

# MICRO WAVE NEWS

Vol. XVI No. 6

A Report on Non-Ionizing Radiation

November/December 1996

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## NAS Finds No EMF-Cancer Link; Report Stirs Controversy

### Wertheimer and Leeper Are Vindicated

There is "no conclusive and consistent evidence" that residential exposures to electromagnetic fields (EMFs) present a human health hazard, according to a long-awaited report from the National Academy of Sciences-National Research Council (NAS-NRC). At the same time, the NAS-NRC found that children living near high-current power lines do have a higher-than-expected incidence of leukemia.

"The findings to date do not support claims that EMFs are harmful to a person's health," said Dr. Charles Stevens of the Salk Institute in La Jolla, CA, the

#### More Coverage of the NAS-NRC Report on pp.5-8

• The Future of EMF Research • What They Are Saying  
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chair of the NAS-NRC committee that wrote the report. Stevens also said, "We have no idea why wire codes are linked to a small increase in leukemia risk."

Wire codes categorize homes according to their proximity to different types of power lines, a system first devised by Dr. Nancy Wertheimer and Ed Leeper. In 1979, Wertheimer and Leeper reported that children living in high-current wire code homes had an elevated risk of developing cancer.

Dr. Daniel Wartenberg and his fellow NAS-NRC committee members did a meta-analysis of 11 epidemiological studies of power lines and childhood

(continued on p.5)

#### Views on the News: The NAS-NRC Report

### Cancer Near Power Lines: The Search for "Factor X" Continues

The NAS-NRC panel decided that children living near power lines do indeed have elevated rates of leukemia, but that EMFs are not to blame. What then is responsible? The committee members said they don't know.

In the 17 years since Dr. Nancy Wertheimer and Ed Leeper first announced that power lines and, most probably, EMFs are associated with childhood cancer, electric utilities and their consultants have argued that Wertheimer and Leeper were wrong. They have looked far and wide for an elusive "factor X" that would exonerate EMFs—but without success.

Critics have used three arguments against Wertheimer and Leeper. First, they contended that the epidemiology was faulty. In 1985, while Dr. David Savitz was still working on his replication study, an Electric Power Research Institute (EPRI) report charged that, "All the statistical analyses in the Wertheimer and Leeper paper were performed incorrectly" (see

(continued on p.7)

## « Power Line Talk »

Eight of the U.K.'s major electricity companies, including the **National Grid Co.**, are considering setting up an £8 million fund to fight EMF litigation, Simon Holberton of the *Financial Times* reported on October 11. "A priority of the electricity industry must be to prevent [a] legal precedent being established," stated a confidential memo by **Willis Corroon**, a leading U.K. insurance brokerage. "This will require the strenuous defense of any claims, and the associated defense costs are likely to be high." Several pending lawsuits and increased public awareness have made EMFs a high-profile issue in the U.K. (see *MWN*, M/J95). "The uncertainty surrounding this topic has created unease in the insurance market and has resulted in coverage being restricted," according to the memo, which also noted that, "Some insurers will not participate in the liability program of an electricity utility if it includes protection against liability for EMFs." A 1994 Corroon survey had revealed that British electricity companies saw the potential liability arising out of EMFs as one of two prime areas of concern. (The other was storm damage to transmission and distribution networks.) In the memo—which was mailed to Holberton with an anonymous note that read, "You might find this of interest"—Corroon downplayed the threat of EMFs, contending that a causal relationship between EMFs and negative health effects has not been proven. "Willis Corroon has put forward a proposal and no decision has yet been made," cautioned Derek Lickorish in the October 21 issue of *Business Insurance*. Lickorish is the director of customer service and external affairs at **South Western Electricity**, one of the eight utilities involved. Attorney **Martyn Day** of Leigh, Day & Co. in London—who is representing four families of childhood leukemia victims—said he was "shocked" by the memo: "This is stacking the deck against the plaintiffs."

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On November 22, the Georgia Supreme Court refused a utility request to block a new trial in the **Jordan** EMF–cancer lawsuit. In May 1994 a jury returned a pro-utility verdict, but a state appeals court ordered a retrial in November 1995 (see *MWN*, M/J 94, J/F96 and M/J96). "We're delighted to have the opportunity to try the case again," said Nancy Jordan's attorney, **Bruce DeBoskey** of Silver & DeBoskey in Denver. "Last time the jury was split 50-50 on causation." **Georgia Power Co.** did not respond to a request for comment.

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The same adversarial reporting style for which **John Stossel** of **ABC News** is renowned could have landed him in prison. As part of his upcoming television special on "junk science"—which was to include a segment on EMFs (see *MWN*, J/A96)—Stossel sent two women posing as multiple chemical sensitivity (MCS) victims to visit Dr. **Grace Ziem**, a Baltimore-based specialist in the field. In an interview, Ziem said she thought the women appeared to be too healthy to be chemically sensitive. Her suspicions were confirmed when a colleague told her that Stossel was setting her up. Upon reading the transcript of Stossel's 1994 special "Are We Scaring Ourselves to Death?" which questioned

the need for many federal health and safety regulations, Ziem believed that she would be portrayed as a "junk scientist." Rather than go ahead with an interview with Stossel, she sent an assistant, accompanied by two newspaper reporters, to read Stossel a statement. The assistant claimed that afterwards, Stossel and one of the phony patients, **Deborah Stone**, an ABC producer, admitted that the initial medical exams had been recorded without Ziem's consent, which in Maryland is a violation of wiretap laws and a felony. Ziem filed a complaint against Stossel, Stone, ABC and others. Like Stossel, Stone is no stranger to controversy: In 1986 she and nine members of the *Dartmouth Review*, of which she was the managing editor, were suspended from Dartmouth College in Hanover, NH, for destroying shanties set up to protest the school's business interests in South Africa. Ziem said that she knew of MCS cases at ABC, and any attempt by the network to discredit their legitimacy would be a conflict of interest. "Stossel and ABC have harmed many Americans by misinforming them in the area of public health," Ziem told *Microwave News*. A court hearing was scheduled for December 10, but, as we went to press, ABC announced that the prosecutor would not proceed with the case. ABC's Todd Seavey noted that the EMF segment was likely to be cut from the special, which is now scheduled for January. He said that the EMF item would probably appear separately on one of ABC's news magazines, *20/20* or *Prime Time Live*. The MCS segment will run on January 3 on *20/20*.

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When the California Supreme Court dismissed the **Covalt** EMF property devaluation case last August, the Covalts' attorney, **Michael Withey** of Schroeter, Goldmark & Bender in Seattle, called the decision "a frontal attack on the right to private property" and stated that he might take the case to the U.S. Supreme Court (see *MWN*, S/O96). But in December, Withey told *Microwave News* that there would be no appeal (see also p.15).

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Despite protests from the community, **Empire District Electric Co.** intends to go ahead with its plans to build a 161 kV power line in **Joplin, MO**, that would run across the street from an elementary school. **Citizens Concerned for Our Children's Health** includes a number of medical doctors, including Dr. **Jeffrey Greenberg**, a neurologist who told *Microwave News*, "With the information available from the numerous independent scientific investigations from all over the world, the data continue to point towards a strong link of leukemias and brain cancer in relation to exposure to EMFs." The **NAS-NRC report** (see p.1) has apparently done little to appease the community: 75% of respondents to a poll published on November 12 by the *Joplin Globe* still oppose the line. (This figure is not statistically reliable, however, since the voters were self-selected rather than picked at random.) In its own newsletter, Empire District Electric countered the protesters: "[T]hey are trying to scare their neighbors with emotional sound bites from selected research." For his part, Greenberg criticized Empire's use of a statement from the **American Physical Society** to dismiss EMF health effects, saying, "It

was like having a group of physicians disqualifying current new concepts in astrophysics." An editorial in the *Globe* on October 10 cautioned readers about the doctors' involvement: "If this indicates a long-term, organized effort by the medical community to offer its voice on health and environmental issues, welcome. But failure to maintain involvement could be interpreted by some as self-serving, since several doctors and their families are among those being affected by the proposed line." Greenberg's wife, Susan, a spokesperson for the citizens' group, said that she and her husband helped organize the protest in the interest of the community's concerns, pointing out that their children do not attend the elementary school and that the proposed line would not pass near their home. Empire will begin construction on the line when condemnation hearings are completed, according to Amy Bass, director of corporate communications for Empire, which is based in Joplin.

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**John Altoonian** and his wife have agreed to an out-of-court settlement of their EMF-cancer lawsuit against **Atlantic Electric**. Neither side would comment on the terms of the agreement or the date it was reached, but notice of the settlement was filed on September 4 in New Jersey Superior Court in Cape May County. The agreement was reached following a jury verdict that would have required the utility to pay the Altoonians \$946,267, and after

appeals had been filed by both sides (see *MWN*, M/J96 and J/A96). In a statement issued through the utility's local attorney, **Randolph Lafferty** of Youngblood, Corcoran in Pleasantville, NJ, Atlantic Electric explained that there had been "a confidential settlement of the non-EMF-related issues." The utility asserted that its decision to settle had been "primarily motivated by economic considerations and humanitarian concerns for the plaintiff." The statement emphasized the company's view that, "The jury verdict in this case, which established that there is no causal connection between EMFs and the plaintiff's leukemia, stands as a vindication of the company and the industry." Altoonian's lawyer, **William Wolf** of Bathgate, Wegener & Wolf in Lakewood, NJ, told *Microwave News* that he would have no comment on the settlement. Altoonian was diagnosed with chronic myelogenous leukemia in 1990 and filed suit in 1991. On April 19, 1996, a jury found the Egg Harbor, NJ-based utility not guilty of causing Altoonian's disease, but concluded that an Atlantic Electric power line illegally buried on the Altoonians' property had caused the couple to suffer emotional distress. The settlement is believed to be the first cash payment from a utility to put an end to an active EMF lawsuit. In mid-1995, **Massachusetts Electric** was reported to have paid an undisclosed amount to **Scot David** and his wife, whose child had contracted leukemia (see *MWN*, J/A95). But that settlement was a preemptive one, coming before the David family had actually filed court papers.

### **Prudent Avoidance, Utility-Style**

The concept of "prudent avoidance" of EMF exposures has recently been the target of repeated attacks. For example, Dr. Patricia Buffler has written that this policy is "in conflict with the scientific evidence, since we don't know that there is anything here to avoid." She has been joined in this criticism by a number of physicists, including Drs. David Hafemeister, Robert Park and Richard Wilson (see *MWN*, J/F95, M/J95, J/A95, S/O95 and N/D95).

Dr. Jack Sahl of Southern California Edison Co. in Rosemead, CA, has many views in common with these critics as to whether EMFs are harmful to human health. As he told *Microwave News*, he rejects the notion that there is "some significant chance" that EMFs will turn out to pose a public health threat. But in the September 1996 issue of *Environmental Health Perspectives*, he argued that attacking prudent avoidance is shortsighted. Instead, he wants to shape how it is defined.

Sahl's article, which he coauthored with Dr. Michael Dolan of the Electricity Supply Association of Australia Ltd. in Melbourne, contained almost no discussion of what possible health risks a policy of prudent avoidance might prevent. It emphasized how accepting some type of prudent avoidance policy can help shape public opinion.

Whether or not EMFs pose any health risk, Sahl said, "There's a larger societal benefit from having embraced this kind of decision-making and getting a certain level of acceptance and support." He explained that this "should help the whole society have more support for science-based policy in the future."

Sahl and Dolan summed it up this way:

Our fundamental goals are to increase cultural and societal trust in our scientific and regulatory authorities...and avoid ineffective risk regulation and inappropriate litigation.

Key to their argument is the idea that prudent avoidance and "science-based policy" are two very different categories. They cited the International Committee on Non-Ionizing Radiation Protection

(ICNIRP) limit of 1,000 mG for public EMF exposures as an example of the latter.

The benefit of prudent avoidance, to Sahl and Dolan, is that it is "seen to be addressing people's concerns rather than simply waiting for more formal science-based regulation." If authorities show that they are sensitive to those concerns, then it will be easier to get the public to accept the work of "quasi-governmental scientific panels" in the future.

