chairman **William Kennard** to "terminate all action" on his agency's proposals to preempt state and local rules on wireless telephone and digital television (DTV) antenna siting. Such proposals "violate both the language...and the Congressional intent" of the 1996 **Telecommunications Act**, emphasizes the group's January 30 letter to Kennard. Rep. **Robert Goodlatte** (R-VA), who assembled this group of legislators, helped write the act's federal preemption clause, so he can claim to know what Congress intended. Last summer, the FCC proposed to preempt all community tower moratoriums of unspecified length and any siting decisions influenced by concerns about RF safety (see *MWN*, S/O97). In response to a petition from the broadcasting industry, the FCC also asked whether it should apply a similar policy to community decisions on DTV transmitters (see below and *MWN*, S/O97). Since Kennard took over as head of the FCC from Reed Hundt, however, the agency appears to be more sympathetic to the lawmakers' and the public's concerns. According to the trade journal *RCR* (February 2), Kennard told reporters in Washington that federal preemption "shouldn't even be considered" until local officials and the wireless industry attempt to resolve their differences through negotiation (see p.15 and *MWN*, J/F98). On March 9, Kennard addressed a public meeting in Hardwick, VT, where Bell Atlantic Mobile's plan to place a 150-foot-tall wireless base station atop Buffalo Mountain, a local landmark, has angered many local residents. Kennard assured his audience that FCC intervention would be a "last resort," according to the March 11 *Hardwick Gazette*. While in the state, he also chatted

with Rep. Bernie Sanders (D-VT) and Sens. Pat Leahy (D-VT) and James Jeffords (R-VT), who are sponsoring bills—H.R.3016 and S.1350—that would reverse the telecom law's restriction against local ordinances based on concerns about RF health effects and block preemption for DTV towers (see *MWN*, N/D97). Goodlatte approves of the substance of these bills, an aide told *Microwave News*, but the congressman feels that the letter is more likely to get results. If the FCC does not drop the proposed rules, the aide said, Goodlatte may press for legislation. As of the end of March, the FCC had not responded to the letter.

«« »»

The **National Audubon Society** in Washington also is objecting to federal preemption of state and local rules for siting DTV transmitters, and has called on the FCC to prepare an environmental impact statement (EIS) before adopting such a policy (see *MWN*, S/O97). On March 6, the FCC issued a public notice seeking comment on whether an EIS is required. The proposed rule is "environmentally unsound" and "overly broad," wrote Daniel Beard, the society's senior vice president for public policy, in a petition submitted last December 1. The national conservation group, which has more than 500,000 members, maintains that such an exemption is a "major federal action," for which federal law requires an EIS. The Audubon Society is concerned that poorly located television towers pose a threat to migratory birds: It notes that each year as many as one million birds are killed flying into broadcast towers in the U.S. If adopted, the society predicts, the exemption would lead to more siting mistakes and bird kills. The society is also worried about the precedent the rule would set as "an inappropriate blanket exemption from state and local laws for a single industry." It "could open the door to a host of similar proposals before other federal agencies," the group warns. Asked whether the Audubon Society will take the FCC to court if the agency does not draft an EIS, society spokesperson Perry Plumart told *Microwave News* that, "We want to keep our options open." Comments on the proposed rule must be submitted to the FCC by April 14.

---

## In Texas, Digital TV Tests Interfere with Medical Devices

On February 27, Baylor University Medical Center in Dallas was confronted with the new era of digital television (DTV) "in a very rude way," according to Steven Juett, a senior clinical engineer at the hospital.

Tests of the new DTV technology by a local station caused widespread electromagnetic interference (EMI) with medical devices at Baylor. The interference "rendered the cardiac monitoring via radio telemetry useless," Juett told a biomedical engineering group on American Online. "This has caught us off guard."

Dallas' WFAA broadcast its first-ever DTV signals on that Friday at 2:00 p.m., the station's Dave Muscari told *Microwave News*. A second test occurred the next day. "It took Baylor a day and a half to figure it out," said Muscari. "They tracked the signal with a spectrum analyzer, and finally somebody remembered reading about our tests and put two and two together." WFAA's

engineering staff got its first call from Baylor around 3:00 a.m. on Sunday, March 1.

Muscari reports that the month of March saw several incidents at other medical centers in the Dallas-Ft. Worth area. "Whenever the hospitals had a problem, we turned the signal off immediately," he emphasized. "It's an issue of public safety."

On March 25, the Federal Communications Commission (FCC) and the Food and Drug Administration (FDA) issued a joint statement explaining the cause: "Certain medical telemetry devices...are allowed to use TV broadcast channels that are unoccupied in their geographic area." DTV broadcasts are now taking over some of those previously unused channels. "Fortunately," the federal statement continues, "no patients were significantly affected" in any of these EMI cases.

The problem is not limited to medical equipment. An FCC engineer told the March 12 *Washington Post* that maritime radios, local cable TV systems, wireless microphones and apartment satellite antennas could also be affected.

One report blames DTV for an even more serious kind of



EMI. "After we did a DTV test a few months ago, a guy from the FAA called up frantic, wanting to know where the plane had crashed," a source at the UPN network told *Variety's* new daily New York City edition (March 16). The paper explained that, "The DTV test had emitted a signal identical to a jetliner's distress code, making officials think an aircraft had collided with the city's tallest building," the World Trade Center, which holds UPN's digital antennas. But Les Dorr, a Federal Aviation Administration spokesperson in Washington, told *Microwave News* he could not confirm that such an incident ever took place.

If DTV begins to use a frequency on which hospital equipment currently relies, the devices must either be replaced or retuned to a new frequency, usually by installing a different crystal oscillator. Baylor decided to move up the date of a planned upgrade of its equipment.

"We were not aware that this was a possible problem," said Muscari. Juett asserted that, "There was no coordination between FDA and FCC to prepare our medical center." The FCC had issued its own warning last October, according to the March 12 *New York Times*, but federal officials conceded that this had received little attention.

In mid-1996, the FDA urged the FCC to allocate frequencies "for the exclusive use of biomedical telemetry, as we understand is already the case in Europe." That June, the FDA's Dr. Elizabeth Jacobson warned that as long as medical devices were restricted to a secondary, unlicensed status, the FDA would remain "deeply concerned with the potential for injury to patients that might occur" in EMI cases. The FCC rejected the FDA's suggestion.

## **Finns Launch Research Program on Wireless Health Risks**

Finland's Technology Development Center (TEKES), based in Helsinki, has begun a three-year research effort on possible health risks from cellular phone radiation.

Contributions from the government-run TEKES and from the Finnish wireless industry will amount to approximately 4.5 million marks (\$800,000), about two-thirds of the program's cost. Dr. Jukka Juutilainen of the University of Kuopio, the program's coordinator, told *Microwave News* that the participating research institutes will cover the remaining expenses.

The program will include six projects:

- Development of exposure systems for animal and cell culture experiments, at the Center for Radiation and Nuclear Safety in Helsinki;
- Experiments on cocarcinogenic effects of wireless radiation, at the University of Kuopio;
- A feasibility study for an epidemiological study of cellular phone use and cancer, at the Institute of Occupational Health in Vantaa.
- A study of cellular phone radiation and electrosensitivity, at the Institute of Occupational Health;
- *In vitro* systems for studying RF/MW bioeffects, at the University of Kuopio and the Center for Radiation and Nuclear Safety;
- Computer models of exposure to wireless phone radiation, at the State Technical Research Center's (VTT) Information Technology lab in Espoo.

Several of the investigators, including Juutilainen, previously

## **1998 Conference Calendar (Part III)**

*Parts I and II appeared in our last two issues.*

April 25-26: **3rd COST 244bis Workshop on Biomedical Effects of EMFs: Intermediate Frequency Range (3 kHz-3 MHz)**, Centre Universitaire Scientifique et Biomédical des Saints-Pères, Paris, France. Contact: Dr. René de Seze, Laboratoire de Biophysique Médicale, Faculté de Médecine, Av. Kennedy, F-30900 Nîmes, France (33+04) 66 68 32 44, Fax: (33+04) 66 23 55 38, E-mail: <biomed@zeus.sc.univ-montpl.fr>, Web: <www.radio.fer.hr/cost244/main/paris.htm>.

April 28-29: **RAPID EMF Engineering Review Symposium: Status and Summary of EMF Engineering Research**, Sheraton Hotel, Charleston, SC. Contact: W/L Associates, 7519 Ridge Road, Frederick, MD 21702, (301) 663-1915, Fax: (301) 371-8955, E-mail: <75230.1222@compuserve.com>.

July 19-24: **EMFs in Biology and Medicine: Sensory Perception, Self-Organization and Therapeutic Applications** (Gordon Research Conference on Bioelectrochemistry), New England College, Henniker, NH. Contact: Dr. Paul Gailey, Oak Ridge National Laboratory, PO Box 2008, MS 6070, Oak Ridge, TN 37831, (423) 574-0419, Fax: (423) 574-5227, E-mail: <pg7@stc06.ctd.ornl.gov>, Web: <www.ornl.gov/emf/gordon.htm>. See *Science*, February 27, 1998, p.1374.

