Utility Group Develops Home Measurement Protocol

In an effort to help utilities respond to customers' requests, a task force of utility engineers is developing a protocol for EMF measurements. "Power companies all over the country are taking readings in different ways," said Peter Jump, a spokesman for the Edison Electric Institute, a member of the task force. "We wanted a standard way of doing them."

The protocol will help small utilities that might not have the resources to develop expertise in measuring EMFs, as well as the larger companies that are confronted with growing numbers of requests for information, explained Kate Maracas, director of the task force, formally known as the National EMF Measurement Protocol Group (NEMPG). Maracas is an environmental engineer at the Salt River Project, a publicly owned utility based in Phoenix. She said the group also plans to produce a training video to accompany the protocol, which should be completed by the spring of 1993.

The Institute of Electrical and Electronics Engineers (IEEE) Magnetic Fields Task Force—a subcommittee of IEEE's AC Fields Working Group—has been working closely with NEMPG in developing the standard, Maracas said. The IEEE group will publish its own protocol for power frequency fields in January.

NEMPG was formed last September. Its members include utility representatives and three utility trade organizations: the American Public Power Association, the Edison Electric Institute and the National Rural Electric Cooperative Association.

EMF Measurement Guides

Dr. Granger Morgan of Carnegie Mellon University has written a new booklet, *Measuring Power Frequency Fields*, which offers advice on EMF surveys in the home and workplace. The guide is for individuals who ask experts to take readings for them or who plan to take measurements themselves. Morgan and his colleagues, including Drs. Jack Adams, Baruch Fischhoff and Indira Nair, are also working on a second booklet, which is meant to be consulted after a survey has been done. *Making Sense out of Measurements of Electric and Magnetic Fields* offers ways of interpreting the findings and reviews EMF health risks. The second booklet will be available in a couple of months.

Carnegie Mellon has distributed more than 100,000 copies of its original booklet, *Electric and Magnetic Fields from 60 Hertz Electric Power: What Do We Know About Possible Health Risks?* since it was first published in 1989.

To order the measurement guides, contact: Department of Engineering and Public Policy, Carnegie Mellon University, Pittsburgh, PA 15213. Prices were not available as we went to press.

Legal Notebook

PG&E Worker's Family Files EMF Claim

The family of a former Pacific Gas & Electric (PG&E) maintenance worker filed a wrongful death claim against the northern California utility on August 10, charging that the electrician's fatal leukemia was caused by his on-the-job exposure to EMFs. John Lacey, who died in February at the age of 40, had worked at various substations in the San Francisco Bay area from 1971 to 1981; his leukemia was diagnosed in 1990, according to his attorney, Flora Chu of the San Francisco firm of Hawes & Chu. Chu said that she might also bring a personal injury suit on the family's behalf.

Lacey's duties for PG&E included inspecting and reading meters on electrical equipment and checking devices in underground vaults, according to a stipulation of facts signed by Chu and PG&E's lawyer, Carl Allen. EMFs from switching devices in such vaults can reach 37 G, according to measurements commissioned by the International Brotherhood of Electrical Workers (IBEW) Local 1245, based in Walnut Creek, CA. IBEW's Landis Martula told *Microwave News* that union members are concerned about EMFs and that they are considering assembling a cancer registry for utility workers.

PG&E is reviewing Lacey's job records and medical history, according to PG&E spokesman Scott Blakey. It is too early in the investigation to say "anything meaningful" about the case, Blakey said. In March, a Washington State agency rejected a claim that a Seattle City Light electrical worker's death from leukemia was caused by his exposure to EMFs (see *MWN*, M/J92). That decision has been appealed.

A Change in the Course of EMF Litigation?

Mounting evidence of a potential link between EMFs and health hazards is likely to change the course of EMF personal injury litigation, writes Kristopher Brown in the March 1992 issue of the *Boston University Law Review*.

Owners and manufacturers of equipment that generates EMFs will find it increasingly difficult to argue that they were unaware of the risks associated with EMFs and, as a result, they will face a greater threat of liability under negligence and strict product liability laws, Brown predicts.

Meanwhile, plaintiffs will continue to face the difficult task of proving causation—the connection between exposure to EMFs and injury—as scientific evidence on the subject remains inconclusive and courts may decide not to admit EMF expert testimony, further hindering plaintiffs' efforts, according to Brown. Judges have rejected such testimony in the past due to a lack of scientific evidence (see, for example, *MWN*, J/A92).

"The EMF debate is not likely to be resolved in the near future," Brown concludes, "[but] unless serious consideration is soon given to these complex questions, EMF personal injury litigation is destined to become a legal quagmire."

Are Navy Communications Towers Responsible for Hawaiian Childhood Leukemia Cluster?

A cluster of childhood leukemia cases near a Navy submarine communications facility in the Waianae Coast section of the island of Oahu, HI continues to defy attempts to pinpoint a cause. But recent reports by the Hawaii Department of Health (DOH) and by the U.S. Environmental Protection Agency (EPA) add evidence that the cluster, first investigated in the mid-1980s, was not due to chance and might be related to radiofrequency (RF) radiation emissions from the Navy facility, which is known as Lualualei.

The DOH investigation, a case–control study of 14 children who were diagnosed with leukemia between 1977 and 1990, found that the incidence of the disease was higher among children who lived closer to Lualualei. This finding was not statistically significant, but elevated odds ratios were identified for all six variables the researchers used to assess proximity to Lualualei. The DOH report concluded that there may be a "weak association" between proximity to the transmitters and the incidence of leukemia but cautioned that, "We do not have enough knowledge to link the two causally."

"I don't think the cluster is a chance event," Dr. Gertraud Maskarinec, coauthor of the DOH report, told *Microwave News*. She added that childhood leukemia rates in the area have been normal in recent years.

Overall, the 14 cases constitute a statistically significant doubling of the expected number, based on childhood leukemia rates for the state. But the researchers found that the greatest cause for concern was in a three-year period: seven children were diagnosed with leukemia from 1982 to 1984. "These...cases are unusual in several respects," the report explains, because:

- Five of [the seven] were acute non-lymphocytic leukemias, while three out of four childhood leukemias statewide are of the lymphocytic type.
- Six of the cases were girls, while childhood leukemia is usually somewhat more common in boys than in girls.
- Four of these girls were between nine and twelve years old at diagnosis, [while the] peak age of onset for childhood leukemias is around three years.

A number of possible causes for this cluster have been raised: RF radiation from Lualualei; benzene from used motor oil; pesticide-contaminated milk; some other, unknown carcinogenic chemical; or exposure to a carcinogen in combination with RF emissions from Lualualei.

Dr. Bruce Anderson, DOH's deputy director for environmental health administration, said in an interview that he is less concerned about the Lualualei transmitters than he is about possible exposure to carcinogenic chemicals, such as benzene. "There was a lot of used motor oil being brought to that community," he said, explaining that a waste-oil hauler had operations there. Rather than disposing of the oil, the hauler sprayed it on roads to keep dust down and gave large amounts to area residents, some of whom used it on their farms. The waste oil, found in 55-gallon drums on property throughout the area, is the object of a DOH-led cleanup effort begun in 1991.

DOH researchers considered the waste oil problem but did not analyze it in the case–control study. "I cannot think of a practical way to assess exposure," Maskarinec said.

The possibility that emissions from Lualualei could be harmful has worried nearby residents for more than a decade. In 1982, reacting to their concerns, the Navy measured radiation within the boundaries of its facility and declared that there was no health risk (see *MWN*, J/A82). By 1985, however, the unusual occurrence of childhood leukemia had been noticed and was brought to the attention of the Cancer Research Center of Hawaii, which ran a preliminary investigation; the center recommended further study, including measurements of RF exposures (see *MWN*, M/J87). In the summer of 1990, U.S. Sen. Daniel Akaka (D-HI) and a state legislator held separate hearings that addressed Lualualei. Shortly thereafter, the DOH

Similar Cluster Near U.S. Navy Transmitters in Scotland

A cluster of childhood leukemia has also been documented in Thurso, on the north coast of Scotland, near a U.S. Navy communications facility. This cluster has prompted several studies—primarily examining ionizing radiation—which have yielded few answers. No detailed investigation of RF radiation from the Navy complex, in Forss, has yet been done.

An extensive analysis of a possible connection with ionizing radiation from a nearby nuclear fuel reprocessing plant at Dounreay was completed in 1988 by the Committee on Medical Aspects of Radiation in the Environment (COMARE), a government-sponsored panel. The report concluded that the elevated cancer rates could not be linked to radiation from the nuclear facility: "Conventional dose and risk estimates suggest that neither authorised nor accidental [radioactive] discharges could be responsible."

But the report also argued that the cluster was not a chance occurrence. Between 1979 and 1984, six children developed leukemia—a statistically significant increase. The panel noted that, "These are extreme results and this is a remarkable observation."

A follow-up study by the Scottish Health Service, published in 1991, failed to establish a link between the children's leukemia and their fathers' exposure to nuclear radiation at the Dounreay plant.

The Navy's Forss transmitter facility is located about halfway between the Dounreay nuclear station and the town of Thurso.

EPA May Return to RF/MW Limits

The Environmental Protection Agency (EPA) is considering resuming work on setting safety limits for human exposures to radiofrequency and microwave (RF/MW) radiation. EPA stopped developing the limits—commonly known as RF/MW guidance—in 1988.

"We are currently evaluating the need for the guidance," Margo Oge, the director of EPA's Office of Radiation Programs (ORP), announced at a Senate hearing on police radar on August 10 in Washington (see p.7). EPA is also planning to hold a conference on the health effects of RF radiation, she said.

Following the hearing, Sen. Joseph Lieberman (D-CT) urged EPA Administrator William Reilly "to take up the development of [the RF/MW] guidance again." This was the second time this year that EPA was asked to return to the question of RF/MW exposure limits. Accompanying its review of the agency's cancer report, EPA's Science Advisory Board recommended that the agency "complete its efforts with regard to [RF/MW radiation] and issue exposure guidelines independent of present issues pertaining to lower frequencies" (see *MWN*, J/A91 and J/F92).

At the end of September, Marty Halper, the director of ORP's Radiation Studies Division, told *Microwave News* that the EPA conference, which is tentatively scheduled for April, will address RF/MW bioeffects and cost–benefit issues. "If those at the conference perceive a need for the guidance, we'll do it," he said.

In an interview, Oge said, "It will be important for the agency to finalize its work."

EPA began work on the guidance in the late 1970s and was set to propose a 100 $\mu W/cm^2$ limit for 30-300 MHz radiation in 1984 when the agency's policy office forced a delay (see *MWN*, Jun84 and J/A84). EPA continued to work on the standard but abandoned the effort in 1988 (see *MWN*, J/A86 and S/O88).

began its investigation, asking EPA to measure the RF radiation near the Navy facility (see *MWN*, S/O90 and J/F91).

The RF emissions from Lualualei are uncommon, since the Navy transmitters are used for long-distance communications with submarines and are found in only three other U.S. communities, according to EPA. The Navy uses equipment operating in the very low frequency (VLF), low frequency (LF) and high frequency (HF) ranges (see box p.7).

"VLF electric and magnetic fields were studied much more intensively than fields at other frequencies because of the high power of this transmitter," according to the report, which was prepared by Edwin Mantiply of EPA's National Air and Radiation Environmental Laboratory in Montgomery, AL. The VLF transmitter operates continuously at 23.4 kHz, with an output of 512 kW. Mantiply also sampled electromagnetic fields from power lines at several outdoor locations in the community.

Mantiply found electric field strengths as high as 82 V/m from the VLF transmitter, and magnetic field strengths as high as 99 mA/m, in an open area just outside the facility. In a telephone interview, he said that in the adjacent communities "people do get exposed to 80 V/m outdoors," adding that, "you see 60 V/m in wide areas." But the EPA report was not designed to assess typical exposures, and no measurements were taken indoors or near the residences of those who developed leukemia. "The object was to gain some understanding of field levels in the community rather than conduct a detailed exposure assessment," the report states. The results are generally consistent with the measurements the Navy made in 1982.

Some significant questions about this cluster remain unanswered. For example, the DOH investigators noted in their report that four of the children with leukemia lived in Quonset huts—WWII surplus buildings which have corrugated metal roofs in a half-cylinder shape. There are several hundred such buildings used as homes in the area. Maskarinec said she could reach no conclusions about this finding. "I'm tempted to think it's a surrogate for something else," she said—perhaps time spent outdoors, since Quonset huts are presumably less comfortable than other homes, or exposure to some toxic chemical or metal. She said that she would expect these buildings to shield their occupants against radiation from Lualualei but added that, "It would be a good idea to measure there."

EPA's Mantiply said the Quonset huts would affect RF exposures. "They could be your best shield or your worst nightmare," he said. "It all depends on how they are built." If the metal roof is well grounded, it will function as a shield. If it is not, he explained, it will work much like an antenna and could "be a strong source of VLF current" for someone who came in direct contact with it. He emphasized that he had not investigated these buildings.