The article noted that there is scientific uncertainty about whether EMFs pose a health risk. But Sahl does not believe there is much evidence that they are harmful. Accordingly, his version of "prudent avoidance" is narrower than some others. Sahl and Dolan argued that prudent avoidance can never be used to justify a numerical exposure limit—such as the interim guidelines proposed by the National Council on Radiation Protection and Measurements (NCRP) committee on EMFs in mid-1995 (see *MWN*, J/A95). They compared "nonscience-based numeric standards" to "wolves dressed as sheep."

They also insisted that "ALARA (as low as reasonably achievable)-type responses" are "inappropriate to the EMF issues because they do not provide guidance as to what is reasonable."

Finally, they favored a strict interpretation of the "no- or low-cost" nature of prudent avoidance measures, since "it would be a mistake to divert scarce resources from something with known benefits to the uncertain benefits of reducing exposures to EMFs." Asked what he thought of the California Public Utilities Commission's definition of "low-cost" as less than 4% of the total cost of a power line project, Sahl replied, "That's been working fine" (see *MWN*, N/D93).

If prudent avoidance is "carefully used," Sahl and Dolan concluded, it can be adopted by utilities and regulators "without compromising [their] legal or public policy positions." In other words, prudent avoidance is something they can live with—as long as it's defined in the right way.

## No Magnetic Field Risks for Adult Cancers, Says New Finnish Study

Adults living near high-voltage power lines do not have an increased risk of cancer, according to a large new epidemiological study. Researchers at the University of Helsinki reached this conclusion after examining the cancer history and magnetic field exposure of every such adult in Finland.

"The results of the present study suggest strongly that typical residential magnetic fields generated by high-voltage power lines are not related to cancer in adults," Dr. Pia Verkasalo and coworkers reported in the October 26 issue of the *British Medical Journal* (*BMJ*, 313, pp.11-15, 1996).

Verkasalo and her coauthors found "no major increases" in risk among the cohort for 21 varieties of cancer. "The previously suggested associations between magnetic fields and tumors of the nervous system, lymphoma, leukemia, and breast cancer in women were not confirmed," they wrote.

The Finnish team pointed out that this was the first nationwide study of its kind, involving 5 to 25 times more people than past residential cohort studies. It included 8,415 cancer cases from a cohort of 383,700 adults living within 500 meters of all 110-400 kV high-voltage lines in Finland.

Verkasalo did not take any magnetic field measurements; instead, she based exposures on historical power company records. A detailed account of the exposure assessment was published in *Bioelectromagnetics* last year (16, pp.365-376, 1995).

### NIEHS Plans Risk Assessment

The National Institute of Environmental Health Sciences (NIEHS) has announced its strategy for the EMF risk assessment required by Congress under the RAPID program.

In the first phase of the process, scientific studies will be evaluated in a series of symposia, explained Dr. Christopher Portier, who is leading the effort. Planning is under way for the first symposium, to be held March 24-27, which will focus on *in vitro* research. Two more are planned—on epidemiological and *in vivo* studies—after which a working group will analyze all the data. (The symposia will be open to the public.) The director of the NIEHS will then prepare a report for Congress.

As to whether there is a need for another review in the wake of the NAS-NRC report, Dr. Gary Boorman, NIEHS' RAPID program manager, told *Microwave News* that, "There's been a lot of data published since the cutoff date for the NAS report, which we will have to look at."

To receive future updates, write to Portier at: NIEHS, PO Box 12233, MD A3-06, Research Triangle Park, NC 27709. For more on the strategy, visit the EMF RAPID Web site: <[www.niehs.nih.gov/emfrapid/home.htm](http://www.niehs.nih.gov/emfrapid/home.htm)>.

Meanwhile, the results of the first five of eight engineering studies funded by the RAPID program will be presented on February 3 at the *IEEE PES Winter Power Meeting* (see p.17), according to Bill Feero of Electric Research & Management Inc. in State College, PA.

### Adult Residential Studies Reviewed

A new review of the seven published studies on cancer rates among adults living near power lines concluded that the research to date is insufficient to establish a link.

"[I]t seems that the evidence is not strong enough to support the putative causal relation between residential exposure to magnetic fields and adult leukemia, brain tumors or breast cancer," Drs. Chung-Yi Li and Gilles Thériault of McGill University and Dr. Ruey Lin of the National Taiwan University in Taipei wrote in *Occupational and Environmental Medicine* (53, pp.505-510, 1996).

They suggested that future studies should focus on female breast cancer and should include occupational exposures.

Dr. Richard Stevens of the Battelle Pacific Northwest Labs in Richland, WA, who carried out his own adult residential study, (see *MWN*, N/D86 and M/J88) expressed concern over possible misclassification of cumulative EMF exposure. "No account is taken of distribution lines or appliance use...which can play a large role in determining cumulative exposure," he said.

Although the *BMJ* paper did not detail exposures at work, Verkasalo has now discounted their possible influence. "We looked at possible confounding from occupational exposures and found they did not change our results," she told *Microwave News*. The occupational assessment as well as an analysis of leukemia subtypes appears in the December 1996 issue of the *Scandinavian Journal of Work, Environment and Health*.

At the Department of Energy's EMF review in November in San Antonio, Verkasalo reported that there was a statistically significant risk ratio of 4.8 for chronic lymphatic leukemia among those adults exposed 12 or more years before diagnosis. "It's not clear what this means," she said.

A similar study by Drs. Maria Feychting and Anders Ahlbom of the Karolinska Institute in Stockholm, Sweden, found that adults with the highest cumulative exposures to power line EMFs had twice the risk of developing acute or chronic myeloid leukemia than did less-exposed adults (see *MWN*, S/O92 and S/O94). Comparing the new findings to the Swedish study, Dr. Gilles Thériault of McGill University in Montreal, Canada, noted that, "Verkasalo has only four cases of leukemia among people exposed at 2  $\mu$ T-yr (20 mG-yr) and above, whereas Feychting-Ahlbom had 29 cases in this same category." He pointed out that Verkasalo's confidence interval includes Feychting-Ahlbom's risk ratio and therefore the results are "compatible."

In an interview on the Finnish study, Feychting commented, "It's hard to make any firm conclusions given the small number of cases."

Verkasalo did observe increases in melanoma, female colon cancer and male multiple myeloma. The 8% increased risk found in melanoma—which would translate into one extra case per year in Finland—was viewed as "rather low." She also stated that the increase in female colon cancer, although statistically significant, "may well be due to chance." While men showed a 22% higher risk for multiple myeloma, the risk for women was 2% lower than expected. Verkasalo concluded that, "[T]he role of extremely low frequency magnetic fields in the pathogenesis of myeloma, melanoma and colon cancer remains uncertain."

cancer, and they agreed with Wertheimer and Leeper's finding. The panel calculated that the studies indicated a 50% higher rate of childhood leukemia, a statistically significant increase. The committee called the association "robust," explaining that, "Eliminating any single study from the group does not alter the conclusion that the association exists."

The panelists did not attribute the excess leukemia to EMFs because of two "contradictions." First, present-day measurements of magnetic fields do not show an association with leukemia. Second, there is no consistent dose-response relationship.

"The lack of an association with measured fields is not as important as some people have said," Leeper, of Boulder, CO, told *Microwave News*. "Careful use of wire codes may simply be the better way to evaluate historical field levels, rather than an indicator of some hidden factor."

In response to a question from the audience at the November EMF research review in San Antonio, Dr. William Kaune stressed that, "The argument that contemporaneously measured magnetic fields are not associated with a cancer that occurred 20-25 years in the past is not a valid argument." Kaune, of EM Factors in Richland, WA, is leading the EMF measurements for the ongoing childhood cancer study at the National Cancer Institute (NCI).

Committee members noted that there were no explanations better than EMFs: "Past efforts to identify [other risk factors] have failed, and few strong candidates can be postulated at present," they wrote in their report.

In addition to rejecting a link between EMFs and cancer, the NAS-NRC committee also rejected the idea that residential exposures to EMFs lead to adverse neurobehavioral effects or reproductive and developmental effects.

The committee also concluded that:

- There is "no convincing evidence" that exposure to 60 Hz EMFs causes cancer in animals.
- Above 500 mG, there are "credible positive results" for *in vitro* effects, including gene expression, but not at 0.1-10 mG.
- There is "convincing evidence" that 5 G pulsed magnetic fields can induce bone repair in animals.

Some observers have complained that by seeking "conclusive" proof of an EMF health risk, the NAS-NRC panel set an impossible standard. "They set the bar too high," said Dr. Paul

### **How To Order NAS-NRC Report**

The NAS-NRC report, *Possible Health Effects of Exposure to Residential Electric and Magnetic Fields*, is only available in prepublication (typescript) form at present.

The National Academy Press (NAP) will publish the report in late January or early February 1997, according to Dan Quinn of the NAP press office.

For now, a copy costs \$45.00, plus any applicable taxes; write: NAP, 2101 Constitution Ave., NW, Lockbox 285, Washington, DC 20055. With a credit card, call (800) 624-6242 or (202) 334-3313. You can also order the report over the Internet at: <www.nap.edu>.

Gayley of the Oak Ridge National Lab in Oak Ridge, TN. "We all agree that there is no *conclusive* evidence linking EMFs and cancer," said Dr. Imre Gyuk, who managed the report for the Department of Energy (DOE). "We didn't need the academy to tell us that." The report cost the DOE \$622,000 (see *MWN*, S/O91 and S/O96).

"Only by setting the threshold that high could we come to a consensus," Dr. David Savitz, the committee vice chair, explained to *Microwave News*.

Neither Stevens nor Savitz would estimate the likelihood that EMFs may be responsible for the increased leukemia risk among children. "I can't commit to a number," Savitz said. "Based on the epidemiology alone, EMFs are the most likely risk factor, though the case is far from compelling."

Many of the 16 committee members agree with Stevens's view that EMFs pose no cancer risks. Dr. Paul Slovic, for one, went further and questioned whether the data can support the link to power lines. "The epidemiological studies are hard to get a handle on," he said in an interview. "They are very crude."

Other panelists with extensive EMF experience think that EMFs are probably the cause. "I would estimate that the possibility that EMFs are responsible is greater than 50%, but not above 75%," said Dr. Larry Anderson.

Wartenberg offered a similar assessment: "While the data do not show a causal link between EMFs and childhood leukemia, I believe that magnetic fields are still the most likely candidate."

At the San Antonio meeting, committee member Dr. Daniel Driscoll told the audience that, in fact, the NAS-NRC report says that EMFs are "the best candidate" for the risk factor to explain the excess childhood leukemia.

Both Driscoll and Savitz expressed regret for the way the conclusions had been phrased. "It seemed like a natural thing to do to use a high level of proof," Driscoll said. "But when I saw the headline in *Science*, PANEL FINDS EMFS POSE NO THREAT—which is a total misinterpretation of what the report says—I thought perhaps we should have been more alert as to how the conclusions were written." Savitz commented that, "I did not think through the implications of offering such a flatly negative verdict."

Dr. Indira Nair of Carnegie-Mellon University in Pittsburgh argued against the use of absolutes by the committee members. "By leaving out the uncertainty, they gave a false impression of certainty about an absence of health effects," she said.

Ongoing studies may dispel some of that uncertainty. "I think

### **NAS-NRC EMF Panel Members**

Dr. Charles Stevens, Salk Institute, La Jolla, CA (chair), Dr. David Savitz, University of North Carolina, Chapel Hill (vice chair). The other members are: Drs. Larry Anderson, Battelle Pacific Northwest Labs, Richland, WA; Daniel Driscoll, New York Department of Public Service, Albany; Fred Gage, Salk Institute, La Jolla, CA; Richard Garwin, IBM Watson Research Center, Yorktown Heights, NY; Lynn Jelinski, Cornell University, Ithaca, NY; Bruce Kelman, Golder Associates, Redmond, WA; Richard Luben, University of California, Riverside; Russel Reiter, University of Texas, San Antonio; Paul Slovic, Decision Research, Eugene, OR; Jan Stolwijk, Yale University School of Medicine, New Haven, CT; Maria Stuchly, University of Victoria, BC, Canada; Daniel Wartenberg, University of Medicine and Dentistry of New Jersey, Piscataway; John Waugh, Massachusetts Institute of Technology, Cambridge; and Jerry Williams, Johns Hopkins University, Baltimore, MD.

## The Future of EMF Research

There was a pall over the November DOE EMF research review in San Antonio. Many were worried that the NAS-NRC report would lead to major cuts in EMF funding.