August 3-5: **International Symposium on Power Line to Microwave Radiation**, Montréal, Québec, Canada. Contact: Dr. A. Kumar, PO Box 240, 30 Rue Lippee, Les Coteaux, Québec J7X 1H5, Canada, (514) 620-3717, Fax: (514) 267-1144, E-mail: <kumar@colba.net>.

September 13-16: **DOE-EPRI Annual Review of Research on Biological Effects of Electric and Magnetic Fields from the Generation, Delivery and Use of Electricity**, Inn Suites, Tucson, AZ. Contact: W/L Associates, see April 28-29 above.

September 13-16: **International Symposium on Electromagnetic Fields in Biological Systems**, Prague, Czech Republic. Contact: Symposium EFBS, Institute of Radio Engineering and Electronics, Chaberská 57, 18251 Prague 8-Kobylisy, Czech Republic, (42+02) 688-1804, Fax: (42+02) 688-0222, E-mail: <pokorny@ure.cas.cz>, Web: <www.ure.cas.cz>.

September 19-21: **4th COST 244bis Workshop on Biomedical Effects of EMFs: Health Risks of Prolonged EMF Exposure**, Graz, Austria. Contact: COST 244bis Secretariat, Unska 3, HR-10000 Zagreb, Croatia, (385+1) 6129-606, Fax: (385+1) 6129-717, E-mail: <cost244@fer.hr>, Web: <www.radio.fer.hr/cost244/main/meetings.htm#WORKSHOPSb>.

September 27-30: **3rd Congress of the International Association of Biologically Closed Electric Circuits in Biomedicine and 2nd International Symposium on Electrochemical Treatment of Cancers**, Beijing, China. Contact: Dr. Xinchao Bao, China-Japan Friendship Hospital, Beijing 100029, China, (86+1) 064227535, Fax: (86+1) 064217749, E-mail: <gzliu@hns.cjfh.ac.cn>.

November 11-14: **18th Annual Meeting of the Society for Physical Regulation in Biology and Medicine**, The Queen Mary, Long Beach, CA. Contact: W/L Associates, see April 28-29 above.

November 19-21: **4th European Bioelectromagnetics Association (EBEA) Congress**, University of Zagreb, Croatia. Contact: EBEA Secretariat, Unska 3, HR-10000 Zagreb, Croatia, (385+1) 6129-606, Fax: (385+1) 6129-717, E-mail: <4thebea@fer.hr>, Web: <www.radio.fer.hr/cost244/4thebea>.

November 21-22: **5th COST 244bis Workshop on Biomedical Effects of EMFs: Biomedical Effects of Mobile Communications Equipment**, University of Zagreb, Croatia. Contact: COST 244bis Secretariat, see September 19-21 above.

worked on studies of cellular phone safety led by the VTT. A VTT press release last May announced that this research had determined that mobile phones "pose no health threat to phone users," although some projects had not been completed at the time (see *MWN*, J/A97).

---

# Microwave News EMF–EMR World Wide Web Directory

All site addresses begin with: <http://>

## U.S. Government

For additional online regulatory information, see Health Physics, 73, pp.310-311, August 1997.

### Congress

House of Representatives <[www.house.gov](http://www.house.gov)>

Library of Congress <[www.loc.gov](http://www.loc.gov)>

Senate <[www.senate.gov](http://www.senate.gov)>

### Federal Agencies

Department of Defense <[www.dtic.mil/lablink](http://www.dtic.mil/lablink)>  
(umbrella site for the military's research programs)

Department of Energy <[www.doe.gov](http://www.doe.gov)>  
Office of Environment, Safety and Health <[www.eh.doe.gov](http://www.eh.doe.gov)>

Environmental Protection Agency <[www.epa.gov](http://www.epa.gov)>  
Office of Air & Radiation <[www.epa.gov/oar](http://www.epa.gov/oar)>

Federal Communications Commission <[www.fcc.gov](http://www.fcc.gov)>  
Office of Engineering and Technology <[www.fcc.gov/oet](http://www.fcc.gov/oet)>  
State and Local Focus <[www.fcc.gov/state&local](http://www.fcc.gov/state&local)>  
Wireless Telecommunications Bureau <[www.fcc.gov/wtb](http://www.fcc.gov/wtb)>

Food and Drug Administration <[www.fda.gov](http://www.fda.gov)>  
Center for Devices and Radiological Health  
<[www.fda.gov/cdrh](http://www.fda.gov/cdrh)>

National Institute for Occupational Safety and Health  
<[www.cdc.gov/niosh](http://www.cdc.gov/niosh)> (see p.13)

National Institute of Environmental Health Sciences  
<[www.niehs.nih.gov](http://www.niehs.nih.gov)>  
EMF RAPID <[www.niehs.nih.gov/emfrapid](http://www.niehs.nih.gov/emfrapid)> (see p.13)  
Environmental Health Information Service <[ehis.niehs.nih.gov](http://ehis.niehs.nih.gov)>  
National Toxicology Program <[ntp-server.niehs.nih.gov](http://ntp-server.niehs.nih.gov)>

National Library of Medicine <[www.nlm.nih.gov](http://www.nlm.nih.gov)>

National Technical Information Service <[www.fedworld.gov](http://www.fedworld.gov)>

National Telecommunications and Information Administration  
<[www.ntia.doc.gov](http://www.ntia.doc.gov)>

Occupational Safety and Health Administration  
<[www.osha-slc.gov](http://www.osha-slc.gov)>

The White House <[www.whitehouse.gov](http://www.whitehouse.gov)>

### State and Local Agencies

California EMF Program  
<[www.dnai.com/~emf](http://www.dnai.com/~emf)>

New Jersey Dept of Environmental Protection  
Radiation Protection Program (page on non-ionizing radiation)  
<[www.state.nj.us/dep/rpp/ber/nrs/nrsindex.htm](http://www.state.nj.us/dep/rpp/ber/nrs/nrsindex.htm)>

### Quasi-Governmental Groups

National Academy of Sciences-National Research Council  
<[www.nas.edu](http://www.nas.edu)>

National Council on Radiation Protection  
and Measurements <[www.ncrp.com](http://www.ncrp.com)>

## Professional Societies & Trade Associations

American Industrial Hygiene Assn <[www.aiha.org](http://www.aiha.org)>

American National Standards Institute <[www.ansi.org](http://www.ansi.org)>

American Public Power Assn <[www.appanet.org](http://www.appanet.org)>

Bakken Library and Museum <[www.bakkenmuseum.org](http://www.bakkenmuseum.org)>

Bioelectromagnetics Society <[biomed.ucr.edu/bems.htm](http://biomed.ucr.edu/bems.htm)>

Cellular Telecommunications Industry Assn (CTIA)  
<[www.wow-com.com](http://www.wow-com.com)>

Conference of Radiation Control Program Directors  
<[www.crcpd.org](http://www.crcpd.org)>

Edison Electric Institute <[www.eei.org](http://www.eei.org)>

Electric Power Research Institute <[www.epri.com](http://www.epri.com)>

Electromagnetic Energy Assn <[www.elecenergy.com](http://www.elecenergy.com)>

Electronic Industries Alliance <[www.eia.org](http://www.eia.org)>

Health Physics Society <[www.hps.org](http://www.hps.org)>

Institute of Electrical and Electronics Engineers <[www.ieee.org](http://www.ieee.org)>  
Committee on Man and Radiation  
<[homepage.seas.upenn.edu/~kfoster/comar.htm](http://homepage.seas.upenn.edu/~kfoster/comar.htm)>

National Assn of Broadcasters <[www.nab.org](http://www.nab.org)>

National Assn of Regulatory Utility Commissioners  
<[www.erols.com/naruc](http://www.erols.com/naruc)>

National Assn of State Energy Officials <[www.naseo.org](http://www.naseo.org)>

National Assn of Telecom.Officers & Advisors <[www.natoa.org](http://www.natoa.org)>

National Assn of Tower Erectors <[daknet.com/nate](http://daknet.com/nate)>

National Electrical Manufacturers Assn <[www.nema.org](http://www.nema.org)>

National Electromagnetic Field Testing Assn  
<[www.theramp.net/nefta](http://www.theramp.net/nefta)>

National Rural Electric Cooperative Assn <[www.nreca.org](http://www.nreca.org)>

Personal Communications Industry Assn <[www.pcia.com](http://www.pcia.com)>

Radiological Society of North America <[www.rsna.org](http://www.rsna.org)>

Telecommunications Industry Assn <[www.tiaonline.org](http://www.tiaonline.org)>

Western Electric Power Institute <[www.powerin.org](http://www.powerin.org)>

## Outside U.S.

### International

International Commission on Non-Ionizing  
Radiation Protection <[www.sz.shuttle.de/dm1001/icnirp.htm](http://www.sz.shuttle.de/dm1001/icnirp.htm)>