The DOH investigators also explored the possibility that something unusual had happened at the Lualualei facility to trigger the leukemia outbreak that occurred from 1982 to 1984. They searched a newspaper index and found that maintenance problems and disrepair led to the firing of the maintenance contractor at Lualualei in early 1981, but they were hesitant to draw any conclusions from this. "One hypothesis about the effects of electromagnetic radiation suggests intermittent or irregular exposures may be more harmful than continuous exposures," the report states. "However, a real association between the leukemia cluster and the events in 1981 appears unlikely because of the short incubation period."

Another episode from the early 1980s was not addressed by the DOH. In January 1982, milk supplies on the island of Oahu were found to have been accidentally contaminated with heptachlor, a pesticide that had been sprayed on pineapple leaves used as feed for dairy cattle. The tainted milk was sold for at least 57 days before a general recall was begun, according to a report in *Science (217*, pp.137-140, July 9, 1982). Several experts "are concerned that infants in particular will suffer a heightened risk

of leukemia or liver disorders," the article stated.

DOH's Anderson said he does not believe that the heptachlor contamination could be associated with the cluster since "the milk problem was an island-wide problem" and the cluster just appeared in the Waianae Coast section.

Several recent studies have suggested that electromagnetic radiation can act synergistically with known chemical tumor promoters to accelerate the development of cancer (see *MWN*, J/A89, N/D90 and J/A91). None of these studies has specifically addressed VLF radiation, however, nor did the DOH look into such combined effects. In the mid-1980s, the DOH found that people living next to radio and TV broadcast towers in Honolulu had elevated rates of cancer (see *MWN*, M/J87).

If a child had ever lived within 2.2 miles of the Lualualei facility, or lived within 2.6 miles just before diagnosis or at birth, the leukemia risk was more than double that of the controls. Residence within 2.6 miles of the transmitters in 1981 yielded a risk more than three times that of the controls, as did a summary index used to assess proximity to Lualualei. A history of cancer in the family also showed an association with the incidence of leukemia. None of the findings in the case–control study achieved statistical significance.

The DOH report, *Investigation of Childhood Leukemia on the Waianae Coast 1977-1990*, is available from: Hawaii DOH, Communication Office, 1250 Punchbowl Street, Honolulu, HI 96813, (808) 586-4442. The EPA report, *Measurements of Electric and Magnetic Fields in the Waianae, Hawaii Area* (400R-92-009, July 1992), is available from: EPA, National Air and Radiation Environmental Laboratory, 1504 Avenue A, Montgomery, AL 36115, (205) 270-3400.

RF Radiation from Lualualei

The following are the maximum field strengths as measured by EPA outside the boundaries of the Lualualei Naval Radio Transmission Facility:

	Electric Field	Magnetic Field
VLF (23.4 kHz)	82 V/m	99 mA/m
LF (146.1 kHz)	0.5 V/m	0.9 mA/m
HF (3-30 MHz*)	8.8 V/m	22 mA/m

From: EPA, *Measurements of Electric and Magnetic Fields in the Waianae, Hawaii Area*, 1992.

* Various frequencies.

Congress Directs NIOSH To Study Police Radar–Cancer Link

The U.S. Congress has directed the National Institute for Occupational Safety and Health (NIOSH) to begin an epidemiological study of the possible link between police radar use and cancer.

At a Senate hearing in August, scientists, radar manufacturers, federal health officials and police officers all voiced support for a federal study. Such an effort was first proposed by Sen. Christopher Dodd and strongly promoted by Sen. Joseph Lieberman—both Democrats from Connecticut.

"Senator Dodd and I are going to stick with this until we get some answers," Lieberman said at the August 10 hearing of the Senate Governmental Affairs Committee's ad hoc subcommittee on consumer and environmental affairs, which he chairs.

"There's a patience level of [how much delay] we'll tolerate here, and it's about to run out," Dodd added, after announcing that the National Institute of Environmental Health Sciences had responded to his May request for a study by saying only that it might do a feasibility study (see *MWN*, M/A92).

Sen. John Glenn (D-OH), chairman of the committee, who also participated in the hearing, said that he is "extremely disturbed" about reported links between police radar use and cancer (see *MWN*, J/A91, S/O91 and M/A92).

After the hearing, Lieberman, Dodd, Glenn and Sen. Dennis DeConcini (D-AZ) asked the Senate Appropriations Committee subcommittee on labor, health and human services and education to fund the study. The subcommittee did not earmark funds for a study but added language to appropriations legislation for NIOSH urging the agency to conduct one. An aide to Sen. Tom Harkin (D-IA), who chairs the subcommittee, told *Microwave News* that NIOSH "seems willing to move forward," but added that the legislation does not require the study. Funding would come from the agency's general operating budget, she said.

NIOSH's Dr. Bryan Hardin endorsed the study at the August hearing and said that "caution in the use of radar guns...is prudent" until more research is done. In materials sent to Lieberman in late August, NIOSH estimated that the study would cost $1.7 million and take three to five years.

Lieberman has asked the Environmental Protection Agency

"Wow!"

At one point during the hearing, Sen. Lieberman asked Dr. Ross Adey what other technologies might pose health risks if police radar is indeed a cancer threat.

Adey listed electric blankets, microwave ovens, radio-frequency sealers and cellular phones, which he said can produce "a quite high field in the brain."

"Wow! There's a lot to be worried about here," Lieberman said, acknowledging a moment later that his response was "non-senatorial."

Adey's point was reinforced by a letter Lieberman received following the hearing from Dr. Eleanor Adair of the John Pierce Laboratory in New Haven, CT, who is skeptical of police radar hazards. She wrote: "If you accept the indictment that radar guns produce cancer, then you must so indict every similar device."

(EPA) to transfer to NIOSH some of the $1.8 million in unspent funds that EPA received last year for electromagnetic field (EMF) research (see *MWN*, J/A92). On August 13, Lieberman wrote to EPA Administrator William Reilly urging the agency to transfer the money "so that NIOSH can initiate this needed study at the earliest possible time." In a September 21 response, EPA's assistant administrator for R&D, Dr. Erich Bretthauer, declined, for the present, to release any funds.

The study was backed by John Kusek, a vice president of Kustom Signals Inc., one of the nation's largest manufacturers of police radar devices, though he maintained that police radar is not hazardous. In his testimony, Kusek explained that, "We feel research would substantiate our view of the risk." He defended the safety of Kustom's radar units on the basis of the 1991 Institute of Electrical and Electronics Engineers (IEEE) exposure guidelines, which he said were designed to be "as conservative as possible" (see *MWN*, N/D91).

Kusek also disclosed that his company has sued Connecticut to block the ban on hand-held radar units that the state enacted earlier this year (see below). About 30% of all police radar units are hand-held, he estimated.

Dr. Ross Adey of the Veterans Administration Hospital in Loma Linda, CA testified that low-power radar sources could be harmful. Citing recent findings by Germany's Drs. Werner Grundler and Friedemann Kaiser, Adey suggested that it may not be possible to define a threshold below which radar emissions are safe. "Clear responses occurred at incident field levels of 5 picowatts/cm^2, about one million times below field levels permitted" under the IEEE guideline, Adey said, concluding that the standard, which permits exposures to 5 mW/cm^2 at police radar frequencies, is too lenient.

Asked by Lieberman whether police officers have "a legitimate cause to worry," Adey responded that police radar "may carry a significant biological and biomedical risk based on both the physical evidence and the biological evidence."

Henry Kues of the Johns Hopkins University Applied Physics Lab (JHU-APL) in Laurel, MD described his research on the effects of microwaves on the eye (see *MWN*, S/O91). He noted that, under certain circumstances, police officers using hand-held radar are exposed to levels higher than those allowed under the 100 μW/cm^2 JHU-APL exposure standard (see *MWN*, D84).

John Rankine, a member of the IEEE's standards board, said he doubts police radar is harmful. But he added that he views anecdotal reports of an association between police radar and cancer "with concern" and supports a study. Rankine said the 1991 IEEE standard was written by "the most open, best attended and best qualified committee" among the hundreds that have developed IEEE standards.

Police officers testifying at the hearing urged Lieberman and Dodd to make sure the federal study gets done. "Senators, you are our last best hope," Ohio State Trooper Gary Poynter testified. Poynter's compilation of cancer incidence among police officers first brought the police radar issue to national attention. He noted that the total number of cancer cases he has cataloged is now 168, up from the 89 cases he had identified as of last spring (see *MWN*, M/A91 and M/A92).

Windsor Locks, CT policeman Thomas Malcolm, whose testicular cancer is in remission, showed the senators at the hearing how he had rested the radar unit near his groin without turning it off (see *MWN*, S/O91). He also urged Lieberman and Dodd to act. "If I can save one more police officer, then I've done my job. If you can force a study, then you've done your job," he said.

Sam Franzo, representing the International Brotherhood of Police Officers in Rocky Hill, CT, said that his union supports a national ban on the use of police radar transmitters inside cars. "We just want the antenna outside the car and a national study. What's the big deal?" he asked.

Radar Manufacturer Sues Connecticut

Kustom Signals Inc. of Lenexa, KS has filed suit against Connecticut Governor Lowell Weicker and other state officials, challenging the state's ban on hand-held radar. In its August 7 complaint, Kustom said that the law violates the company's constitutional rights and was passed "without credible scientific support."

Connecticut enacted the law on June 1 to "protect police officers from the risk of cancer caused by the use of hand-held radar devices," according to Sen. Joseph Lieberman (see *MWN*, M/A92 and M/J92). The senator told *Microwave News* that he is confident the ban will be upheld, adding that it is a "moderate, reasonable response" to the threat police officers face when they use hand-held radar.

Kustom Signals, a leading manufacturer of traffic radar, argued in its claim that "non-ionizing emissions from hand-held radar devices are very low, and exposure even at the closest possible distance to them does not constitute a hazard to human health....It is not reasonable to conclude from the existing data that radiofrequency exposure from hand-held radar devices is a cause of cancer."

The defendants in the suit have not yet been served. Kustom has 120 days from the time the claim was filed in U.S. District Court in Hartford to notify Weicker and others formally about the complaint; otherwise, it could be dismissed. William Ruppert, chairman and CEO of Kustom Signals, did not respond to repeated telephone calls from *Microwave News*.

VDT Foundation Establishes Health Research Center at JHU

The Johns Hopkins University (JHU) School of Hygiene and Public Health in Baltimore has been selected to run the Center for VDT and Health Research on behalf of the VDT Health Research Foundation (HRF). Dr. Ronald Gray, a physician and epidemiologist with a background in reproductive health issues, was named director, and Dr. Patrick Breysse, a well-known EMF researcher, was named associate director.

Gray told *Microwave News* that a high priority will be an examination of what parameters of video display terminal (VDT) EMFs are important for studies of human health. The

center may host a workshop on this topic next year. Gray noted, however, that it is too early to say precisely what mix of studies the center will pursue.

An advisory board with ten to twelve members will select the center's projects, he explained. The board should be complete soon and will hold its first meeting later this year or early next year. It will include "some outstanding people" on exposure assessment, as well as experts on epidemiology, ergonomics and stress, Gray said.

The JHU School of Hygiene and Public Health has, in the past, been involved in research on cancer and occupational exposure to EMFs. Breysse has worked with Dr. Genevieve Matanoski on a major study of cancer among telephone workers (see *MWN*, N/D89 and J/A91). JHU researchers will be allowed to compete for funding from the center, Breysse said.

Launched last winter by IBM Corp., Apple Computer Inc. and Compaq Computer Corp. (see *MWN*, M/A92), the VDT HRF has so far failed to enlist support from other corporations to expand its research funding base—a goal of the organization. Some computer makers may be apprehensive about pointing to a problem, said Philip Shellhaas, director of public policy programs for IBM and executive director of the foundation. In an interview at the *Work With Display Units '92* conference in Berlin in early September, Shellhaas said there may also be a concern "that any research that is sponsored by industry would be seen as less credible than work done by a government agency like NIOSH." He said that the foundation is presently talking to a "short list" of six or eight interested companies, and that he hopes to attract international support.

To date, the foundation has committed to providing the research center with about $2.25 million over three years.

Columbia University, Harvard University, the University of California and the University of Texas had also been considered for the center.

FROM THE FIELD

BPA Updates EMF Guidelines

Following the recommendations of its EMF task force, the Bonneville Power Administration (BPA) has updated its EMF guidelines, last revised in 1988. "Where EMF[s] had been one of the many considerations in design and location of new BPA facilities, [they are] now a major decision factor," according to a memo that accompanied the new guidelines. The full text of the 1992 Bonneville Interim Guidelines on Electric and Magnetic Fields, *which went into effect in June, appears below. For more information, contact: Dr. Jack Lee, Bonneville Power Administration, PO Box 3621 (EFB), Portland, OR 97208, (503) 230-4530.*

Recognizing

- that public concern is increasing over potential health effects of EMFs and that this concern is important to BPA,
- that a clear course of action cannot be determined from present scientific evidence and
- that defining and addressing any risks associated with EMFs is the responsibility of the entire society, which values both the availability of energy and the well-being of its citizens,

BPA adopts the following revised interim guidelines governing its practices with regard to electric and magnetic fields. As new information becomes available, these guidelines will be reexamined. Such reexamination will occur at least every two years.