Two questions came up over and over again: Would the congressionally mandated RAPID program escape the budget knife? And would the separate DOE biological mechanisms program survive?

These concerns had already prompted three members of the NAS-NRC committee to issue a minority statement at the same time as the release of the official report. Drs. Larry Anderson, Richard Luben and Maria Stuchly stressed that, "There are still important questions that need to be addressed."

"Research is the only way to find the answers to unexplained observations such as an apparent link between EMF exposure and some forms of cancer," they argued. Luben is the president of the Bioelectromagnetics Society (BEMS); Anderson and Stuchly are both past presidents of BEMS.

As a whole, the NAS-NRC committee was more ambivalent, though it did agree that, "Continued research is important" because "the possibility that some characteristic of the electric or magnetic field is biologically active at environmental strengths cannot be totally discounted."

Even some of the committee members who are skeptical about EMF health effects are not totally against more research, albeit at a low level of funding. "I do believe that there should be a modest amount of high-quality research on physiological effects of EMFs," Dr. Richard Garwin, a physicist, told *Microwave News*, explaining that, "Since there is no evidence that EMFs at residential levels do anything bad to anyone, there is no great urgency."

Dr. Charles Stevens, the committee chair, commented that the whole issue will never be settled until the association between increased childhood leukemia rates and high-current power lines can be explained. The panel members called this need "most compelling." However, like Garwin, they argued that, because there is no "threat to public health," no "adjustment in national research policy" is warranted.

One committee member argued passionately against any more epidemiological studies, however. "They increase public concern at a faster rate than they reduce scientific uncertainty," said Dr. Paul Slovic in an interview. Slovic favors *in vitro* research instead.

Most utility representatives want EMF studies to continue. "There is more research to be completed," said Dr. Kelly Gibney of BC Hydro in Burnaby, Canada, at the DOE meeting. Bill Croker of Georgia Power in Atlanta agreed, but cautioned

that his managers and those at other companies see the EMF issue as being in decline. "It is easy for the utility industry to de-emphasize the EMF issue in our new, competitive environment," he said.

Dr. Leeka Kheifets, the manager of EMF research at the Electric Power Research Institute (EPRI) in Palo Alto, CA, said that she hopes that her program will continue at about the same level of funding. She noted that, "EPRI's emphasis is very much in line with the academy's recommendations for future research."

Half of the money for the RAPID program is supposed to come from industry, but this pledge has never been fulfilled. Indeed, with a shortfall of government appropriations and industry funding, what was billed as a \$65 million research program may pay for only \$35 million worth of biological studies.

Over the last two years, corporate donations have fallen more than \$1.5 million behind even the reduced levels of government funding. And some see more trouble ahead: "I am hearing that the DOE may have difficulty raising the utility contributions for the RAPID program," said Lynne Gillette, DOE program manager for RAPID.

Richard Loughery, the EMF issue manager at the Edison Electric Institute (EEI) in Washington, predicted that the EEI's members would come through. "We are very committed to seeing that the RAPID program is successfully completed, as originally intended by Congress." But he did interject a note of caution: "Because of the publicity on the NAS-NRC report, it may take a greater effort to get utility contributions."

Speaking for the National Electrical Manufacturers Association (NEMA) in Washington, Douglas Bannerman reaffirmed his trade group's support for EMF RAPID. But he was lukewarm about the DOE's own biological mechanisms program. "NEMA has no feeling one way or another," he told *Microwave News*.

Loughery was less certain about funding after the RAPID effort is completed. "I would like to see what recommendations come out of the RAPID program. It is a very important milestone," he said. Bannerman took a similar position, saying that, "We'll do what the risk assessment dictates."

Many of those at the San Antonio meeting see the future of funding for EMF research as dependent on the outcomes of a few ongoing studies. As Rolf Lindgren of Vattenfall, Sweden's principal power company, in Göteborg, noted, "We are waiting for the Karolinska breast cancer study. If that fails to find a link to EMFs, it will be very hard to raise money for further studies."

the results of the three upcoming epidemiological studies should help clarify the childhood cancer issue," said Dr. Mary McBride of the British Columbia Cancer Agency in Canada. McBride is leading a major study in Canada, which she expects to release next year. Also due in 1997 is the study by the NCI (see *MWN*, J/F89). A U.K. report is expected in 1998 (see *MWN*, J/A91 and M/A92).

The findings of the NAS-NRC report stand in sharp contrast

to two officially unfinished EMF reviews. In 1990, the Environmental Protection Agency (EPA) concluded that EMFs should be classified as a "probable human carcinogen" (see *MWN*, M/J 90). After extensive criticism, the EPA report was completely revised. But the agency has refused to release it, at least in part because of pressure from industry (see *MWN*, M/A95).

In an unpublished letter to the *Washington Post* dated Novem-

## **What They Are Saying**

“There is a statistical association between living near a power line and an increased incidence of childhood leukemia. That’s for sure. The question is what caused that association.”

—Dr. Charles Stevens, NAS-NRC panel chair, on *Living on Earth*, broadcast on National Public Radio, November 10, 1996

“Compared to other things you might worry about or spend money on, [EMF research] doesn’t look to me like the best one to spend it on. If you have money to spend, spend it on breast cancer or smoking.”

—Dr. John Waugh, NAS-NRC panel member, MIT, quoted in the *Boston Globe*, November 1, 1996

“People may interpret the report [to mean] the matter is settled, but we don’t think it is.”

—Dr. Richard Luben, NAS-NRC panel member, University of California, Riverside, quoted in *Science*, November 8, 1996

“I paid dearly for being out there on the front line....I don’t believe the [NAS-NRC] report....Unfortunately, not every scientist is unbiased. I just don’t want to mess with this thing anymore.”

—Dr. Robert Becker, author of *The Body Electric* and *Cross Currents*, quoted in the *San Francisco Examiner*, November 1, 1996

Junk science has no place in the media, public policy arena or the courtroom. Hopefully, the NRC report will help short-circuit future scares over minuscule environmental risks in the modern world.

—Editorial, *Seattle Times*, November 7, 1996

“If [ongoing EMF studies] came in positive, the NRC report would be out of date immediately.”

—Dr. Gary Boorman, National Institute of Environmental Health Sciences, manager of the RAPID program, quoted in the *Philadelphia Inquirer*, November 1, 1996

“This report confirms what our position has been for some time.”

—Eric Schmitt, spokesperson, TU Electric, a Texas utility, quoted in the *Dallas Morning News*, November 1, 1996

“We went through this with cigarette smoking for many years and then with asbestos....there may be no absolute evidence, but there is compelling evidence that there is a problem.”

—Shirley Linde, chair, National EMF Advisory Committee, quoted in the *Baltimore Sun*, November 1, 1996

Opponents of power lines have invested too much emotion to give up their cause, but the scientific process seems at least to have sorted out the truth from the scaremongering.

—Dr. Robert Park, American Physical Society, op-ed article, *New York Times*, November 13, 1996

There is not enough evidence to convict electromagnetic fields beyond a reasonable doubt, but there is every reason to view them as a prime suspect.

—Dr. Louis Slesin, *Microwave News*, letter, *New York Times*, November 18, 1996

“[The report] should allay some concerns but may not put the issue to rest, as is the case with most scientific controversies.”

—Madalyn Cafruny, American Public Power Association, quoted in the *New York Times*, November 1, 1996

“There is no conclusive evidence that there *isn’t* a problem.”

—Dr. Keith Florig, Carnegie-Mellon University, quoted in *Newsweek*, November 11, 1996

ber 6, Dr. Robert McGaughy, writing as a private citizen, chastised the NAS for misleading the public “into what may be a false sense of security.” McGaughy has led the EPA assessment of EMF cancer risks for more than a decade.

Dr. Ross Adey, who has chaired a committee on EMF health effects for the National Council on Radiation Protection and Measurements (NCRP) over the last 12 years, had a more caustic view of the NAS-NRC report. “It fails to meet the most elemental responsibilities of the academy to itself or to the American public,” Adey, of the VA Hospital in Loma Linda, CA, told *Microwave News*. The NCRP committee advocates strong action to reduce human exposures to EMFs, according to a draft report obtained by *Microwave News* last year (see *MWN*, J/A95).

A third review—carried out by the Oak Ridge Associated Universities (ORAU) for the White House science office, and commissioned in response to the EPA report—found “no convincing evidence” of an EMF health hazard (see *MWN*, N/D92). At the press conference, Stevens said that his committee was “more balanced” than either ORAU’s review or the assessment by the American Physical Society, which also discounted health risks (see *MWN*, M/J95).

Undoubtedly, the most controversial aspect of the NAS-NRC report was the press release. Wertheimer, who lives in Boulder, CO, expressed frustration that the press release had failed to mention that the often-cited alternative risk factors, such as automobile traffic and the age of each house, had been tested and “have thus far failed quite uniformly to explain the wire code-leukemia link.”

Committee member Dr. Richard Luben was also upset. “It’s unfortunate that the NAS report turned into a media sound bite,” he said in an interview. “We did not conclude that EMF exposure is safe. It is very clear that the committee did not write the press release.”

“It would have been better if the press release had presented a more balanced view of the report,” Wartenberg told *Microwave News*.

### **Views on the News: NAS-NRC** (continued from p.1)

*MWN*, My85).

Others tried to redo the calculations. Eight years ago, Battelle’s Dr. Thomas Tenforde trotted out some dubious assumptions by an obscure Australian researcher showing how the Wertheimer-Leeper and Savitz links to cancer could be made to disappear (see *MWN*, N/D88 and J/F89). No one was impressed and Tenforde’s thesis was soon forgotten.

And there was Dr. Philip Cole’s contention that the Wertheimer-Leeper and Savitz studies were not well controlled. His criticism could not be so easily dismissed, but Cole, the utilities’ favorite expert witness, lost credibility when the Swedish study by Drs. Maria Feychting and Anders Ahlbom, using different techniques, confirmed the childhood cancer risk.

The NAS-NRC has now agreed that wire codes are linked to childhood cancer. This vindication of Wertheimer and Leeper was nearly lost in the headlines proclaiming that EMFs are safe.

The second argument, especially popular among some physicists, is that power-frequency fields have too little energy to promote cancer. This was also part of the NAS-NRC’s logic.

## Views on the News: The NAS-NRC Report

But there are many biological realities that physicists can't yet explain. The most obvious EMF example is the demonstrated ability of some animals to sense infinitesimal fields—which are even weaker than those implicated by Wertheimer and Leeper.

Even if these physicists are right about 60 Hz fields, their objections don't apply to electromagnetic transients—short, intense pulses of energy. As Dr. Antonio Sastre, now at the Midwest Research Institute, told us last year, “pedestrian physics” can show that transients are strong enough to rise above the “background noise” of normal cellular activity (see *MWN*, J/A95).

Enertech Consultants measured transients in homes and found that they were more common near high-current power lines; that is, the transients were associated with wire codes (see *MWN*, S/O 95). When Sastre's models are coupled with Enertech's measurements, the physicists' objections turn fatuous.

The key idea here is that EMFs are more than just power-frequency magnetic fields. There are many different types of EMFs and limiting the analysis to one—the weakest—is disingenuous. Long ago, Dr. Ross Adey warned that EMFs in the real world are not well represented by nice, clean 60 Hz sine waves (see *MWN*, D83).

As committee member Dr. Daniel Driscoll told *Microwave News*, “My gut feeling is that it is EMFs—but we are not measuring magnetic fields correctly yet—and that there is some aspect of EMFs that will correlate very well with childhood leukemia.”

This brings us back to factor X. The third argument is that wire codes are surrogates not for EMFs, but for something else, because measured fields are not associated with cancer. Dr. Robert Park, the physicist, says it's poverty; Dr. Howard Wachtel, the electrical engineer, says it's air pollution; others have their own ideas.

But in a letter to the *New York Times* (November 19), Drs. Richard Luben and Daniel Wartenberg, two members of the NAS-NRC committee, said Park has gotten it backwards: “What little data on poverty and EMFs exist suggest that poverty is associated with the absence of electric power transmission lines.”

Wachtel of the University of Colorado, Boulder, presented his latest paper on the role of traffic in a lighthearted fashion at this year's DOE meeting. It had a curious ring. Air pollution was indeed a risk factor for childhood cancer—but only for those who lived well away from it. Up close, there was no link! Certainly, a counterintuitive finding—but not one that appeared to worry Wachtel or his coauthor, EPRI's Dr. Kristie Ebi.