International Conference on Large High-Voltage Electric  
Systems (CIGRE) <[www.worldnet.net/~cigre/HomePage.shtml](http://www.worldnet.net/~cigre/HomePage.shtml)>

International Electrotechnical Commission <[www.iec.ch](http://www.iec.ch)>

International Mobile Telecommunications Assn  
<[www.imta.org](http://www.imta.org)>

World Health Organization International EMF Project  
<[www.who.ch/peh-emf](http://www.who.ch/peh-emf)>

## Europe

European Bioelectromagnetics Assn  
<[bioem.ing.uniroma1.it/ebea/welcome.html](http://bioem.ing.uniroma1.it/ebea/welcome.html)>

European Committee for Electrotechnical Standardization  
<[server.cenelec.be](http://server.cenelec.be)>

European Cooperation on Scientific and Technical Research  
Program on Biomedical Effects of EMFs (COST 244 and 244bis)  
<[www.radio.fer.hr/cost244](http://www.radio.fer.hr/cost244)>

## Australia

Australian Mobile Telecommunications Assn <[www.amta.org.au](http://www.amta.org.au)>

Australian Radiation Lab: Non-Ionizing Radiation Section  
<[www.health.gov.au/hfs/arl/hm\\_nir.htm](http://www.health.gov.au/hfs/arl/hm_nir.htm)>

Electricity Supply Assn of Australia  
<[www.ozemail.com.au/~esaamelb/emf.htm](http://www.ozemail.com.au/~esaamelb/emf.htm)>

Electromagnetic Radiation Alliance of Australia  
<[www.acay.com.au/~ssec/emraa.htm](http://www.acay.com.au/~ssec/emraa.htm)>

EMFacts Information Service (Don Maisch)  
<[www.tassie.net.au/emfacts](http://www.tassie.net.au/emfacts)>

## Canada

Alberta Workers' Health Center  
<[www.web.net:80/~wrkrhlth/index.html](http://www.web.net:80/~wrkrhlth/index.html)>

Bridlewood Residents Hydro Line Committee  
<[www.ncf.carleton.ca/bridlewood-emfinfo](http://www.ncf.carleton.ca/bridlewood-emfinfo)>

Canadian Electricity Assn <[www.canelect.ca](http://www.canelect.ca)>

Canadian Wireless Telecommunications Assn <[www.cwta.ca](http://www.cwta.ca)>

## Germany

Research Association for Radio Applications (FGF)  
<[www.fgf.de/links\\_e.html](http://www.fgf.de/links_e.html)>

## Italy

EMF-in-the-Web (Italian National Research Council)  
<[safeemf.iroecfi.cnr.it/safeemf/emfref.htm](http://safeemf.iroecfi.cnr.it/safeemf/emfref.htm)>

## Japan

Electronic Industries Assn of Japan  
<[www.eiaj.or.jp/english/index.htm](http://www.eiaj.or.jp/english/index.htm)>

Japan Electronic Industry Development Assn  
<[www.jeida.or.jp/index-e.html](http://www.jeida.or.jp/index-e.html)>

## Sweden

National Institute for Working Life <[www.niwl.se/niwl.htm](http://www.niwl.se/niwl.htm)>

Swedish Assn for the Electrosensitive (FEB) <[www.feb.se](http://www.feb.se)>

Swedish Council for Work Life Research <[www.ralf.se](http://www.ralf.se)>

## Electric Utilities

American Electric Power  
<[www.aep.com](http://www.aep.com)>

Arizona Public Service  
<[www.aps.com](http://www.aps.com)>

Baltimore Gas & Electric  
<[www.bge.com](http://www.bge.com)>

Bonneville Power  
Administration  
<[www.bpa.gov](http://www.bpa.gov)>

Boston Edison  
<[www.bedison.com](http://www.bedison.com)>

British Columbia Hydro  
<[ewu.bchydro.bc.ca](http://ewu.bchydro.bc.ca)>

Carolina Power & Light  
<[www.stockprofile.com/~hastings/cpl](http://www.stockprofile.com/~hastings/cpl)>

Central and South West  
<[www.csw.com](http://www.csw.com)>

Central Maine Power  
<[www.cmpco.com](http://www.cmpco.com)>

Cinergy  
<[www.cinergy.com](http://www.cinergy.com)>

Commonwealth Edison  
<[www.ucm.com/ucm/info/comed.htm](http://www.ucm.com/ucm/info/comed.htm)>

Consolidated Edison  
<[www.coned.com](http://www.coned.com)>

Consumers Energy  
<[www.cpeco.com](http://www.cpeco.com)>

Delmarva Power & Light  
<[www.delmarva.com](http://www.delmarva.com)>

Detroit Edison  
<[www.detroitdison.com](http://www.detroitdison.com)>

Duke Energy  
<[www.duke-energy.com](http://www.duke-energy.com)>

Duquesne Electric Power  
<[www.dqe.com](http://www.dqe.com)>

Entergy  
<[www.entergy.com](http://www.entergy.com)>

Florida Power  
<[www.fpc.com/flapower.htm](http://www.fpc.com/flapower.htm)>

GPU  
<[www.gpu.com](http://www.gpu.com)>

Green Mountain Power  
<[www.gmpvt.com](http://www.gmpvt.com)>

Hawaiian Electric Industries  
<[www.hei.com](http://www.hei.com)>

Houston Lighting & Power  
<[www.hlp.com](http://www.hlp.com)>

Hydro Québec  
<[www.hydro.qc.ca](http://www.hydro.qc.ca)>

Illinois Power  
<[www.illinova.com](http://www.illinova.com)>

Indianapolis Power & Light  
<[www.ipalco.com](http://www.ipalco.com)>

Kansai Electric Power  
<[www.kepco.co.jp](http://www.kepco.co.jp)>

Kansas City Power & Light  
<[www.kcmo.com/kcpl](http://www.kcmo.com/kcpl)>

LG&E Energy  
<[www.lgeenergy.com](http://www.lgeenergy.com)>

Long Island Lighting  
<[www.lilco.com](http://www.lilco.com)>

Maine Public Service  
<[www.mainerec.com/mpsco.html](http://www.mainerec.com/mpsco.html)>

Minnesota Power & Light  
<[www.mnpower.com](http://www.mnpower.com)>

Mississippi Power  
<[www.msppower.com](http://www.msppower.com)>

Montana Power  
<[www.mtpower.com](http://www.mtpower.com)>

National Grid Co.  
<[www.ngc.co.uk](http://www.ngc.co.uk)>

New Century Energies  
<[www.psc.com/nce/index.htm](http://www.psc.com/nce/index.htm)>

New York Power Authority  
<[www.nypa.gov](http://www.nypa.gov)>

New York State Electric & Gas  
<[www.nyseg.com](http://www.nyseg.com)>

Niagara Mohawk  
<[www.nimo.com](http://www.nimo.com)>

Northeast Utilities  
<[www.nu.com](http://www.nu.com)>

Northern States Power Company  
<[www.nspco.com](http://www.nspco.com)>

Ohio Edison  
<[www.ohioedison.com](http://www.ohioedison.com)>

Ontario Hydro  
<[www.hydro.on.ca](http://www.hydro.on.ca)>

Orange and Rockland Utilities  
<[www.oru.com](http://www.oru.com)>

Pacific Gas & Electric  
<[www.pge.com](http://www.pge.com)>

PacificCorp  
<[www.upl.com](http://www.upl.com)>

PECO Energy  
<[www.peco.com](http://www.peco.com)>

Pennsylvania Power & Light  
<[www.papl.com](http://www.papl.com)>

San Diego Gas & Electric  
<[www.sdge.com](http://www.sdge.com)>

EMF Litigation Home  
Page  
<[www.sdge.com/emf](http://www.sdge.com/emf)>

Southern California Edison  
<[www.sce.com](http://www.sce.com)>

Southern Company  
<[www.southernco.com](http://www.southernco.com)>

Tampa Electric  
<[www.teco.net/TampaElectric.html](http://www.teco.net/TampaElectric.html)>

Tennessee Valley Authority  
<[www.tva.com](http://www.tva.com)>

Texas Utilities  
<[www.tu.com](http://www.tu.com)>

Tokyo Electric Power  
<[www.tepco.co.jp/index-e.html](http://www.tepco.co.jp/index-e.html)>

TransAlta Utilities  
<[www.transalta.com](http://www.transalta.com)>

Union Electric  
<[www.ue.com](http://www.ue.com)>

United Illuminating  
<[www.connix.com/~uil](http://www.connix.com/~uil)>

UtiliCorp United  
<[www.utilicorp.com](http://www.utilicorp.com)>

Virginia Electric & Power  
<[www.vapower.com](http://www.vapower.com)>

Wisconsin Public Service  
<[www.wpsc.wpsr.com/wpsr.html](http://www.wpsc.wpsr.com/wpsr.html)>

Swedish Mobile Telecommunications Assn <[www.mtl.se](http://www.mtl.se)>  
Swedish Radiation Protection Institute (SSI) <[www.ssi.se](http://www.ssi.se)>

