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INSIDE...

EMF NEWS pp.2-8

Power Line Talk:

\$1.2 Million Prospective Miscarriage Study
• Key Melatonin Experiment Replicated •
How To Cut Ground Currents • Enertech
on the Web • Buffler and Trichopoulos
Support Utility in Court Battle

Does Radon Explain EMF-Cancer Link?

Utility Appeals \$1 Million Property Award

Finns Say EMFs May Promote Animal Tumors

Battelle Wins \$1.5 Million Contract To Repeat German Animal Study of Breast Cancer

Epidemiology Roundup:

**Brain Tumors in USAF • Utility Worker
Mortality and Suicide • EPRI Plans Major
Leukemia Study • Brain Cancer at IBM •
Childhood Brain Tumors and Power Lines**

HIGHLIGHTS pp.8-12

Mobile Phone Health Standards:

ICNIRP Follows Looser European Limits

FCC-EPA Report on Amateur Radio Fields

HP Probes mm-Wave Effects on the Eye

The New Telecom Law and RF/MW Safety:

- Pacific Bell Wins Antenna Fights
- What the Law Says
- Why Industry Favors ANSI, Not NCRP

RECENT BOOKS pp.13-14

Short Reviews

FROM THE FIELD pp.14-16

Clippings from All Over

American Cancer Society's Dr. Clark Heath Talks About EMF Cancer Risks

Flashback: 5, 10 and 15 Years Ago

UPDATES pp.17-19

**Melatonin Madness • RAPID Budget •
Policeman Compensated in Radar Case •
People in the News • EMF Bibliography**

CLASSIFIEDS pp.17-20

Industry Pressures FCC To Adopt ANSI RF/MW Exposure Standard

The Federal Communications Commission (FCC) is facing a massive lobbying campaign from the broadcast, communications and electronics industries as it prepares a new radiofrequency and microwave (RF/MW) exposure standard. Under the Telecommunications Act of 1996, which became law on February 8, the agency must adopt acceptable limits by August 5.

The new telecommunications law also bans state and local governments from restricting towers for cellular phones and other communications devices because of safety concerns—as long as the towers comply with the FCC's new RF/MW limits (see p.10).

At issue is whether the FCC should follow the 1992 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE) standard—as it first proposed in March 1993 (see *MWN*, M/A93)—or the limits recommended by the National Council on Radiation Protection and Measurements (NCRP) in 1986. The FCC could also select elements from each of them. Essentially all the corporate interests have lined up in favor of the ANSI standard—only the Environmental Protection Agency (EPA) is urging the commission to favor the NCRP guidelines.

“We interpret EPA's advice to mean that the best option would be to combine what are considered the best elements of the ANSI and NCRP standards,” FCC's Dr. Robert Cleveland told *Microwave News*. Cleveland is coordinating the agency's effort to establish regulations by early August.

But industry representatives are adamant that only the ANSI standard

(continued on p.11)

Commentary

ANSI/IEEE v. NCRP: Battle for Control of RF/MW Standards

Who would have believed there would be such an intense lobbying effort over which RF/MW radiation standard the FCC should adopt? After all, the 1992 ANSI/IEEE and 1986 NCRP standards were largely based on the same studies and written by the same people.

Although the ANSI standard is more recent, it is not altogether based on better science. Instead, the current campaign reflects the preferences of a small clique of individuals who run IEEE's SCC28 committee that wrote this standard, and who have longtime connections to industry and the military.

At a critical SCC28 meeting held in Tucson, AZ, in 1989, in addition to the representatives from AT&T, GE, IBM, Lockheed, Motorola and Raytheon, approximately a quarter of those present were from the military.¹ Many of them showed up only to swing the vote on a number of key

(continued on p.12)

« Power Line Talk »

Dr. **De-Kun Li** of Kaiser Permanente in Oakland, CA, will run a three-year prospective epidemiological study of **spontaneous abortions** among 1,500 women, under a \$1.2 million contract from the **California EMF Program**. Starting in July, Li's team will measure EMF exposures for a 24-hour period as soon as possible after a woman becomes pregnant. Enertech Consultants in Campbell, CA, will collect the exposure data, and T. Dan Bracken Inc. in Portland, OR, will analyze them. Li and his colleagues recently completed a study which found that use of electric blankets during pregnancy was associated with an elevated risk of birth defects among babies born to women with fertility problems (see *MWN*, S/O95). The award represents close to 30% of the program's \$4.2 million, five-year external research budget. (The program's total budget is \$7 million.) The announcement of this contract comes as a surprise to many who are still waiting for the results of an earlier study by the California Department of Health Services on EMF exposures and miscarriage risks among electric blanket users. Dr. **Gerri Lee** and Dr. **Raymond Neutra**—who heads the California EMF Program—collected prospective and retrospective data in the early 1990s, but the project has been delayed, ostensibly due to shortages in funding to finish the analysis. In 1992, Lee did report preliminary findings showing an up-to-fivefold increased miscarriage risk among women using electric blankets, at an invitation-only workshop sponsored by EPRI and the DOE (see *MWN*, J/A92 and N/D95). But Lee and Neutra have consistently refused to discuss their results in public. Dr. **Jack Sahl**, a senior research scientist at Southern California Edison in Rosemead, objects to proceeding with this new project because, he argues, Lee and Neutra should issue a report on the first study and have it peer-reviewed before considering the next project. "This would be the normal process," he said in an interview. Lee sees it differently: "The study doesn't have to be complete to know that we should proceed. We already have preliminary results that might not change once further work is done." And funding is available now, she told *Microwave News*. "Internally, we are finished, but a lot of work needs to be done on validation before it is published," which will take months, she explained. Lee said that she plans to present the first phase of the study, which looked at self-reported electric blanket use, at this June's Bioelectromagnetics Society (BEMS) meeting. And the rest of the study should be ready for publication by the end of the year. Dr. **Vincent Delpizzo**, the program's research director, stands behind proceeding with the new project. "This is a priority area for the California EMF Program," he said. "We hope that these prospective measurements may help clarify the concept of exposure," he explained, noting that Lee and Neutra's study indicated that measurements taken early in pregnancy did not correlate well with those taken later. "Reproductive health studies offer a unique opportunity to measure exposure at, or close to, the 'right' time," he said, adding that in most cancer studies exposure can only be measured long after the disease has been diagnosed. Neutra declined to be interviewed.

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EPA's Dr. **Carl Blackman** has replicated a key **melatonin** experiment first reported by Dr. **Robert Liburdy** of the Lawrence Berkeley National Laboratory in Berkeley, CA. Four years ago, Liburdy announced that weak magnetic fields could inhibit melatonin's ability to slow the growth of human breast cancer cells, known as MCF-7 (see *MWN*, J/A92). In June, Blackman's team will tell the BEMS annual meeting in Victoria, Canada, that "a 12 mG, 60 Hz magnetic field can completely block [melatonin's] oncostatic action." The results are significant on two levels. First, it is another factor in favor of the "melatonin hypothesis," the leading theory to explain the EMF-cancer link. But equally important, at a time when EMF research is looked at skeptically, Blackman has done what few have done before: achieve an exact replication of a key EMF biological experiment. "It's a robust effect," Blackman said in an interview. Liburdy is delighted. "This *in vitro* effect now stands as an interaction whose important experimental parameters have been identified and can be studied in other labs," he told *Microwave News*. Further tests of Liburdy's results are planned at the Battelle labs in Richland, WA—one of the four sites dedicated to replicating EMF experiments under the RAPID program.

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EPRI has developed a new, cost-effective way to reduce EMFs from ground currents substantially. Past EPRI research identified such ground currents as a principal source of magnetic fields in the home, and a recent analysis by Dr. Nancy Wertheimer, Dr. David Savitz and Ed Leeper found that the presence of ground currents was linked to higher risks of cancer (see *MWN*, S/O95). Ground currents are created when some of the return current in a house escapes through conductive plumbing—which is often used to ground the electrical system—instead of flowing back through the neutral conductor in the service cable. EPRI's new net current control (NCC) device ensures that the neutral conductor acts as the path of least resistance, causing return current to flow through the service cable instead of the pipes. This virtually eliminates ground currents—and when current flow in the cable is approximately the same in both directions, the magnetic fields from the house wiring cancel each other out. **Rochester Gas & Electric Co.** (RG&E) recently tested an NCC device in response to a family's request that magnetic fields in its home be reduced, especially in the child's bedroom. The device cut peak magnetic fields from 12 mG to 4.5 mG, while average fields were reduced by half, to 2.0 mG. These remaining fields were almost entirely due to ground currents from neighbors' homes. If NCC devices were installed for those homes as well, RG&E engineers estimated, the fields in the first house would fall to near zero. Richard Lordan, manager of EPRI's magnetic field management program, told *Microwave News* that the NCC device can be a low-cost alternative to other mitigation methods. The device itself—a ferromagnetic core through which the service cable is looped—is expensive, costing as much as \$2,000. But it is easily installed on the service pole, which often makes it cheaper

than other approaches. "Tracking down the exact sources of ground currents and fields inside the home can be time-consuming and expensive," Lordan explained. Inserting an inexpensive plastic coupler between two sections of water pipe is another way to reduce ground currents—but the expense of digging up water pipes can make this option cost more than the NCC device.

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Enertech Consultants, based in Campbell, CA, has created a magnetic field calculation program called **B-Fast** and has made it available for public use through its home page on the World Wide Web <<http://www.etc-inc.com>>. Since it is written in Sun Microsystems' Java programming language, users do not need specialized software of their own. Instead, they simply input a few parameters—e.g., the current on the line—and the program does the rest. B-Fast is accessible on the Internet to anyone with a Web browser that can take advantage of Java (such as Netscape Navigator 2.0). "Our test version of B-Fast produces the same results as the BPA and SCE-FIELDS programs," Enertech's **Michael Silva** told *Microwave News*, referring to software from the Bonneville Power Administration and Southern California Edison. "It's not full-blown,

but it is fine for most applications," he added. Silva says Enertech will add new features to the program in the coming months—but it already plays background music.

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San Diego Gas & Electric (SDG&E) announced in late March that "three of the nation's top scientists" have joined a friend-of-the-court brief in support of the utility in the *Covalt* property devaluation suit. The brief, which argues that there is no scientific reason for concern about an EMF-cancer link, was originally filed in September by the **Atlantic Legal Foundation** on behalf of 14 scientists, including six Nobel laureates (see *MWN*, N/D95). The new signers are Dr. **Patricia Buffler**, an epidemiologist and the dean of the School of Public Health at the University of California, Berkeley; Dr. **Dimitrios Trichopoulos**, chair of the Department of Epidemiology at the Harvard School of Public Health in Boston; and Dr. **Leonard Hamilton**, retired head of the Biomedical and Environmental Assessment Group at the Brookhaven National Laboratory in Upton, NY. Buffler and Trichopoulos have both been employed as expert witnesses on behalf of utilities, with Buffler having testified for SDG&E in two earlier lawsuits over EMFs.

Electric Fields Concentrate Radon Daughters; U.K. Researchers See Answer to EMF-Cancer "Enigma"

A team of British scientists has found that the decay products of radon—a naturally occurring radioactive gas—are attracted to such common sources of EMFs as power lines and electrical appliances. The researchers, led by Dr. Denis Henshaw of the University of Bristol, argue that this finding may help explain the link between EMF exposure and cancer.