Feychting, who at one point shared the stage with Wachtel in San Antonio, gently but emphatically told him that she and Ahlbom had gone to great lengths to see if air pollution was the missing risk factor but had found no support for the idea.

Savitz had himself looked at potential confounding from traffic and discounted the idea years ago (see *MWN*, J/F90). Today, Savitz remains unmoved by Wachtel's analysis. “I stand by our published results,” he said.

But some members of the NAS-NRC committee continue to think a risk factor is lurking somewhere out of sight. Dr. Charles Stevens, the panel chair, is among them. “So far, there's only been one risk factor that's been evaluated, and that's electromagnetic fields—and there's no evidence at all, not a bit, that EMFs are the risk factor,” Stevens said in a November 8 interview with WBUR, a National Public Radio station in Boston.

Really? Perhaps Stevens never read key parts of his own re-

port and dozed through the committee's discussions. After all, the report states that, “Past efforts to identify [other risk factors] have failed and few strong candidates can be postulated at present.” We asked Driscoll, who helped draft the NAS-NRC's chapter on epidemiology, how Stevens could make such a comment. “I can't explain it,” Driscoll replied.

The NAS-NRC panel cited two reasons for finding EMFs not guilty and continuing the search for factor X: the lack of an association with spot magnetic field measurements and the lack of a dose-response relationship.

The absence of an association with a single 60 Hz magnetic field measurement taken up to 30 years after a cancer diagnosis should not be surprising. It is like testing paint chips in a home a generation after a child has suffered from lead poisoning.

When Feychting and Ahlbom calculated what the residential fields would have been at the time of diagnosis, using power consumption records, they did find an association and they did find a dose-response relationship (see *MWN*, S/O92).

One of the best reasons to suspect that EMFs are responsible for the childhood cancers—as many members of the committee do—is that whatever factor X might be, it would not be likely to play a role in occupational environments. “If both research avenues have been misleading, they have been so in different ways,” the NAS-NRC panelists wrote in their report.

In fact, the committee acknowledged that workplace studies “have increased rather than diminished the likelihood of an association between occupational exposure to [EMFs] and cancer.” Why then did the committee only do what Savitz called a “superficial overview” of this literature? The official answer is that it was not directly relevant to the committee's assignment.

“I can't imagine how anyone could consider the residential data without also considering the extensive occupational data set,” commented Dr. Samuel Milham, of Olympia, WA, who in 1982 first reported an EMF-leukemia risk among workers.

It all comes down to the fact that the panel insisted on *conclusive* evidence of an EMF-cancer link. If such evidence already existed, there would have been no need for the NAS-NRC report, as DOE's Dr. Imre Gyuk has pointed out. The U.S. Congress requested the study in 1991 because of an already growing body of troubling data—and that was more than a year before the Feychting-Ahlbom results were announced. The report cannot make that data disappear.

The NAS-NRC report may mislead the public into a false sense of security—for a while. But the real link between power lines and cancer must still be addressed, as must the evidence that points to EMFs.

*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 site: <<http://www.microwavenews.com>> • Editor and Publisher: Louis Slesin, PhD; Senior Editor: Peter Hogness; Associate Editor: Christopher Doherty; Assistant Editor: Georgina Keenan; Copy Editors: Jim Feldman, Roy Thomas Jr.; Production Coordinator: Joe Munglioli; Circulation Assistant: Diana Cooper • Subscriptions: \$325.00 per year (\$350.00 Canada & Foreign, U.S. funds only); Single copies: \$60.00 • Copyright © 1996 by Louis Slesin • Reproduction in any form is forbidden without written permission.



## « Cellular Phone Notes »

After **WTR** was named as a defendant in two cellular phone lawsuits, the **CTIA** agreed to pay its research group's legal expenses (see *MWN*, M/A95, J/F96, M/J96 and J/A96). Since then, WTR has tried to persuade the CTIA to indemnify WTR staff and researchers against *all* future damage awards and legal costs. In early October, WTR Chair Dr. **George Carlo** warned that without this protection, research could not proceed. The group's public affairs manager, **Susan O'Donnell**, explained that the lack of an agreement "would leave George open to being involved with litigation for years to come, even after WTR is over and done with." In an interview at the end of October, Carlo said, "We are exploring every avenue to resolve this dispute—and it is a dispute." CTIA's **Tim Ayers** responded that, "What we need is something that provides protection for everybody, and I think we're moving towards that." Both Ayers and Carlo indicated that one option under discussion was for the CTIA to buy additional insurance coverage for WTR, and Carlo revealed that Lloyd's of London is willing to provide it for "a couple of hundred thousand dollars a year." WTR's legal bills to date total about \$600,000. On December 3, CTIA's board of directors approved "the outline of a contract with WTR for reimbursing WTR's legal expenses through insurance and other means." Carlo, however, indicated that negotiations were still continuing.

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Cellular phone companies are finding antenna siting to be difficult even with the support of the President and Congress. Prompted by an executive order from President Clinton and the 1996 telecom law (see *MWN*, S/O95 and M/A96), the **U.S. Postal Service** signed a contract with **Unisite Inc.** to find sites for tens of thousands of antennas across the country. The Postal Service entered the partnership hoping for a financial windfall, with rents

### **New Book on Cell Phone Safety**

Cellular phone health issues are given their most thorough examination to date in *Mobile Communications Safety*, edited by Drs. Niels Kuster of the ETH in Zurich, Switzerland, Quirino Balzano of Motorola in Ft. Lauderdale, FL, and James Lin of the University of Illinois, Chicago. The book grew out of a symposium held in Copenhagen, Denmark, in June 1994 (see *MWN*, J/A94).

The volume includes descriptions of ongoing studies, as well as results of past biological and epidemiological research. Other chapters feature detailed discussions of international standards, analyses of dosimetry issues (both experimental approaches and mathematical models) and an overview of interference with medical devices.

To be published in January 1997 by Chapman & Hall, the book can be ordered in the U.S. for \$74.95, plus shipping and handling, from: International Thomson Publishers, PO Box 6904, Florence, KY 41022, (800) 842-3636, Fax: (606) 525-7778. For international ordering information, check Chapman & Hall's Web site at: <[www.chaphall.com/chaphall.html](http://www.chaphall.com/chaphall.html)>.

from the antennas helping to stabilize postage rates. But at least two communities have contended that—contrary to instructions from Washington—the Postal Service and Unisite have not followed state and local siting regulations. Unisite is based in Richardson, TX, and headed by **Mark Fowler**, a former chairman of the FCC. In September, the town of **Schaumburg**, a suburb of Chicago, filed a lawsuit against the Postal Service for building a 100-foot tower without permission. "Our issue isn't the fact that they are installing antennas as much as the Postal Service feeling they don't have to go through the hearing process," Tom Dabareiner, Schaumburg's acting director of planning, said in an interview. Before the case was scheduled to begin, however, Unisite agreed to file for a special use permit, according to a Postal Service spokesperson. Last June, town officials in **Half Moon Bay, CA**, discovered that Unisite was planning to build a tower on their local post office. Company representatives would neither show them plans nor answer their questions, according to Chris Gustin, the town's planning and building director. "They just came in and tried to muscle us," Gustin said in an interview, noting that access to the proposed site would require permission from both the town and the state. Gustin added that the small town of 9,500 was not opposed to having wireless facilities, but that Unisite did not go through the proper channels for approval. "Modern technology is going to catch up to us sooner or later—I just don't think it needs to be in the form of a 150-foot tower," he said. Fowler told *Microwave News* that the company was in negotiations with Half Moon Bay officials.

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Long before health risks due to cellular phones became an issue, two conglomerates received **Japanese patents** for techniques to reduce users' exposure to RF/MW radiation. **Hitachi** received a patent (No. JP03-238936) on October 24, 1991, for a telephone designed "to prevent the health of the user from being injured." To avoid the absorption of RF/MW radiation in the user's head, the transmitting antenna is placed near the mouthpiece, rather than near the earpiece. The designers also included built-in shielding near the microphone. Similarly, **Mitsubishi** was issued a patent (No. JP04-220851) on August 11, 1992, for a "cordless" telephone designed to "reduce the effect of an electromagnetic wave onto a head of a human body." The handset is coated with shielding material on the side closest to the user's head.

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**Medina, WA**, the posh Seattle suburb that is home to Microsoft CEO Bill Gates, has been one of the most active communities in the U.S. in dealing with the siting of wireless facilities. In October, the city council passed a six-month moratorium on new antenna applications—its second this year. The first was issued in February and was allowed to expire in July when the city adopted an ordinance that established standards and requirements for antenna siting. The city council found that even with the ordinance in place, community concerns remained (see *MWN*, S/O96). The new moratorium will allow officials to evaluate effects on property values, choose a method for measuring RF/MW radiation,

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review other ordinances, discuss changing zoning codes to address local concerns and reconsider using city parks for wireless sites. Medina officials are apparently not worried about industry reaction, since a federal judge ruled in a case brought by **Sprint Spectrum** (see *MWN*, M/J96) that the first moratorium did not violate the telecom law. City Attorney **Kirk Wines** told *Microwave News* that two Sprint antenna applications have been turned down since the second moratorium was adopted, but no lawsuits have been filed as a result. In the same Seattle courthouse in which Medina prevailed over Sprint, **US West** has charged that a moratorium which was passed by the **San Juan Islands, WA**, violates the telecom law (see *MWN*, S/O96). A decision is still pending. In September, **BellSouth** won a lawsuit in which a

U.S. District Court judge ruled that **Gwinett County, GA**, had not supported its decision to deny a tower site with a written record, as required by the telecom law.

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The October 1996 issue of *IEEE Transactions on Microwave Theory and Techniques* features papers from **Canada, Japan, Switzerland** and the **U.S.** on the distribution of cellular phone radiation in the human head. A team from Nagoya Institute of Technology, Tokyo Metropolitan University and NTT Mobile Communications Network Inc. reported that the maximum energy absorption calculated with computer models is significantly higher than that estimated with experimental techniques.

## Reports of Headaches Emerge Among Cell Phone Users in U.S.

Last year occupational health specialists in Australia, Sweden and the U.K. noted a number of reports of headaches associated with the use of cellular phones. Now such complaints are emerging in the U.S. as well.

Both the National Institute for Occupational Safety and Health (NIOSH) and the Food and Drug Administration (FDA) have received several reports linking cellular phones and headaches, and the issue is now on the agenda of an informal interagency group dealing with cellular phone health issues.

"Headaches have been the main thing we've heard about, but we have also heard [other] complaints: some people getting just headaches, others complaining about headaches and problems of dizziness or just not feeling quite the same," Dr. Linda Rosenstock, director of NIOSH in Washington, told CNN in November.

Dr. Ron Kaczmarek of FDA's Center for Devices and Radiological Health in Rockville, MD, told *Microwave News* that the FDA knew of about a dozen possible cases altogether. "The case reports by themselves don't tell you much," he said. "There are several million cellular phone users, so it's not surprising that headaches would occur among them." But Kaczmarek said that the FDA will monitor the issue, and is particularly interested in the ongoing Scandinavian epidemiological study (see box at right).

The federal interagency group first discussed the headache question at its meeting in August and held a session devoted to the issue in late October. "It was primarily an information-sharing meeting," according to Dr. Gregory Lotz, the chief of NIOSH's Physical Agents Effects Branch. "We discussed whether this was important enough to investigate, and there was a consensus that it was." Representatives of the Environmental Protection Agency, the FDA and the industry group WTR also participated in the October meeting and held a teleconference with Sweden's Dr. Kjell Hansson Mild to hear about his current work.

"None of us have the resources to do anything in addition to the European efforts," said Lotz from his office in Cincinnati, "but we're eager to stay abreast of what's going on." Both Lotz and Kaczmarek indicated that the interagency group will return to the headache issue next year, when Mild's results are available.

Dr. George Carlo, the Washington-based chair of WTR, said in an interview that the initial reports in the U.S. so far seem to

involve more digital than analog phones. Last year a Swedish researcher described the same apparent trend in complaints in his country (see *MWN*, N/D95). Kaczmarek said that in the cases of which the FDA was aware, the agency did not have information on the types of phones involved.

Lotz noted that at the October 25 meeting there had been some concern that widespread news of this research could itself cause an increase in cellular phone/headache reports. "The Swedes are hoping to beat that curve," he said. "The subjective nature of headaches makes this harder to study," commented FDA's Kaczmarek. "But it's not impossible—just more difficult."