### **United Kingdom**

Health and Safety Executive  
<[www.open.gov.uk/hse/hsehome.htm](http://www.open.gov.uk/hse/hsehome.htm)>  
National Radiological Protection Board <[www.nrpb.org.uk](http://www.nrpb.org.uk)>  
Powerwatch Network  
<[www3.mailbox.co.uk/www.powerwatch.org.uk](http://www3.mailbox.co.uk/www.powerwatch.org.uk)>

### **Research Groups**

Chalmers University of Technology (Sweden)  
Bioelectromagnetics Group  
<[www.nt.chalmers.se/BioEMgroup/BioElHomepage.html](http://www.nt.chalmers.se/BioEMgroup/BioElHomepage.html)>  
Federal Institute of Technology (Switzerland)  
Laboratory for EMF Theory and Microwave Electronics  
<[www.ifh.ee.ethz.ch](http://www.ifh.ee.ethz.ch)>  
University of Oklahoma  
Center for the Study of Wireless EM Compatibility  
<[www.ou.edu/engineering/emc](http://www.ou.edu/engineering/emc)>  
University of Victoria (Canada)  
Industrial Research Chair in EMFs and Living Systems  
<[www.bioelec.ece.uvic.ca/chair](http://www.bioelec.ece.uvic.ca/chair)>  
University of Western Australia  
Biomagnetics and Iron Biomineralization Group  
<[www.pd.uwa.edu.au/BioPhys/Biophysics\\_Page\\_V.2.html](http://www.pd.uwa.edu.au/BioPhys/Biophysics_Page_V.2.html)>  
Wireless Technology Research (WTR) <[www.wtrllc.com](http://www.wtrllc.com)>

### **Consultants**

Amuneal Manufacturing Corp. <[www.amuneal.com](http://www.amuneal.com)>  
Coghill Research Laboratories <[www.cogreslab.demon.co.uk](http://www.cogreslab.demon.co.uk)>  
Enertech Consultants <[www.etc-inc.com](http://www.etc-inc.com)>  
Ergonomics Inc. <[www.ergonomicsusa.com](http://www.ergonomicsusa.com)>  
Field Management Services Corp. <[www.fms-corp.com](http://www.fms-corp.com)>  
Holistic Homes Design (low-EMF homes)  
<[www.efn.org/~andrewm/HHD/HHD\\_main.html](http://www.efn.org/~andrewm/HHD/HHD_main.html)>  
Richard Tell Associates Inc. <[www.radhaz.com](http://www.radhaz.com)>  
VitaTech Engineering Inc. <[www.mnsinc.com/emf](http://www.mnsinc.com/emf)>

### **Citizens and Interest Groups**

Cellular Tower Coalition <[www.cellulartower.com](http://www.cellulartower.com)>  
Cellular Towers, EMR and Health Effects  
<[www.wwnet.com/~babbles](http://www.wwnet.com/~babbles)>  
Communications Workers of America <[www.cwa-union.org](http://www.cwa-union.org)>  
Electrical Sensitivity Network <[www.bslnet.com/esn](http://www.bslnet.com/esn)>  
EMR Alliance <[www2.emralliance.com](http://www2.emralliance.com)>  
Families Against Cell Towers at Schools (FACTS)  
<[www.flipag.net/nopoles](http://www.flipag.net/nopoles)>  
Mind Control Forum <[www.mk.net/~mcf](http://www.mk.net/~mcf)>  
West Virginia Power Line Fight  
<[hill.concord.wvnet.edu/~noline](http://hill.concord.wvnet.edu/~noline)>

### **Personal Sites**

Howard Bassen (FDA-CDRH)  
<[www.networkkconnection.com/~hibem](http://www.networkkconnection.com/~hibem)>

## **Wireless Companies**

AirTouch Communications < <a href="http://www.airtouch.com">www.airtouch.com</a> >	Hagenuk < <a href="http://www.hagenuk.de">www.hagenuk.de</a> >
Ameritech < <a href="http://www.ameritech.com">www.ameritech.com</a> >	Iridium < <a href="http://www.iridium.com">www.iridium.com</a> >
AT&T < <a href="http://www.att.com">www.att.com</a> >	MCI Communications < <a href="http://www.mci.com">www.mci.com</a> >
AT&T Wireless Services < <a href="http://www.attws.com">www.attws.com</a> >	Motorola < <a href="http://www.mot.com">www.mot.com</a> >
BellSouth < <a href="http://www.bellsouth.com">www.bellsouth.com</a> >	Nextel Communications < <a href="http://www.nextel.com">www.nextel.com</a> >
British Telecom < <a href="http://www.bt.co.uk">www.bt.co.uk</a> >	Nippon Telegraph & Telephone Corp. < <a href="http://www.ntt.com">www.ntt.com</a> >
Cellular One < <a href="http://www.cellularone.com">www.cellularone.com</a> >	Nokia < <a href="http://www.nokia.com">www.nokia.com</a> >
Deutsche Telekom < <a href="http://www/dtag.de">www/dtag.de</a> >	Omnipoint < <a href="http://www.omnipoint.com">www.omnipoint.com</a> >
Deutsche Telekom Mobil < <a href="http://www.T-Mobil.de">www.T-Mobil.de</a> >	Siemens < <a href="http://www.siemens.com">www.siemens.com</a> >
Eircell < <a href="http://www.eircell.ie">www.eircell.ie</a> >	Sprint PCS < <a href="http://www.sprintpcs.com">www.sprintpcs.com</a> >
Ericsson < <a href="http://www.ericsson.com">www.ericsson.com</a> >	Telecom New Zealand < <a href="http://www.telecom.co.nz">www.telecom.co.nz</a> >
Esat Digifone < <a href="http://www.digifone.com">www.digifone.com</a> >	Teledesic < <a href="http://www.teledesic.com">www.teledesic.com</a> >
France Telecom < <a href="http://www.francetelecom.fr">www.francetelecom.fr</a> >	Telstra < <a href="http://www.telstra.com">www.telstra.com</a> >
GTE Mobilnet < <a href="http://www.mobilnet.gte.com">www.mobilnet.gte.com</a> >	U.S. West < <a href="http://www.uswest.com">www.uswest.com</a> >

*For additional wireless company web site addresses,  
see the directory at Wireless Week's web site, listed at right.*

Robert Bedard (California EMF activist)  
<[www.cruzio.com/~rbedard/waveguide](http://www.cruzio.com/~rbedard/waveguide)>  
Stewart Fist (Australian journalist) <[www.electric-words.com](http://www.electric-words.com)>  
Andrew Marino (Louisiana State University Medical Center)  
<[www.ortho.lsumc.edu/Faculty/Marino](http://www.ortho.lsumc.edu/Faculty/Marino)>  
Michael Milburn (author of *EMFs and Your Health*)  
<[ourworld.compuserve.com/homepages/mpm\\_mo/homepage.htm](http://ourworld.compuserve.com/homepages/mpm_mo/homepage.htm)>  
John Moulder (Medical College of Wisconsin)  
<[www.mcw.edu/gcrc/cop.html](http://www.mcw.edu/gcrc/cop.html)>  
Valdemar Gisli Valdemarsson (EMF page in Icelandic)  
<[www.isholf.is/vgv](http://www.isholf.is/vgv)>  
Arthur Varanelli (Raytheon) <[pw1.netcom.com/~art16](http://pw1.netcom.com/~art16)>

### **Meters**

EMC Test Systems <[www.emctest.com](http://www.emctest.com)>  
Enertech Consultants <[www.etc-inc.com](http://www.etc-inc.com)>  
EnviroMentor <[www.enviromentor.se](http://www.enviromentor.se)>  
Ergonomics Inc. <[www.ergonomicsusa.com](http://www.ergonomicsusa.com)>  
F.W. Bell <[www.fwbell.com](http://www.fwbell.com)>  
Holaday Industries Inc. <[www.holadayinc.com](http://www.holadayinc.com)>  
Narda Microwave <[www.nardamicrowave.com](http://www.nardamicrowave.com)>  
Safe Technologies Corp. <[www.milligauss.com](http://www.milligauss.com)>  
TecHealth Corp. <[www.tec-health.com](http://www.tec-health.com)>

Walker Scientific Inc. <[www.walkerscientific.com](http://www.walkerscientific.com)>

Wandel & Goltermann <[www.wg.com](http://www.wg.com)>

## Other Products

Better Electromagnetic Environment  
<[www.bemi.se/index\\_e.html](http://www.bemi.se/index_e.html)> (products for the electrosensitive)

BIOflex <[www.magnaflex.com](http://www.magnaflex.com)>

Magnetherapy <[www.das-mall.com/tectonic/index.htm](http://www.das-mall.com/tectonic/index.htm)>

Magnetic Shield Corp. <[www.magnetic-shield.com](http://www.magnetic-shield.com)>

Microshield Industries <[www.microshield.co.uk](http://www.microshield.co.uk)>

PhoneShield <[www.codem.com/phoneshield](http://www.codem.com/phoneshield)>

Safe Technologies Corp. <[www.safelevel.com](http://www.safelevel.com)>

## Publications

*American Journal of Public Health*  
<[www.apha.org/news/publications/Journal/AJPH2.html](http://www.apha.org/news/publications/Journal/AJPH2.html)>