"The observations show that EM fields can concentrate in their vicinity a cocktail of radon daughter nuclei, a known carcinogen, and presumably other potentially harmful agents," they concluded in a paper that appeared in the January 1996 *International Journal of Radiation Biology* (69, pp.25-38). "We have crossed a major conceptual barrier," declared Henshaw, explaining that the results could reveal a mechanism by which EMFs cause cancer.

Henshaw and his coworkers found up to 18 times higher levels of radon daughters in the vicinity of power lines and appliances than in other areas. (Radon daughters result from the decay of radon and include isotopes of polonium, which emit alpha particles that can damage DNA.)

The Bristol team outlined a number of different mechanisms by which electric fields may affect radon daughter aerosols, leading to their deposition on nearby surfaces. "A clear implication of the experimental results is that a person situated near a source of [EMFs] would receive a higher skin dose," which is likely to be significant, the researchers noted. They argued that the presence of electric fields potentially could result in higher levels of radon daughters and other contaminants being deposited in the lungs of those close to the field

source. Organs other than the lungs could then be affected by the movement of the particles within the body.

"Henshaw may be onto something, but it is not necessarily just electric fields that can move radon daughters around; AC magnetic fields can do so, too. Henshaw has not really checked that yet," Ed Leeper, a physicist based in Boulder, CO, told *Microwave News*.

But other members of the scientific community interpret the study more skeptically. The U.K.'s National Radiological Protection Board (NRPB) called the group's theory "implausible" and "purely speculative." The NRPB, based in Chilton, contends that when radon is deposited on surfaces, fewer are then available to be breathed. "Electric fields have in the past been suggested as a way of reducing radon exposure," the NRPB argued in a February 14 press statement. "The attachment of radon daughters to particles present in room air will also tend to reduce doses to the sensitive cells in the airways of the lung because these particles will deposit less effectively than the unattached daughters."

While the Bristol study has received little attention in the U.S., the British media covered it extensively—some even rushed the story into print, breaking a press embargo. The findings appear to have hit a raw nerve among a U.K. public that is increasingly concerned about cancer clusters and low property values near power lines (see *MWN*, J/F96).

On the same day that the study was published, *Dispatches*, a television program on the U.K.'s Channel Four, featured "Electricity and Cancer," on the Bristol radon findings and on

several towns where citizens attribute increased rates of cancer to high EMF levels.

On February 8, even before the program aired, the *Times* prophesied that the study “could open the way to scores of legal actions against electricity companies and suppliers.” Martyn Day, an attorney whose London firm, Leigh, Day & Co., is pursuing a dozen EMF-childhood leukemia cases, noted in the February 14 *Financial Times* that, “Judges are likely to be most persuaded by the human data, but the Bristol theory does plug a gap by offering a plausible mechanism.”

Indeed, Henshaw and his colleagues concluded that, “We believe that the observations may have implications for the apparent enigma that there is no persuasive biological evidence to show that power frequency [EMFs] can influence any of the accepted stages in carcinogenesis.”

The February 17 *Daily Telegraph* reported that the Bristol study will add weight to the arguments of those who are fighting the construction of new power lines. And the February 18 *Sunday Telegraph* noted that the study has “given rise to questions about whether developers should continue to build houses near pylons,” and that “the renewed publicity is certain to feed the paranoia within the housing market.”

Yet an item in the February 15 issue of *Nature* argued that publicity surrounding the study greatly overstated the significance of the results. And a review of the *Dispatches* program, in the February 24 *British Medical Journal*, suggested that the show presented an unbalanced view of Henshaw’s work and needlessly worried parents over the risk to their children.

Dr. James McLaughlin of the Radon Research Group at University College in Dublin, Ireland, wrote in the *Irish Times* (February 21) that he agreed with the NRPB that electric fields “help to deposit radon decay products onto surfaces, thereby reducing the probability of inhaling these substances,” but nevertheless he recommended prudent avoidance in the siting of future power lines.

Henshaw responded in a March 4 letter to the *Irish Times* that, “Using the experimental measurements in our paper, it is possible to show that there is no significant reduction in radon decay product concentrations in room air from 50 [Hz] electric fields, in contradiction to Dr. McLaughlin’s assertions.” The evidence suggesting that electric fields may increase human exposure to radon is too strong to ignore, he concluded.

McLaughlin also noted that while radon is believed to be linked to lung cancer, it is premature to suggest that radon causes leukemia—a disease that epidemiological studies have more commonly linked to EMFs. Henshaw and his coworkers contended in their paper, however, that evidence is emerging that may establish an association between radon and leukemia, brain tumors and kidney cancer, especially in children.

While there are few studies tying lung cancer to EMFs, Dr. Gilles Thériault and his coworkers at McGill University in Montreal, Canada, found a strong association between transient EMFs and lung cancer among utility workers (see *MWN*, N/D94). Dr. Genevieve Matanoski of the Johns Hopkins University School of Hygiene and Public Health in Baltimore was the first to observe an EMF link to lung cancer (see *MWN*, N/D89).

Virginia Power Granted Appeal of \$1 Million Property Award

On January 12, the Virginia Supreme Court, in Richmond, allowed Virginia Electric & Power Co. (VEPCO) to appeal a \$967,000 award in a power line property devaluation suit. John and Janet Dolzer had won their case, arguing that the public’s fear of EMFs played a large role in driving down their property’s value. The Supreme Court’s four-member majority based its order for a new trial on legal issues separate from EMF questions.

The Dolzers contend that VEPCO’s two 230 kV transmission lines on their property significantly depreciated the overall value of their 140-acre farm. The utility, based in Richmond, had been granted a seven-acre easement by eminent domain in July 1993. Ten months later, at the Circuit Court in Louisa County, a jury valued the easement at \$254,000 and assessed damages to the remaining property at \$713,000.

At the Circuit Court, the Dolzers presented testimony from three experts—a broker and two real estate appraisers—who valued the farm at more than \$1.5 million. The appraisers cited examples in which property values had depreciated by 50% or more due to concerns about EMFs from power lines, and they estimated the Dolzers’ loss at over \$650,000.

A real estate appraiser for VEPCO testified that the Dol-

zers should receive \$15,000 for the easement, but no compensation for alleged devaluation to the remaining property.

The Supreme Court ruled that the Circuit Court had wrongly denied a motion in which VEPCO offered to offset the impact on the Dolzers’ land values by limiting its access to the easement and by allowing railroad construction on it. Four judges favored a new trial without considering VEPCO’s contention that the claim of public fear of EMFs is speculative.

In an unpublished opinion, the three dissenting judges agreed with the Dolzers’ assertion that EMFs had devalued their property: “[T]he Dolzers’ experts supplied the necessary quantification of damage to the market value of their remaining property caused by prospective purchasers’ fear of EMF[s].”

VEPCO’s attorney, Joseph Spivey of Hunton & Williams in Richmond, told *Microwave News* that he expects the new trial to begin early this summer. The attorney for the Dolzers, Charles Purcell of Purcell & Purcell in Louisa, did not respond to calls for comment.

In an article that appeared in the January 1996 *Appraisal Journal*, attorney Michael Rikon wrote: “It is entirely possible to conclude, after an EMF market study, that most parcels of EMF-affected property will have a restricted resale value.”

Finnish Animal Study Suggests EMFs May Promote Tumors

Magnetic fields may indeed promote cancer in mice, according to a new study from Finland. In a paper presented at the *3rd International Congress of the European Bioelectromagnetics Association* in Nancy, France, on March 1, Dr. Jukka Juutilainen of the University of Kuopio reported that 50 Hz magnetic fields can accelerate the development of skin tumors induced by ultraviolet (UV) radiation.

"Magnetic fields seemed to increase the rate at which skin tumors appeared, although the total number of animals with malignant tumors was similar in all of the groups exposed to UV radiation," Juutilainen, who led the study, told *Microwave News*. But he cautioned that, "This is just one experiment that has not been replicated here or elsewhere."

Nevertheless, there is further support for the hypothesis that EMFs act as tumor copromoters in related, unpublished work by Drs. Craig Byus of the University of California, Riverside, and Maria Stuchly of the University of Victoria in British Columbia, Canada. In a study funded by the U.S. National Institute of Environmental Health Sciences (NIEHS), Byus and Stuchly saw a significant increase in skin tumors among mice that had been treated with DMBA, a known chemical carcinogen, and then exposed to 60 Hz magnetic fields and TPA, a known chemical promoter.

"We found more total tumors and a higher percentage of animals with tumors among the EMF-exposed mice," Byus said in a March interview, adding that he is preparing his results for publication. These findings were first reported at last June's Bioelectromagnetics Society annual meeting in Boston (see *MWN*, J/A95).

In addition, Dr. Wolfgang Löscher has observed a dose-response relationship between 50 Hz magnetic field exposure and the development of breast cancer among rats exposed to DMBA (see story on right).

The Finnish team used female mice genetically engineered to have multiple copies of a human gene that regulates the production of ornithine decarboxylase (ODC), a naturally occurring enzyme. ODC plays a key role in cell growth and differentiation.

The Finnish team used UV radiation to initiate tumors in both ODC-transgenic and normal mice. Three groups of 44 mice, each consisting of equal numbers of transgenic and normal mice, were exposed to a constant 1 G field, an intermittent field varying from 12.6 mG to 1.26 G for one hour (followed by two-hour breaks) or to UV radiation alone. A fourth group served as controls.

Juutilainen and coworkers found that by the end of the experiment, the number of mice with malignant tumors was similar in all UV-exposed groups. But "skin tumors appeared slightly sooner in the magnetic-field-exposed compared to the UV-only-exposed groups," Juutilainen said.

There was no significant difference between the groups exposed to a constant field and those exposed to an intermittent field, he noted.

In the exposed and control groups, the ODC-transgenic mice

Battelle Gets \$1.5 Million To Repeat German Breast Cancer Study

Dr. Larry Anderson of the Battelle Pacific Northwest Labs in Richland, WA, has won a \$1.5 million contract from the NIEHS to repeat Dr. Wolfgang Löscher's breast cancer study. Löscher and his associate Dr. Meike Mevisen, both of the School of Veterinary Medicine in Hannover, Germany, found that magnetic fields can promote the action of the carcinogen DMBA, increasing the rate of breast cancer among rats (see *MWN*, J/A93, J/F95, M/A95 and J/A95).

"We have had a number of conversations with Löscher and we plan to replicate his study as closely as possible," Anderson said in an interview.

Löscher told *Microwave News* that he is satisfied with Battelle's study design. "The statistical power of the replication study gives a 75% chance of replicating our findings," he said.

Beginning in July, Anderson's team will run a series of studies using a total of 1,300 rats. A set of three-month exposures will include an *exact* replication of Löscher's experiment, in which rats were given four 5 mg doses of DMBA over four weeks and were continuously (18.5 hrs/day) exposed to 1 G, 50 Hz magnetic fields. Anderson will conduct two other similar experiments, using 60 Hz magnetic fields at 1 G and at 10 G.

In a set of six-month studies, rats will be treated with a single 10 mg dose of DMBA before being subjected to one of the same three magnetic field exposures. Dr. Gary Boorman of the NIEHS favors using such a "standard" protocol—longer exposures and less total DMBA—because of its greater sensitivity to weak cancer promoters.

In each experiment, Anderson will measure melatonin levels, which Löscher found to be lower among EMF-exposed rats. The controls will be exposed to fields of less than 1 mG.

The Department of Energy also has a strong interest in Löscher's work and is funding him directly to confirm and extend his results. Löscher has been unable to secure financial support for his work in Germany since his results were published.