The current issue of *Electro- and Magnetobiology* (15, pp. 253-258, 1996) features a paper showing how microwave radiation can affect electrical activity in the brain, by Drs. R.A. Chizhenkova and A.A. Safroshkina of the Institute of Cell Biophysics in Pushchino, Russia. Soviet and other East European researchers had reported an association between microwave exposure and headaches in numerous studies in the 1960s and 1970s, mainly among radar workers. The headaches were often linked to other subjective symptoms, such as irritability, fatigue, nausea and sleep disturbances. These studies were reviewed 20 years ago in *Biological Effects of Microwaves* by Drs. S. Baranski and P. Czerski—but they have received little attention in the U.S.

### Scandinavian Headache Study

Dr. Kjell Hansson Mild of the National Institute for Working Life in Umeå, Sweden, is in the midst of an epidemiological study that is examining whether there is a connection between cellular phone use and the incidence of headaches.

"We are looking at subjective disorders in general," Mild told *Microwave News*, "such as headaches, memory loss, etc. We want to find out if these symptoms are connected to phone use, and, if so, which parameters are most important."

Mild is collaborating on the study with Gunnhild Oftedal of the Norwegian phone company Telenor in Trondheim. The project involves 12,000 subjects in Sweden and 5,000 in Norway. The researchers are starting to receive the first completed questionnaires and will begin analyzing the data sometime after mid-January. They do not expect to have results before the *2nd World Congress for Electricity and Magnetism in Biology and Medicine*, which will be held in June 1997 in Bologna, Italy (see p.17).

Mild is a member of the European Commission's expert group on mobile phone safety (see *MWN*, N/D95).

## Cell Phone Industry on How To Avoid Pacemaker EMI: User Precautions for Now, Better Shielding in Future

The Cellular Telecommunications Industry Association (CTIA) and its research group, Wireless Technology Research (WTR), have come out in support of a range of actions to avoid electromagnetic interference (EMI) with cardiac pacemakers. They emphasize the need for precautions by users in the short run, and look to changes in pacemaker design as a long-term solution. These measures were advocated in a report that was the centerpiece of a WTR conference in Washington on September 30 (see below).

"We are pleased with the success we've had with the pacemaker interference program and consider our role to be finished," WTR Chair Dr. George Carlo told *Microwave News*. "Implementation of our recommendations is now the purview and responsibility of the wireless and pacemaker industries."

The CTIA supports all of WTR's recommendations, according to spokesperson Tim Ayers in Washington. A statement from CTIA President Thomas Wheeler asserted that the cellular phone industry "has provided a model of how an industry can and should

handle a potential health issue."

"We are basically pleased with the report," said Bernard Liebler of the Health Industry Manufacturers Association (HIMA), a Washington-based trade group of medical device makers. Liebler called the document "reasonably evenhanded," and said, "The most important thing is that we're talking to each other."

The U.S. Food and Drug Administration (FDA) generally supports "the kinds of recommendations that WTR is making," FDA's Don Witters told *Microwave News*. WTR's guidelines for pacemaker users incorporate many points from earlier statements by the FDA, HIMA and Health Canada, the Canadian government's health agency.

"I'm very happy to notice a change in both industries," commented Dr. Roger Carrillo of Mt. Sinai Medical Center in Miami Beach, FL, who began research on the issue in 1993 and eventually received some funding from WTR (see *MWN*, M/J95; also N/D95 and M/J96). "Now both are concerned about the possibility of conflict—we have wireless manufacturers thinking, 'Will

### WTR Recommendations for...

#### **Pacemaker Users:**

- Wireless phones should be kept at a safe distance from a pacemaker. Existing data indicate that the greater the distance between a pacemaker and a wireless phone, the less the risk of EMI and that six inches is the proper separation distance for minimal risk. Practical steps to achieve this separation include: (i) The phone should not be placed over the pacemaker, such as in the breast pocket, when it is in the ON position; (ii) The phone should be used at the ear opposite to the pacemaker.

#### **Physicians:**

- A process should be established for educating cardiologists and other physicians regarding the data about the risks of EMI between pacemakers and wireless phones so that they are equipped to advise their patients about the risks of interference. Specifically, physicians should be aware that: (i) Pacemaker-dependent patients have a higher risk of clinically significant EMI; (ii) Analog phones are associated with a low incidence of EMI; (iii) Some pacemakers are resistant to EMI.
- Physicians should *not* conduct *ad hoc* testing of wireless phones and pacemakers.

#### **Pacemaker Industry:**

- Premarket screening of pacemakers should be expanded to include tests for potential EMI from the emissions from wireless phones.
- EMI standards for premarket screening of wireless phones should be established. The WTR/FDA screening working group has established that *in vitro* testing is a useful tool for predicting clinically significant EMI between pacemakers and wireless hand-held phones.
- Pacemaker manufacturers should include labeling that details the

Adapted from WTR's *Evaluation of Interference Between Hand-Held Wireless Phones and Implanted Cardiac Pacemakers: Final Recommendations for Corrective Intervention*, released on September 30 in Washington.

results of pacemaker/phone EMI research and current recommendations for mitigation.

- Monitoring of EMI cases should be incorporated into the industry's current postmarketing surveillance practices for pacemakers.
- Pacemaker manufacturers should use shielding and filtering techniques in the design of future pacemakers, and should encourage the use of pacemakers already EMI-resistant for patients who use wireless phones.
- The industry should continue research on, and development of, successful design features that prevent EMI.

#### **Wireless Telephone Industry:**

- Wireless phone manufacturers should expand existing informational inserts included in wireless phone packaging to detail the results of phone/pacemaker EMI research and current recommendations for mitigation.
- The wireless phone industry should make details of phone specifications readily available to the pacemaker industry and the public to facilitate effective screening for EMI. Specifically, EM emissions should be available to the pacemaker industry and whether the phone is analog or digital should be available to the public.
- The wireless phone industry should continue to participate in standards committees, such as those affiliated with ANSI, AAMI and IEC, to facilitate the development of adequate EMI standards.
- The wireless phone industry should continue to evaluate potential pacemaker EMI when developing future technology.
- The wireless phone industry should study the effects of phone EM emissions characteristics on EMI.
- The wireless phone industry should continue to work with the FDA and the medical device industry regarding reported incidences of EMI between medical devices and wireless phones.

#### **Wireless Phone/Pacemaker Industries Jointly:**

- A forum for collaborative guided research between the wireless phone and pacemaker industries should be established.

## HIGHLIGHTS

my product interfere with some implanted medical device?’ and vice versa. This was not the case a couple of years ago.”

WTR’s report urged specific precautions such as a six-inch separation distance between cellular phones and implanted pacemakers (see below). It noted that wider use of pacemakers that are resistant to EMI could drastically reduce the problem in the future. But since “hardening techniques effective today may not be effective with technologies of the future,” the report called on both the pacemaker and wireless industries to pay attention to the EMI problem as they design new products.

A May 10 letter from Carlo to the FDA had urged that “people who are dependent on their pacemakers...should use the more common analog-type phones” rather than digital models (see *MWN*, M/J96). WTR’s final recommendations retreated somewhat from this position, noting only that doctors “should be made aware”

### **Cell Phones and Pacemakers: How Close Is Safe?**

A consensus has formed in support of six inches as a minimum “safe separation distance” between pacemakers and cellular phones. But EMI is possible, though rare, even at greater distances, according to several researchers.

Preliminary data from recent work by Dr. Roger Carrillo “support a six-to-eight-inch threshold for interference,” according to WTR’s report. However, the report’s recommendations called for only a six-inch separation.

“The effects that could pose a major risk to the patient all occurred within a range of three inches,” Dr. Carrillo told *Microwave News*, adding that 99% of interference of any kind happens within six inches. “There are some less clinically significant events that may occur beyond that range, but as a doctor I’m especially concerned about the significant events. A skipped beat here or there is not a major problem.”

WTR’s Dr. George Carlo said in an interview that he had originally suggested specifying “six-to-eight inches.” But he explained that peer reviewers at the Harvard Center for Risk Analysis in Boston, among others, had said a more definite number was needed, and that six inches should be adequate. The WTR report stated that with a six-inch separation, “approximately 99% of pacemaker wearers would be protected.”

Dr. Kok-Swang Tan, a research scientist with Health Canada’s Health Protection Branch (HPB), found one pacemaker that was affected at 12 inches. “It’s not only myself,” he told *Microwave News*. “The U.S. FDA and the University of Oklahoma center also found examples of EMI beyond six inches.” Although the HPB has not endorsed any particular separation distance, Tan personally argued at the WTR meeting for consideration of a greater threshold.

But Tan said that others at the conference expressed “a clear consensus to stick with the six inches.” Both the FDA and HIMA support a six-inch separation. Given that the six-inch guideline now has such wide support, Tan said that he would not necessarily oppose its adoption by the HPB in the future.

that analog phones cause much less interference. “We decided just to give physicians all the relevant information,” Carlo explained, “so that they can assess the needs of their individual patients.”

A WTR study of 975 pacemaker users had previously found that the PCS-1900 type of digital phones produced very little interference (see *MWN*, M/J96; also M/J95 and N/D95). The Center for Electromagnetic Compatibility (EMC) at the University of Oklahoma, Norman, reported a similar finding at the September 30 WTR conference. These phones provide what the industry calls “personal communications services” (PCS), integrating telephone, paging and voice mail, and transmitting at a higher frequency of around 1900 MHz.

But the final WTR report noted that PCS-1900 phones are just now coming to market and have only been studied in “test mode”—not in the discontinuous transmission (DTX) mode, which customers use for making phone calls. European GSM phones with DTX have been reported to cause interference. “It is therefore important,” the report stated, “that the PCS-1900 phones be studied further in actual transmission.”

The report also called on the cellular phone and cardiac pacing industries to support more research on EMI to cardiac defibrillators. “We firmly believe that follow-up *clinical* studies of defibrillators must be done,” Carlo told *Microwave News*. “Unfortunately, WTR has not been funded to accomplish this very important work.”

WTR had planned to sponsor a study of defibrillator wearers by Dr. Hans Moore of George Washington University (GWU) in Washington (see *MWN*, N/D95), but was unable to work out the details before funding problems with the CTIA forced a cutback (see *MWN*, M/J96 and J/A96). “We do not have funding for a research agenda on defibrillators,” said CTIA’s Ayers, “but we’ll continue to cooperate with the FDA and others researching the issue.”

Witters explained that due to funding cutbacks at the FDA, its main focus on defibrillator EMI would be to continue laboratory testing. As for studies with people who have implanted defibrillators, he said the FDA would probably do some work with Moore at GWU. He added that the FDA was already looking into PCS-1900 phones and may collaborate on a clinical study with scientists at Johns Hopkins University in Baltimore and corporate researchers from Sprint PCS, Sprint Spectrum’s new corporate name.

The WTR report ended by urging the wireless and pacemaker industries to establish “a forum for collaborative guided research,” and CTIA’s Wheeler stated that the University of Oklahoma’s EMC Center “will provide the forum for the future exchange of information between the two industries.” But HIMA’s Liebler declined to endorse Wheeler’s view: “Oklahoma is one place, and certainly they did good work, but I can’t speak for the pacer companies on that. That’s a business decision.”

Dr. Ravi Ravindran, director of the Oklahoma center, and Dr. Hank Grant, chair of its board, said in an interview that the center is planning laboratory research on cardiac defibrillators and on pacemakers with PCS-1900 phones. They added that they know of no institution with definite plans for clinical studies of people using these devices.

## Local Autonomy for Siting Cellular Towers in New Zealand

In contrast to the U.S., where a national radiofrequency and microwave (RF/MW) radiation standard has preempted state and local government rules for cellular tower siting (see *MWN*, M/A 96 and M/J96), communities in New Zealand have adopted a variety of policies, including a 50  $\mu\text{W}/\text{cm}^2$  public exposure limit and a minimum distance between antennas and homes.

New Zealand has a tradition of public participation in environmental issues, and this has encouraged local governments to be involved in siting decisions for cellular antennas, a process that some say is working well.

“Where a local authority has developed a policy on transmission sites, public concern has generally been met,” according to *Public Authority Planning for Cell Phone Transmission Facilities*, a report released by the office of New Zealand’s Parliamentary Commissioner for the Environment in September.