*Aviation Week* <[www.aviationweek.com](http://www.aviationweek.com)>

*Bioelectromagnetics* <[journals.wiley.com/0197-8462](http://journals.wiley.com/0197-8462)>

*Cancer Causes & Control* <[www.cancercauses.com/cc/cctext.htm](http://www.cancercauses.com/cc/cctext.htm)>

*Compliance Engineering* <[www.ce-mag.com](http://www.ce-mag.com)>

*Conformity* <[world.std.com/~csweb/conformity.html](http://world.std.com/~csweb/conformity.html)>

*Electromagnetics Forum* <[www.tassie.net.au/emfacts](http://www.tassie.net.au/emfacts)>

*EMF Health and Safety Digest*  
<[www.rsba.com/hsd/hsd\\_highlight\\_f.shtml](http://www.rsba.com/hsd/hsd_highlight_f.shtml)>

*Environmental Health Perspectives*  
<[ehpnet1.niehs.nih.gov/docs/journals.html](http://ehpnet1.niehs.nih.gov/docs/journals.html)>

*Epidemiology* <[www.wwilkins.com/EDE](http://www.wwilkins.com/EDE)>

*Health Physics* <[www.wilkins.com/health\\_physics](http://www.wilkins.com/health_physics)>

*International Journal of Radiation Biology*  
<[www.tandf.co.uk/jnls/rab.htm](http://www.tandf.co.uk/jnls/rab.htm)>

*Journal of the American Medical Association*  
<[www.ama-assn.org/public/journals/jama](http://www.ama-assn.org/public/journals/jama)>

*The Lancet* <[www.thelancet.com](http://www.thelancet.com)>

*Microwave Journal* <[www.mwjjournal.com/mwj.html](http://www.mwjjournal.com/mwj.html)>

*Microwave News* <[www.microwavenews.com](http://www.microwavenews.com)>

*Nature* <[www.nature.com](http://www.nature.com)>

*New England Journal of Medicine* <[www.nejm.org](http://www.nejm.org)>

*Public Health* <[www.stockton-press.co.uk/ph](http://www.stockton-press.co.uk/ph)>

*Radiation Research* <[www.cjp.com/radres](http://www.cjp.com/radres)>

*RCR (Radio Communications Report)* <[www.rcrnews.com](http://www.rcrnews.com)>

*Science* <[www.sciencemag.org](http://www.sciencemag.org)>

*Transmission & Distribution World* <[www.tdworld.com](http://www.tdworld.com)>

*Wireless Week* <[www.wirelessweek.com](http://www.wirelessweek.com)>

## Online Resources

Brooks Air Force Base (U.S. Air Force)

*Compilation of the Dielectric Properties of Body Tissues at RF and Microwave Frequencies*

<[www.brooks.af.mil/HSC/AL/OE/OER/Title/Title.html](http://www.brooks.af.mil/HSC/AL/OE/OER/Title/Title.html)>

*Radiofrequency Radiation Dosimetry Handbook*

<[www.brooks.af.mil/HSC/AL/OE/OER/handbook/cover.htm](http://www.brooks.af.mil/HSC/AL/OE/OER/handbook/cover.htm)>

EMF Bionet Newsgroup Archive  
<[www.bio.net/hypermail/EMF-BIO](http://www.bio.net/hypermail/EMF-BIO)>

EMF Guru <[www.feb.se/EMF-L/EMF-L.html](http://www.feb.se/EMF-L/EMF-L.html)>  
(selected correspondence from Roy Beavers's dialogue group)

*Microwave News* ELF Gaussmeter Manufacturers List  
<[www.microwavenews.com/gaus.html](http://www.microwavenews.com/gaus.html)>

National Academy of Sciences

*EMF Research Activities Completed Under the Energy Policy Act of 1992: Interim Report, 1995*

<[www.nap.edu/readingroom/books/epact](http://www.nap.edu/readingroom/books/epact)>

*Evaluation of the U.S. Navy's ELF Communications System Ecological Monitoring Program*

<[www.205.130.85.235/readingroom/books/elf](http://www.205.130.85.235/readingroom/books/elf)>

October 31, 1996, press release announcing the NAS EMF report  
<[www2.nas.edu/whatsnew/25ba.html](http://www2.nas.edu/whatsnew/25ba.html)>

NIEHS EMF RAPID Program

Measurements Database <[www.emf-data.org](http://www.emf-data.org)>

Progress Report December 1995

<[www.niehs.nih.gov/emfrapid/RepToCongress/INT\\_RPT.html](http://www.niehs.nih.gov/emfrapid/RepToCongress/INT_RPT.html)>

Research Information

<[www.niehs.nih.gov/emfrapid/html/resinfo.htm](http://www.niehs.nih.gov/emfrapid/html/resinfo.htm)>

Science Review Symposium: Theoretical Mechanisms and *In Vitro* Research Findings

<[www.niehs.nih.gov/emfrapid/html/Symposium1.html](http://www.niehs.nih.gov/emfrapid/html/Symposium1.html)>

Science Review Symposium: Epidemiological Research Findings

<[www.niehs.nih.gov/emfrapid/html/Symposium2.html](http://www.niehs.nih.gov/emfrapid/html/Symposium2.html)>

Science Review Symposium: *In Vivo* Laboratory Findings

<[www.niehs.nih.gov/emfrapid/html/Symposium3.html](http://www.niehs.nih.gov/emfrapid/html/Symposium3.html)>

NIOSH EMF Fact Sheet

<[www.cdc.gov/niosh/emf2.html](http://www.cdc.gov/niosh/emf2.html)>

**MICRO  
WAVE  
NEWS**

**Subscribe Now!**

*A Report on Non-Ionizing Radiation*

**Please send me the following:**

1-Year Subscription (6 issues)—\$325.00  
(Outside the U.S., \$350.00)

6-Month Trial Subscription—\$170.00  
(Outside the U.S., \$180.00)

Sets of Back Issues—\$95.00/calendar year  
1981-1997 (Outside the U.S., \$100.00)

Enclosed is my check for \$ \_\_\_\_\_

*Prepaid Orders Only.*

*U.S. Funds or International Money Order, Please.*

Name \_\_\_\_\_

Organization \_\_\_\_\_

Address \_\_\_\_\_

City/State/Zip \_\_\_\_\_

Country \_\_\_\_\_

**MICROWAVE NEWS • PO Box 1799 • Grand Central Station**

**New York, NY 10163 • (212) 517-2800 • Fax: (212) 734-0316**

**E-mail: <[mwn@pobox.com](mailto:mwn@pobox.com)>**

**Web: <[www.microwavenews.com](http://www.microwavenews.com)>**

# FROM THE FIELD

---

Letter to the Editor

## **ELF Magnetic Fields from Spinning Steel-Belted Radial Tires: Implications for Epidemiological Studies**

February 6, 1998

To the Editor:

A few months ago, one of us (SM) measured extremely low frequency (ELF) magnetic fields in his car, a 1993 Eagle Vision, using an F.W. Bell triaxial gaussmeter (model 4080). The fields were 3.0-4.0 mG (0.3-0.4  $\mu$ T) at the driver's seat level and 6.0-20.0 mG on the rear seat, with higher fields measured laterally near the doors. Mysteriously, the fields were present only when the car was moving, and persisted when the car was coasting at 60 mph with the engine turned off.

Kjetil Vedholm and Dr. Yngve Hamnerius<sup>1</sup> recently explained that, "The metal cord in the tires is often permanently magnetized, which gives rise to an alternating magnetic field when the car is rolling." These Swedish researchers reported fields on the back seats of passenger vehicles as high as 50 mG (in the 5 Hz-2 kHz frequency range) when the car was traveling at 60 mph.

A visit to the two largest tire retailers in the Seattle area revealed that virtually all new radial tires contain steel belts and attract a compass needle. At the annual Department of Energy EMF review in San Diego last November, a number of colleagues suggested that SM's gaussmeter readings might have been motion-induced artifacts due to interaction with the Earth's static magnetic field. Hamnerius dismissed this idea, noting that an isolated tire spinning in his lab generated fields similar to those he had measured in moving cars.

A spinning wheel without a tire did not change the 0.2 mG field measured near the safety cover of the tire balancer, but a spinning steel-belted radial tire mounted on a wheel generated fields of about 6.8-7.0 mG in the same place.

Why had these fields not been discovered sooner, given the many hours of personal monitoring done with sophisticated recording gaussmeters in epidemiological studies of utility workers? Dr. William Kaune of EM Factors in Richland, WA, suggested that the fields were of such low frequency that they were filtered out by the meters.