1. Because it appears that it will take several more years before sufficient scientific data is available to establish whether EMFs are a threat to public or worker health, it does not appear prudent at this time for BPA to modify existing electrical field standards or establish numerical field strength standards for magnetic fields produced by BPA facilities.

As states in the region review the issue of EMFs and consider limits on these fields, BPA will participate in the process. BPA will adopt practices consistent with EMF standards in such states, to the maximum extent practicable.

2. BPA will continue to support R&D efforts dealing with EMF issues.

3. In arriving at design and location choices for new transmission facilities:

- EMF exposure shall be a major decision factor to be balanced with other major decision factors (such as reliability).
- Accordingly, BPA shall seek to keep EMF exposures as low as are reasonably achievable, considering social, economic and environmental factors.
- BPA will consider both existing mitigation techniques (such as developing alternative facility locations; increasing right-of-way widths; altering line or tower geometry; using higher voltages to reduce current levels; and undergrounding) and developing technology. The practicability of these options will be determined on a case-by-case basis.

4. Where practical alternatives exist, public and employee exposure to EMFs should not be increased by any BPA operations, practices or actions.

5. BPA employees will be kept informed on current research and information.

6. BPA will explore, in conjunction with its employees, ways to reduce exposures in carrying out their jobs.

7. BPA will actively seek to inform and involve affected customers and the public in BPA project development, including evaluation of siting factors such as EMFs. BPA will continue to develop appropriate educational materials and to respond to requests from the public for information or measurement of EMFs associated with the BPA transmission system.

8. BPA will involve its utility customers and the public in its policy deliberations on EMFs.

Radar and Nerve Damage: A WWII Veteran's Case Report

To the Editor:

During World War II, I served in the U.S. Navy as an aviation radar specialist assigned to an airborne antisubmarine branch of the Atlantic Fleet.

For three years, I worked on S-band (2-4 GHz) airborne search radar units that were rated at 50 kW peak power (36 W average power). In a small shop set up for the purpose, I serviced and tested these radars,

often using something known as an echo box—a cylindrical cavity that simulated echoes when placed in the radar beam. The echo box required tuning adjustments during this procedure, forcing me to work directly in front of the radiating antenna.

During training I was never told of any microwave exposure hazards, and in fact I was taught this specific maintenance procedure, which required extensive, direct exposure to microwaves. I would commonly spend an hour or two at a time in the beam of the radiating antenna.

Generally, the right side of my head was nearest the radar antenna—just four feet away. At this distance, the radar had a free-space field intensity of about 32 mW/cm^2. But I believe that numerous field reflections were present to cause even higher exposures. Possibly most important, the radar signals were intensified by a two-inch metal denture I wore on the right side of my mouth—with the result that the adjacent facial nerve tissue was thermally injured.

My nerve injury occurred suddenly in late 1944. After servicing a radar with the echo box procedure, a swelling developed under my right maxillary bone prominence, just above the location of the denture. Soon I found that my face was insensitive to touch around the swelling. I assumed it was an insect bite. After a week or two, the swelling receded but a sense of facial numbness on the right side remained and has persisted to this day.

I began to drool saliva uncontrollably and dribble food out of the right side of my mouth. Feeling at the time that this was a temporary but personal ailment that should be hidden from my peers and my superiors to avoid ridicule and possible discrimination in advancement, I developed ways to hide my injury from others.

When I was discharged from the Navy in 1946, my wife saw my condition and insisted that I consult with the family doctor, who promptly directed me to a neurologist. The neurologist performed extensive nerve tests, X-ray studies and a spinal tap, and he had tissue removed from the right maxillary sinus for examination. He concluded that the fifth, seventh, and, to a lesser degree, third nerves were damaged and said he believed that demyelination had occurred. This doctor found no evidence of a tumor or disease, but he remarked that the onset of the condition and other symptoms reminded him of an X-ray or diathermy exposure injury.

I related the story of my radar exposure but the doctor expressed total ignorance of microwave effects on humans. I dropped the matter though the symptoms remained and, I believe, presented handicaps in my relationships with employers and social contacts.

I developed eye problems that can be connected to my radar exposure as well: bilateral cataracts and retinal detachments. My right eye conjunctiva had no feeling (as a result of the damage to the fifth nerve), and this eye had retinal lesions, seriously restricting the sharpness of my vision and my field of view.

In 1976, 32 years after my microwave exposures, I read a news article by Jack Anderson revealing to the public for the first time evidence of injuries to World War II veterans who worked on radar. Noting similarities with my own neural and visual disorders, I sought and obtained new neurological and eye examinations. This time, the doctors concluded that the wartime exposures were the logical cause. The neural disorder was believed to be the result of a thermal lesion produced by focused microwave radiation in the vicinity of the metal denture that I wore.

I then prepared and presented claims to the Veterans Administration (VA) for both the eye and nerve injuries. After several denials and subsequent appeals over a period of 14 years, the VA agreed to my claim for eye injuries, but flatly disagreed that the neuropathy had anything to do with microwaves. VA officials argued that it was impossible to prove that my exposure could have been "excessive," and they claimed that there is no scientifically or medically recognized link between exposure to microwave radiation and peripheral (facial area) cranial nerve damage.

I am now 75 years of age, and I still live with my neural disorder and still believe that it resulted from being exposed to radar microwaves. I hope to prove it somehow, if only to benefit a fuller scientific and medical understanding of injuries such as mine.

Sincerely,
John McWade
67690 Ontina Rd.
Cathedral City, CA 92234

UPDATES

BROADCAST TOWERS

Expansion Limits... Health concerns are keeping the debate over radio and television towers alive in Seattle. In August, the city enacted a height limit that is designed, according to City Councilwoman Sue Donaldson, to keep new "super towers" from being built and to provide an incentive for broadcasters to move their facilities to nonresidential areas. The ordinance sets an overall height limit of 1,100 feet above sea level, which is about 100 feet higher than the tallest existing towers, and specifies other restrictions on expansion. Donaldson, chair of the city's land-use committee and the sponsor of the measure, told *Microwave News* that the cap would "keep a speculative, very tall tower from coming in." She was referring to a proposed 1,000-foot tower—rising 1,400 feet above sea level—that could have encouraged other broadcasters in the area to increase the height of their existing towers. Don Wilkinson, director of engineering for KOMO television, said that his station has had plans since the mid-1980s to raise its existing tower to 1,350 feet above sea level. With this move now blocked, Wilkinson explained, the station may have difficulties in accommodating new broadcast technologies such as high-definition television. But Wilkinson argued that the new ordinance will not force the station to move its facility to a less-populated location outside the city, stating that the towers for all local TV stations "need to be centrally located and reasonably close together." The ordinance is a compromise "that we're not terribly pleased with," Wilkinson said. The most vehement opponents of Seattle's broadcast towers were also dissatisfied with the new rules, according to Steve Ludwig, president of Citizens Against Tower Expansion (CATE). Members of his organization, who are concerned about reports of elevated cancer rates in their Queen Anne Hill neighborhood, were part of an angry, noisy crowd of protesters that twice forced the city council to adjourn while it voted on the broadcast tower ordinance on August 10. Seattle adopted public exposure guidelines for RF radiation last January (see *MWN*, J/F92).

INTERNATIONAL

Radar and Power Line Fears in Ireland... In the small town of Crossmaglen, Northern Ireland, near the border with the Republic of Ireland, ten people have died from brain hemorrhages and three from brain tumors—out of a population of about 2,400—in the last two years, and residents suspect NIER from a nearby British Army surveillance post, according to an account in the Dublin *Sunday Press* (June 28). A local physician, Dr. Mary Allen, sounded the alarm. "In all the areas I have worked I have never experienced such a high level of general illness," Allen told the *Press*. "This ranges from listlessness and insomnia to cancer and mental illnesses, including anxiety and depression. We need a comprehensive survey of the health of the community...and we need the Army to disclose what type of equipment they're using." The newspaper reported that the British Army has "been using surface movement radar in the area since 1986."...EMFs from power lines are causing concern in the Dublin suburb of Ballymun. The June 8 *Evening Herald* reported that seven women in a 400-house development known as Belclare Estate have died of cancer in the last 14 months. An environmental group, Healthwatch Ireland, has taken EMF measurements, which are in turn being reviewed by a government agency, and the Irish Minister for Health, Dr. John O'Connell, has begun an investigation into the Ballymun cancer cluster. "You cannot start a total scare, but these figures warrant further study...by a team of epidemiologists," Dr. Patricia Sheehan, a radiation researcher, told the *Herald*. "No one knows what causes cancer, but it has been established that when people are exposed to non-ionizing radiation and ionizing radiation there is an increase in cancer."

BBC Tower Sparks Controversy... An environmental health specialist in Birmingham, U.K., Dr. Mark Payne, has identified seven cases of leukemia and lymphoma among residents who live within 1,500 meters of a British Broadcasting Corp. (BBC) radio and television tower, according to reports on March 30 in *The Guardian* and in *The Birmingham Post*. All but one lived in the area for at least 14 years. The 750-foot tower transmits four television and seven radio stations. Payne culled the cancer cases from the medical records of a general practitioner in the area who has about 2,600 patients. He also found that there are 12 area residents currently receiving treatment for mental illness. "Had the Sutton Coldfield transmitter been a new drug, it would have to have passed elaborate tests as to its long-term safety," Payne wrote in an as-yet-unpublished letter to a British medical journal obtained by *Microwave News*. Such tests are not required, he added, "because of the widely held view that, apart from the heating effect, non-ionizing radiation presents no health hazards. We need to reassess this [view]."

MILITARY SYSTEMS

Microwave Weaponry... An article in *Aviation Week & Space Technology* flatly contradicts a report in a competing publication that an EMP weapon was used in the Gulf War. The earlier story, in the April 13-19 issue of *Defense News*, stated that an EMP warhead mounted on the Navy's Tomahawk cruise missile was used in the opening days of Operation Desert Storm (see *MWN*, M/J92). The weapon, also referred to as a high-power microwave (HPM) device, was meant to disrupt electronics in Iraq's air defense systems, wrote coauthors Robert Holzer and Neil Munro. The piece in the April 27 *Aviation Week* confirmed part of the earlier report, quoting unnamed U.S. defense officials who said that a "Tomahawk-size" EMP warhead is being developed in projects at Los Alamos National Laboratory, NM and Eglin Air Force Base, FL. "[B]ut no such weapon was used against Iraq," *Aviation Week* reporter David Fulghum wrote. His story was not primarily about EMP weapons and made no specific reference to *Defense News*. Rather, the three-page article described a secret offensive to disrupt Iraqi air defenses. *Defense News*' Munro said his sources stick by their original story.

TECHNOLOGY

Microwave Dryers... For those who have toyed with the possibility of drying clothes in a microwave oven, just wait. American Micro-Tech Inc. of Lake Oswego, OR is developing a microwave clothes dryer. Tests of the appliance that were sponsored by Southern California Edison have shown a 10% energy savings as compared with a conventional electric dryer. The utility also touts faster drying, fewer wrinkles and less static cling. The dryer is a modified household tumble dryer: microwave generators have been added, along with door locks and shielding; a low-wattage electric heating unit is still needed to help carry moisture out of the dryer....EPRI researchers are also studying this technology and have recently completed a prototype. They are still working out some kinks, however: metal buttons, coins and zippers are not a problem in the microwave dryer, but long, thin metal objects such as bobby pins or nails can heat up and damage clothing. "In a microwave dryer...microwaves 'target' the water molecules clinging to the clothes rather than the molecules constituting the fabrics," EPRI's John Kesselring wrote in the June *EPRI Journal* (pp.34-36). "In experimental testing, dryer temperatures...generally have not exceeded 110°F, an excellent range for drying delicate fabrics." Kesselring, who is with EPRI's Customer Systems Division, predicted that the dryers could be on the market as early as 1994. Past announcements that this technology would soon be available to consumers have proved to be premature, however (see *MWN*, N/D88).

CORRECTION

In our last issue, we misstated the per-mile construction costs of overhead and underground power lines in the article on "The Economics of Mitigation" (p.4). The cost of a 345 kV H-frame configuration is $390,000 per mile and the cost of burying the same line is $1,450,000 per mile, according to a report prepared for Rhode Island's EMF task force by Commonwealth Associates.

might require that average annual exposures be less than 2 mG, noting that peak fields would be less than 4 mG. The average exposure could end up being 3 or 4 mG, Nöu said. "We will have to balance the health of the Swedish population with the economic costs of the standard." NUTEK is responsible for electrical safety regulations in Sweden.