On the other hand, New Zealand’s wireless industry—comprised of three providers: Telecom New Zealand, a subsidiary of the U.S.’s BellSouth and Australia’s Telstra—has been critical of the local councils, arguing that they have developed inconsistent policies.

The environment commissioner, Helen Hughes, recommends that local governments pursue a “prudent approach” for setting

RF/MW radiation exposure limits for cellular towers, develop plans to protect both community concerns and industry interests, take into account high-risk groups when setting exposure limits for the public and devise strategies for monitoring RF/MW exposures.

New Zealand’s Resource Management Act of 1991, which allows local governments to formulate their own environmental plans, has brought about a diversity of siting policies:

- The city of Auckland has adopted a 50  $\mu\text{W}/\text{cm}^2$  exposure limit, which is stricter than the 200  $\mu\text{W}/\text{cm}^2$  advisory guideline New Zealand adopted in 1990.
- The city of Christchurch has maintained discretion as to whether transmitters may be erected within 300 meters of residential areas or entail exposures exceeding 50  $\mu\text{W}/\text{cm}^2$ .
- The city of Hutt requires that wireless companies get consent for any facilities sited outside industrial locations and then only if they can demonstrate that their transmitters comply with the New Zealand standard.
- The district of New Plymouth permits antennas in industrial areas, but requires the district’s consent to site them in rural areas.
- The city of Waitakere, which was the first to adopt a bylaw with regard to RF/MW exposures, enforces the 1990 New Zealand standard for the general public.

Hughes suggests that the central government can assist local governments that do not want the burden of developing rules for antenna siting by setting guidelines and by urging industry to show that it is minimizing RF/MW exposures.

Although the report recognizes children as a risk group, it is silent on the issue of siting antennas near schools. New Zealand’s Ministry of Health issued a report in August favoring prudent avoidance where children are concerned (see box at left). Earlier this year, New Zealand’s Ministry of Education issued a policy statement banning the placement of cellular antennas near public schools (see *MWN*, S/O96).

### **New Zealand: More RF/MW Health Studies “Imperative”**

An independent report commissioned by New Zealand’s Ministry of Health has called for more research to examine the potential health effects from exposure to RF/MW radiation. In the interim the ministry advises taking “no-cost” measures to reduce exposures from wireless transmitters—especially for potentially sensitive groups such as children.

“It is imperative that the scientific issues be clarified as soon as possible, as there is much at stake,” according to a report, *Literature Review on the Health Effects of RF Radiation*, which was published in August for in-house policy-making and is available on request. Reviews in Australia, Europe and the U.S. have reached similar conclusions (see *MWN*, S/O94 and S/O95).

The report, by Dr. Michael Bates of the Institute of Environmental Science and Research in Porirua and Drs. Marten Hutt and Alistair Woodward of the Wellington School of Medicine, cautioned policy-makers not to use the limited information on nonthermal RF/MW interaction to dismiss potential health effects: “[T]here is a high level of scientific uncertainty, and the implications for policy-making depend largely on where the onus of proof lies: the epidemiological evidence may be construed as either ‘incomplete evidence of cause’ or ‘incomplete evidence of safety.’”

The authors added that while there are no widely accepted biological mechanisms to explain health effects, it would be premature to dismiss these effects as biologically implausible.

The review turned up strong evidence for electromagnetic interference with medical devices, but a dearth of research to link RF/MW exposure to leukemia, brain and lung cancers and effects on the blood, chromosomes, eyes and cardiovascular system. Additionally, studies on the female reproductive and nervous systems are inconclusive, according to the report.

## Belgian Study: Tower Radiation Strengthens Chemical Mutagen

A Belgian research team has found that very-close-range exposure to microwaves from a cellular telephone base station increases the effect of a chemical mutagen on human blood cells.

“A genotoxic effect was demonstrated in *in vitro*-exposed human blood cells, as indicated by an elevated frequency of cells with chromosomal aberrations,” a team led by Drs. Annemarie Maes and Luc Verschaevé wrote in *Environmental and Molecular Mutagenesis* (28, pp.26-30, 1996).

Whole blood samples were exposed to 954 MHz microwaves from an actual GSM base station and then to the “DNA damaging agent” mitomycin C (MMC). Other samples were exposed to either the microwaves or MMC alone. Exposure to the microwaves alone had no mutagenic effect. But blood samples exposed to the microwaves and then to MMC showed a “considerably higher” and statistically significant number of chromosomal abnormalities than those exposed only to MMC.

Microwave exposure increased the subsequent effect of MMC by approximately 20-50%. The greatest impact of prior microwave exposure appeared to occur when the highest concentration of MMC was administered.

## HIGHLIGHTS

The blood samples were exposed to the microwaves for two hours at a distance of 5 cm from an antenna with a 15 W power output, resulting in a specific absorption rate (SAR) of 1.5 W/Kg.

“No cytogenic damage was observed in cells placed at 10 cm or longer distances from the emitting antenna,” according to the study, which noted that while the general public is always more than 10 cm away from the antennas of cellular phone base stations, such is not the case for telecommunications workers.

The researchers stressed that this does not prove that microwave radiation promotes cancer—but they concluded that “this possibility must be taken into serious consideration,” since “genetic effects are very often directly linked to carcinogenesis.”

They are currently investigating whether the radiation emitted by cellular phones themselves plays a similar synergistic role with any of several different chemicals. They cautioned that the results from exposure to base station signals cannot be extrapolated to exposure from phones.

Maes and Verschaeve are both at VITO, the Flemish Technological Research Institute in Brussels. Verschaeve is a member of the European Commission’s expert group on cellular phone health effects research (see *MWN*, N/D95).

### **Australia To Study the Health Impacts of Wireless Technology**

The Australian government will sponsor a five-year, \$3.5 million project on potential health effects of mobile phone technology. The new initiative will include a research program, support for the ongoing World Health Organization effort and dissemination of information on RF/MW radiation.

“An important part of this project will be the provision of factual information about the use of mobile phones and about exposure levels,” Dr. Michael Wooldridge, minister for health and family services, said in a statement. Senator Richard Alston, minister for communications and the arts, stressed the need to respond to public concern about possible effects from long-term

exposure to RF/MW radiation, especially on children.

Australia’s National Health and Medical Research Council will coordinate the research program with the help of a committee that will likely include representatives from the Australian Radiation Laboratory, the Commonwealth Scientific Industrial Research Organization (CSIRO) and the Department of Communications and the Arts. The telecommunications industry will face an increase in licensing fees to cover the project, which will cost 4.5 million Australian dollars.

The project was prompted in part by a 1995 Spectrum Management Agency report by Dr. Stan Barnett of CSIRO, which recommended that Australia establish a research program to bring about “relevant and focused research” (see *MWN*, S/O95), according to a spokesperson for Senator Lyn Allison in Victoria.

In an interview, however, Barnett cautioned that enthusiasm for the new project may cause the funds to be spread over several small studies in the hope of achieving a big research effort, thereby running the risk of “spurious, possibly false-positive results.”

While Barnett initially favored an Australian program, he is now seeking the involvement of other research centers—including some in the U.S.—to provide the “wide base of technical expertise” he feels is necessary. “I believe that the perception of a health risk related to telecommunications is a global problem and that effective research programs should be undertaken by international collaboration,” he said.

Australia has recently proposed a new Telecommunications National Code, which would restrict the ability of local governments to regulate tower siting, according to the inaugural issue of *Electromagnetics Australia/New Zealand*. The newsletter’s editor, Don Maisch, who is based in North Hobart on the island of Tasmania, reports that despite these restraints, one local council in Sydney has proposed a 0.1-0.2  $\mu\text{W}/\text{cm}^2$  exposure limit and the Queensland Democrats passed a motion opposing antennas near schools. Last year, after community protests, Telstra, a telecommunications company, shut down a transmitter in Sydney that was located near a kindergarten and baby health care center (see *MWN*, N/D95).

### **“MICROWAVE NEWS” FLASHBACK**

#### **Years 15 Ago**

- The family of Seaman Charles Day attempts to file suit against the U.S. government over the 19-year-old’s “wrongful” death from cardiac arrhythmia while serving in the Navy. Although the Navy refuses to reveal the nature of his work, the *Providence Sunday Journal* reports that Day installed microwave equipment.
- Senior EPA officials weigh issuing non-ionizing radiation safety standards for the general population.
- NIOSH fails to identify anything “unusual” about a cluster of six cancer cases among women working with RF sealers at the Beaverite Products plant in Beaver Falls, NY.

#### **Years 10 Ago**

- Dr. David Savitz stuns the DOE contractors review meeting when he announces that he has replicated the 1979 Wertheimer-Leeper study linking childhood cancer to power lines.

- A team of Italian researchers led by Dr. Santi Tofani observes serious reproductive and developmental effects—such as lower body-weight gain and incomplete cranial ossification in fetuses—among rats exposed to extremely low levels of RF radiation.
- Drs. Ross Adey, Asher Sheppard and Samuel Milham take issue with a *Scientific American* article by Drs. Kenneth Foster and Bill Guy on rats exposed to RF/MW radiation. “[Foster and Guy’s] apology for the elevated cancer incidence,” Adey and Sheppard write, “has all the aspects of an option more often exercised by politicians: If the facts are unattractive, bury your head in the sand (i.e., statistics) and hope no one will notice the odd posture.”

#### **Years 5 Ago**

- The IEEE approves a revision of the 1982 RF/MW safety standard.
- As concern over a possible police radar–cancer link mounts, the Connecticut police department bans hand-held radar units.

# FROM THE FIELD

## Letter to the Editor: Childhood Leukemia and Electric Fields

November 7, 1996

To the Editor:

I welcome your recent coverage of the importance of electric fields in EMF studies.<sup>1,2</sup>

I am a coauthor of the first childhood leukemia epidemiological study to have measured and reported both ELF magnetic and electric fields over a meaningful time period, instead of simply taking spot measurements, which can be misleading.<sup>3</sup> The fields were measured at the bedplaces of 56 cases and 56 controls overnight. We found a dose-response relationship, with a significant fivefold increase in the relative risk of developing leukemia [from] electric fields above 20 V/m, but no significant difference in the case of magnetic fields.

For many years now, Roger Coghill and I have been saying that electric field exposure is important. I designed the data-logging equipment used in our study six years ago, and we have been using it since then.

The large, ongoing U.K. Childhood Cancer Study (UKCCS) originally [did not] include electric fields because the U.K. National Radiological Protection Board (NRPB) had stated that they could not be quantified meaningfully in a bedroom setting. However, we and Dr. Alan

Preece<sup>2</sup> managed to convince the NRPB that the measurements were possible and meaningful. The board has now designed an effective electric field probe assembly, which fits around an EMDEX II. This was tested earlier this year, and is now being used in the UKCCS Phase II measurements.

As there is no dependent relationship between ELF electric and magnetic field levels, this may explain the lack of consistent findings between studies [that] only consider magnetic fields.

Alasdair Philips, Powerwatch Network  
2 Tower Rd., Sutton, Ely, Cambs. CB6 2QA, U.K.  
<aphilips@gn.apc.org>

1. Anthony Miller et al., "Leukemia Following Occupational Exposure to 60 Hz Electric and Magnetic Fields Among Ontario Electric Utility Workers," *American Journal of Epidemiology*, 144, pp.150-160, July 15, 1996. See *MWN*, J/A96.

2. Alan Preece, Letter, *MWN*, p.15, S/O96.

3. R. Coghill, J. Steward and A. Philips, "Extra Low Frequency Electric and Magnetic Fields in the Bedplace of Children Diagnosed with Leukemia: A Case-Control Study," *European Journal of Cancer Prevention*, 5, pp.153-158, June 1996.

## Clippings from All Over

"There are waves of health [alarms] that spread like locusts across the lands. I wrote the book because the breast implant story was the most extreme example, but by no means the only one. We can see it in electromagnetic fields, for example. People don't look at the evidence. They say, oh, my gosh, here's another health risk, here's something else that's going to kill me out there, and probably the big companies know about it, and probably the government is covering it up, I'd better go to court. There is that, that predilection. I think the media plays into it."