Dr. Bo Holmberg of Sweden's National Institute for Working Life in Solna is also trying to repeat Löscher's experiments (see *MWN*, M/A94).

developed tumors more quickly than did the normal mice, Juutilainen said. But the results among the two types of mice were qualitatively similar. The strain of ODC-transgenic mice used in the experiment was established by Dr. Juhani Jänne and his group at the University of Kuopio. Jänne has an international reputation for his work in developing transgenic animals.

"ODC-transgenic mice have a greater susceptibility to cancer promoters," pointed out Byus. In 1987, Byus and Dr. Ross Adey of the VA hospital in Loma Linda, CA, reported that

EMF exposure stimulated transient increases in ODC activity *in vitro* (see *MWN*, N/D87).

The Finnish researchers used the experiment to test the hypothesis that increased ODC activity might explain why

magnetic fields promote cancer. But the data did not support this. On the contrary, the team found that the effects of long-term magnetic field exposure were independent of those of high ODC activity.

Epidemiology Roundup

RF Exposure and Brain Tumors in U.S. Air Force

U.S. Air Force personnel exposed to RF/MW radiation had a 39% elevated risk of brain tumors, according to a study by Dr. J. Kevin Grayson of the Armstrong Laboratory at Brooks Air Force Base, TX. Grayson also found that exposure to low-frequency EMFs was linked to an increased brain cancer risk of 28%. Both results are of borderline statistical significance.

“This result could easily be explained in terms of bias,” Grayson said in an interview. “This study is just a baby step—but you’ve got to start somewhere.”

Grayson’s research, published in the March 1, 1996, *American Journal of Epidemiology*, was carried out in response to concern among Air Force personnel about the relationship between cancer and RF/MW radiation from various kinds of electronic equipment, as well as EMFs from power lines and VDTs. He noted that, although there have been many occupational studies of EMFs and brain cancer, “Few epidemiologists have attempted to examine the association between exposure to [RF/MW] fields and brain tumor risk.”

On-the-job exposure to low levels of ionizing radiation was not associated with an increased likelihood of brain cancer. Possible interactions between different types of fields were analyzed, but no increase in risk was found. Grayson concluded that the latter result “calls into question the role of extremely-low-frequency EMFs as a tumor promoter.”

The study examined 230 cases of brain cancer from hospital records for 880,000 active-duty Air Force personnel. The data were from military records only; Grayson did not attempt any follow-up on those who had left the service.

Exposure assessment was based on a job-exposure matrix, which drew on various sources. Overall, Grayson described exposure estimation as one of his study’s main limitations. “The only recommendation I could make from here is that we do a prospective study and measure actual exposures,” he said. “That’s extremely expensive, but we’re not going to have the answers until we do that.”

A strong relationship was found between senior military rank and the chance of brain cancer. Grayson did not offer any explanation for this result, other than citing previous findings of an increase in risk at higher levels of socioeconomic status.

In a related paper in the February 1996 *Aviation, Space and Environmental Medicine*, Grayson and Dr. Terence Lyons, also of the Armstrong Lab, reported a higher incidence of certain cancers among flying than among nonflying officers in the U.S. Air Force. This study did not examine possible effects of EMFs and RF/MW radiation.

No EMF Effect on Overall Mortality

In a study of 22,000 utility workers at Hydro-Québec, researchers at McGill University in Montreal, Canada, found no increase in overall mortality among those with relatively high EMF exposures. But they cautioned that “small numbers and approximate exposure assessments preclude the denial of any risk, in particular if it were to affect a rare cause of death.”

Writing in the January 1996 issue of *Occupational and Envi-*

ronmental Medicine, Drs. Dalsu Baris, Ben Armstrong, Jan Deadman and Gilles Thériault explained that they conducted this study because, “Nearly all epidemiological studies have focused on cancer, with no attention given to other causes of death.” They analyzed data from a cohort of Hydro-Québec employees that was used in their earlier Canadian-French study of occupational EMF exposure and cancer risk (see *MWN*, M/A94 and N/D94).

They did find a significant doubling of risk of death by accident or violence among workers with higher EMF exposures, part of which was attributable to electrocutions. In addition, Baris and coworkers saw some nonsignificant associations between EMF exposure and leukemia, brain cancer and suicide, and between pulsed EMFs and lung cancer.

Comparisons of utility workers with the general population—using standardized mortality ratios (SMRs)—showed that utility employees had generally *lower* death rates than the population as a whole. The research team attributed this finding to the “healthy worker effect”—the fact that those who hold a regular job are healthier, on average, than those who do not. Drs. David Savitz and Dana Loomis drew similar conclusions about SMR comparisons in their study of 139,000 American utility workers, which found an EMF-brain cancer connection (see *MWN*, J/F95).

Baris and his coworkers cautioned that the weak associations they observed may have been understated, due to potential biases in their study. But despite this uncertainty, they concluded, “These results are broadly reassuring that major causes of death are not strongly associated with exposure to electric and magnetic fields.”

EMF–Suicide Link Not Strong

Baris’s team at McGill also analyzed the relationship between death by suicide and EMF exposure, using data from the same cohort of Hydro-Québec utility workers.

Several earlier studies of residential exposure to power line EMFs had found an association with increases in suicides and/or symptoms of depression, although one other residential and two occupational studies found no such link (see *MWN*, M/J88, J/A92 and M/A94, and Baris’s companion article in the January 1996 *Occupational and Environmental Medicine*).

The McGill researchers explained what might cause such a connection:

EMFs have been found to reduce the production of melatonin hormone by the pineal gland and disturb its circadian rhythm. There is substantial evidence that disruption in the normal circadian rhythm of pineal melatonin secretion is associated with depression.

After examining the Hydro-Québec data, Baris’s group found “mostly small, nonsignificant increases” among workers with higher-than-normal cumulative EMF exposure. One out of ten indices of EMF exposure did show a significant rise in the suicide rate, and this did not seem to be explained by confounding factors such as alcohol use and marital status. But the team did not put much weight on this finding, noting that this index had not been identified in advance as being more relevant than the others, and there was no evidence of a dose–response relationship. The researchers also noted that there were

many weaknesses in their ability to control for confounders.

"Thus," they concluded, "the evidence from this study for a causal association...is weak."

EPRI Study of Childhood Leukemia Survival

The Electric Power Research Institute (EPRI) is funding a \$1,724,000 study on whether EMFs are related to survival or relapse among children with acute lymphocytic leukemia (ALL). The study will examine whether EMF exposure is associated with specific biological predictors of survival at the time of diagnosis, and will prospectively measure whether it is related to survival.

Researchers will measure EMF exposures of 610 children with ALL at three times over a three-year period, each measurement to be taken in a different season of the year. The children will be monitored by an EMDEX-Lite meter 24 hours a day over a several-day period. A pilot study conducted in 1991 at Children's Hospital at Stanford in Palo Alto, CA, determined that bedroom monitoring was "not...an adequate surrogate for personal monitoring."

"Since everybody pretty much agrees that EMFs don't initiate cancer, the question is whether they might be involved in other stages of the disease," Dr. Leeka Kheifets, head of EPRI's EMF health effects research, told *Microwave News*. "This is an innovative way to look at whether EMFs might influence late stages of carcinogenesis, in terms of promotion or progression."

The study is being led by the Western Consortium for Health, a

nonprofit consulting group based in Berkeley, CA, which is affiliated with several Schools of Public Health in the University of California system. Also participating are the Pediatric Oncology Group, a health network that includes Children's Hospital at Stanford, and Energetech Consultants in Campbell, CA. The principal investigator is Dr. Donna Foliart of the Consortium's Moraga, CA, office.

Brain Cancer Among IBM Computer Programmers

Computer programmers at IBM Corp. with more than ten years on the job had three times as many brain tumors as other employees, according to a company-sponsored study. But the University of Alabama, Birmingham, researchers who did the study believe that the statistically significant finding "may be due to chance," because, as Dr. Colleen Beall explained, "There were too many inconsistencies in the data."

Writing in the March 1996 issue of *Epidemiology*, Beall and Dr. Elizabeth Delzell, Dr. Philip Cole and Ilene Brill reported that the higher risks for programmers were "unanticipated." Their research had focused on workers in "VDT development"—defined as jobs that involve "work on cathode ray tube displays...with the power on and the metal or plastic covers removed."

IBM originally commissioned the study after an unpublished epidemiological survey found "a cluster of three brain tumors" at a British IBM plant engaged in the development of VDTs and other products. The University of Alabama team examined 10,331 records

No Power Line Connection to Childhood Brain Tumors Seen

Two recent studies of childhood brain tumors did not find any clear-cut association between the disease and power lines.

Dr. Susan Preston-Martin of the University of Southern California School of Medicine in Los Angeles analyzed 298 children with brain cancer in Los Angeles County, while Dr. James Gurney, working at the Fred Hutchinson Cancer Research Center in Seattle, studied 133 children with brain tumors in western Washington state. Their papers were both published in the January 15, 1996, *American Journal of Epidemiology*, together with an invited commentary by Dr. Charles Poole of the Boston University School of Public Health and replies from the authors of the two papers.

Preston-Martin and colleagues measured EMF exposures directly and also used wire codes devised by Dr. Nancy Wertheimer and Ed Leeper in Denver. Higher-current wire codes correlated with higher measured EMFs, but the field levels within each wire code were much lower than for the same category in Denver. "Very-high-current configuration" homes in Los Angeles had fields only half as high as such homes in Denver, Preston-Martin reported.

Preston-Martin told *Microwave News* that in Los Angeles, 3 mG is "an exceptionally high field." Analyzing only the homes with fields this high gave results that were "consistent with the hypothesis of elevated risk," but the numbers involved were too small for a clear result. "It could be that Los Angeles is not a good place" for such a study, Preston-Martin said. She does not plan to do another case-control EMF study but disagrees with those who call EMF research "junk science": "There is something going on and it would be good to get to the bottom of it."

Preliminary results from the Preston-Martin study had indicated a *higher* cancer risk for homes with *underground* service cables, a finding that she had described as "perplexing" (see *MWN*, N/D 94). She and her team have now concluded that this was "an artifact attributable to bias in the control selection process." Poole noted that while random-digit dialing and nonconcurrent control

selection are popular because they are quick and inexpensive, the experience of Preston-Martin's team "should make others think twice" about the possible pitfalls of these practices.

"My work does not indicate that there is a relation between childhood brain tumors and wire codes," Gurney said in an interview. "My opinion is that we are not going to resolve the magnetic field issue with any more wire code studies," he added. The study by Gurney and coworkers did not directly measure field levels, but used wire codes only. Gurney is now at the Wayne State University School of Medicine in Detroit.

Drs. David Savitz of the University of North Carolina, Chapel Hill, and Bill Kaune of EM Factors in Richland, WA, both told *Microwave News* that field levels in Seattle-area homes are more similar to those in Denver than to those in Los Angeles. But Wertheimer contended that, "It's tricky to apply our wire codes to mixed neighborhoods on the West Coast."

"These studies reduce the likelihood that magnetic fields from power lines are related to childhood brain cancer," commented Savitz.

Poole wrote that these negative findings on brain tumors are independent of previous findings on childhood leukemia. Nonetheless, he added, they "might weaken" the EMF-leukemia link. To argue otherwise, he wrote, "one would be obliged to conclude that both [Wertheimer's and Savitz's] earlier studies were 'false positives' for brain cancer but 'true positives' for leukemia."