If the 2 mG average limit is adopted, there will be a right-of-way (ROW) of approximately 200 meters—about 300 feet on each side—for a 400 kV power line, according to Nöu. He noted that this ROW could be reduced to 100 meters with low magnetic field transmission designs and the use of other mitigation strategies.

"The most difficult problem is what to do about existing homes and power lines," Nöu said. "The cost of decreasing these magnetic fields will be enormous."

Rolf Lindgren, the EMF manager for the state power company, Vattenfall, and a member of NUTEK's safety standards committee, told *Microwave News* that exposures above 2 mG from existing power lines and substations would be addressed "on a case-by-case basis," adding that, "Changes would have to be weighed against the economic costs."

When asked whether Sweden would adopt a 2 mG occupational standard, Lindgren replied that such a limit "would bring an end to industrial society in Sweden." He predicted that market forces, which will now favor low magnetic field systems, would yield ways of reducing worker and public exposures.

A 2-4 mG population standard would be up to 100 times more stringent than the standards adopted by New York State and Florida—the only two magnetic field limits in the U.S. (see *MWN*, M/A89 and S/O90). It would be up to 500 times stricter than the International Radiation Protection Association (IRPA) guidelines for public exposures to 50/60 Hz magnetic fields and up to 2,500 times stricter than IRPA's occupational standard (see *MWN*, M/J89).

The new epidemiological results are, in the words of NIOH's Dr. Kjell Hansson Mild, "remarkably clear in pointing to a connection between cancer and magnetic field exposures." And Dr. Lars-Erik Paulsson of the Swedish Radiation Protection Institute in Stockholm said that, "The childhood cancer study confirms earlier findings with astonishing precision." Both Mild, who is based in Umeå, and Paulsson were present when the epidemiological results and the NUTEK policy were announced in Stockholm.

Lindgren and Mild both cited the need to design new homes with electrical circuitry that would limit magnetic field exposures. Similarly, in an interview with *Microwave News*, Per Erik Boivie of the Swedish Confederation of Professional Employees, TCO, in Stockholm, argued for low magnetic fields in new office buildings. "We think our strategy to bring down fields as low as possible is a very good strategy," he said.

In its public statement, NUTEK made a commitment to sponsor more research to determine the mechanism of interaction—a move endorsed by many of the Swedish officials interviewed for this report.

The Ahlbom–Feychting and Floderus studies cost more than $2 million and took more than five years to complete (see *MWN*, M/J87). Both groups said that they will soon submit their results for publication. The epidemiological studies are part of a larger Swedish research program, which includes studies on animals and on cellular systems.

Reactions in the U.S. and the U.K.

Few American researchers have yet seen the full reports of the two studies, but summaries have been widely disseminated (see p.14 for the full texts of the abstracts). "The results are very suggestive of a real association with childhood leukemia," said Dr. David Savitz, an epidemiologist at the University of North Carolina, Chapel Hill. Similarly, Dr. Richard Stevens of the Battelle Pacific Northwest Lab in Richland, WA said that, "It is hard to imagine what obvious problem could account for these results other than magnetic fields." With respect to the occupational study, Dr. Sam Milham, who recently retired from the Washington State Department of Health, said, "It's a confirmation that EMF exposures are associated with certain cancers."

"My first thought is that this further evidence, coming from extensive work by well-established scientists, may finally allow scientists who would like to work on the problem to do so without unwarranted put-downs by the 'old boys' of science," Dr. Nancy Wertheimer told *Microwave News* from her office in Boulder, CO. In 1979, Wertheimer, working with physicist Ed Leeper, first identified the link between childhood cancer and high current lines by using a system of wire codes to estimate long-term magnetic field exposures.

Representatives of utilities outside Sweden are reserving final judgment on the new research until they have had a chance to analyze the studies carefully.

The Ahlbom–Feychting study was "rigorously conducted" and "provides important new information," according to the Electric Power Research Institute (EPRI) in Palo Alto, CA. In an interview, Dr. Stanley Sussman, manager of EMF health studies, said, "We're trying to put it into perspective with the rest of the literature. Frankly, we need more information, particularly with respect to the modeling of the historical fields, which is critical to their results." Sussman said that EPRI had not yet completed its review of the Floderus occupational study.

Robert Beck, vice president for environmental affairs at the Edison Electric Institute (EEI) in Washington, called the studies "important contributions to our body of knowledge," adding

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that they "provide us with some more answers, and questions, to the EMF puzzle." He stressed "the need for a coordinated and comprehensive national research program into possible EMF health effects." (Congress has now passed such a plan, see p.2.)

Richard Loughery, EEI's EMF issue manager, said that he looks forward to debating the new results at the Department of Energy's (DOE) annual review of EMF research, which will be held in San Diego on November 9-12. Both Ahlbom and Floderus will present their results at the DOE meeting.

In the U.K., Dr. John Male of the National Grid Co. in Leatherhead, Surrey told *Microwave News* that, "We see this as an important addition to the scientific data base. We await an assessment of its significance by the National Radiological Protection Board (NRPB)." Last spring, the board issued a report which concluded that there is "no firm evidence" of a cancer risk from exposures to power frequency EMFs (see *MWN*, M/A92).

Ahlbom–Feychting Residential Study

Ahlbom and Feychting used the most detailed exposure assessment ever attempted, reconstructing long-term magnetic field exposures for those living next to high voltage power lines. First, they used a computer model to calculate the magnetic fields inside homes next to power lines carrying a known amount of current and confirmed the accuracy of the model with spot measurements. Then, using Vattenfall's historical records of the current loads on the nation's power lines, they estimated the average field exposures for each case and for corresponding controls at the year of diagnosis as well as one, five and ten years before diagnosis; they also estimated exposures for children at the time of birth and at the time of conception.

Based on these estimated long-term exposures, Ahlbom and Feychting found that childhood leukemia rates rose with increasing magnetic field exposures—a clear dose–response relationship. Children exposed to more than 1 mG had twice, those exposed to more than 2 mG had close to three times, and those exposed to more than 3 mG had nearly four times the incidence of leukemia of those exposed to less than 1 mG. Despite a small number of cases, the risk ratios are statistically significant. The researchers found similar results when exposure was defined by proximity to power lines.

Ahlbom and Feychting noted that controlling "for confounding from air pollution or socioeconomic status did not change the results."

In the U.S., Savitz and Dr. John Peters of the University of Southern California (USC) have each shown that children living near high current power lines have higher rates of cancer, but neither found a significant association with measured magnetic fields (see *MWN*, N/D86 and M/A91). Savitz and Peters each confirmed the landmark Wertheimer–Leeper study.

Importantly, like Savitz and Peters, Ahlbom and Feychting did not find a link between childhood cancer and spot magnetic field measurements. In a telephone interview, Feychting explained that, because currents on power lines have increased over the years, spot measurements do not correlate with the historical estimates—and tend to overestimate past exposures.

Norwegian and Danish Studies Also Point to Cancer Risk

Two other Scandinavian epidemiological studies—one on Norwegian workers and one on Danish children—also point to an EMF–cancer risk.

Drs. Tore Tynes, Aage Andersen and Frøydis Langmark of the Cancer Registry of Norway in Oslo report that male electrical workers with a "long duration of employment" had a statistically significant 40% increase in acute and chronic leukemia. The highest risks were among radio and TV repairmen, radio and telegraph operators and power line workers.

The results, which were based on an investigation of approximately 38,000 workers, appear in the July 1 issue of the *American Journal of Epidemiology (136*, pp.81-88, 1992). The researchers did not see an increased risk of brain tumors. Tynes and Andersen previously reported that this group of workers had an abnormally high rate of breast cancer (see *MWN*, J/F91).

And on October 7, as we went to press, Dr. Jørgen Olsen of the Danish Cancer Registry in Copenhagen announced that children living near high voltage power lines with magnetic field exposures of 1 mG or more had a statistically significant fivefold elevated risk of lymphoma, as compared with controls. Although no excess risk of leukemia or brain tumors was observed, the combined risk for these three types of childhood cancer was more than five-and-a-half times greater for exposures of 4 mG or more, as compared with controls.

"It is not possible to use spot measurements to know historical exposures," she said. "Our study provides a possible explanation as to why Savitz and the USC researchers found associations with wire codes and not with spot measurements," she concluded.

Savitz pointed out that the new study "has its own methodological strengths and weaknesses and these are different from the U.S. studies—it's not another Wertheimer–Leeper or Peters study." Battelle's Stevens noted that questions about control selection that have been raised with regard to the American studies—for instance, potential biases due to random digit dialing—do not apply to the Ahlbom–Feychting study.

For adults, Ahlbom and Feychting found a 70% excess of both acute myeloid leukemia (AML) and chronic myeloid leukemia (CML) for those exposed to more than 2 mG, as compared to those exposed to less than 1 mG. Neither of these results is statistically significant, however.

Unlike Wertheimer and Savitz, or Sweden's Dr. Lennart Tomenius (see *MWN*, N82, M/J86 and N/D87), Ahlbom and Feychting did not identify an EMF link to brain tumors in children. (Peters only looked at leukemia.) Nor did they find a link to brain tumors among adults. "We were surprised that we did not see a risk for brain tumors," Feychting said. Savitz

commented that, "Up until this study, the evidence was stronger for brain cancer than for leukemia. This shifts the balance somewhat."

The elevated cancer risk appears to apply only to those children who lived in single-family homes. In their report, Ahlbom and Feychting argued that this lack of an association may be explained by the small number of cases and because the "precision of the calculated fields may be lower for apartment houses than for one-family homes."

Ahlbom and Feychting's case–control study included all children with cancer and all adults with leukemia or brain tumors diagnosed between 1960 and 1985, among the nearly 500,000 people who lived within 300 meters of any of Sweden's 15,000 km of 220 and 400 kV lines. The researchers identified 142 children with cancer—39 with leukemia and 33 with brain tumors—and 558 controls. Among the adults, 325 cases of leukemia and 223 cases of brain tumors were compared with 1,091 controls.

"It would be very difficult to do this kind of study in the U.S.," Savitz pointed out, citing the detailed population, cancer

Abstracts of the Swedish Epidemiological Studies

On September 30, Maria Feychting and Anders Ahlbom of the Institute of Environmental Medicine at the Karolinska Institute, Stockholm, released their study, Magnetic Fields and Cancer in People Residing Near Swedish High Voltage Power Lines. *On the same day, Dr. Birgitta Floderus and coworkers at the Department of Neuromedicine at the National Institute of Occupational Health in Solna released* Occupational Exposure to Electromagnetic Fields in Relation to Leukemia and Brain Tumors: A Case–Control Study. *Reprinted below are the authors' summaries of the studies.*

Ahlbom–Feychting Residential Study

The aim of the present study was to test the hypothesis that exposure to magnetic fields of the type generated by high voltage power lines increases cancer incidence. The study was designed as a case–control study based on the population comprised of everyone who lived on property located within 300 meters from any of the 220 and 400 kV power lines in Sweden during the period from 1960 through 1985. For adults it was required that the duration of residence was at least one year. The corridor was chosen to be wide enough to ensure that it included both exposed and unexposed homes. The cases were all instances of cancer diagnosed between 1960-85. For children, all types of cancer were included, while for adults the study was restricted to leukemia and brain tumors. The cases were identified through a record linkage to the Cancer Registry. The controls were matched to the cases on time of diagnosis, age, sex, parish and power line. Exposure was assessed in several different ways. First, spot measurements were performed in the homes of the subjects. Second, the magnetic fields generated by the power lines were calculated by means of a computer program taking distance, line configuration and load into account. At the same time as a spot measurement was performed, the load on the line was obtained and the magnetic field calculated. Historical loads were obtained from records that were kept by the station managers. By using these in the program, calculated historical fields were obtained for various time periods appropriate from the etiological point of view. These calculated historical fields were the main source for classifying study subjects into different levels of magnetic field exposure. Thus, the main exposure metric was the annual average of the calculated magnetic field generated by the line. Third, for a sample of the subjects, 24-hour measurements were also performed.

For childhood leukemia and with cutoff points at 0.1 and 0.2 μT, the relative risk (RR) increased over the two exposure levels and was estimated at 2.7 (95% c.l.: 1.0-6.3) for 0.2 μT and over. The test for trend gave a p-value of 0.02. When the upper cutoff point was shifted to 0.3 μT the RR was instead 3.8 (1.4-9.3) and the corresponding trend test gave a p-value of 0.005. These results persisted when data were broken down by gender, age, time of diagnosis and area of living. However, it appeared that the relationship was confined to one-family homes. There was some relationship with distance but no relationship with spot measurements. Control for confounding from air pollution or socioeconomic status did not change the results. For brain tumors or for all childhood cancers together there was little support for an association.

In adults and for magnetic fields of 0.2 μT and over, the RRs for acute myeloid leukemia (AML) and chronic myeloid leukemia (CML) were estimated at 1.7 (0.8-3.5) and 1.7 (0.7-3.8), respectively. This result persisted in most analyses. For brain tumors no association was seen.