—Dr. Marcia Angell, executive editor of the *New England Journal of Medicine* and author of *Science on Trial: The Clash of Medical Evidence and the Law in the Breast Implant Case* (Norton, 1996), in an interview with David Gergen on PBS' *News Hour*, October 1, 1996

We have not committed, nor can we commit to complete, the full research agenda within the current financial or five-year time frame. Indeed, the task of completing the science embodied within the WTR research agenda may well fall to others when our commitment of five years is fulfilled or when the industry's financial commitment of \$25 million is exhausted.

—Drs. George Carlo and Ian Munro of Wireless Technology Research (WTR) in Washington, DC, letter, "WTR Will Not Cut Corners on Study," *RCR (Radio Communications Report)*, p.26, October 21, 1996

Probably the gravest mistake an attorney can make with respect to EMF litigation is to discount the potential effects and liabilities involved based upon the success of defendants to date...[O]n the experience gained from asbestos litigation, it is clear that what may start out as an apparent win-win situation for the attorney and the defendant/client can sumarily be reversed. Another error in judgment would be to become overly enthusiastic about the present scientific opinions which currently support the defense's posture. Ultimately, these cases will be decided by the jurors' hearts and not their minds....As with asbestos litigation, it may take another ten years before EMF litigation finds its center.

—Donald L'Abbate of L'Abbate, Balkan, Colavita & Contini in Garden City, NY, "Electromagnetic Field Litigation: Developments—Lawyers Need Deeper Understanding," *New York Law Journal*, p.S6, October 15, 1996

[W]hile the lights have not gone out completely, in view of the currently inconclusive nature of the scientific evidence on EMF health effects, EMF property damage litigation in California courts retains but a flicker of life. It appears likely to fall to the federal courts, as the ultimate guardians of landowners' constitutional property rights, to decide either to revive the patient or pull the plug.

—Arthur Coon of Miller, Starr & Regalia in Walnut Creek, CA, "What You Can't See Can't Hurt You—Or Can It? The California Supreme Court Holds That Landowners Must Bear Losses in Property Value Caused by 'Intangible' EMF Intrusions," *California Environmental Law Reporter*, p.328, October 1996 (see also p.2)

Experience has shown that there will be a steady stream of "new information" as the scientific community explores the effects of RF radiation ....However, the industry cannot change course, or be subjected to a much stricter "as low as reasonably possible" standard, every time a new study is issued. This is especially true where it is not clear that the new information directly concerns the particular frequencies used by the wireless industry, and where the implications of the new information are not known. For example, the study cited by the Ad-Hoc Association concerning the effect of 900 MHz radiation on REM sleep may not reliably predict the impact of cellular operations on REM sleep....Billions of dollars are being invested in telecommunications infrastructure, and it is no simple matter to change out a telecommunications system in the wake of each new study. If this "assume the worst" approach were followed in all areas of environmental concern, everyone would be required to wear an oxygen mask, and drinking water would be declared off-limits.

—From *Comments of Ameritech Mobile Communications Inc. on Petitions for Reconsideration*, filed with the FCC by attorneys for Ameritech in Hoffman Estates, IL, October 8, 1996 (see also *MWN*, S/O96)

"We have come to the stage where we have got to say to the companies, 'The ball is in your court, it's up to you to prove safety,' rather than the researchers and consumers having to prove danger."

—Stewart Fist, writer and commentator on the communications industry, quoted by Ben Potter in "'Ear, What's All this Fuss About Mobile Phones?'" *The Guardian* (U.K.), November 14, 1996

### **Prudent Avoidance in Sweden: A Cost-Benefit Analysis**

*The following is excerpted from Low-Frequency Electric and Magnetic Fields: The Precautionary Principle for National Authorities, a new pamphlet issued by the five agencies responsible for addressing EMF health risks in Sweden—the National Board of Health and Welfare; the National Board of Housing, Building and Planning; the National Board of Occupational Safety and Health; the National Electrical Safety Board; and the Radiation Protection Institute. All of these agencies have endorsed a policy of prudent avoidance (see MWN, N/D95; see also M/J94).*

*The pamphlet provides some benchmarks for the cost of avoiding illness and death. In Sweden, the cost of preventing one statistical case of cancer from ionizing radiation was estimated to be 12 million kronors (MSK), while avoiding one traffic death was estimated to cost 7 MSK. (1 MSK is approximately equal to \$152,000 U.S.) Comparable values in the U.S. ranged from 5 MSK to 50 MSK, with the lowest estimates for traffic accidents and the highest for environmental protection and nuclear power policies, according to the pamphlet. It notes that in the U.S., "In the field of radiation protection, measures against ionizing radiation costing less than 5 MSK per statistical case avoided are looked on as urgently necessary."*

*For a copy of the pamphlet, which is in English, contact the National Board of Occupational Safety and Health, S-171 84 Solna, Sweden, (46+8) 730-9000, Fax: (46+8) 730-1967.*

On average in Sweden and most other industrialized countries, one child in 25,000 per annum develops leukemia. Although the hypothesis of the connection between the occurrence of childhood leukemia and exposure to magnetic fields cannot be deemed scientifically established, the observed risks are presumed valid in our examples. In one Swedish epidemiological survey, it was observed that children living close to power transmission lines ran a 2.7 higher risk of developing leukemia than those living a long way from such transmission lines. This figure has also been applied to transformer stations and stray currents in the following examples, for lack of other risk estimates. We also assume a lifetime of 40 years for the measure taken and an interest rate of 4%. On these assumptions, it can be shown that the cost per statistical case avoided will be  $R=735K/N$  [SK/case], where K is the cost of the measure taken and N the number of individuals whose exposures the measure [prevents]. Cost is only slightly affected by the lifetime chosen for the measure if it is long-lasting. If the lifetime of the measure is put at 80 years instead of 40, the estimated costs in the examples below will be 17% lower. It is not possible in these examples to make general allowance for the effects of different doses on the number of leukemia cases.

It has to be noted that our examples are only intended to illustrate a calculation model for arriving at a comparison between different costs. Depending on the circumstances of the individual cases, there may be other solutions or bases of economic calculation that are more appropriate.

...The examples show that exposure reduction measures can cost between a couple of million and several hundred million SK per statistical case of childhood leukemia avoided, subject to the risk estimates employed remaining valid. Note that the precautionary principle recommends that measures should be considered when the fields deviate strongly from what can be deemed normal in the environment concerned.

#### **Power Line near Multifamily Dwellings:**

An existing 220 kV power transmission line crosses a multifamily housing area with 300 children living within a distance of the line where the risk of childhood leukemia is presumed to be elevated by proximity to the power line. The cost of replacing the power line with another solution—laying a cable along an existing road—is 60 MSK. If this measure is taken, the cost per case avoided, assuming the estimated risk to be true, will be about 150 MSK. Calculations by local authorities may involve other aspects on which a value can be placed, e.g., the fact of land being released for alternative use.

#### **Preschool near a Power Line:**

A day nursery used every day by 40 children is so close to a power transmission line that the risk of childhood leukemia can be deemed elevated. The cost of building a new day nursery elsewhere is 4 MSK. If this measure is taken and there are no other economic aspects to be

taken into consideration, the cost per case avoided will be 74 MSK. If instead it were possible to use tuned, screened circuits, at an estimated cost of 0.5 MSK, the cost per case would be about 9 MSK.

#### **Transformer Station in a School Building:**

A transformer station in a school building causes elevated magnetic fields in three classrooms. One possible means of reducing the magnetic fields is to line the space with sheet metal. A measure of this kind costs about 1,000 SK/m<sup>2</sup>, materials and labor included, which can mean a total cost of about 0.2 MSK. Assuming the measure will reduce exposure for 75 children using the classrooms, the cost per case avoided will be less than 2 MSK.

#### **Stray Currents in Single-Family Dwellings:**

A single-family dwelling has elevated magnetic fields, which are presumed to augment the risk of childhood leukemia. These magnetic fields are caused by stray currents from installations in the house, and these currents will cost 5,000 SK to eliminate. Assuming that there will be, on average, one child living in the home over a period of 40 years, the cost per statistical case avoided will be about 4 MSK.

#### **Power Line in Rural Area:**

A 400 kV power transmission line is planned in a rural area. An effort was made at the planning stage to locate the line as favorably as possible, e.g., from the viewpoint of persons living close by. It is intended to use a power line structure, a T-pole, which is more advantageous from a magnetic field viewpoint than the traditional transmission line structure. These measures can be taken without any appreciable added expense or other consequences. Even so, for 80 km of its length, the line will pass within such a distance of 71 scattered properties that the magnetic fields on the properties can be deemed elevated. With a view to reducing the fields locally on each property, the possibility of using tuned, screened circuits is being investigated. Every such circuit costs an estimated 0.5 MSK. Assuming that, on average, there is one child living on each property and there are no other economic aspects to be taken into consideration, the cost per case avoided will be about 370 MSK. The cost per case will be the same if it is preferred to purchase the properties for an average of 0.5 MSK each.

#### **Power Line Planned Through Suburban Area:**

A 220 kV power transmission line is planned for a suburban area. The line will pass a multifamily dwelling within a distance at which it can be deemed to elevate the risk of childhood leukemia. There are 60 children living in the building. To avoid an elevated magnetic field, it is planned to splice a split-phase line into the section that passes the building. The additional cost entailed by this solution is estimated at 0.7 MSK. If the measure is taken, the cost per case avoided will be about 9 MSK.



# CONFERENCES

## 1997 Conference Calendar (Part I)

*Web site addresses are in italics. Part II will appear in our next issue.*

January 5-9: **1st World Congress on Microwave Processing**, Hilton Hotel, Walt Disney Village, FL. Contact: Dr. William Wisecup, W/L Associates Ltd., 7519 Ridge Rd., Frederick, MD 21702, (301) 663-1915, Fax: (301) 371-8955, E-mail: <75230.1222@compuserve.com>.

January 6-9: **Progress in Electromagnetics Research Symposium 1997**, City University of Hong Kong, Kowloon, Hong Kong. Contact: Prof. K.F. Lee, Department of Electrical Engineering, University of Missouri-Columbia, 349 Engineering Bldg. West, Columbia, MO 65211, (314) 882-6387, Fax: (314) 882-0397, E-mail: <lee@ece.missouri.edu>.

January 21-22: **Workshop on Infrared Lasers and Millimeter Waves**, Brooks Air Force Base (AFB), TX. Contact: Debra Jurek, AL/OERS/SRL, PO Box 35505, Brooks AFB, TX 78235, (210) 536-3138, Fax: (210) 534-2919.

February 2-6: **1997 IEEE Power Engineering Society (PES) Winter Meeting**, New York Hilton, New York, NY. Contact: IEEE PES Executive Office, 445 Hoes Lane, PO Box 1331, Piscataway, NJ 08855, (908) 562-3882, Fax: (908) 981-1769, E-mail: <soc.pe@ieee.org>, <www.ieee.org/power>.

February 7: **Physical Characteristics and Possible Biological Effects of Microwaves Applied in Wireless Communications**, Rockville, MD. Contact: Dr. Ewa Czerska, Center for Devices and Radiological Health, FDA (HFZ-113), 5600 Fishers Lane, Rockville, MD 20857, (301) 443-7197, Fax: (301) 594-6775, E-mail: <emc@fdadr.cdrh.fda.gov>.

February 10-14: **5th Annual Wireless Symposium & Exhibition**, Convention Center, Santa Clara, CA. Contact: *Microwaves & RF*, 611 Route 46 West, Hasbrouck Heights, NJ 07604, (201) 393-6289, Fax: (201) 393-6297.

February 18-20: **EMC Zurich '97: 12th International Zurich Symposium & Technical Exhibition on Electromagnetic Compatibility**, Swiss Federal Institute of Technology, Zurich, Switzerland. Contact: Dr. Gabriel Meyer, ETH Zentrum-IKT, CH-8092 Zurich, Switzerland, (41+1) 632-2790, Fax: (41+1) 632-1209, E-mail: <gmeyer@nari.ee.ethz.ch>, <www.nari.ee.ethz.ch/>.

February 20-23: **15th Annual International Symposium on Man and His Environment in Health and Disease: Special Focus on Bioelectricity (EMFs, EM Sensitivity and Subtle Energy)**, Le Meridien Hotel, Dallas, TX. Contact: American Environmental Health Foundation, 8345 Walnut Hill Lane, Suite 225, Dallas, TX 75231, (214) 373-5132, Fax: (214) 361-2534, E-mail: <aehf@ixnetcom.com>.