Using the circumference of passenger car tires, Kaune and SM estimated that, at legal speeds, the tires would always spin at less than 20 revolutions/second (20 Hz). Nearly all the EMF epidemiologic studies published to date, both occupational and residential, have used versions of one of three meters to measure magnetic fields: the EMDEX and the AMEX, both made by Enertech Consultants in Campbell, CA, and the Positron, made by Positron Industries in Montreal, Canada. All of these units filter out frequencies below 35-40 Hz in order not to register effects of movement in Earth's static magnetic field.

Using the Bell 4080 meter and an EMDEX II meter, side-by-side measurements were made around appliances and under high-voltage transmission lines. The meters gave nearly identical readings. But in a moving car, the EMDEX usually gave substantially lower readings. At 60 mph, the EMDEX read 1.9 mG on the floor of the front seat, while the Bell meter read 7.9 mG in the same location. Similarly, on the back seat close to the doors, the EMDEX read 2.9-5.0 mG, while the Bell read 15.0-20.0 mG. More importantly, at a commercial tire-balancing machine, the EMDEX read 1.0 mG one foot from a spinning steel-belted radial tire, while the Bell read 6.0 mG and 6.4 mG in two trials with one tire, and 7.6 mG with another tire. Clearly, fields below 40 Hz are more effectively rejected by the EMDEX meter than by the Bell meter. (The Bell meter is designed to measure 60 Hz fields but filters the low frequencies somewhat less effectively than the EMDEX.)

Next, the static magnetic field associated with the tires in the store

was corroborated with a fluxgate magnetometer (Walker FGM-301). We routinely detected static fields above the meter's maximum measurable level of 2.0 G at the tread surface of radial tires. In fact, we found some tires above the 5.0 G maximum measurable level of another magnetometer (R.B. Annis Co.). The fields varied dramatically in both strength and polarity across the tread of the tire within very short distances (less than an inch), with many "hot spots." Some new tires had stronger fields than others, but all steel-belted radial tires—whether new, on cars or in a tire dump—showed similar fields. The fields dropped off quickly with distance from the tread surface, from over 2.0 G at the tread to about 100 mG at 3 inches from the tread.

The alternating magnetic fields generated by spinning tires were studied at a tire-balancing machine and in a moving car using the magnetometer connected to a portable oscilloscope (Tektronix 222 Digital Storage Oscilloscope) and a Toshiba portable computer (loaded with Metrtek Waveform Manager, version 2, for Microsoft Windows 3.1). Magnetic flux density time-series data were acquired at different tire rotation rates and transformed into the frequency domain using a fast Fourier transform (FFT) algorithm in the computer.

We found that the frequency of the magnetic field was directly proportional to the speed of the automobile, 6 Hz at 30 mph and 12 Hz at 60 mph, while the intensity (rms) of the magnetic field remained fairly constant at 19 mG. (Note that care must be taken in interpreting magnetic field readings using common loop-type magnetic field probes, because field sensors will give the appearance of increasing magnetic flux density with increasing tire-rotation rate since the meters are more responsive to higher frequencies.) The waveform was roughly sinusoidal, but was distorted by high harmonic content. The magnitudes of the fundamental and harmonic components of the 30 mph magnetic waveform were 16 mG rms at 6 Hz, 10 mG at 12 Hz and 3 mG at 18 Hz.

Tires were easily degaussed using a hand-held magnetic tape degausser (Geneva Audio/Video Tape Eraser, Model PF211). With the car jacked up, the degausser was held near the tread of a tire—as it was spun by hand—and was gradually moved away over a 15-second period. Magnetic field measurements were taken after each tire was degaussed, and it became clear that each tire has its own sphere of magnetic influence inside the car. For instance, degaussing the right rear tire dropped the fields on the rear seat near the right door from 20 mG to 2.0 mG but had no effect on the fields on the rear seat near the left door.

Once the tires were degaussed, their magnetic fields stayed very low over a period of a few months.

Steel belts are made of very fine high-carbon wire (diameter=0.0092 in). Each tire contains nearly one mile of wire. All iron wire products tested (nails, springs and paper clips) were magnetic, and the static field of a single strand of wire varied along its length in both polarity and intensity, suggesting that the wire manufacturing process may be the source of magnetism in tires. However, some specialty stainless steel wires are weakly magnetic, or not magnetic at all, and are difficult to magnetize.

Our observations suggest the need to reevaluate how exposures were assessed in previous residential and occupational epidemiological studies. If magnetic fields below 35 Hz are included, a child riding to and from school in the back seat of a car for one hour could receive as much magnetic field exposure on a time-weighted average basis as he could from spending 24 hours at home.

Similarly, electric utility line crews may spend as much time driving between jobs as they do climbing poles or towers—most of them

no doubt commute to work in cars. A rural area meter reader driving around in a car all day will have a significant magnetic field exposure below 35 Hz but relatively little exposure at power frequencies.

If magnetic field exposures below 35-40 Hz are biologically important, the use of meters that reject this part of the EMF spectrum could give a very distorted picture of ELF magnetic field exposure, thereby compromising epidemiological study results.

The focus on power frequency (50 and 60 Hz) magnetic fields was logical, since they are a pervasive concomitant of electricity use. However, the human nervous system operates at frequencies below 20 Hz as measured by brain waves, and magnetic fields sinusoidally modulated at 0.2 Hz were long ago shown to affect reaction time performance in humans.<sup>2</sup>

In view of our observations, we must wonder whether the outcomes of various EMF epidemiological studies would have been the same if the exposures had been assessed with meters that could measure magnetic fields below 35 Hz. Indeed, if cars are a major source of ELF fields, inclusion of exposures away from home should be considered in designing field measurement strategies for residential EMF studies.

It should not be technically difficult to build meters that can detect these ELF fields and isolate them from the effect of Earth's magnetic field. Also, it should not be very difficult to build field-free radial tires or to degauss existing tires.

Samuel Milham, MD  
2318 Gravelly Beach Loop, NW  
Olympia, WA 98502  
<smilham@halcyon.com>

Richard A. Tell  
Richard Tell Associates Inc.  
8309 Garnet Canyon Lane  
Las Vegas, NV 89129  
<rtell@radhaz.com>

James B. Hatfield, PE  
Hatfield and Dawson  
Consulting Engineers Inc.  
9500 Greenwood Ave. N,  
Seattle, WA 98103  
<hatdaw@halcyon.com>

1. K. Vedholm and Y.K. Hamnerius, "Personal Exposure from Low Frequency Electromagnetic Fields in Automobiles," *2nd World Congress for Electricity and Magnetism in Biology and Medicine*, Abstract No.F-9, Bologna, Italy, 1997.

2. H. Friedman, R.O. Becker and C.H. Bachman, "Effect of Magnetic Fields on Reaction Time Performance," *Nature*, 213, pp.949-950, 1967.

## Clippings from All Over

"I have no intention of turning the FCC into a national zoning board."

—William Kennard, chairman, Federal Communications Commission, in a speech at CTIA's *Wireless '98*, Atlanta, GA, February 23, 1998

"I had thought it was voodoo."

—Dr. Fatih M. Uckun, pediatric oncologist, Wayne Hughes Institute, St. Paul, MN, on his earlier skepticism regarding a possible EMF-cancer link, quoted by Janet Raloff in "Electromagnetic Fields May Trigger Enzymes," *Science News*, p.119, February 21, 1998 (see p.7)

EMF RESEARCH PROGRAM ENDING; HEALTH HAZARD NOT YET FOUND

—Headline of article on the impending conclusion of the EMF RAPID program, in *Electroindustry*, published by the National Electrical Manufacturers Association, Washington, DC, p.3, February 15, 1998

"...lowering per-minute costs will dramatically enlarge the market. The name of the game is to get people to talk more."

—Mario Gabelli, mutual fund manager, quoted by Susan Pulliam in "Bell Atlantic's Move May Spark a Price War in Cell Phone Service, Hurting Some Players," *Wall Street Journal*, p.C4, March 5, 1998

Home values can still be affected. Although the National Association of Realtors receives fewer inquiries on EMFs, real estate agents continue to contend with buyer anxieties, a problem also inextricably entangled with a dislike of the aesthetics of utility towers. Susan Coveny, president of RE/MAX Prestige, a realty agency in Long Grove, IL, says a home near a power line can sell for 20% less than a comparable house at some distance away. Coveny says she has commissioned tests of field strength in homes near power lines and has shown buyers literature about studies that have cast doubt on health effects. "It doesn't matter," she states. "Their reaction is, 'I know somebody near a power line who has brain cancer'."

—Gary Stix, "Closing the Book: Are Power Line Fields a Dead Issue?" *Scientific American*, p.33, March 1998

## "MICROWAVE NEWS" FLASHBACK

### Years 15 Ago

- Drs. José Delgado and Jocelyne Leal of the Centro Ramon y Cajal Hospital in Madrid, Spain, report that 12 mG, 100 Hz PMFs caused "drastic" changes in developing chick embryos.
- In comments on EPA's announced intention to propose rules on RF/MW exposures, telecom lobbyists say it is vital that the EPA preempt stricter state and local ordinances. The FCC notes that it "lacks the necessary expertise" to write its own health and safety guidelines.
- Critics question a Sandia Labs conclusion that electromagnetic pulse (EMP) radiation from a high-altitude nuclear blast would not interfere with the safe shutdown of a nuclear power plant.