The finding of an association, in childhood leukemia, with calculated historical fields but not with measurements is consistent with the assumption that historical calculated fields are reasonably good predictors of past fields but that spot measurements are poor predictors of those fields. The confinement of an association to one-family homes might be explained by a limited accuracy in exposure assessments in apartment houses. The results provide support for the hypothesis that exposure to magnetic fields increases the risk of cancer. This is most evident in childhood leukemia. What aspect of the fields might be involved remains unclear.

Floderus Occupational Study

The relationships between occupational EMF exposure and leukemia or brain tumors were analyzed in a case–control study. The exposure assessment was based on measurements, the cancer diagnoses were verified from medical records and the cases and the controls were representative samples of the general male population.

Based on the job held longest during the 10-year period before diagnosis, an association between leukemia risk and EMF exposure was observed. The association was attributed to chronic lymphocytic leukemia (CLL) and in particular to exposure based on EMF mean values; the relative risk increased with increasing level of exposure. No association was found for AML. Ever having had a high-exposure job during lifetime was more common among patients of CLL compared with control subjects. No such relationship was found for AML. It is unlikely that the results for leukemia are explained by confounding from benzene, ionizing radiation, pesticides, solvents or smoking habits.

For brain tumors, some results speak in favor of an association. The relative risk of brain tumors was increased in the highest exposure categories, based on median values for the job held longest during the decade before diagnosis. The occurrence of benzene, ionizing radiation, pesticides, solvents or smoking did not have any decisive influence on the results. The association found was mainly attributed to subjects below the age of 40, with no major difference between the two groups of brain tumors (astrocytoma grade I-II and III-IV). Ever having had a high-exposure job was more common among brain tumor cases than among control subjects in the youngest age group.

The complex relationships between age at first exposure, cumulative exposure and age at diagnosis have to be further explored, as well as the possible interactions of EMF with other factors. Also the inconsistencies between sub-diagnoses have to be evaluated. The results of this study speak in favor of the hypothesis that occupational EMF exposure is a hazard in the development of certain cancers.

and real estate registries, together with the long-term current load data, available in Sweden. "They used a very clever study design," he said.

Floderus Occupational Study

Floderus's occupational study also found a dose–response association between EMF exposures and cancer risk.

Floderus and coworkers, including Dr. Bengt Knave, divided the workers into four groups based on the intensity of their mean daily exposures to magnetic fields. The workers in the lowest quartile were exposed, on average, to less than 1.6 mG and in the highest quartile to 2.9 mG or more. A fifth group, the 10% of the workers who were most exposed, was used to evaluate further a possible dose–response relationship; this group was exposed, on average, to 4.1 mG or more. The bottom quartile served as the control group.

Workers in the top quartile had 60% more leukemia and three times as much CLL as those in the bottom quartile. The risk of CLL among the 10% most highly exposed workers was approximately four times that of the controls. All these results are statistically significant.

Interestingly, Floderus did not see elevated rates of AML among her male subjects. Many of the U.S. studies have identified an EMF link to AML rather than to CLL. "The CLL finding is very curious," Milham said, "but it's not the first time that it has turned up." Milham pointed to the studies by Dr. Michel Coleman in the U.K. (see *MWN*, Jun83), Dr. Neil Pearce in New Zealand (see *MWN*, J/A89) and Drs. Siv Törnqvist, Knave and Ahlbom in Sweden (see *MWN*, N/D91).

Floderus and coworkers noted that, "It is unlikely that the results for leukemia are explained by confounding from benzene, ionizing radiation, pesticides, solvents or smoking habits."

They also found a link between EMF exposures and brain tumors. In a telephone interview, Floderus told *Microwave News* that there was a stronger association with leukemia than with brain tumors and that the dose–response relationship was "more obvious" for leukemia.

"This is the first time that a dose–response relationship has been identified in an occupational study," Floderus said. "Of course, this makes the association more credible," she added.

The case–control study included 250 men with leukemia and 261 with brain tumors, and 1,121 controls. EMF exposures were measured with EMDEX meters. In their report, Floderus and coworkers wrote that, "In all, 1,015 [sets of] measurements were carried out on 169 job categories. The mean duration of measurements was 6.8 hours, which gave about 25 million recordings." Floderus declined to specify the occupations of the workers.

Milham was the first to identify a link between EMF exposures on the job and leukemia (see *MWN*, J/A82). Over the last ten years, occupational studies in Canada, Finland, France, New Zealand, Norway, Sweden, Switzerland, the U.K. and the U.S. have all pointed to an EMF–leukemia link (see *MWN*, D82, Jun83, My85, J/A85, M/A86, J/A86, M/J87, J/A89, S/O90, M/A91, J/A91 and p.13). In addition, a host of studies have indicated a link to brain tumors (see *MWN*, M/A90 for a review).

Is There a Nonexposed Population?

For both the occupational and residential studies, the differences in exposure levels between the exposed populations and controls were small. "These studies all understate the real risk because of background exposures," Milham said. "There is no such thing as nonexposed people. It's like comparing a three-pack-a-day smoker with a one- or two-pack-a-day smoker."

Wertheimer stressed the same point about the pervasiveness of EMF exposure. "We need to recognize that looking for a risk among people living near certain power lines is clouded by the many other sources of magnetic fields in modern society. As a result, one would expect results that are repeatedly positive but are relatively modest and variable in the risk levels observed."

The lack of a dose–response relationship between magnetic fields and cancer has long been cited by U.S. officials as a reason for doubting the EMF–cancer link (see *MWN*, M/J90).

In its review of the Environmental Protection Agency's (EPA) 1990 report on EMFs and cancer, EPA's Science Advisory Board argued that, "The conclusion of causality is currently inappropriate because of limited evidence of an exposure–response relationship and the lack of a clear understanding of biologic plausibility" (see *MWN*, J/A91).

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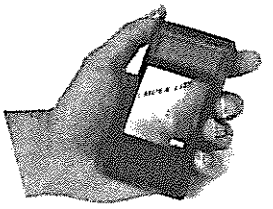
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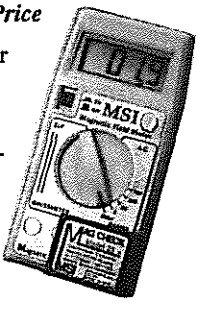
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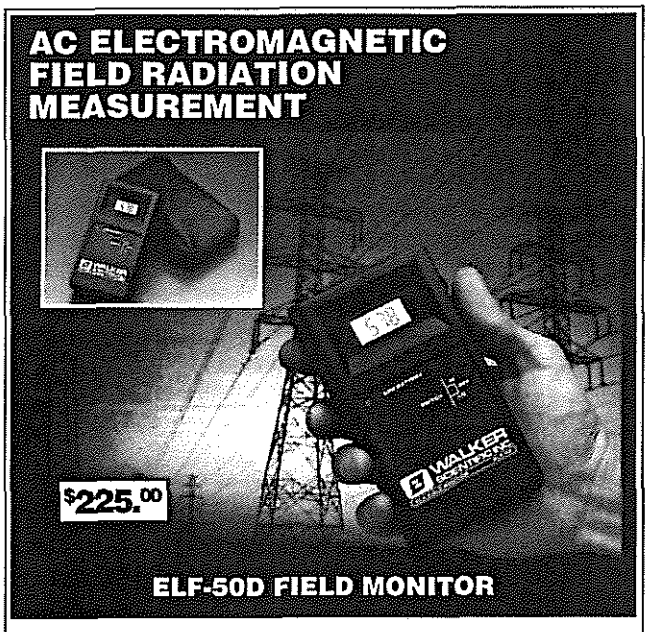
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MICRO WAVE NEWS

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ANSI RF/MW Standard Challenged

U.S. Air Force and Hughes Units Adopt Limits up to 100 Times Stricter

A research group at the Kirtland Air Force Base in New Mexico has adopted guidelines for human exposures to radiofrequency and microwave (RF/MW) radiation that are much stricter than those developed by the Institute of Electrical and Electronics Engineers (IEEE) and endorsed last year by the American National Standards Institute (ANSI). This follows a similar decision by a group at the Hughes Aircraft Co., a major military contractor and a subsidiary of General Motors Corp.

Taken together, these moves could undermine the dominance of the ANSI C95.1 standard, which, in the absence of official government limits, has been the de facto U.S. standard for more than 25 years. A loss of confidence in the ANSI/IEEE standard would have serious implications for the evaluation of the safety of cellular phones and towers, civilian and military radars, radio and television broadcast antennas and the many other sources of RF/MW radiation.

In June, Dr. Brendan Godfrey, the director of the Advanced Weapons and Survivability Directorate (AWSD) at Kirtland's Phillips Laboratory, instituted a policy that limits exposures to 100 $\mu W/cm^2$ for 30 MHz to 100 GHz. The Phillips guidelines are similar to those adopted by the Johns Hopkins University Applied Physics Lab (JHU-APL) in 1984 (see *MWN*, D84). The 1992 ANSI limits are, by contrast, frequency-specific: They allow occupational exposures ten times greater between 100 MHz and 300 MHz and up to 100 times greater above 3 GHz.

(continued on p.10)

U.S. Air Force v. U.S. Air Force: Labs at Odds over RF/MW Health Risks

The U.S. Air Force's Armstrong Laboratory in San Antonio has consistently maintained that electromagnetic radiation cannot cause nonthermal effects and has disputed all claims to the contrary. So it is surprising that one of the strongest challenges to this view has come from another group within the Air Force—the Phillips Laboratory at Kirtland Air Force Base in New Mexico.

Dr. Cletus Kanavy, a bioeffects researcher at the Phillips Lab, has no doubts that nonthermal effects occur. "It is absolutely 'shocking' to hear the Armstrong Laboratory ([Dr. David] Erwin) deny the existence of any biological effects which are not thermal," Kanavy wrote in a memo to his superiors last year. "Something is drastically wrong here."

To support his claims, Kanavy prepared a White Paper on the biological effects of RF/MW radiation in which he concluded that "a comprehensive search of [the] worldwide literature" found that "a large amount of data exists... to support the existence of chronic, nonthermal effects." He also stressed that

(continued on p.11)

« Power Line Talk »

When the **National Academy of Sciences-National Research Council**'s (NAS-NRC) new EMF committee invited three scientists to give tutorials on biological effects at its first public meeting in Washington, September 22-23, some observers were surprised that all three were members of the White House **CIRRPC** panel, which, in a report last fall, dismissed EMFs as a potential health risk (see *MWN*, N/D92). That all three—Dr. **Joseph Brady** of the Johns Hopkins University in Baltimore on behavior, Dr. **Robert Brent** of the A.I. duPont Institute in Wilmington, DE, on reproduction and Dr. **Gary Stein** of the University of Massachusetts, Worcester, on cellular growth and regulation—restated CIRRPC's conclusions was predictable. But what dismayed many members of the committee, as well as a number of others in the audience, was how little the three knew about EMFs. Practically every time they were asked to cite specifics on a particular study—the type and intensity of the exposure, for instance—they were at a loss. Stein, for one, was repeatedly stumped by the committee's questions. Brady and Brent peppered their talks with advice. "Keep your names and addresses out of the published literature," Brady suggested as a way of avoiding the calls and letters that EMFs inevitably prompt from the press and the public. Brent advised the committee not to worry about EMFs at the expense of "real" public health problems, such as alcohol consumption by pregnant women. When Brent flashed a slide showing the increase in power generation in the 20th century, with no parallel increase in the rates of birth defects over the same period, some of the epidemiologists on the committee grimaced. "This has become one of the myths of the EMF health debate—it's distracting and not helpful," one committee member commented privately afterwards. Brent raised the most eyebrows when, at the end of his talk, he interjected, "I have chosen not to be an advocate. I don't take a position." Later, one incredulous committee member countered: "He was the biggest advocate we heard." By the time Brent reached the end of his talk, patience was running short. The CIRRPC panel was "the most wonderful committee I have been on," Brent said, adding that, "If you have to disassociate yourself from us..." Before he could complete his thought, DOE's Dr. Imre Gyuk, the project officer for the academy committee, finished it for him: "Please do," he said. The following day, the committee met in closed session and decided that they will seek others to fill in the gaps left by the CIRRPC crew, according to a number of those present. One member of the NAS-NRC committee sees a silver lining: "It was so obvious that they had no understanding of this body of research that it's clear that our committee has a contribution to make."