Poole also argued that "publication lies much closer to the beginning than to the end of peer review." In highlighting what he called "the postpublication phase" of the peer-review process, Poole urged investigators "to view publication not as a claim to knowledge, but simply as an open invitation to inspect one's results." Wertheimer concurred, and said, "We need to study *why* different studies have produced different results if we are to avoid regressing to an argument of 'Is not!' versus 'Is too!'"

in IBM's U.S. mortality file, all for employees who had worked for the company after 1967, and analyzed 149 cases of brain cancer. They write that they found that there was "no meaningful association between VDT development work and brain tumor mortality." They did find somewhat higher brain cancer rates in the broader category of "engineering/technical workers," but this increase was less than that found among programmers.

For programmers, the chance of brain cancer rose along with the number of years spent on the job. Those with five to nine years' experience had a risk that was twice as large as for other workers, and for ten or more years, the risk tripled. The likelihood of gliomas, a specific type of brain tumor, also rose as the length of time spent in programming increased.

Beall and her coworkers doubt that this reflects a real job-related health risk or that VDTs might have been to blame. They noted that programmers in different departments faced varying levels of risk, and that before 1975, programs were usually written and cor-

rected on paper, not on computer display screens.

Beall, who is now at the University of Alabama's Tuscaloosa campus, told *Microwave News*, "I personally don't think it's too likely" that the IBM programmers' increased risk could have been related to EMF exposure. Does the question deserve more research? "If it were up to me," she answered, "I wouldn't put a lot of resources into that. I think our findings are more likely to have been a result of chance." Cole, one of Beall's Birmingham colleagues, has been a frequent expert witness for utilities, testifying that EMFs pose no cancer risk.

A number of recent studies have focused on the relationship between brain tumors and EMFs (see p.7 and *MWN*, M/A90 and J/F 96). An Australian study in 1992 found that women working at VDTs developed gliomas at almost five times the normal rate (see *MWN*, J/A92). Half of the subjects in that study were computer programmers. But no increased risk was found among men in that study, while among IBM programmers there was no increased risk for women.

HIGHLIGHTS

Mobile Phone Health Standards: ICNIRP Follows European Proposal, Looser than ANSI and NCRP

The International Commission on Non-Ionizing Radiation Protection (ICNIRP) has issued limits for human exposures to cellular phones that are similar to those proposed in 1994 by the European Committee for Electrotechnical Standardization, known as CENELEC. The ICNIRP guidelines are weaker than those adopted by both ANSI/IEEE and the NCRP.

In a statement published in the April issue of *Health Physics* (70, pp.587-593), the ICNIRP recommends maximum localized specific absorption rates (SARs) of 2 W/Kg for the public and 10 W/Kg for workers—the same levels under review by CENELEC. The 1992 ANSI and the 1986 NCRP guidelines prescribe two sets of stricter partial-body SARs—1.6 W/Kg and 8 W/Kg.

The ICNIRP also follows the European guidelines in that SARs are averaged over any 10 g of tissue in the head, as compared to any 1 g of tissue, as recommended by ANSI and the NCRP. In general, as the averaging volume gets larger, com-

pliance becomes easier.

In 1992, the International Non-Ionizing Radiation Committee of the International Radiation Protection Association (IRPA/INIRC)—ICNIRP's predecessor—proposed rejecting the 7 W exclusion clause that the committee had included in its 1988 RF/MW exposure guidelines (see *MWN*, M/J92). But in its final, published statement, the ICNIRP did not explicitly abandon the exclusion clause; rather it specified the 10 W/Kg localized SAR for workers that had been recommended in 1988. The 1988 standard did not include a partial-body recommendation for the general public.

"The ICNIRP definitely does not support any exclusion that violates the basic SAR limits," Rüdiger Matthes, scientific secretary at the ICNIRP, told *Microwave News*.

Reprinted below are ICNIRP's conclusions in the statement, "Health Issues Related to the Use of Hand-Held Radiotelephones and Base Transmitters."

1. The results of published epidemiological studies do not form a basis for health hazard assessments of exposure to RF fields, and neither can they be used for setting quantitative restrictions on human exposure. They do not provide a basis for hazard assessments in relation to the use of hand-held radiotelephones and base transmitters.
2. Data from laboratory studies relevant to cancer do not provide a basis for limiting exposure to the fields associated with the use of hand-held radiotelephones and base transmitters.
3. Limits for human exposure to the fields associated with the use of hand-held radiotelephones and base transmitters should be those of the INIRC (IRPA/INIRC-1988 [see *MWN*, J/F88]) for whole-body average SAR[s] and those of ICNIRP for localized SAR[s] set out in this document.
4. There is no substantive evidence that adverse health effects, including cancer, can occur in people exposed to levels at or below the limits on whole-body average SAR[s] recommended by INIRC

(IRPA/INIRC-1988) or at or below the ICNIRP limits for localized SAR[s] set out in this document.

5. At the frequencies and power levels involved in the use of hand-held radiotelephones, there will be no concern about shocks and burns.
6. The localized SARs in the head associated with the use of hand-held radiotelephones must be assessed for each frequency and configuration used.
7. For hand-held radiotelephones used in occupational situations, ICNIRP recommends that the localized SAR in the head be limited to 10 W/Kg averaged over any 10 g mass of tissue in the head (0.1 W absorbed in any 10 g mass of tissue in the head).
8. For hand-held radiotelephones used by the general public, ICNIRP recommends that the localized SAR in the head be limited to 2 W/Kg averaged over any 10 g mass of tissue in the head (0.02 W absorbed in any 10 g mass of tissue in the head).
9. The use of radiotelephones should be restricted to areas where

interference effects are unlikely to occur (for example, well away from hospital intensive care departments and similar locations). Manufacturers of electrical equipment are encouraged to design and manufacture equipment that is insensitive to RF interference.

The ICNIRP members that drafted the statement are: Drs. Anders Ahlbom, Karolinska Institute, Stockholm, Sweden; Ulf Bergqvist, National Institute for Working Life, Solna, Sweden; Jürgen Bernhardt, Institute for Radiation Hygiene (IRH), Neuherberg, Germany; Jean-Pierre Césarini, Fondation Rothschild, Paris, France; Louis Court, Center for Military Health Research, La Tronche, France; Martino Grandolfo (vice chairman), National Institute of Health, Rome, Italy; Henri Jammet (chairman emeritus), Paris, France; Rüdiger Matthes (scientific secretary), IRH, Germany; Alastair McKinlay, NRPB, Chilton, U.K.; Michael Repacholi (chairman), Royal Adelaide Hospital, Adelaide, Australia; David Sliney, U.S. Army Center for Health Promotion and Preventive Medicine, Aberdeen Proving Ground, MD, U.S.; Jan Stolwijk, Yale University, New Haven, CT, U.S.; Mays Swicord, Motorola, Plantation, FL, U.S. (formerly FDA, Rockville, MD); Laszlo Szabo, National Research Institute for Radiobiology and Radiation Hygiene, Budapest, Hungary; and Thomas Tenforde, Battelle Pacific Northwest Labs, Richland, WA, U.S.

FCC–EPA on RF & EMF Levels at Amateur Radio Stations

A survey of nine amateur radio stations by the FCC and the EPA found that most meet current RF/MW guidelines for human exposures in accessible areas.

Typical readings in accessible areas near antennas and equipment were 1-20 V/m for RF electric fields and less than 50 mA/m for RF magnetic fields, concluded authors Dr. Robert Cleveland of FCC's Office of Engineering and Technology (OET) in Washington and Edwin Mantiply of EPA's National Air and Radiation Environmental Lab in Montgomery, AL.

The highest readings were near vehicle-mounted antennas and wire antennas mounted just above a roof or a yard—some of these levels exceeded the ANSI/IEEE guidelines. Levels in inaccessible areas close to the installations reached 237 V/m and 1,350 mA/m. The measurements were taken under conditions Cleveland and Mantiply believe would result in "worst-case" exposures.

The operating power of the antennas ranged from 100 watts to as much as 1,400 watts at frequencies between 1.8 MHz and 250 GHz.

Although published earlier this year, the report is based on measurements originally made in 1990 at stations in Southern California that used a wide variety of equipment. There are currently more than 500,000 licensed amateur radio operators in the U.S.

Measurements of 60 Hz magnetic fields were also taken at the operators' locations. The levels were as high as 14 mG but were generally less than 4 mG, according to the report. Unlike the RF surveys, however, no attempt was made to find the maximum EMF levels, Cleveland told *Microwave News*.

While the FCC currently excludes amateur operators from being routinely evaluated for compliance with RF guidelines, this policy is being reevaluated (see p.1). "Data obtained as a result of this study will assist the FCC in determining how to ensure compliance with new RF guidelines that may be adopted

in the near future," wrote Cleveland and Mantiply.

The 55-page report, *Measurements of Environmental Electromagnetic Fields at Amateur Radio Stations* (FCC/OET ASD-9601), is available for \$23.50 from: The National Technical Information Service, Springfield, VA 22161, (800) 553-6847; Order No. PB 96-145016. It can also be ordered from the International Transcription Service Inc. at (202) 857-3800. For further information, call the OET RF Safety Program at (202) 418-2464.

Millimeter-Wave Eye Research Funded by Hewlett-Packard

Hewlett-Packard Co. (HP) is funding research into the effects of millimeter waves on the eye. The company is supporting a study on safety issues for a new class of short-range computer communications devices that would operate at 59-64 GHz. "We don't want to have products that cause any harm," HP's Cynthia Johnson said in an interview.

At the same time, HP is intensively lobbying the FCC to choose the less stringent of two proposed exposure standards for this part of the spectrum (see p.11). The company has told the FCC that a 5 mW/cm² limit could make its new technology "impractical," and is unnecessary because "scientific data simply does not exist for health effects of power levels at these frequencies."

"Millimeter waves don't penetrate beyond four-tenths of a millimeter into the skin," said Johnson, HP's government affairs manager, in Washington. She explained that for this reason, "The only place there could be any reason for worry is in the eye."

HP has given a total of \$96,000 to Henry Kues of the Johns Hopkins University's Applied Physics Laboratory in Laurel, MD, to study the effects of 60 GHz continuous-wave exposure on the eyes of rabbits. Previous work in Kues's lab has shown damage to the eyes of monkeys at microwave frequencies of between 1.2 and 2.85 GHz (see *MWN*, J/A83, S/O86, J/A87, J/A88 and S/O91). Pulsed microwaves caused much more damage at the same power levels than did continuous waves. Drugs used for treatment of glaucoma also led to effects at lower power levels.

"Ours is one of the few, if not the only, study that I know of at 60 GHz," Kues said of his new research for HP. Because these higher-frequency waves do not penetrate as deeply as the microwaves he has studied previously, Kues will look at possible damage to the cornea and the iris, but not the retina, which is at the rear of the eye. In an interview with *Microwave News*, he said that he may report some initial results at the Bioelectromagnetics Society meeting in June.

Damage to the corneas of rabbits exposed to 35 GHz millimeter waves was found by Dr. John Trevithick of the University of Western Ontario in London, Canada, in the late 1980s, in work that has been recently submitted for publication. In a 1995 report to the U.S. Army Medical Research and Materiel Command, which funded the research, Trevithick stated that damage was found with pulsed signals as low as

HIGHLIGHTS

30 mW/cm² (see also *MWN*, S/O86).

In research done under contract for Bell Labs in the mid-1970s, Saul Rosenthal and colleagues at what is now Polytechnic University in Brooklyn, NY, found damage to rabbit corneas after both 35 and 107 GHz continuous-wave exposures at estimated power levels down to 26 mW/cm². They also found transitory effects below 10 mW/cm².