### Years 10 Ago

- The New York Public Service Commission affirms its 1.6 kV/m limit for electric fields at the edge of power line rights-of-way and proposes a 100 mG companion limit for magnetic fields.

- An international team announces it has confirmed Delgado and Leal's finding that weak PMFs affect chick embryos.
- Resignations, legal worries and a dearth of funds bring the revision of ANSI's 1982 RF/MW standard to a halt. "The first order of business is to get some kind of liability insurance for the members," says Dr. Om Gandhi of the University of Utah in Salt Lake City.

### Years 5 Ago

- Cancer clusters in three office buildings—in Washington, in San Jose, CA, and in Garden Grove, CA—continue to resist any explanation as investigators explore EMFs as a possible cause.
- In the Chrysler Building in New York City, magnetic fields greater than 2 G, generated by electrical equipment one floor below Klockner Chemical Co., force the firm to vacate its offices.
- Female paramedics worry that the Motorola 800 MHz two-way radios they use on the job may be the cause of their menstrual irregularities and their abnormal pap smears.

**Short Course****Safety Issues and Requirements  
for PCS & Wireless  
Communications Devices****June 3-5 or October 7-9, 1998  
Washington, DC***Offered by the Continuing Education Program  
George Washington University, Washington, DC**Instructor: Howard Bassen, M.S.*

Fee: \$975.00

Contact: P.J. Mondin, (202) 496-8449

E-mail: &lt;pj@ceep.vpaa.gwu.edu&gt;

Web: &lt;www.gwu.edu/~ceep/g-documents/2121.html&gt;

**Bound Volumes of Microwave News**

Order all three sets of bound issues and save 40%.

*Please send me the following bound volumes@ \$450.00 each:*

\_\_\_ 1981-1985 \_\_\_ 1986-1990 \_\_\_ 1991-1995

or \_\_\_ Send me **all three** for **\$750.00***Prepaid Orders Only. U.S. Funds or International Money Order, Please.***MICROWAVE NEWS • PO Box 1799 • Grand Central Station  
New York, NY 10163 • (212) 517-2800 • Fax: (212) 734-0316****MICRO  
WAVE  
NEWS****Reprints**

- **EMF Litigation** (\$38.50)
- **Cellular Phones/Towers** (\$38.50)
- **EMFs & Breast Cancer** (\$38.50)
- **Police Radar** (\$38.50)

**EMFs in the 90s: 1997 Update** (\$12.50)*Complete sets of EMFs in the 90s (1990-1997)  
are also available for \$80.00 each.**Outside the U.S., add \$5.00 airmail postage for each publication.**Prepaid Orders Only.**U.S. Funds or International Money Order, Please.***MICROWAVE NEWS • PO Box 1799 • Grand Central Station  
New York, NY 10163 • (212) 517-2800 • Fax: (212) 734-0316**

Web: &lt;www.microwavenews.com&gt;

E-mail: &lt;mwn@pobox.com&gt;

**ELECTROMAGNETIC INTERFERENCE**

**The Literati Tune In...** The loss of 230 people aboard TWA Flight 800 may have been caused by EMI from military sources, argues Dr. Elaine Scarry in an 18-page supplement to the *New York Review of Books*' April 9, 1998, issue. The Boeing 747 went down in a fireball off the coast of Long Island, NY, on its way to Paris in July 1996. While there is general agreement that the fuel tank exploded, there is no consensus as to what sparked the explosion. Scarry teaches English literature at Harvard University in Cambridge, MA, where she is the Cabot Professor of Aesthetics and the General Theory of Value. In her heavily footnoted article—there are 106 in all—Scarry offers three scenarios: (1) A pulse of energy from outside the plane caused a spark that lit vapors in the fuel tank; (2) high-intensity RF radiation directly ignited the vapors coming out of a vent from the central fuel tank; and (3) a sudden pulse of energy “from a military jammer or countermeasures system” knocked the plane out of control. Scarry closes with three recommendations: First, that EMI be made part of the TWA 800 investigation (there are strong indications that it already was); second, that the Department of Defense reveal which radiation emitters aboard nearby planes and ships were in use at the time of the explosion; and third, that two long-classified Air Force reports on EMI be released to the public (see *MWN*, M/A89, as well as N/D87 and S/O88).

**EMF REPRODUCTIVE EFFECTS**

**Offspring of Men at Work...** Children whose fathers were exposed to power frequency EMFs on the job around the time of conception differ little from other children in the occurrence of birth defects or other health problems, according to a new Swedish study. Siv Törnqvist, a nurse at the National Institute for Working Life (NIWL) in Solna, found “no clear-cut effects” of paternal exposure to workplace EMFs, she reports in the February issue of the *Journal of Occupational and Environmental Medicine* (40, pp.111-117, 1998). Törnqvist analyzed birth and cancer registry data on two sets of “exposed” children and two control groups. Study I included 2,077 infants born from 1973 through 1986 whose fathers were power-industry electrical workers one year prior to their children’s birth, according to census records. Study II included 178 children born from 1981 through 1994 to workers in electric utility jobs involving measured magnetic fields greater than 5.0 mG and electrical fields measuring above 30 V/m for a period of ten minutes or more over a six-hour work shift. In Study I, perinatal deaths were 30% more common among the exposed children than among the controls, but the difference was not statistically significant. Exposed children and controls differed only slightly in the incidence of low birth weight and of chromosomal anomalies. The two groups also differed little in the occurrence of birth defects, except for hypospadias, malformations of the urethral opening, which were more than twice as frequent in the exposed infants—but this excess was also not significant. And the two groups differed little in the overall incidence of cancers, with higher-than-normal morbidity rates in both. The exposure assessment method used in Study I is “relatively crude,” Törnqvist writes, adding that the exposed group probably included infants whose fathers were not



exposed “at the crucial time.” In Study II, Törnqvist reports a 59% excess of severe malformations in the high-exposure group, again noting that this is not statistically significant. As Törnqvist points out, however, the relatively small size of both the exposed and the control groups in Study II means that only major differences between them would be statistically significant. No cancers were identified among the Study II children. Törnqvist recently retired from the NIWL.

---

### **MEDICAL DEVICES**

**A Museum of Magnetic Frauds...** Feeling stressed? If so, you may be interested in the Magnetic Resonance Belt that Torralvoma Research has been advertising lately in New York City's *Village Voice*. Besides preventing illness, the ads claim, the belt eliminates stress and “improves sexual power 200%.” *Microwave News* called the contact number—(212) 673-1670—and spoke to Edgardo Torralvoma. He said that the belt holds quartz crystals magnetized at specific “resonances” for each of the seven chakras—yoga jargon for fields of spiritual energy. The magnetic fields energize the chakras, Torralvoma explained, and “as long as your chakras are charged, you don't get sick.” When *Microwave News* told Robert McCoy about the belt, he said, “That's a new one.” McCoy is the founder and director of the Museum of Questionable Medical Devices in Minneapolis, MN. The magnetic resonance belt is by no means the first medical device claimed to produce beneficial effects with magnetic fields. The museum has examples dating back to the 19th century. A 1911 ad in the *New York Medical Journal* touted the Bachelet magnetic wave generator as “promoting secretions and arresting the progress of degeneration.” Another belt on exhibit is the I-ON-A-CO, whose makers claimed it would “improve the catalytic value” of iron in the blood, “thus enabling it to deliver an increased supply of oxygen to the system.” Gaylord Wilshire, whose name lives on as a boulevard in Los Angeles, sold thousands of I-ON-A-COs in the 1920s. More recently, a farmer wishing to rid his crops of insect pests could place a dead bug in an Auto Sweep Resonator, along with a vial of pesticide and a photo of his field. The resonator, it was claimed, would ascertain the operative frequencies of these objects and, *voilà!*—no more pest problem. The resonator was seized by the Minnesota Attorney General in 1993 in connection with consumer fraud charges. McCoy got the idea for a museum of quackery after a friend offered him a collection of skull-measuring machines used in phrenology, a discipline popular until the 1930s in which inferences about intelligence and character were drawn from the shape of the head. For more information on the museum, contact: Museum of Questionable Medical Devices, 201 Main St., SE, Minneapolis, MN 55414, (612) 379-4046, E-mail: <quack@mtn.org>, Web: <www.mtn.org/quack>.

---

### **MELATONIN**

**Insomnia in Outer Space...** One of the few documented benefits of melatonin supplements is their usefulness in overcoming jet lag. Soon “orbit lag” may be added to the list. “The space environment causes...sleeplessness in astronauts,” according to the January 26, 1998, *Aviation Week & Space Technology*, and

Sen. John Glenn (D-OH) will soon be part of an experiment designed to find out why. This October, NASA will study how life in zero G affects the circadian rhythms of Glenn and the rest of the crew of the space shuttle *Discovery*. Their melatonin levels and sleep patterns will be monitored, and before going to sleep, each of them will take either a melatonin pill or a placebo. A similar study was slated for a shuttle flight that began on April 2.