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A neighbor of the **Studholme** family in the U.K., which filed a suit against a local utility, Norweb, alleging that EMFs caused their son's leukemia (see *MWN*, J/A93), also died of the disease, according to British news reports. Norman Schofield, of Manchester in northern England, lived three doors away from Simon Studholme, who died last year at age 13. The Schofields, whose home is identical to the Studholmes', slept in the same front bedroom as the boy—just one foot away from the household electricity meter, according to the August 26 *Bolton Evening News*. Schofield was 47 years old when he died of acute myeloid leukemia in 1989. His widow, Mavis Schofield, told the paper that she plans to watch the Studholme case carefully. The Studholmes believe that their claim will be strengthened by this new information, according to the September 1 *Daily Star*. Their case has already received considerable public attention and is credited with influencing a nearby town to reconsider a planned move of a substation. The August 28 ***New Scientist*** argues that Norweb is unlikely to lose the case since the link between EMFs and cancer is "tenuous" and the company operates within national guidelines. "But at the same time," the editorial states, "it is surely right to argue that they should inform their customers about the latest research." The **BBC**'s Panorama program—which last ran a major piece on power lines in 1988 (see *MWN*, J/F88)—is also investigating the story.

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Some eagerly awaited papers are now in print. Dr. **Anders Ahlbom** and **Maria Feychting**'s childhood cancer epidemiological study appears in the October 1 issue of the *American Journal of Epidemiology*. The other Swedish report, the occupational study by Dr. **Birgitta Floderus** and coworkers, is in the September issue of *Cancer Causes and Control*. And the Danish childhood study by a team led by Dr. **Jørgen Olsen** is published in the October 9 *British Medical Journal (BMJ)*—the same issue also features the new Finnish study (see p.4). In an accompanying editorial in *BMJ*, Dr. Gerald Draper, director of the U.K. Childhood Cancer Research Group in Oxford, writes: "The possibility that magnetic fields associated with electricity transmission may cause some cases of childhood cancer cannot be dismissed, but the lack of consistency among published studies, and the absence of an accepted biological explanation for such a relation, means that we have to conclude that at present no causal relation has been established." In contrast, at the NAS-NRC workshop (see above), Ahlbom concluded that, on looking at all the studies together, "I personally find the results to be fairly consistent." (For our coverage of the two Swedish studies, see *MWN*, S/O92; for the Danish study, see *MWN*, N/D92)....But the waiting continues for the

NY Landowners Win Appeal

As we go to press in early October, the New York state Court of Appeals, the state's highest court, has ruled that landowners should be compensated by the New York Power Authority (NYPA) for losses in property value due to power line EMFs, regardless of whether the health risk is real or simply perceived. "This decision could pave the way for the other claims against the NYPA," Michael Rikon, the landowners' New York City-based attorney, told *Microwave News*. The case has been sent back to the Court of Claims, where damages, if any, will be decided. (For more on the Marcy-South power line, see *MWN*, M/A87, S/O89, J/F90 and N/D92.)

Reviews of Paul Brodeur's The Great Power Line Cover-Up

Excerpted below are reviews of Paul Brodeur's new book, The Great Power Line Cover-Up: How the Utilities and the Government Are Trying To Hide the Cancer Hazard Posed by Electromagnetic Fields *(304 pp., $21.95), published this September by Little, Brown and Co. in New York City.*

This important, riveting exposé deserves an even wider audience than Brodeur's previous book on the subject, *The Zapping of America*....This urgent book should be on Al Gore's desk as he tackles environmental health problems, and on Hillary Rodham Clinton's bookshelf as she reorders national health priorities.

—Publishers Weekly, ***July 12, 1993.***

Perhaps EMFs, which emanate from power lines and electric appliances, are deadly. The problem is that many, many respected scientists believe that, at worst, EMFs probably pose a very low risk of increased disease. Yet even careful lay readers of Brodeur's book would not get that impression. Brodeur's is a rabid advocate's case against EMFs, to my mind just within the bounds of journalistic license. His is an attack so factually detailed, so relentless that the reader is almost battered into agreement....His basic tactic is to emphasize the findings that suggest EMFs are a hazard, and to dismiss or ignore negative findings....In his book, Brodeur flips aside with the ease of a judo master one renowned scientist after another who disagrees with him on EMFs.

—Joel Lang, **Hartford Courant,** ***September 9, 1993.***

...Brodeur deserves credit for drawing the public's attention to another possible threat, but his work would be far more persuasive if it were less polemical and more evenhanded. In the Fresno case, for example, he gives no hint of having talked with the state health officials who were grappling with an emotional issue...He also dismisses out of hand certain EMF studies by respected university researchers just because they were funded by [EPRI]....The very existence of such investigations would seem to refute Brodeur's assertion of an industry cover-up, since it's hard to imagine that academic scientists would risk their careers and reputations by publishing questionable data in professional journals to please a benefactor. Yet even if Brodeur doesn't make a convincing case for the cover-up, he is certainly right in one important respect: For too long we've accepted the presence of power lines and other EMF sources in our midst without really examining their possible influence on public health. Flawed though it is—by a lack of documentation, by too many repetitions, by the absence even of a really good explanation of EMF—Brodeur's book surely deserves to be read, carefully and skeptically.

—Frederic Golden, **San Francisco Chronicle,** ***September 19, 1993.***

While Brodeur's arguments make for chilling reading, it's nonetheless hard to judge whether all the official dodging and weaving is a well-orchestrated conspiracy, or just more of the friendly regulation the power industry has often enjoyed. But that makes Brodeur's calls for preventive action no less compelling. In discussing the potential health risks of electromagnetic radiation, Brodeur draws a parallel to tobacco. It too is widely acknowledged to be an agent that causes cancer, even though no one knows exactly how. Whether magnetic radiation poses the same peril is still open to question. But if Brodeur's volume provokes more intense and honest questioning, it will have served its mission well.

—William Glasgall (senior writer at **Business Week), New York Newsday,** ***September 26, 1993.***

After reading *The Great Power Line Cover-Up,* the only thing I am convinced of is that author Paul Brodeur truly believes that electromagnetic waves from power lines cause cancer....Brodeur is understandably outraged at the authorities' cavalier behavior. However, his dismissals of scientific literature are even more cavalier as he builds a case against the power companies by fixating on a single part of a complicated technological situation—the magnetic fields. ...[I]njured parties are beginning to bring their cases to court. He predicts an avalanche of such cases, and I hope he is right. We need to spend whatever is necessary to investigate with greater imagination and rigor the ramifications of living in an electrically powered world.

—Bettyann Kevles, **Los Angeles Times,** ***September 28, 1993.***

[Brodeur] not only warns of a looming cancer epidemic, but also accuses government officials, utility executives, even the nation's top newspapers, of hiding the threat....Well, don't head for the log cabin just yet. A little knowledge of the controversy, or even a close perusal of the book, turns up enough inconsistencies, dubious interpretations, and selective reporting to cast immense doubt on the whole argument—and to reveal Brodeur as more zealot than journalist. That's too bad, because there's a need for an unbiased assessment of the dozens of often contradictory studies of power line exposure....*The Great Power Line Cover-Up* repeatedly strains credulity. It's difficult to believe that any single factor can cause the long list of ailments Brodeur attributes to [EMFs]....Brodeur's charges of a cover-up are similarly unconvincing....*The Great Power Line Cover-Up* is an odd beast. The new evidence it purports to present is too weak to have much impact on policy, and as an exposé, it's remarkably lame. What's left is merely a good read that needs to be approached with a sturdy dose of skepticism.

—John Carey, **Business Week,** ***October 4, 1993.***

U.S. and Canadian–French occupational epidemiological studies, which were originally due at the end of this year. Dr. **David Savitz** now predicts that his study of U.S. workers will be released in March or April, with publication scheduled a week or two later. And Dr. **Gilles Thériault** said that his study is completed and that he submitted it for publication at the end of September. At last word, he was waiting to hear from the reviewers.

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Dr. **Charles Powers,** the founder of the Health Effects Institute (HEI) in Cambridge, MA, who became acting president when Dr. **Andrew Sivak** left in March 1992 (see *MWN,* M/J92), has resigned. Two senior staffers, Drs. **Jane Warren** and **Kathleen Nauss,** are now serving as acting co-executive directors. A search committee has been formed to select a new president....**Lynne Gillette** has left EPA's Office of Radiation and Indoor Air to join DOE's Office of Energy Management, where she will continue to work on EMF issues....Dr. **Luciano Zaffanella** has opened the East Coast office of Enertech Consultants in Lee, MA. Previously, Zaffanella was at the EPRI/GE High Voltage Transmission Research Center in Lenox, MA. Enertech's headquarters are in Campbell, CA.

Finnish Childhood Cancer Study: No Link Reported; Others Unsure

Finnish researchers have concluded that they failed to find an excess cancer risk among children living near high voltage power lines. But other epidemiologists say that the Finnish results are consistent with past studies that show an EMF–cancer link.

"Our study shows no significant excess of leukemia, lymphoma or cancers overall in children exposed to residential magnetic fields," Dr. Pia Verkasalo of the department of public health at the University of Helsinki and coworkers wrote in their paper, published in the October 9 issue of the *British Medical Journal.*

Verkasalo's group investigated the incidence of cancer among children under 20 years of age who lived within 500 meters of 110, 220 or 400 kV overhead power lines between 1970 and 1989. Using a technique similar to the one used by Sweden's Maria Feychting and Dr. Anders Ahlbom (see p.2 and *MWN,* S/O92)—though developed independently—and data from the major Finnish power company, Imatran Voima Oy, the Finnish team calculated the magnetic fields in the children's homes for the years they were exposed.

Of the 134,800 children in the study, 140 had some type of cancer. Eleven of the children with cancer—five with nervous system tumors and three with leukemia—were exposed to 2 mG or more. These children had approximately double the rates of leukemia and nervous system tumors, but in each case the excess was not statistically significant. There was a 50% greater incidence of all cancers among those exposed to 2 mG or more, but here again, the result fell short of statistical significance.

"We think of this as a negative study," Verkasalo told *Microwave News,* but she added that she could not rule out the possibility of a small increased risk. A number of American and Swedish epidemiologists who heard Verkasalo present these results at the *5th Conference of the International Society for Environmental Epidemiology,* held August 15-18 in Stockholm, Sweden, interpret her findings differently.

"It is clear to me that their results are fairly consistent with the other studies showing effects," Ahlbom, of the Karolinska Institute in Stockholm, said in an interview. When asked if there was a conflict between Verkasalo's findings and those he reported with Feychting last year, Ahlbom replied, "Not at all."

Similarly, Dr. David Savitz of the University of North Carolina, Chapel Hill, told *Microwave News* that, "The overall pattern is entirely consistent with the Swedish results."

Both Ahlbom and Savitz stressed that the lack of statistical significance could be due to the small number of cases—there were fewer than in the Swedish study. Savitz noted that, "The Finnish study is so small that to achieve statistical significance, [the EMF–cancer risk] would have to be a huge effect." Verkasalo responded that her study could have detected a two- to threefold relative risk.

Verkasalo said that she is aware of Ahlbom's and Savitz's arguments. But, she added, "No link between magnetic fields and childhood cancer has been confirmed in previous epidemiological or biological studies—I don't think our study changes this, though the basic question of magnetic fields and cancer is still open."

Ahlbom and Verkasalo are collaborating in an effort to combine their data sets to increase the reliability of their risk estimates. "There are some differences that may make it difficult," Ahlbom cautioned. He pointed out that he and Feychting had done a case–control study, while Verkasalo did a cohort study.

The Finn's method of estimating magnetic field exposures is described in a paper published in *Electricity and Magnetism in Biology and Medicine,* M. Blank, ed. (San Francisco: San Francisco Press, 1993), pp.426-430.

Brain Tumors at St. Louis Paper Prompt Requests for EMF Study

The National Institute for Occupational Safety and Health (NIOSH) will do a preliminary investigation of a brain tumor cluster at the *St. Louis Post-Dispatch* in Missouri at the request of The Newspaper Guild (TNG). At least seven people, all of whom worked in the paper's fifth-floor newsroom, have been diagnosed with brain tumors since 1982; five of them have died, according to local guild officials.

"The brain tumor cluster at the *Post-Dispatch*—where high EMF readings have been reported—must be investigated," Dave Eisen, TNG's research and information director, in Silver Spring, MD, told *Microwave News.*

Investigations of previous cancer clusters in other office buildings have included the measurement of magnetic fields, but none determined that there was a connection between the two (see *MWN,* M/A93). The surveys were prompted by the more than 12 epidemiological studies that linked EMFs to brain tumors (see *MWN,* M/A90). Last year, an Australian study found that women who worked at cathode ray tube (CRT) computer monitors developed brain tumors at nearly five times the expected rate (see *MWN,* J/A92).

To date, there has not been a systematic survey of magnetic fields in the St. Louis newsroom. But Bill Allen, a *Post-Dispatch* science writer who did a special report on EMFs for the paper earlier this year, has taken a small sample of readings. He found telephone lines and power cables underneath the raised floor of the newsroom which he said are causing localized, high EMFs. For example, on the floor by the city desk, magnetic fields reached 80 mG. At lap level they measured 23 mG and at head level they were 11 mG, Allen said, noting that there were no video display terminals within five feet of where he took these measurements.

Meanwhile, tension at the paper has been growing over how to proceed. The local guild chapter has been seeking a government study of the cancer cluster for more than two years, but *Post-Dispatch* management has refused to cooperate. Recently, the publisher agreed to a study by a private group, according to the local's executive secretary, Herb Goodrick.