March 2-5: **9th EPRI EMF Seminar**, Royal Sonesta Hotel, New Orleans, LA. Contact: Robert Banks Associates Inc., 2701 University Ave. SE, Suite 203, Minneapolis, MN 55414, (612) 623-4600, Fax: (612) 623-3645, E-mail: <vlprock@rsba.com>.

March 9-13: **36th Annual Meeting of the Society of Toxicology (SOT)**, Convention Center, Cincinnati, OH. Contact: SOT, 1767 Business Center Dr., Suite 302, Reston, VA 20190, (703) 438-3115, Fax: (703) 438-3113, E-mail: <sothq@toxicology.org>, <www.toxicology.org>.

March 24-27: **1st RAPID Science Symposium: In Vitro Effects**, Regal Hotel, Durham, NC. Contact: Dr. Chris Portier, NIEHS, PO Box 12233, MD A3-06, Research Triangle Park, NC 27709, <www.niehs.nih.gov/emfrapid/home.htm>.

April 1-3: **59th Annual Meeting of the American Power Conference**, Marriott Downtown Hotel, Chicago, IL. Contact: Robert Porter, Illinois Institute of Technology, Chicago, IL 60616, (312) 567-3196, Fax: (312) 567-3892, E-mail: <apc@iit.edu>, <http://apc.iit.edu>.

April 1-4: **Intermag '97: International Magnetics Conference**, Hyatt Regency Hotel, New Orleans, LA. Contact: Intermag '97, c/o Courtesy Associates, 655 15th St., NW, Suite 300, Washington, DC 20005, (202) 639-5088, Fax: (202) 347-6109, E-mail: <magnetism@mcimail.com>, <http://yara.ecn.purdue.edu/~nyenhuis/ieeesmag.html>.

April 2-3: **33rd Annual Meeting of the National Council on Radiation Protection and Measurements (NCRP)**, Crystal City Marriott, Arlington, VA. Contact: NCRP, 7910 Woodmont Ave., Suite 800, Bethesda, MD 20814, (301) 657-2652, Fax: (301) 907-8768.

April 7-10: **Annual Convention of the National Association of Broadcasters**

(NAB), Convention Center, Las Vegas, NV. Contact: Laura Cary, NAB, 1771 N St., NW, Washington, DC 20036, (202) 429-5419, Fax: (202) 429-5343, <www.nab.org/conventions>.

April 12-18: **5th Scientific Meeting and Exhibition of the International Society for Magnetic Resonance in Medicine (ISMRM)**, Trade and Convention Center, Vancouver, BC, Canada. Contact: ISMRM, 2118 Milvia St., Suite 201, Berkeley, CA 94704, (510) 841-1899, Fax: (510) 841-2340, E-mail: <info@ismrm.org>.

April 14-17: **10th International Conference on Antennas and Propagation**, Heriot-Watt University, Edinburgh, U.K. Contact: IEE Conference Services, Savoy Pl., London WC2R OBL, U.K., (44+171) 344-5467, Fax: (44+171) 240-8830, E-mail: <lhduson@iee.org.uk>.

April 19-24: **28th Annual Meeting of the Environmental Mutagen Society (EMS)**, Hyatt Regency Hotel, Minneapolis, MN. Contact: EMS, 11250 Roger Bacon Dr., Suite 8, Reston, VA 22090, (703) 437-4377, Fax: (703) 435-4390, E-mail: <emsdmg@aol.com>.

April 20-24: **1997 Electricity Conference & Exposition**, Hyatt Regency, Vancouver, BC, Canada. Contact: Canadian Electricity Association, 1 Westmount Sq., Suite 1600, Montréal, PQ H3Z 2P9, Canada, (514) 937-6181, Fax: (514) 937-6498.

April 27-May 1: **29th Annual National Conference on Radiation Control**, Sheraton Hotel, Tacoma, WA. Contact: Conference of Radiation Control Program Directors, 205 Capital Ave., Frankfort, KY 40601, (502) 227-4543, Fax: (502) 227-7862, E-mail: <cariganlin@aol.com>, <www.webpub.com/crcpd/>.

May 8-9: **1st World Congress on Bioelectromagnetics in Nature**, Baden Powell House, Queen's Gate, London, U.K. Contact: Roger Coghill, Coghill Research Laboratories, Lower Race, Gwent, Wales NP4 5UH, U.K., (44+149) 576-3389, Fax: (44+149) 576-9882, E-mail: <100771.1170@compuserve.com>.

May 9-16: **American Occupational Health Conference**, Convention Center, Orlando, FL. Contact: Kay Coyne, American College of Occupational and Environmental Medicine, 55 West Seegers Rd., Arlington Heights, IL 60005, (847) 228-6850, ext.152, Fax: (847) 228-1856.

May 13-14: **International Conference on Electromagnetic Energy**, Washington Vista Hotel, Washington, DC. Contact: Amy Nelson, Electromagnetic Energy Association, 1255 23rd St., NW, Suite 850, Washington, DC 20037, (202) 452-1070, Fax: (202) 833-3636, E-mail: <eea@elecenergy.com>, <www.elecenergy.com>.

May 13-15: **IEEE National Radar Conference (NATRAD)**, Sheraton University Hotel & Conference Center, Syracuse, NY. Contact: Michael Wicks, Rome Laboratory/OCSS, 26 Electronic Pkwy., Rome, NY 13441, (315) 330-4437, Fax: (315) 330-2528, E-mail: <natrad97@rl.af.mil>.

May 21-23: **1997 International Symposium on Electromagnetic Compatibility**, Beijing, China. Contact: Ms. Fang Min, Chinese Institute of Electronics, PO Box 165, Beijing 100036, China, (86+106) 828-3463, Fax: (86+106) 828-3458, E-mail: <shaz@sun.ihep.ac.cn>.

May 23-25: **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+10) 422-7535, Fax: (86+10) 421-7749, E-mail: <gzliu@hns.cjfh.ac.cn>.

June 8-13: **1997 IEEE MTT-S International Microwave Symposium**, Denver, CO. Contact: LRW Associates/Chesapeake Mailing Services, 707 E. Ordinance Rd., Suite 401, Baltimore, MD 21226, (410) 768-8757, <www.ieee.org/mtt/mtt.html>.

June 8-13: **2nd World Congress for Electricity and Magnetism in Biology and Medicine**, Meeting of the Bioelectromagnetics Society, the Bioelectrochemical Society, the Society for Physical Regulation in Biology and Medicine and the European Bioelectromagnetics Association, Bologna, Italy. Contact: Dr. William Wisecup, W/L Associates Ltd., 7519 Ridge Rd., Frederick, MD 21702, (301) 663-4252, Fax: (301) 371-8955, E-mail: <75230.1222@compuserve.com>.

**ELECTRIC BLANKETS**

**Low Magnetic Field Models & Induced Currents...**Electric blankets with dramatically reduced magnetic fields can still induce significant electrical currents within the body of the user, according to a study by Yaofei Liu and Dr. Indira Chatterjee at the University of Nevada, Reno. In the November 1996 issue of *Health Physics* (71, pp.676-684), Liu and Chatterjee explained that low magnetic field blankets use two electrical wires running parallel to each other. Since the currents flow in opposite directions, the magnetic fields virtually cancel each other out (see *MWN*, M/J90). However, each wire also generates an electric field, which is not reduced. Concerns about possible EMF health effects generally center on the biological effects of electric currents induced in the human body—and since both magnetic and electric fields can induce currents, each must be assessed. Using a mathematical model, Liu and Chatterjee calculated that the current induced by the electric field of a low magnetic field blanket is indeed somewhat higher than that attributable to the electric field of a conventional model. Overall, with both electric and magnetic fields taken into account, the low-field blanket induces a current density about two-thirds that of a conventional blanket. “We haven’t taken into account the details of the anatomy,” Chatterjee emphasized in an interview. They used a simple model, composed of basic geometric forms like cylinders, lacking any limbs. They noted that a more complex model would make it possible to assess current densities in the more sensitive regions of the body and evaluate their health risks. And the geometry of the anatomy can be important: Liu and Chatterjee found that, “The average current density in the head is higher than in the torso because of the smaller cross section of the head.”

**MEDICAL APPLICATIONS**

**Treating Depression with EMFs...**Studies have linked EMF exposure to depression, although these results remain controversial (see *MWN*, J/A92 and M/A94). Now it turns out that low-frequency fields can also be used to treat depression. Dr. Alvaro Pascual-Leone of the University of Valencia, Spain, and colleagues reported in *The Lancet* (348, pp.233-237, July 27, 1996) that of 17 depression patients given 10 Hz transcranial magnetic stimulation over a period of five days, 11 had improvements that lasted for two weeks. Transcranial magnetic stimulation “is practically painless, does not require anesthesia, is not coupled with the induction of a seizure and has fewer risks and cognitive side effects,” the authors noted. There may be a downside, however, as Dr. P. Brown of the National Hospital for Neurology and Neurosurgery in London, U.K., pointed out in a letter in the October 5 *Lancet* (348, p.959): “[I]n studies with repetitive transcranial magnetic stimulation of the brain, the possibility of delayed malignant disease has not been considered.”

**OCCUPATIONAL HEALTH**

**Resources from EMF RAPID Program and NIOSH...**Two new publications for workers concerned about EMFs were recently issued by the EMF RAPID program and by NIOSH. RAPID’s *Questions and Answers: EMF in the Workplace* was written by staff members of the DOE, the NIEHS, NIOSH and Oak Ridge

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National Lab. The 66-page booklet provides information on EMF basics and a reader-friendly account of the major occupational and biological studies to date. It also offers a thorough discussion of typical worker exposures and 22 pages of further sources of information: studies, research reviews and official documents. To receive a free copy of the booklet, call the EMF Infoline at (800) 363-2383; outside the U.S., call (703) 442-8934. NIOSH's four-page fact sheet, *EMFs in the Workplace*, answers some of the most common questions asked about occupational exposures. "Our pamphlet is essentially a microcosm of the longer booklet" from the RAPID program, said NIOSH's Dr. Gregory Lotz. The NIOSH document is also on the World Wide Web at: <<http://www.cdc.gov/niosh/homepage.html>>, or it may be ordered by calling 1-800-35-NIOSH.

**POLICE RADAR**

**Another Lawsuit Filed...** Although manufacturers of police radar guns have prevailed in well over 20 cases so far, another lawsuit was filed on October 2 in U.S. District Court in Greenbelt, MD, according to the *Gaithersburg Gazette* (October 16). The paper reported that Alan Grant, a lawyer based in Rockville, MD, had filed the suit on behalf of the family of John McKone, a Montgomery County traffic police officer who died three years ago from a metastatic melanoma that originated above his left knee. "The causation is dramatic," Grant told the *Gazette*. "That gun sitting on his knee [was in] the exact same place where the cancer started." Grant indicated that some of his witnesses would be qualified to "testify that there is a causal link." The newspaper explained that Grant would have preferred to wait longer to file the suit, but was forced to act by the state's statute of limitations. Mark Oium of O'Connor, Cohn, Dillon & Barr in San Francisco, attorney for defendant Kustom Signals, told *Microwave News* that the suit had not yet been served on Kustom. Grant did not return calls requesting comment. (For details on past lawsuits, see *MWN*, J/F96, M/A96 and J/A96.)

**VISIBLE LIGHT**

**Frequency-Specific Bioeffects...** Researchers in Switzerland and France reported in the October 26 issue of *The Lancet* on a skin rash induced exclusively by visible light. A team headed by Dr. Pierre Piletta of the Department of Dermatology at Geneva University Hospital described the case of a 52-year-old pilot who repeatedly developed a polymorphous light eruption (PLE) five to eight hours after exposure to sunlight in the cockpit. Sunscreen did not help, and clinical tests with UVA and UVB exposures did not trigger the reaction. The pilot's skin did react, however, to test exposures in the 595-625 nm range of visible light. "This is the first case of PLE specifically induced by light in the visible spectrum," according to Piletta and his colleagues. They noted that, "Visible light penetrates through the epidermis and dermis to the subcutis, where it is absorbed by hemoglobin, bilirubin and  $\beta$ -carotene," and added, "Although these wavelengths carry much less energy than UVA or UVB, they still might induce biological reactions." Finally, they concluded, "The fact that different wavelengths might induce PLE supports the existence of molecules with specific absorption-spectrum characteristics capable of eliciting an immunological process."

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