In more recent studies, Drs. Werner Grundler and Friedemann Kaiser in Germany have found effects at millimeter-wave frequencies on the growth of yeast cells.

The FCC must soon adopt regulations covering the millimeter wave part of the spectrum, and it is considering both the NCRP standard of 5 mW/cm² and the ANSI/IEEE standard of 10 mW/cm². A March 4 letter from HP's Johnson to the FCC blasted the NCRP standard, stating that it "cannot

be considered to be the product of scientific method." Johnson told *Microwave News* that, "It would make us cut our power to such a point that millimeter-wave applications wouldn't make sense."

Wireless local area networks for computers and point-to-point links between buildings are some of the products that HP is planning for the millimeter-wave band. In the 59-64 GHz frequencies that HP wants to use, millimeter waves are absorbed by oxygen molecules—which means that the strength of the signal falls off rapidly with distance.

"This oxygen-absorption band is especially suited for short-range communication, so you need more power to boost your range," Johnson explained. HP intends to develop what Johnson called "hot spot" applications—communications and data links in localized settings such as airports, campuses and shopping malls.

RF/MW Safety Standards and the New Telecom Law

New Law Helps Pacific Bell Beat Tower Opponents

The new telecommunications law has already had an impact on antenna siting decisions in three California cities. Federal preemption of safety issues (see box on right) helped Pacific Bell win approval for antenna construction in San Diego, San Francisco and San Jose—part of the \$1.7 billion personal communications services (PCS) system it is building in California and Nevada.

In San Francisco, residents concerned about possible health effects from rooftop towers organized a petition drive and demonstration. They cited the California Public Utilities Commission's recent recommendation that cellular phone towers be kept away from schools and hospitals (see *MWN*, N/D95). But on March 7 the San Francisco Planning Commission voted 5-1 to give Pacific Bell the go-ahead.

"We've been preempted by the feds on the health concerns," Commissioner Kelly Hayden explained to the *San Francisco Chronicle*. While commission members had expressed sympathy with opponents' health worries, they were told by the city's legal department that the city could not set its own emissions standard under the new federal law.

One of the anti-tower petitions had been signed by Nobel Prize-winning physicist Dr. Martin Perl of Stanford University in Stanford, CA. Perl told *Microwave News* he had no further comment on the controversy.

In San Diego, opposition to Pacific Bell's towers focused more on potential interference from digital PCS phones to hearing aids and pacemakers (see *MWN*, J/A94, M/J95 and J/F96). San Diego's City Council voted 8-1 on February 13 to delay its decision for a month, responding to protests from a coalition of advocates for the hearing-impaired, senior citizens and investors in a rival type of digital technology. But on March 19 the council voted 5-3 in favor of Pacific Bell.

Bill Hart of the Personal Communications Industry Association (PCIA) in Alexandria, VA, said in an interview that

FCC Chair Reed Hundt had intervened in San Diego by notifying the City Council that it could block Pacific Bell only if the antennas would violate specific zoning regulations. "That was something that we at PCIA helped to get in the language of the law," said Hart.

San Jose's planning commission gave its approval to Pacific Bell on March 27, ending a city-imposed delay. According to Pacific Bell's Lou Saviano in San Francisco, federal preemption of safety issues played a role in San Jose as well.

What the Telecom Law Says

Under the Telecommunications Act of 1996, which President Bill Clinton signed into law on February 8, state and local governments will retain general authority in "placement, construction and modification of personal wireless service facilities," but can no longer deny permits based on RF/MW levels.

The FCC will be responsible for RF/MW guidelines and must adopt an exposure standard before August 5, 1996. By the same date, President Clinton must present a plan by which federal agencies will make government property available for cellular facilities.

Specifically, the law states that state and local governments:

- Cannot set RF/MW standards that are stricter than those specified by the FCC in the siting of "personal wireless service facilities";
- Cannot "unreasonably discriminate" among cellular providers but can favor some applicants on the basis of aesthetic, visual or safety concerns;
- Cannot ban cellular facilities entirely—siting decisions must be made on a case-by-case basis;
- Must handle siting requests within a "reasonable period of time";
- And must have a written record of any decision denying the placement, construction or modification of cellular facilities.

The new law also enables anyone adversely affected by state or local government decisions to pursue court action or petition the FCC for relief in cases that are inconsistent with RF/MW regulations.

is acceptable. They argue that the ANSI standard is more recent, better reflects the consensus of the RF/MW community and is the product of a more open process.

On March 11, 1996, Dr. Eleanor Adair of the John Pierce Laboratory, Dr. C.K. Chou of the City of Hope National Medical Center, Dr. John Osepchuk, formerly of Raytheon Co., and Ron Petersen of AT&T Bell Labs, as well as representatives from the Cellular Telecommunications Industry Association (CTIA), met with senior FCC staff members to urge the adoption of the ANSI limits.

It would be a "serious mistake" for the FCC to adopt the NCRP guidelines, Adair wrote in a March 14 letter distributed to FCC staff by the CTIA. She warned that "utter confusion" would result from the FCC's reliance on the NCRP's 1986 report (see comments on right). Dr. Arthur (Bill) Guy, a professor emeritus at the University of Washington, Seattle, and Chou also submitted their own letters.

Adair, Chou and Guy were intimately involved in developing both the ANSI and NCRP standards. Chou and Guy are currently working on the CTIA's research program investigating the safety of cellular phones.

The strongest criticism of the NCRP report came in a March 4 letter from Hewlett-Packard Co. to FCC Chairman Reed Hundt. "The NCRP guidelines are seriously flawed" and "arbitrarily set limits that lack scientific basis," wrote the company's Cynthia Johnson. "The NCRP report has not even been subject to true peer review," she stressed.

Arthur Varanelli of Raytheon used e-mail to register a similar point: "There are aspects of the NCRP document that lend credibility to the unsubstantiated claims of nonthermal effects and modulation, and likewise encourage 'prudent avoidance' philosophies."

In a February 23 statement, the National Association of Broadcasters (NAB) argued that the ANSI standard is "the only rational choice."

Motorola is one of the few companies on the sidelines. Spokesperson Norman Sandler said that Motorola does not have a strong preference between the two standards. "They are essentially the same with respect to specific absorption rates," he said in an interview from his office in Schaumburg, IL. He added that Motorola wants the matter resolved soon. "Our position is that the public interest is best served by bringing this proceeding to a close."

The EPA appears to stand alone. In comments filed with the FCC in November 1993, the EPA called the ANSI standard "seriously flawed." The EPA disputes the ANSI high-frequency exposure limit of 10 mW/cm², its imprecise distinction between "controlled" and "uncontrolled" environments, the absence of special precautions for high-risk individuals (for instance, those with heart conditions) and the fact that the limit is based only on thermal effects (see *MWN*, J/F94).

The Electromagnetic Energy Association (EEA), a trade group based in Washington, has tried to convince the EPA to support the ANSI standard instead of setting its own RF/MW exposure guidelines. The EEA argued its case in a series of letters sent to EPA's Office of Radiation and Indoor Air (ORIA) last spring and at a June 1995 meeting with Ramona Trovato,

ANSI Is Better than NCRP Because...

Below are excerpts of comments sent to the FCC urging the adoption of the 1992 ANSI/IEEE RF/MW exposure guidelines.

Were the commission...to reject the overwhelming majority of the comments in this proceeding and focus solely on brief comments of the staff of the [EPA]—an agency which largely has discontinued its RF radiation regulatory and research program—we would have the classic case of the government listening only to the government.

—National Association of Broadcasters, February 23, 1996

No reasons are presented in the NCRP report to explain or justify the recommendations and conclusions. Therefore, these recommendations cannot be considered to be the product of scientific method. As is apparent from even a cursory review of the report, not a single peer-reviewed paper on millimeter waves was referenced....Indeed, as a purely academic matter, the NCRP report has not even been subject to true peer review. The NCRP report was, in fact, subject to a much more casual review than any ordinary scientific paper would undergo. According to NCRP staff, the recommendations simply were reviewed by unnamed NCRP council members who may or may not be experts in this field. In short, the NCRP report does not even constitute a conclusive academic study of the problem at this stage and, therefore, it should not be used to guide an industry.

—Cynthia Johnson, Hewlett-Packard, March 4, 1996

Adoption or incorporation of NCRP Report No. 86 will result in increased nuisance litigation for persons and companies involved with [RF] radiation. As we have seen with the global reaction to the "leaked" NCRP pseudoscience report on 60 Hz, where fear and suspicion about home appliances has been inflamed, the use of anything but a legitimate consensus standard, such as ANSI/IEEE C95.1-1992, will entice people to consider as legitimate the "standard" promulgated by the FCC. The resulting conflict will increase litigation concerning products, services and installations previously "approved" by the FCC.

—Frank Kendall, Raytheon, March 11, 1996

The differences between the ANSI/IEEE and NCRP guidelines emphasized by EPA do not involve significant public health concerns but rather reflect the preferences of the EPA technical staff. In fact, the ANSI/IEEE standard arguably provides a *higher* level of protection than the NCRP standard.

—Cellular Telecommunications Industry Association, March 11, 1996

I am greatly disturbed by news that the FCC intends to adopt all or part of the 1986 NCRP report...instead of the ANSI/IEEE C95.1-1992 standard....I currently serve on the newly formed NCRP Scientific Committee 89-5, charged with revision of the 1986 report, and can already assure you that this revision will in no way resemble its 1986 predecessor. The exposure criteria will, in fact, closely reflect the more up-to-date ANSI/IEEE C95.1-1992 standard developed by IEEE SCC28, subcommittee 4, of which I served as cochairman until late 1995.

—Dr. Eleanor Adair, John Pierce Laboratory, March 14, 1996

I believe that it would be a mistake for the FCC to adopt the older 1986 NCRP standard at this time, considering the fact that newer and more advanced standards have been developed since the publication of the NCRP standard....

—Dr. Arthur Guy, University of Washington, Seattle, March 14, 1996

the director of ORIA. Sources told *Microwave News* that the EEA's intense—and sometimes heavy-handed—lobbying deterred the EPA from proposing its own RF/MW guidelines. AT&T Bell Labs, the CTIA, the NAB and Raytheon are all members of the EEA.

The FCC has not indicated what direction it will take, but

has previously maintained that it will defer to government health agencies in its decision.

On March 26, however, at the CTIA convention in Dallas, FCC Commissioner Rachelle Chong, who will have a say in the final decision, told attendees that she is “comfortable” with the ANSI standard.

Commentary: ANSI/IEEE v. NCRP (continued from p.1)

decisions. Dr. Mays Swicord, formerly with the FDA and now at Motorola, was so incensed that he threatened to stop at a local bar on his way to the next subcommittee meeting to pick up a few sots to vote his way.

“I am not happy with the process,” complained Dr. Elliot Postow sometime later. Postow, a former Navy man now with the National Institutes of Health, had identified 17 of the 31 members of the IEEE committee as being associated with the Department of Defense (DOD). Even Dr. Om Gandhi of the University of Utah in Salt Lake City, the cochair of the subcommittee that wrote the standard, warned that this “is not going to sit well with the public.”² An investigation was promised but was soon abandoned.

Similar complaints had been lodged years earlier. In 1984, Dr. Nicholas Steneck, a professor of history at the University of Michigan and the author of a book on how the ANSI RF/MW radiation standards were set, put the ANSI leadership on notice: “It is irresponsible and possibly immoral to continue with the status quo,” he wrote.³

Not long afterwards, EPA's Dr. Carl Blackman and a number of others became so concerned over what they perceived as improprieties in the subcommittee's work—for instance, deciding on proposed limits before the scientific data had been reviewed—that they refused to vote, stalling progress on the standard.⁴ The impasse was finally cleared when the IEEE stepped in and indemnified all those working on the standard against future liability.