Published reports indicate that the *Post-Dispatch* has asked Washington University in St. Louis to investigate. Michael Hammett, the *Post-Dispatch*'s director of industrial relations, declined to comment, while Nicholas Penniman and Foster Davis, publisher and managing editor, respectively, did not return telephone calls seeking confirmation. Joni Westerhouse,

a spokeswoman for the Washington University School of Medicine, said that she could not say whether the university has an agreement with the paper.

NIOSH's Dr. Bruce Bernard, based in Cincinnati, said that the agency will most likely commit to a full-blown investigation but that it needs evidence that the majority of the *Post-Dispatch* staff members had primary brain tumors that were of a similar type. Bernard cautioned, however, that cancer cluster investigations generally do not yield answers when the study populations are small—as at the *Post-Dispatch*—and said that determining what EMF levels people were exposed to in the past could prove difficult. "If you measure today you may not show what was occurring 10 or 15 years ago," he said. The guild turned to NIOSH—which does not need permission from the paper to become involved—after *Post-Dispatch* management refused to agree to a study by the Missouri Department of Health.

"With the proportion of brain tumors of one sort or another, whether primary or not, I suspect that there is something that connects them; something in the workplace that creates this susceptibility," Jane Heitman, one of the two brain tumor survivors, told *Microwave News*. Heitman, who began working at the paper in the fifth-floor newsroom in 1973, was diagnosed with a brain tumor in 1982 at the age of 49. The other brain tumor survivor had been working there for ten years when he was diagnosed, while reports indicate that all five who died had worked at the paper for between 15 and 31 years.

Zuidema Request for New Trial Denied; Case Closed

Attorneys for the Zuidema family have failed to reopen their case against San Diego Gas & Electric Co. (SDG&E). On August 27, a California superior court judge in San Diego denied their request for a new trial. The deadline for an appeal to a higher court passed in late September and representatives for both sides now say the case is closed.

In a July 12 motion, Michael Withey, the Zuidemas' attorney, argued that the court had "committed several errors in law which prejudiced the plaintiffs' case, resulting in a verdict for the defendant." In an interview with *Microwave News*, Withey pointed, in particular, to the court's decision to bar his expert witnesses from discussing the scientific studies on which they based their opinions of an EMF–cancer link. The Zuidemas had claimed that their daughter's kidney cancer was caused by her exposure to power line EMFs (see *MWN*, J/A91, N/D92 and M/J93).

The court disagreed. In her written order, Judge Judith Haller said that the Zuidemas' attorneys had failed to show that the court had prejudiced the case against their clients.

SDG&E applauded Haller's order. "The judge's rejection of the motion confirms that the plaintiffs were given every opportunity at the trial to show that EMFs can make people sick, and the jury resoundingly rejected this in a very speedy verdict," said Greg Barnes, an SDG&E attorney.

Second EMF–Cancer Suit Set for November Trial in Georgia

The argument that power line magnetic fields cause cancer will be tested once again when the second EMF personal injury suit goes to trial on November 29. Lawyers for a woman with non-Hodgkin's lymphoma (NHL) say that their case is very different from the Zuidema lawsuit, which involved Wilms' tumor and was rejected by a jury last spring (see box above and *MWN*, J/A91, N/D92 and M/J93).

Lawyers for Nancy and Larry Jordan and their children, who live in Douglasville, GA, will seek to prove that Oglethorpe Power Co. and Georgia Power Co. are responsible for Nancy's condition. The utilities operate 230 kV and 46 kV lines, respectively, which are strung on a pole within 45 feet of the Jordans' bedroom, according to one of the family's lawyers, Bruce DeBoskey of Silver & DeBoskey in Denver, CO.

"These utilities can no longer stick their heads in the sand and deny the existence of any adverse health effects, including Nancy Jordan's cancer," DeBoskey told *Microwave News*. The suit charges negligence, trespass, nuisance and fraud, and asks for $5 million in compensatory and punitive damages. It was filed in Superior Court for Douglas County, GA, on July 24, 1991 (see *MWN*, S/O91, M/J92 and J/A92).

"Oglethorpe's position is that EMFs on the Jordans' property did not cause [Nancy's] disease or otherwise damage the Jordans' property," said James Orr of the Atlanta firm of Sutherland, Asbill & Brennan. Orr is representing Oglethorpe, which is based in Tucker, GA. Georgia Power's attorney, Robert Pennington of Troutman & Sanders in Atlanta, said that "the plaintiffs' case—that power line EMFs caused [Nancy's] cancer—will not be proven."

Magnetic fields in the Jordans' home range from 4 to 30 mG, DeBoskey said. Nancy moved into the house in 1983 and was diagnosed with breast cancer in 1986 and with NHL in 1989. Her lymphoma is now in an advanced state, according to her family. The breast cancer is in remission, DeBoskey said.

Several of the expert witnesses who testified in *Zuidema v. San Diego Gas & Electric Co.*—Drs. Bruce McLeod, David Ozonoff and Peter Wright—will also appear on the Jordans' behalf, as will Dr. David Carpenter, dean of the School of Public Health at the State University of New York in Albany, DeBoskey said. This marks Carpenter's first appearance as an expert witness in a trial. He was executive secretary of the New York State Power Lines Project's scientific advisory panel, which sponsored David Savitz's landmark study of childhood cancer and EMFs (see *MWN*, N/D86 and J/A87). The Jordans' other witnesses are Dr. Arthur Frank, chairman of the Department of Preventive Medicine and Environmental Health at the University of Kentucky School of Medicine in Lexington, Dr. Ben Johnson of Ben Johnson & Associates in Tallahassee, FL, and Roy Martin, an electrical engineer in Atlanta.

Neither Oglethorpe's Orr nor Georgia Power's Pennington would say who they will use as expert witnesses. DeBoskey said that their experts could include: Dr. Scott Baker, formerly of the Environmental Protection Agency; Dr. Richard Bland, a clinical radiation oncologist in Carrollton, GA; Dr. Edwin Carstensen of

the University of Rochester, NY; Dr. Philip Cole of the School of Public Health at the University of Alabama, Birmingham; Fred Dietrich of Electric Research and Management Inc. in Pittsburgh; and Dr. Saul Rosenberg of Stanford University Medical Center in Palo Alto, CA. Carstensen, Cole and Dietrich have testified on behalf of a number of utilities (see *MWN*, M/A93), while Rosenberg testified for Kustom Signals Inc. in the first police radar suit (see *MWN*, J/F93).

Last spring, Trial Lawyers for Public Justice, a public-interest legal group in Washington, drew attention to the Jordan case when it moved to block Oglethorpe's request for a protective order that would have permitted the utility to keep certain documents out of the public file. The utility later withdrew its request (see *MWN*, M/J92 and J/A92).

The Effect of EMFs on Property Value: Four Noteworthy Cases

Across the country, utilities seeking rights-of-way (ROWs) for new power lines are faced with landowners who want compensation for losses in property value due to EMFs. In at least two cases, juries appear to have rejected the landowners' claims, deciding that the real estate market has not been affected by the EMF issue. But, in a third condemnation case, involving the Bonneville Power Administration (BPA), the property owners' attorney has claimed a victory. A fourth case is pending. (See also, p.2.) A review of these cases follows:

Redding, CA

The Transmission Agency of Northern California (TANC) will pay landowners Lewis and Mary Westlake, who live near Redding, CA, a total of $540,000—less than they had requested for damages due to EMFs—to condemn 52 acres for an ROW for a new power line. The decision was reached on July 9 by a Superior Court jury in Shasta County.

The award includes $300,000 for the land and $240,000 for damages from the impact the power line will have on adjacent property, lawyers on both sides of the case told *Microwave News*. But neither of the attorneys could say if, or how much, the jury had compensated the Westlakes for the effects of EMFs.

At the trial to decide the compensation, the Westlakes' lawyer, Clement Glynn of Glynn, Cella & Lange in Walnut Creek, sought to show that the value of their property would be reduced because homes could not be built on property near the line. "A prudent developer would incorporate a 'setback' area to avoid placing residences within an elevated magnetic field," stated Cindy Sage, an environmental consultant based in Montecito, who testified for the landowners.

But Ivor Samson of the San Francisco firm of Marron, Reid & Sheehy, who represented the Sacramento-based agency, said that the jurors did not accept Glynn's approach. "The size of the verdict tells me that the jury didn't buy Sage's argument," he said. "If they had, the award would have been substantially higher." Samson said that his client was "quite pleased" with the decision. In settlement negotiations, TANC had offered to pay $450,000 for the property, while the landowners said that they wanted $1.5 million.

The Westlake property falls in the path of TANC's California-Oregon Transmission Project, a 340-mile, 500 kV transmission line, which will stretch between southern Oregon and the San Francisco Bay Area (see *MWN*, J/F87). The condemned property is part of a 1,000-acre parcel that the couple plans to develop for residential use.

Glynn had wanted to introduce evidence on the health effects of EMFs, but was barred from doing so by the court after TANC's attorneys argued that it was not relevant. "Any evidence involving the merits or substance of the controversy, including that EMFs might cause certain types of biological injury, [should be] inadmissible," according to a motion by TANC. Samson said that the only issue in question in this case was whether "the controversy over the potential health effects of EMFs has an impact on fair market value due to buyer concern."

Samson said that he would be surprised if TANC chose to appeal, while Glynn said that his clients have not yet decided whether to do so.

Overland Park, KS

A Kansas jury has found that there was "not enough evidence to show that the real estate market is reacting to fear about EMFs," according to Greg Musil of the firm of Shughart, Thomson & Kilroy in Overland Park. Musil represented property owner Jim Grier in his case against Kansas City Power & Light (KCP&L), which wants to take over a 40-foot by 2,600-foot strip of land on 27 undeveloped acres Grier owns in Overland Park. The Kansas City, MO-based utility is planning a two-mile, 161 kV power line, said company spokesman David Martin.

On March 16, jurors at the Johnson County District Court in Olathe, KS, awarded Grier $121,700 for the condemnation. KCP&L had initially offered $60,000, and later agreed to pay "up to $150,000" to settle, according to Martin. But Grier refused, Musil said, because he wanted about $1 million from KCP&L, contending that EMFs from the proposed power line would reduce the amount of money potential buyers would pay for the adjacent property.

Musil said that at the trial he had argued that a potential buyer would react to the power line by not purchasing the land, or by offering a lower price for it, because the presence of EMFs would restrict full development of the property. He said that the jury's decision did not "properly reflect [the opinion] that is out there among sophisticated buyers" and that "the jurors didn't value the land the way a buyer would in the real world." Grier's 27 acres have been for sale "on and off" for a number of years, Musil said.

KCP&L's Martin said that even though the utility has been receiving a growing number of calls for information about EMFs, he does not believe that the Kansas City real estate market has been affected.

Yakima, WA

A jury in Yakima, WA, has awarded Lorne and Jeanne Dunning $242,000 for part of their ranch in Ellensburg, where BPA wants to build a substation. Although the March 31 jury verdict does not specify the basis for the award, the couple's

lawyer said that it was due, in part, to EMFs. "The jury recognized that there is a stigma about power lines, as there is about other environmental hazards," said the Dunnings' lawyer, Arley Harrel of the Seattle firm of Williams, Kastner & Gibbs. The case was heard in federal court for the Eastern District of Washington.

On June 23, 1992, at the utility's request, the U.S. Attorney's office in Spokane sought to acquire 134 acres of the Dunnings' 2,500-acre ranch. BPA wanted to pay $41,600 for the condemnation, but the Dunnings asked for $342,000.

Harrel argued that the Dunnings should be compensated for the negative impacts of the substation, including: loss of view (the substation will stand 120 feet high); loss of access to prime cattle-grazing land; and EMFs—their effects both on health and on property value.

BPA's Dulcy Mahar said that although the jury may have felt that the Dunnings should be compensated for the effects of the substation—including EMFs—another reason might also have led to the decision. Jurors may have had a perception "that BPA has deep pockets," she said in a telephone interview. The substation will cost about $35 million to build, she added. It will be one of the largest in BPA's system and is intended to upgrade the supply system for the Puget Sound area, the fastest growing region in the Pacific Northwest.

The Justice Department, on behalf of BPA, has made a motion for a new trial, contending that certain evidence—such as the cost of the substation—should not have been admitted, Mahar said.

San Clemente, CA

The California Supreme Court has rebuffed San Diego Gas & Electric Co.'s (SDG&E) motion to dismiss an EMF lawsuit which charges loss of property value, trespass, nuisance and emotional distress. This is the third time a court has refused to grant an appeal by the utility to drop the case, which was brought by a group of homeowners in San Clemente. The case was returned to the Superior Court in Orange County on July 15. A trial date has not been set.