**MICROWAVE COOKING**

**Depleting Vitamin B<sub>12</sub>...**When milk, beef or pork is cooked in a microwave oven, biologically active levels of vitamin B<sub>12</sub> are diminished. A team of Japanese researchers found that after six minutes in a microwave oven operating at 2450 MHz, these foods lost 30%-40% of their available B<sub>12</sub>, an essential nutrient that can protect against neurological problems and heart disease. Conventional cooking also depletes B<sub>12</sub>, but not as quickly. Dr. Fumio Watanabe of the Kochi Women's University reports that, "The amount of B<sub>12</sub> loss in the six-minute microwave-treated milk sample did not differ from that in the 30-minute boiled milk." Watanabe's paper appears in the January issue of the *Journal of Agricultural & Food Chemistry* (46, pp.206-210, 1998).

**MICROWAVE WEAPONS**

**Information Warfare...**The U.S. Air Force (USAF) has mounted high-power microwave generators on air-launched cruise missiles to test their usefulness in waging computer warfare, reports *Aviation Week* in its January 19, 1998, issue. The tests were somewhat successful, although "there were problems with range and focus," according to the magazine, which has excellent sources at the Pentagon. But the information wars of the future will involve more than just zapping computers. USAF General John Jumper predicts that the military will have the tools to make potential enemies see, hear and believe things that do not exist, according to a follow-up item in the March 9 issue. The same idea was contained in a 15-volume study by the USAF Scientific Advisory Board, issued in 1996, on how to maintain U.S. air and space superiority on the battlefields of the 21st century (see *MWN*, J/F97).

**WIRELESS FICTION**

**Zoning Board Hearing...**What is it like to be at a local zoning board hearing about a telecom tower? A short story ("Unapproved Minutes") by Tom Paine, who teaches creative writing at Middlebury College in Vermont, paints a vivid portrait in the April *Harper's* magazine. On the agenda of the Zoning Board of Adjustment of the fictional town of Carthage, VT, is the problem of a 50 kW radio station (WIKD) causing interference with the townspeople's appliances. For instance, some are picking up rock music (Led Zeppelin) on their electric toothbrushes. Paine clearly did some research: He refers to the classic 1962 Prausnitz-Susskind paper indicating a possible RF/MW-cancer connection and extrapolates from a Johns Hopkins study suggesting an RF/MW risk of Alzheimer's. The short story also includes a child with leukemia, a gaggle of industry lawyers and the telecom act's preemption of local RF/MW rules. It seems like the real thing.

**Precision Test Instruments for EMI/EMC  
Magnetic and Electric Field Meters  
ERGONOMICS Inc.**  
PO Box 964, Southampton PA 18966—Call 800-862-0102  
Website: [www.ergonomicsusa.com](http://www.ergonomicsusa.com)

**EMF Papers**  
A twice-monthly clipping service from MICROWAVE NEWS  
All the information you need:  
key government documents, abstracts of new papers, press releases. Plus...assorted clips.  
Direct to you, twice a month.  
\$100.00 per month. Three-month minimum. Sample packet \$25.00.  
Outside the U.S., please add \$15.00 per month for airmail postage.  
MICROWAVE NEWS • PO Box 1799 • Grand Central Station  
New York, NY 10163 • (212) 517-2800 • Fax: (212) 734-0316  
Web: <[www.microwavenews.com](http://www.microwavenews.com)>  
E-mail: <[mwn@pobox.com](mailto:mwn@pobox.com)>

# VIEWS ON THE NEWS

## Interpreting the EMF Animal Studies: What's Going On?

"Let's get to the bottom of this." Those were the words of Dr. Linda Chatman of Pfizer Inc. in her peer review of the Battelle labs' recent EMF-breast cancer study (see p.1). We couldn't agree more.

The Battelle results are at odds with a series of studies by Germany's Drs. Wolfgang Löscher and Meike Mevissen, and why the two labs differ is far from clear. But this—like the NTP's description of another recent study as "equivocal" (see p.1)—is symbolic of the entire field: There's too much evidence to ignore, but not enough to know what to think.

Ironically, things may be so murky in part because researchers have tried to make them too simple. Most EMF animal studies have used "pure" 50 or 60 Hz sine waves, without the high-frequency transients and harmonic distortions that are common features of electric power. But in the real world, the distribution of electricity is a messy thing.

"It might be cleaner and neater for engineers...to set up pure sine wave signals," Dr. Allan Frey of Randomline in Potomac, MD, comments in an Internet posting, "but that does not mean they are relevant to the biological organism."

As the WHO's Dr. Michael Repacholi told *Microwave News*, fields with transients and harmonics "are the ones to which people are actually exposed in our living and working environments." He pointed to "EPRI studies that indicate these fields produce signals that are above the noise level of cells and are thus detected by them" (see *MWN*, J/A95 and S/O95).

Another area that needs to be pursued is electric fields. In recent years, the research pendulum has swung so far towards magnetic fields that electric fields have been virtually ignored. Certainly, this has been true in EMF animal studies. But as another NTP peer reviewer of the Battelle study, Dr. Maria Stuchly of Canada's University of Victoria, observed, Dr. Anthony Miller's recent epidemiological study has implicated joint exposure to magnetic *and* electric fields (see *MWN*, J/A96).

There are other complexities, as scientists take up the difficult job of trying to model the real world inside the lab. At a February 6 workshop sponsored by the Bioelectromagnetics Society at the Catholic University of America in Washington, Finland's Dr. Jukka Juutilainen said that the results of animal studies so far suggest that, "EMFs potentiate the effects of known carcinogens only when both exposures are chronic, that is, when EMFs and the known carcinogen interact repeatedly during a long-term experiment." For example, in his own recent experiment with thrice-weekly exposures to UV light, EMFs promoted the development of skin tumors in mice (see p.3).

Juutilainen thinks that "the classical two-stage carcinogenesis experiments, with short-term initiator treatment followed by chronic exposure to EMFs as a potential promoter," may not be a good model for revealing EMF effects. Since EMFs may affect DNA repair or other processes that lead "to increased accumulation of mutations in critical genes," Juutilainen proposes that, "The more general concept of 'cocarcinogen' may be more appropriate than 'promoter' for describing the possible role of EMFs."

But it may be that none of these points explains one of the most important riddles—the contradictory results from the Lös-

### Moving at the Speed of Light

It's 1993. Responding to public fears about brain cancer, the Cellular Telecommunications Industry Association (CTIA) announces a five-year, \$25 million safety research plan. Set up in April, the program will become known as Wireless Technology Research (WTR). The U.S. has 12 million cellular phone users.

In 1994, program head Dr. George Carlo promises that the first biological studies will be under way, "with checks signed," by the end of the year. It doesn't happen.

In 1995, WTR calls itself "an unparalleled undertaking in the field of science—literally the largest independent research project of its kind in the world." In December, WTR pays for seven people to attend a conference in Waikiki, Hawaii. Not one test tube has gotten wet.

In 1996, almost half of the \$25 million is gone. Lucent Technologies' Ron Petersen says, "We cannot really account for the money that WTR has spent." The cancer research program, he says, "is really nonexistent. There's nothing there." At year's end, the test tubes are all still dry.

In 1997, WTR announces that it will not do any chronic animal studies, once a key part of WTR's "research agenda," which took two years and countless meetings to produce. Carlo insists that WTR is "moving at the speed of light."

Today, after five years and \$20 million, WTR does not have results from a single biological experiment. More than 55 million Americans now use cellular phones.

We have only one question: Has the CTIA's plan failed—or has it in fact succeeded?

cher and Battelle labs. Both used sine waves, both used repeated applications of a chemical carcinogen. Löscher's studies form a coherent body of work and cannot be easily dismissed, especially given his supporting evidence on melatonin and ODC (see p.5). This is all the more true in light of the high cancer rates among controls that compromise two of the three Battelle experiments.

Understanding the EMF-cancer connection will not be an easy—or rapid—process. But it's important. As Pfizer's Chatman observed, "the strong epidemiological support for a potential association between [EMFs] and human malignancies" obliges us to "explore all reasonable possibilities" for an EMF-cancer mechanism. She's right.

We must get to the bottom of this.

*MICROWAVE NEWS* is published bimonthly. • ISSN 0275-6595 • PO Box 1799, Grand Central Station, New York, NY 10163 • (212) 517-2800; Fax: (212) 734-0316; E-mail: <mwn@pobox.com>; Web: <www.microwavenews.com> • Editor and Publisher: Louis Slesin, PhD; Senior Editor: Peter Hogness; Associate Editor: Douglas Barnes, PhD; Copy Editors: Jim Feldman, Roy Thomas Jr.; Intern: Vijay Baliga; Circulation Assistant: Diana Cooper • Subscriptions: \$325.00 per year (\$350.00 Canada & Foreign, U.S. funds only); Single copies: \$60.00 • Copyright © 1998 by Louis Slesin • Reproduction is forbidden without written permission.

# *CLASSIFIEDS*

---