Any suggestion that the ANSI exposure standard was based on the best available science is insupportable. Take, for example, the decision to double the high frequency limit to 10 mW/cm²—one of the EPA's principal objections against the ANSI standard. The move to abandon the NCRP limit of 5 mW/cm² above 3 GHz was proposed as early as 1986, the year the NCRP guidelines were released. It was as contentious then as it is today.

This proposal was not driven by any sudden breakthroughs. The only rationale was to make the RF/MW limit consistent with a laser standard above 300 GHz⁵—a strange argument which prompts people to scratch their heads and ask why a standard should be changed below 3 GHz to meet an unrelated standard in a different part of the spectrum. In 1989, it was still a sore point. If the limit were doubled, “We would look like yo-yos,” cautioned Dr. Quirino Balzano of Motorola.⁶ But those in control had already made up their minds in favor of the 10 mW/cm² limit.

Or consider the cancer question. The ANSI/IEEE document is totally silent about it. Indeed, there is no indication that the IEEE ever discussed it—an inexplicable lapse, since Dr. Bill Guy, one of the architects of the standard, ran a \$5 mil-

lion animal exposure study at 2450 MHz that many observers are convinced showed a cancer risk.⁷

The NCRP committee, under the chairmanship of Guy himself, had essentially completed its report when his cancer results emerged. But the council realized that it could not release the report without addressing the Guy study. In contrast, the IEEE committee, with Guy as its vice chairman and years to grapple with the data, simply ignored the issue.

Nor is cancer the only omission. The IEEE committee paid little, if any, attention to experiments showing effects on the eye, on the blood-brain barrier and on the nervous system—all at specific absorption rates well below the ANSI and NCRP threshold for ill effects of 4 W/Kg.

The EPA and NIOSH, two health agencies that have studied the RF/MW health data for decades, have each advocated pegging the threshold to 1 W/Kg for the public and to 2 W/Kg for workers, respectively.

Ironically, whether the FCC elects to follow ANSI or the NCRP will not make any difference in the siting of cellular phone towers—the principal reason for the congressional mandate to set standards. Nor will it make much difference to the broadcasters. So why are the CTIA and the NAB fighting so hard to promote the IEEE and ANSI at the expense of the NCRP? And why are so many engineers and physicists lobbying against a standard that they helped write and are now in the process of revising?

The answer is that if the FCC favors the NCRP guidelines, it will diminish the influence of the IEEE's SCC28 committee, which industry and the military effectively dominate. AT&T, the CTIA, Raytheon and the DOD know a good thing when they have it and are fighting to retain control.

The NCRP is a conservative organization, but since it is a congressionally chartered body there is a degree of public oversight. It was this measure of accountability that forced a discussion of the Guy cancer results in 1986.

This also helps explain why so many people involved in writing the NCRP standard are now attacking it. They are comfortable working hand in glove with the military and with industry. But they are uncomfortable with public accountability, even in very small doses.

The FCC is supposed to base its decisions on the public interest. It has long maintained that it would defer to the federal health agencies on RF/MW standards. If so, it has no choice but to listen to the EPA and favor the NCRP guidelines.

1. See *MWN*, S/O89.

2. See *MWN*, J/A90.

3. See *MWN*, O84.

4. See *MWN*, J/A86.

5. See *MWN*, J/A86.

6. See *MWN*, S/O89.

7. See *MWN*, J/A84, Mr85

and N/D86.

RECENT BOOKS

P. Baraton and B. Hutzler, *Magnetically Induced Currents in the Human Body*, Geneva, Switzerland: International Electrotechnical Commission (IEC), 1995, 45 pp., 105 SwF (approximately \$88.25), including postage. Contact: IEC Central Office, 3 rue de Varembe, PO Box 131, 1211 Geneva 20, Switzerland, (41+22) 919-0211, Fax: (41+22) 919-0300.

Describes a method for calculating the relationship between external magnetic fields and induced electric fields and currents in the human body. The authors, both of Electricite de France, the national utility, conclude that "overhead lines and domestic appliances do not pose any field problem for the general public," but add that occupations with high exposures "merit a deeper analysis."

David Bates, *Environmental Health Risks and Public Policy: Decision-Making in Free Societies*, Seattle: University of Washington Press, 1994, 117 pp., \$12.95 (paperback). Contact: University of Washington Press, PO Box 50096, Seattle, WA 98145, (206) 543-4050, Fax: (206) 543-3932.

Bates, professor emeritus at the University of British Columbia in Vancouver, discusses how public policy has evolved around five environmental health risks—air pollution, asbestos, cigarette smoking, EMFs and lead poisoning. "Public involvement in these five hazards has varied from intense, in the case of cigarettes and [EMFs], to episodic in the case of air pollution, to surprisingly almost absent in relation to lead," Bates writes.

Martin Blank, ed., *Electromagnetic Fields: Biological Interactions and Mechanisms*, Washington: American Chemical Society, 1995, 497 pp., \$129.95. Contact: American Chemical Society, PO Box 57136, Washington, DC 20037, (202) 872-4363, Fax: (202) 872-6067.

Includes 26 papers on the characteristics of EMFs, cellular effects, health risks, endogenous fields, biophysics and medical applications. "All of these papers were peer-reviewed," Blank, of Columbia University in New York, told *Microwave News*.

Jean-Marie Danze et al., *Pourquoi et Comment: Mesurer Les Champs Electriques et Magnetiques 50/60 Hz*, Paris, France: Encre, 1994, 151 pp., 120 FF (approximately \$24.50). Contact: Encre/Sté ARYS, 8 rue Darwin, 75018 Paris, France.

A French-Belgian team assembled this how-to book on measuring EMFs. Much of the equipment described is manufactured in the U.S.

R. Timothy Hitchcock and Robert Patterson, *Radiofrequency and ELF Electromagnetic Energies: A Handbook for Health Professionals*, New York: Van Nostrand Reinhold, 1995, 542 pp., \$84.95. Contact: Van Nostrand Reinhold, 115 Fifth Ave.,

New York, NY 10003, (800) 842-3636, Fax: (606) 525-7778. Hitchcock, an industrial hygienist at IBM, and Patterson, a professor of environmental health engineering at Temple University in Philadelphia, have assembled a great deal of data—with hundreds upon hundreds of references. Unfortunately, they have made little effort to help the reader distinguish the strong from the weak studies. The chapter on power frequency EMFs is particularly weak and appears to have been added as an afterthought. (They fail even to mention the Swedish, Danish and Finnish childhood epidemiological studies that have been the focus of international attention.) Transients are also ignored. These omissions are surprising, given that Patterson used to work at EPRI.

B. Blake Levitt, *Electromagnetic Fields: A Consumer's Guide to the Issues and How to Protect Ourselves*, San Diego: Harcourt Brace & Co., 1995, 432 pp., \$15.00. Contact: Harcourt Brace & Co., 525 B St., San Diego, CA 92101, (800) 543-1918, Fax: (800) 235-0256.

This lengthy discussion of the EMF debate by Levitt, a science writer based in Warren, CT, is intended for the lay audience. "The non-ionizing band of the electromagnetic spectrum will probably turn out to be far more significant than anyone heretofore imagined," she concludes.

Michael Milburn and Maren Oelbermann, *Electromagnetic Fields and Your Health: What You Need To Know About the Hidden Hazards of Electricity—And How You Can Protect Yourself*, Vancouver, Canada: New Star Books, 1994, 207 pp., C\$16.00 (US\$12.00). Contact: New Star Books, 2504 York Ave., Vancouver, BC V6K 1E3, Canada, (604) 738-9429, Fax: (604) 738-9332.

While the title implies that this is another self-help book, Milburn and Oelbermann, both EMF consultants in Waterloo, Ontario, provide a compelling discussion of the scientific debates regarding EMFs: "As biological effects from weak [EMFs] are not supposed to exist at all, a scientific battle royal is under way as the different personalities within scientific circles conflict. This is a side of science not often seen by the public." The book, which was released without fanfare in Canada a few years ago, has not received much attention in the U.S.

Charles Polk and Elliot Postow, eds., *Handbook of Biological Effects of Electromagnetic Fields*, Second Edition, Boca Raton, FL: CRC Press Inc., 1996, 618 pp., \$125.00. Contact: CRC Press, 2000 Corporate Blvd., NW, Boca Raton, FL 33431, (800) 272-7737, Fax: (800) 374-3401.

This is a revised and updated overview of what is currently known about the biological effects of non-ionizing radiation. Topics treated briefly or omitted in the 1986 edition are now covered, including evaluations of recent epidemiological studies (see *MWN*, J/F96); the interaction of short-duration, high-intensity pulses with cells; and the use of low-frequency, pulsed EMFs in bone and soft-tissue repair. The chapters on the effects of static magnetic fields, ELF magnetic fields and unmodulated microwave radiation have been changed significantly, as have those on field computations and "window" effects, according to the editors. Polk is at the University of Rhode Island in Kingston and Postow is with the National Institutes of Health in Bethesda, MD. They note in their foreword that the contributors, who include many well-known researchers in the field, "have tried to differentiate between what is clearly established, what is suggested by available evidence without being convincingly proven

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RECENT BOOKS

and what is conjecture at the present time." CRC Press called the first edition, which sold 2,500 copies, a "best-seller," Polk told *Microwave News*.

Robert Proctor, *Cancer Wars: How Politics Shapes What We Know and Don't Know About Cancer*, New York: Basic Books, 1995, 368 pp., \$25.00. Contact: Basic Books, 10 East 53rd St., New York, NY 10022, (212) 207-7057, Fax: (212) 207-7203.

Proctor traces the history of research on cancer and examines its political and social dimensions. "Such knowledge as we have of causes...has done surprisingly little to aid us in our search for solutions," argues Proctor, a professor of history of science at Pennsylvania State University. While he cites the debate over the health effects of EMFs as one example of the many politically charged controver-

sies surrounding cancer research, he does not discuss the subject in detail. Instead, he focuses on asbestos, natural carcinogens, radon and smoking. In a brief submitted in the *Covalt* case (see p.3 and *MWN*, M/J95 and N/D95), the plaintiffs' attorneys cite *Cancer Wars*, comparing Proctor's description of tobacco industry-sponsored research to the work done by utilities.

Russel Reiter and Jo Robinson, *Melatonin: Your Body's Natural Wonder Drug*, New York: Bantam Books, 1995, 290 pp., \$22.95. Contact: Bantam Books, 1540 Broadway, New York, NY 10036, (800) 323-9872.

From soup to nuts on melatonin. A chapter on EMFs is included (see *MWN*, N/D95). Reiter is a professor of neuroendocrinology at the University of Texas Health Sciences Center in San Antonio, and Robinson is a medical writer in Portland, OR.

FROM THE FIELD

Clippings from All Over

You've probably heard all about it. A friend, a coworker or even your doctor has raved about it—melatonin. If you haven't tried the most exciting natural health discovery of the century, now is the time. The evidence is in, and it's overwhelming—melatonin can add up to 20 years to your life and make every one of them more vigorous and fulfilling than you ever dreamed possible. The all-natural hormone can: boost the immune system, beat arthritis, ease insomnia, prevent cancer, zap stress, help prevent heart attack and stroke, lower cholesterol, control high blood pressure and rev up your sex life. It's a fact, say doctors Walter Pierpaoli and William Regelson.

—John Latta, "Melatonin Miracle," *National Examiner*, p.22, February 20, 1996

"There's probably nothing on earth, or in the universe, that we understand as well as electromagnetic fields and the interaction of electromagnetic fields with matter, including biological matter."

—Dr. Robert Adair, Yale University, New Haven, CT, quoted by John Palfreman in "Apocalypse Not," *Technology Review*, p.26, April 1996

[T]he very fact that the APS made a statement dealing with epidemiology and leukemia is strange. The APS Council has as much competence in such areas as proctologists have in quantum theory.

Dr. A.R. Liboff, Oakland University, Rochester, MI, "Power Line Magnetic Fields Are Likely Related to Leukemia in Children (Despite the Opinion of the American Physical Society)," p.47

Improved epidemiological studies, in which exposure to 60 Hz magnetic fields is accurately determined, demonstrate a negligible risk. Relax. Make friends with your toaster. Save your candles for a blackout.

Dr. Robert Park, University of Maryland, College Park, and American Physical Society, "The Great Power Line Scare," p.49

—Both appearing in "Point/Counterpoint," *Alternative Therapies*, March 1996

"This is all for the benefit of those twerps who have these beastly [mobile] telephones. We don't need them. No one who uses one ever has anything useful to say."

—Quinlan Terry, an architect, on the proposed construction of three mobile phone towers in a picturesque valley northeast of London, quoted by Michael Horsnell in "Phone Masts Loom Over Constable Country," *The Times* (U.K.), February 19, 1996

Employers and owners of commercial facilities and offices would do well to keep informed on EMF issues and the outcome of related lawsuits. EMFs are pervasive—they are everywhere. We are all exposed to them and it may be only a matter of time before you or your business is the defendant in an EMF lawsuit. Moreover, there are questions about whether standard commercial liability insurance will afford coverage against such claims.

—James Otto and Alan Stazer of the Los Angeles law firm of Cummins & White in an article, *EMFs—Sources and Liabilities*, distributed by the Pollack PR Marketing Group, also in Los Angeles, with a March 14, 1996, letter to prospective magazine editors, offering "some solid advice from someone who knows what EMFs are all about."

"I trust the [cellular telephone] industry's studies as much as I trust Philip Morris' studies on tobacco."

—Robert Gardner, a Washington Township, OH, resident living near a proposed tower site, quoted by Ron Nissimov in "Praying for Deliverance," *Mansfield News Journal* (OH), p.1A, March 24, 1996

The introduction and widespread use of cellular telephones are very recent phenomena, and no epidemiologic studies have addressed the question of whether microwaves in the operating range of cellular telephones (800 to 900 MHz) might be related to cancer. Only if cellular phones influence a late stage in carcinogenesis would it be likely that epidemiologic studies could detect an effect at this time.

—Drs. Peter Inskip, Martha Linet and Ellen Heineman, "Etiology of Brain Tumors in Adults," *Epidemiologic Reviews*, 17, p.392, 1995

"The big challenge for policymakers will be deciding when to pull the plug on scientific research into the EMF-human health hypotheses. We are not there yet, but, in my opinion, we are getting close."

—John Graham, Harvard Center for Risk Analysis in Boston, quoted in "Graham: EMF Funds Can Be Better Spent," *EMF News*, p.2, March 25, 1996

[I]t may be time to consider the use of melatonin in specific clinical trials where free radical damage is a component of the disease process being studied.

—Dr. Russel Reiter, "Functional Diversity of the Pineal Hormone Melatonin: Its Role as an Antioxidant," *Endocrinology & Diabetes*, 104, p.15, 1996

Dr. Clark Heath of the American Cancer Society on EMF Epidemiology, Past and Future

Dr. Clark Heath, the vice president of epidemiology and surveillance research at the American Cancer Society in Atlanta, is skeptical about possible cancer risks from EMFs. His analysis, "EMF Exposure and Cancer: A Review of Epidemiologic Evidence," appears in the January/February issue of the society's journal, CA—A Cancer Journal for Clinicians. Microwave News interviewed Heath in mid-March.

Q: You describe the epidemiological findings of an EMF–cancer connection as "weak, inconsistent and inconclusive." Could you elaborate?

A: The epidemiological studies are weak because, except in some of the initial studies, the observed elevated risks are not very high. And there are no consistent dose–response relationships.

In epidemiology, a relative risk of two or less is not unlikely to reflect effects of confounding or study design problems. This is the level at which statistical noise starts to interfere with discerning real findings. So when you have low relative risks like that, you're very dependent on finding consistent results across many studies that are done in different ways. There's a lot of strength to that—having different methodologies yielding the same results. But I don't see that kind of pattern in the epidemiological work on EMFs.

In fact, the EMF data are inconsistent. For any one cancer or cancer hypothesis, some studies suggest one thing and others the opposite.

In addition, there's not an underlying foundation of basic biological research in other realms pointing in the same direction. Where cancer risk factors in humans have proved to be not just associations, but cause-and-effect associations, almost all of them involve this kind of coherence with biological data from other disciplines. These are conspicuously absent here.

Q: Do you think demonstrating a biological mechanism is necessary before drawing a conclusion on carcinogenesis?

A: No, I don't think it is absolutely necessary—when the studies are consistent, the risk levels are high and there is a dose–response relationship. If those things are present in epidemiological work, they can quickly lead to a strong belief in cause-and-effect. But none of those things are present so far in the mass of data on EMFs.

Q: What would convince you that EMFs increase the risk of cancer?

A: At this point, what would convince me fastest would be some reproducible biological research demonstrating a plausible mechanism.

Q: The Electric Power Research Institute's recent meta-analysis of occupational studies found "some support" for a small increase in brain tumor risk. What's your assessment of this paper?

A: I don't think it changes the picture very much. But the question of cause-and-effect is by no means closed, and I wouldn't deny that there's room for more research. Future epidemiological studies in this field are going to have to be a good bit more rigorous. They'll have to use methodological approaches that are very difficult to carry out—like being prospective rather than retrospective, and measuring actual exposures to fields instead of using surrogates. A lot of the literature in EMF epidemiology is devoted to this problem of exposure—whether you use wiring configurations, field measurements inside homes, reconstructed field levels from electrical current records, etc.

As far as summing up past research, I relied perhaps the most on the 1992 review by the British National Radiological Protection Board. I think they did a comprehensive job.

Q: You mentioned the reconstruction of past field levels. The Swedish study by Drs. Maria Feychting and Anders Ahlbom calculated historical field levels and found a link to leukemia. What do you think of their findings?

A: Well, this gained some objectivity by using records that existed before all of this controversy occurred—as opposed to having the idea in your mind when you stand outside a home, trying to make

some judgment about the wires. I would feel more convinced by those findings if they were stronger, of course, and if they were coupled with individual measurements of exposure. Of course, that's impossible with those studies, because you can't turn back the clock. That's where prospective studies, where possible, would be useful.

Q: It has been proposed that EMFs may not initiate cancer but only encourage its growth once it exists, and that this may account for some of the inconsistency between studies. What's your opinion?

A: This might make sense if there were some supporting evidence from basic studies at the experimental level—if you had results from biomarker studies that might relate to promotion rather than initiation. But with the present data, I don't think this idea makes the cancer hypothesis any more provocative.

Q: There are various hypotheses about what might be the biologically relevant aspect of EMF exposure. How do you see this issue?

A: You can postulate lots of things about radiation. But any idea about the biological effects of EMFs would gain a lot of strength if you first asked the physicists whether they thought it made any sense. When the physicists look at radiation, they look to see whether it causes cell damage. When you get below ultraviolet radiation, it doesn't—other than when you use it for cooking.

Q: Do you think there's much evidence for nonthermal bioeffects?

A: Well, I think that there are some hypotheses that are intriguing, but they're no more than that without some basic evidence from laboratory experiments. That's not the area in which I'm an expert, nor did I try to review that literature. But as far as I'm aware, they haven't gotten to that stage yet.

Q: Some argue that if EMFs increased the rate of cancer, rising use of electric power would have created a cancer epidemic. You seem to reject this argument.

A: I don't believe that argument is as easily made as it seems on the surface. At the time I put the article together, I concluded that this was not a strong point on which to build a negative case. The arguments for why it was weak are well stated by [Dr. David] Savitz in his second methodological review. The trouble with arguing from these ecological studies, in which you make a population-specific observation, is that you still have to see how it correlates with individual people. By itself, it's very weak evidence, and its absence doesn't tell you much.

Q: Because there are so many other factors at work in that population?

A: It's a much more complicated scene—similar to questions about diet differences between Oriental countries and the West and the frequency of breast cancer. Those correlations seem very strong on the surface: low-fat diet, low breast cancer rates; high-fat diet, high breast cancer rates. But when you start looking at studies of individuals, asking people about their diet, the associations are not strong. Which do you believe? I prefer the individual-based studies.

Q: In your review, you note with concern that, "Considerable research funding is being devoted to the study of potential [EMF–cancer] links." Do you think too much money is currently going into EMF–cancer research?

A: I don't think so—to date. It's a hard thing to judge. This is a very important issue, if only because electrical power is so essential to our society and is so widespread. But in the face of repeatedly in-

FROM THE FIELD

consistent results, particularly in the face of the lack of coherent basic biological findings, one wonders where you draw the line. Funding such studies indiscriminately, without a lot of care in their design and direction, becomes more and more of a problem.

Q: Should we hold off on more epidemiological studies until there are clearer results on possible biological mechanisms?

A: For my part, I'd be inclined that way. I would be much more interested in this field if there were exciting biological findings at the basic research level—animal, molecular, what have you. I don't see that, and in the face of the weakness and fragility of the epidemiological findings, I don't think you're going to get anything stronger until there are clearer basic biological results.

Q: If you had \$100 million to spend on cancer research, how much of it would you allocate to research on EMFs?

A: Not very much. What I would allocate would be towards very specific basic research by biologists—especially on the genetics of cell systems, on promotional agents and on interactions with the cell membrane. And I would pay a lot of attention to the physicists. I probably would not be inclined to spend much of that money on epidemiological studies.

Q: EMF effects on melatonin production have been cited as a potential mechanism by which EMFs might act to promote breast cancer. Do you think the idea of a link between breast cancer and EMFs is worth particular attention?

A: I haven't heard of any basic data that really support the idea. It's an intriguing idea. I think you could write a science-fiction novel about it. But I don't see the data to support it. The epidemiological data don't, and I haven't seen any basic biological work that's carried it much beyond the statement of a hypothesis.

Q: Are you familiar with Löscher's animal studies and the attempts to replicate them that are being funded by the NIEHS?

A: No, I'm not. Again, the article is a review of what has been published in the epidemiological literature.

Q: What's your opinion of "prudent avoidance"—taking low-cost measures to reduce the public's EMF exposures?

A: Avoidance of what, if no risk has been proven? I think that if there is a risk here, it's a very low risk. I haven't drawn a conclusion myself, but I tell people I don't think that the evidence supports that conclusion. There are a lot of situations in which hypothesized risks are suggested. You'd live in a cocoon, isolated from everything, if you paid attention to all of them.

Q: What do you think of specific policies, such as phasing power lines so that the surrounding EMFs are lower, or placing a child's bed on the opposite side of the room from the power service?

A: The science that's the basis for those decisions isn't sound at all. The one effect that has come out of this that may be very real is the increase in property-value litigation. And I suppose some measures to reduce EMFs, if they allay public concern, might have some cost savings on the litigation side that would make them moderately attractive. But I don't think that people should delude themselves into thinking that by taking such measures, they are avoiding a proven biological hazard.

When people call and ask me if they should buy a house near a power line, I say there's no good scientific evidence suggesting that that's a hazard. However, there's good evidence, scientific and otherwise, that it can have an effect on your pocketbook. It's like trying to sell houses near the Love Canal a decade ago. In fact, it's quite the same.

Q: Could you elaborate?

A: Well, at the time of the Love Canal controversy, there was concern about increased cancer and various other health risks. Clearly, there were toxic materials present in the canal, which it's known would cause harm if you were directly exposed at high doses. In that sense, Love Canal is not the same as the EMF issue. But despite the proximity of toxic materials to the homes, no firm evidence was ever found to show scientifically that they had actually harmed health. Nevertheless, the property values fell.

Q: Would you have bought a home there, leaving aside the financial risk?

A: It's not just the financial side. At that time—I don't know how it is now—there was a lot of community anxiety and concern, which really would shape the living environment in which you'd be buying a house. It's complicated.

Q: How likely is it that EMFs are just a phantom risk?

A: You mean, not a risk at all. Well, you're up against the old bugaboo—you can't prove a negative. You try to establish the existence of a negative by ruling out the positives, but you'll never have a pure negative finding. You just have to draw a conclusion about how the evidence looks as a whole.

After 10 or 15 years of EMF research, the existence of any hazard is still speculative. But I wasn't inclined in this review to overstate my conclusions and declare that the case is closed. It's obviously a very complicated issue, and not just a scientific one.

"MICROWAVE NEWS" FLASHBACK

Years 15 Ago

- In a letter to the *New England Journal of Medicine*, Dr. Hylar Friedman of the Army Medical Center in El Paso, TX, reports a link between microwave exposure and polycythemia, a rare blood disorder that entails an increased risk of leukemia.
- A workers' compensation board upholds a claim that Sam Yanon died from overexposure to RF/MW radiation on top of the Empire State Building while working for New York Telephone.
- The U.S. Secretary of the Navy recommends to the Secretary of Defense that the Navy ELF communications system be scrapped.

Years 10 Ago

- Rats chronically exposed to 60 Hz magnetic fields have a greater risk of birth defects and lower birth weights, according to a study by the Battelle Pacific Northwest Labs in Richland, WA.

- Sweden's Karolinska Institute in Stockholm announces that mouse fetuses exposed to pulsed magnetic fields like those from VDTs have five times the rate of malformations as unexposed controls.
- The NAB petitions the FCC to preempt state and local rules for RF/MW radiation and to adopt the 1982 ANSI standard.

Years 5 Ago

- A University of Southern California team in Los Angeles reports a significant link between wire codes and childhood leukemia.
- A police officer in San Francisco sues Kustom Signals contending that microwaves from traffic radar caused his melanoma.
- NIOSH finds no increased risk of miscarriage for telephone operators using VDTs, compared to those using other displays.
- A Seattle widow sues Seattle City Light, claiming that her husband, Robert Pilisuk, died of leukemia from exposure to EMFs.

MELATONIN

From Wonder Drug to Snake Oil...In retrospect, it was almost inevitable. New findings in melatonin research provoked a flurry of pop science books, with titles such as *Melatonin: Your Body's Natural Wonder Drug* (see p.14), *Stay Young the Melatonin Way* and even *The Melatonin Miracle*. The books led a *Newsweek* cover story last August 7 to declare, "Scientists say this hormone could reset the body's aging clock, turning back the ravages of time." Mainstream media enthusiasm spread to the supermarket tabloids: *The National Examiner* of February 20 called melatonin "the most exciting medicine of the century," and "an incredible cure-all that's set the medical world on fire" (see p.14). The paper breathlessly told its readers that "half of Hollywood is using it"—including the actor who plays Superman on TV. In the midst of this frenzy, several of the world's leading scientific journals did their best to set the record straight. In "Melatonin Madness," published in the December 29 issue of *Cell*, Drs. Steven Reppert and David Weaver of Harvard Medical School criticized an experiment conducted by the authors of *The Melatonin Miracle*. Drs. Walter Pierpaoli and William Regelson switched the pituitary glands of old and young mice and cited the results as proof that melatonin can reverse aging. But Reppert and Weaver had some news for the *Miracle* men: The strain of mice used in this experiment does not produce melatonin at all. The Harvard researchers discussed the fact that melatonin has "substantial biological effects" in humans beyond its role in sleep patterns, possibly including influences on the retina and on estrogen receptors. "This potential for interaction with other systems," they argued, "should raise concern about the indiscriminate, unregulated use of melatonin in humans." In the January 20 issue of *The Lancet*, contributing editor Dorothy Bonn noted dryly that, "Melatonin is freely available in the U.S.A., and apparently there has been no need for efficacy claims to be tested there....In the U.K., some other European countries and Canada, however, melatonin is now classified as a medicine and has been withdrawn from general sale." The title of a January 25 *Nature* article by well-known melatonin researcher Dr. Fred Turek of Northwestern University made his opinion clear: "Melatonin Hype Hard To Swallow." He wrote that in *The Melatonin Miracle*, "evidence contradictory to [the authors'] hypotheses is invariably ignored." For instance, the book touts melatonin's beneficial effects on sex drive, but Turek pointed out that "in many animals, treatment with melatonin is associated with gonadal atrophy." Turek called for more research and for large-scale clinical trials of the hormone's possible therapeutic effects. He warned that without such work, "unwitting customers of drug and health-food stores will be the test subjects for melatonin." The April *Journal of NIH Research* focused on this problem in an article, "Media Hype Helps Pill Marketers Cash In on 'Miracle' Melatonin." Reppert and Weaver's article in *Cell* concluded that, "The cure for melatonin madness is to ignore the hyperbole...and focus instead on hypothesis testing and sound science." The mass media have started to change their tune, though whether they can avoid hyperbole is another question. The February 5 *Time* magazine ran a photo of several books on melatonin over the caption "Snake Oil?"



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PEOPLE

It is now *Dr. Paul Gailey*. Gailey, who helps manage the NIEHS-DOE RAPID program at the Oak Ridge National Labs in Oak Ridge, TN, has received his doctorate from the University of Utah in Salt Lake City, working with *Dr. Om Gandhi*. His dissertation was on the theoretical minimum detection limits for human cells exposed to environmental magnetic fields. "The results indicate that magnetic field strengths of less than 100 mG can produce membrane potentials exceeding thermal noise in some cases," Gailey said, pointing out that his results are substantially different from the early predictions by *Dr. Robert Adair* and others....*Dr. Keith Florig* has left Resources for the Future in Washington to return to Carnegie Mellon University's (CMU) Department of Engineering and Public Policy in Pittsburgh as a research engineer. He is now working on the California EMF-School Policy Project (see *MWN*, J/F96), among other risk analysis issues. Florig received his doctorate from CMU in 1986; his thesis advisor was *Dr. Granger Morgan*....*Fred Dietrich* of Electric Research and Management in Pittsburgh has been elected a fellow of the IEEE for "contributions to the development of instrumentation and techniques for the measurement of EMFs."...AT&T is splitting up into three companies, and *Ron Petersen* has a new institutional home—if in name only. The systems and technology business units, including Bell Laboratories, are no longer part of AT&T and are now called Lucent Technologies Inc. "I will continue to do what I have been doing for the last 25 years," said Petersen. Lucent is headquartered in Murray Hill, NJ....*Dr. Thomas Budinger* of the Lawrence Berkeley National Laboratory in Berkeley, CA, has been elected to the National Academy of Engineering in Washington for "contributions in quantitative medical imaging and safety of space exploration and experimentation."...In the listing of recent EPRI reports in our last issue, *Kyle King* was identified as being with GE in Lenox, MA. In fact, King left GE in 1994 to join Enertech Consultants' Lee, MA, office.

POLICE RADAR

Officer Wins Settlement...The Virginia Workers' Compensation Commission has found that a police officer's testicular cancer was caused by his use of a hand-held traffic radar unit. The commission ruled last November 14 that Franklin Chappell of the Portsmouth, VA, police force had proven "to a reasonable degree of medical certainty" that his disease was caused by exposure to radar—but it rejected his claim on the grounds that it had been filed too late. However, rather than fight Chappell through the appeals process, the city agreed to pay the portion of his hospital bill not covered by insurance and to restore his used-up sick leave. Chappell was diagnosed with testicular cancer in January 1993. He underwent chemotherapy and had his right testicle removed. He has been in remission since 1994. His urologist and oncologist both testified that his cancer was a direct result of radar exposure, and even the city's doctor called his exposure "bothersome." Chappell told *Microwave News* that he routinely left the unit—which was always turned on—in his lap, because the bracket that was sup-

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posed to hold it was defective. Chappell is back on the Portsmouth force and says, "The radar training is much better now. Back then, they just gave you the gun and said, 'Now you're a radar man.' Now you have to attend a two-day class, and they go into detail on the do's and don't's."

RAPID

Staff and Budget Changes...DOE's EMF program has a new boss and a new bureaucratic home—but if you don't know where to look, you will never find them on the agency's revised organizational chart. Lynne Gillette and Dr. Imre Gyuk, DOE's only two EMF staffers left in Washington, are now in the Office of Energy Outreach, whose acting director is Ronald Bowes. Bowes reports to Dr. Allan Hoffman, the acting head of the Office of Utility Technologies, who in turn answers to DOE Assistant Secretary Christine Ervin. Robert Brewer, who took over the EMF program from Marvin Gunn in 1994 (see *MWN*, N/D94), has been reassigned and now works with Hoffman on other policy issues. For the 1996 fiscal year, the NIEHS-DOE RAPID program's budget is less than half of that in the previous year: \$3.39 million v. \$7.7 million. The \$3.39 million must still be matched with contributions from industry. In 1995, the utility and related industries fell short of their matching commitments by more than \$1.5 million, a shortfall that meant less research spending. DOE's biological mechanisms program fared better and was only cut by about 10% in 1996—\$5.06 million v. \$5.5 million. President Clinton's 1997 budget, which is still subject to negotiation, would give each program \$4 million before any across-the-agency cuts, which are currently estimated to be 5-10%. (In March, the DOE issued a progress report on the RAPID program (DOE/EE-0088); it is available from the Public Inquiries Center, DOE, 1000 Independence Ave., SW, Washington, DC 20585.)

RESOURCES

EMF Bioeffects Bibliography...From Adair and Adey to Wilson (Bary) and Zaffanella, over 800 listings are included in *Selected Bibliography: Electromagnetic Fields—Investigations into the Biological Activity of Low-Frequency EMFs*, assembled by the Human Ecology Action League (HEAL). Both epidemiological and laboratory studies are included, as well as a few papers each on therapeutic uses of EMFs and on public policy. The listings are not annotated, but the document is more inclusive than some earlier works, including three used by HEAL as a starting point: bibliographies compiled by Congress' Office of Technology Assessment (OTA) in 1989, by the EPA in 1990 and by DOE's Bonneville Power Administration in 1993. In fact, HEAL was surprised to find that these "three core sources did not overlap to any great extent, despite their proximity in time and similarity of purpose." The earlier bibliographies included 571 listings, but only 19 were mentioned in all three. Founded in 1977, HEAL describes its purpose as "to serve those whose health has been adversely affected by environmental exposures," especially to chemicals, and "to alert the general public about the potential dangers of chemicals." Available for \$44.00 from: HEAL, PO Box 29629, Atlanta, GA 30359, (404) 248-1898, Fax: (404) 248-0162.

EMF Papers

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