On November 13, 1992, Mark and Cheryl McCartin, along with 22 neighbors, filed a lawsuit charging that SDG&E failed to warn them about the presence of high EMFs from power lines adjacent to their land, that it "lulled them into a false sense of security" about potential EMF health effects and that it upgraded the power lines without notice. Magnetic fields on the properties now measure between 7 and 11 mG, the group's lawyer, Michael Withey of Schroeter, Goldmark & Bender in Seattle, told *Microwave News*.

On March 31, 1993, Superior Court Judge James Ross denied the utility's motion to drop the case, but he did agree to throw out the homeowners' request for compensation for medical monitoring. The McCartins and their neighbors had claimed that they would incur ongoing medical expenses for the "monitoring and detection of cancer, malignancies and other such life-threatening diseases" which have been linked to exposure to EMFs. Early detection is key in treating these diseases, they said.

SDG&E then argued that the issues raised in the claim should be debated before the Public Utilities Commission (PUC), but on May 25 the Court of Appeals rejected this argument, in effect supporting the idea that the case should be settled by a jury trial. One justice sided with the utility, however: "Like the proverbial bull in a china shop...the present lawsuit (and others which will inevitably follow) will undermine the PUC's efforts" to regulate the siting of power lines, he wrote, adding that the suit is "a preview of the festival of junk science about to embark on a tour throughout the courts of our state."

Withey disagreed with this minority view. "As a matter of public policy it's horrendous—it would remove the right of a jury trial for every EMF case in California," he said, adding that "the PUC is not set up to arbitrate or adjudicate claims between property owners and utilities."

"I don't think you can have a consistent policy of siting power lines if PUC policy can be second-guessed across the state," contended SDG&E's lawyer, Frank Rothrock of Palmieri, Tyler & Wiener in Irvine, CA. "It seems unreasonable and not even feasible."

HIGHLIGHTS

Federal Officials Boycott Cellular Phone Health Research Meeting

The Cellular Telecommunications Industry Association (CTIA) sponsored a symposium on September 30 that was designed, according to the invitation, "to help us focus on the most appropriate research agenda" for CTIA's $15 to $25 million research initiative. But scientists from key federal agencies—including the Food and Drug Administration (FDA), the Federal Communications Commission (FCC), the Environmental Protection Agency (EPA) and the National Institute for Occupational Safety and Health—declined to attend. A second meeting has been scheduled for late October in the hope of involving some of these officials.

Who actually attended the symposium, which was held in Research Triangle Park, NC, remains a mystery. Dr. George Carlo, who organized the session and heads the CTIA program, declined to release any names or affiliations, saying only that 25 or 30 individuals from industry, government and academia came to the meeting.

In a September 14 letter to Carlo, Dr. Elizabeth Jacobson, deputy director for science at FDA's Center for Devices and Radiological Health (CDRH) in Rockville, MD, questioned whether the entire CTIA program will be "objective or credible," and she wrote that FDA researchers would not attend the symposium. (In a previous letter, dated July 19, Jacobson was sharply critical of CTIA officials, complaining that they were portraying FDA's role in the research program inaccurately; see *MWN*, J/A93.) She noted that the people planning the research are, "for the most part, known for their conviction that subthermal exposure to microwave energy cannot interact with biological systems in any adverse way." And she pointed out that, at an August 17 meeting with Carlo, CDRH's Dr. Mays Swicord had suggest-

GAO Report Due Next Spring

The General Accounting Office (GAO) is preparing a report on the possible health risks posed by cellular telephones and plans to have it completed by next spring.

Paul O'Neill, who is in charge of the GAO investigation, said he could not comment because of the "especially sensitive" nature of the topic. He did say, however, that his researchers are focusing more broadly than the report's title —*FCC Standards for Human Exposure to RF Radiation from Cellular Telephones*—would suggest.

Indeed, GAO officials have asked a number of federal agencies, including the FCC, FDA, EPA and Department of Defense, to assess what risks hand-held cellular phones pose. They have also asked for descriptions of any ongoing research that addresses whether cellular phones could be linked to an increased cancer risk, according to a letter obtained by *Microwave News* that GAO sent to one of the agencies.

The investigation was requested last January by Rep. Ed Markey (D-MA), who is chairman of the subcommittee on telecommunications and finance of the House Energy and Commerce Committee (see *MWN*, J/F93).

ed that additional scientists were needed to ensure balance. "Judging from the list of participants for the September 30 meeting... this kind of broad scientific representation was not achieved."

Carlo countered that the decisions to decline his invitations were due to "confusion about the purpose of the meeting" that was the result of "bad information" from the FDA. Carlo, who is chairman of Health and Environmental Sciences Group, a consulting firm in Washington, told *Microwave News* that he sorted out the misunderstandings at a September 22 meeting with Jacobson. Indeed, in a more conciliatory letter to Carlo, dated September 23, Jacobson said the FDA would send representatives to an October 27 session in Washington. "Please understand that our desire is for this process to lead to a research program capable of yielding significant scientific data that will be helpful to FDA in establishing public health policy," Jacobson wrote.

The group charged with writing CTIA's research agenda consists of Carlo, Dr. Bill Guy, formerly of the University of Washington, Seattle, and Dr. Ian Munro, formerly of Health & Welfare Canada. A draft should be completed by mid-November, Carlo said, and it will then be given to the nine-member review panel he has established.

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Police Radar Injury Litigation After Bendure: An Update

Almost half of the injury claims filed by police officers against manufacturers of traffic radar guns have now been dismissed. No damages have been awarded by the courts, and no money has been paid by the manufacturers to settle cases.

Last January, in the first and only trial of a police radar–cancer case, a federal court jury in California rejected Officer Eric Bendure's claim that use of traffic radar caused his non-Hodgkin's lymphoma (see *MWN*, J/A92 and J/F93). Since then, several other lawsuits have been abandoned, bringing to at least nine the number of cases resolved in favor of the manufacturers.

Four new cases have been filed this year, however, for a total of ten claims in five states that are still pending or being pursued. (A table of cases, showing how each was resolved or its current status, appears at right.)

The claim brought by Officer Thomas Malcolm of the Windsor Locks, CT, Police Department (see *MWN*, S/O91) could be the next case to go to trial. Malcolm, who has testicular cancer, is suing Kustom Signals Inc. of Lenexa, KS. "The odds are against us," explained his attorney, Stuart Rothenberg. "But we are still in the game and we will take it as far as it can go." Discovery is completed, Rothenberg said, and a trial date is expected this year.

John Wykoff, who is lead counsel for radar manufacturer MPH Industries Inc. of Owensboro, KY, predicts more dismissals soon. "I am seeing a pattern," he said. When cases reach the point at which experts must be selected—and paid—plaintiffs' attorneys seek dismissal, Wykoff said: "The plaintiffs are just not coming up with the experts to support their claims."

The claim brought by Officer William McGuigan, for example, was withdrawn just before a trial was to begin last May. "[O]ur office, and our clients, have concluded that there is not yet sufficient scientific information...to clearly produce a strong case that radar guns, as used by our client in particular, cause cancer," wrote McGuigan's attorney, James Thompson.

Others have cited lack of money, not lack of evidence, as the main difficulty in pursuing this litigation. Attorney John Sweeney, who filed the first police radar claims (see *MWN*, M/A91, J/A 91 and S/O91), including Bendure's, has now dropped all of his cases. "We put a fortune into the cases we did pursue," said Sweeney, who has previously estimated that Bendure's lawsuit cost his firm $150,000 in direct expenses and as much as $750,000 in attorney-hours.

Notes to Police Radar–Cancer Cases Table

* Names in **bold** denote active cases; some lawsuits name relatives or the estate of the police officer; police departments are for identification only; the department named is the most recent employer; dec.=deceased.
‡ MPH was named in the original complaint but was dropped prior to trial.
¶ Five insurance companies are also named as defendants.
§ Kustom and Decatur were named in the original complaint but were later dropped; General Electric Co. was added as a defendant prior to the entire case being withdrawn.
† Two firms that serviced the units, Raytheon Service Co. and RF Communications Co., were also named as defendants.
¥ Decatur Electronics Inc. of Decatur, IL, denies it manufactured the unit in question in this case.

Police Radar–Cancer Cases

Plaintiff *	Date Filed/Court	Defendants	Type of Cancer	Status
Hyman Rosen [A] U.S. Park Police (dec.)	March 12, 1991, Federal, N. District of CA	Kustom Signals Inc. [1]	Melanoma (back of neck); diagnosed 1986	Withdrawn by plaintiffs; dismissed without prejudice, Feb. 7, 1992
Eric Bendure [A] Petaluma (CA) Police Department (PD) (dec.)	April 18, 1991, Federal, N. District of CA	Kustom ‡	Non-Hodgkin's lymphoma (originated in right groin); diagnosed Feb. 1989	Jury decision for defendants, Jan. 20, 1993
Leo Hutchison [A] Petaluma (CA) PD (dec.)	April 18, 1991, Federal, N. District of CA	Kustom, MPH Industries Inc. [2]	Non-Hodgkin's lymphoma; diagnosed March 1985	Plaintiff died, April 25, 1992; case withdrawn; deadline for refiling has passed
Thomas Malcolm [B] Windsor Locks (CT) PD	April 1991, Federal, District of CT	Kustom	Testicular	Discovery completed; trial date expected later this year
Steven Cottini [A] Concord (CA) PD	Sept. 10, 1991, Federal, N. District of CA	Kustom, MPH	Testicular	Withdrawn by plaintiffs; dismissed with prejudice, July 1993
Arnold Sudbrink [A] [C] WI State Patrol (dec.)	Sept. 13, 1991, Circuit Court, Eau Claire County, WI	Kustom ¶	Melanoma (eye)	Withdrawn by plaintiffs, fall 1992; dismissed with prejudice, Feb. 1, 1993
David Berndt [A] [D] Grand Rapids (MI) PD	Nov. 8, 1991, Circuit Court, Kent County, MI	MPH §	Testicular; diagnosed Jan. 1988	Withdrawn by plaintiffs; dismissed with prejudice, July 1993
Richard Rein [E] Ft. Lauderdale (FL) PD	1991, Circuit Court, Broward County, FL	MPH	Testicular	Plaintiffs have missed deadline for disclosing expert witnesses
William McGuigan [F] Belmont (CA) PD	Jan. 16, 1992, Superior Court, San Mateo County, CA	Kustom	Myxoid liposarcoma (left thigh)	Withdrawn by plaintiffs, April 1993; dismissed with prejudice
Wayne Vessels Jr. [G] OH State Patrol (dec.)	March 23, 1992, Federal, S. District of OH	Kustom, MPH	Basal and squamous cell carcinoma; diagnosed 1977	Plaintiff died, Dec. 1992; case withdrawn; may be refiled as a wrongful death suit
Steven VanDerAa [H] IN State Police	March 27, 1992, Federal, N. District of IN	Kustom, MPH	Testicular	Discovery; trial not expected before 1994
Eric Vedborg [I] Santa Ana (CA) PD	April 14, 1992, Superior Court, Orange County, CA	Kustom, MPH †	Malignant melanoma (calf); diagnosed 1991	Withdrawn by plaintiff; dismissed with prejudice, Sept. 1993
Rory Coontz [J] CO State Police	June 1, 1992, Federal, N. District of IL	Kustom	Testicular; diagnosed May 1991	Case withdrawn due to jurisdictional problems, June 18, 1992
Vincent Casertano [B] Shelton (CT) PD	Aug. 1992, Federal, District of CT	MPH	Thyroid	Case dismissed by the court for procedural reasons; may be refiled
Cary Davis [H] IN State Police	Dec. 28, 1992, Federal, N. District of IN	MPH, Decatur Electronics Inc. ¥	Testicular	Early stages of discovery; trial not expected before 1994
Peter Fortunato [K] Broward County (FL) Sheriff	May 1993, Circuit Court, Broward County, FL	Kustom, MPH	Testicular	Early stages of discovery
James Edwards [L] Mason (OH) PD (dec.)	June 2, 1993, Court of Common Pleas, Warren County, OH	Kustom, MPH	Acute leukemia; diagnosed Jan. 1992	Early stages of discovery
Stewart Hauck [L] Mason (OH) PD	June 2, 1993, Court of Common Pleas, Warren County, OH	Kustom, MPH	Multiple myeloma; diagnosed June 1991	Early stages of discovery
Harold Moser [M] PA State Police (dec.)	Aug. 20, 1993, Federal, Middle District of PA	Kustom Decatur	Stomach	Discovery not yet begun

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Godfrey's new policy was prompted by Dr. Cletus Kanavy, chief of the biological effects group at Phillips' Electromagnetic Effects Division. In an October 29, 1992, memo to Godfrey, Kanavy concluded, based on a survey of the scientific community engaged in RF/MW radiation bioeffects research, that there is a "consensus" that "nonthermal effects do exist and that the ANSI/IEEE standards are deemed inadequate to protect human health."

In an accompanying White Paper, which has been circulated within the U.S. Air Force, Kanavy noted that, "The literature published in the late 1980s is abundant with information on nonthermal effects which are produced at levels below the ANSI standards." In the ANSI/IEEE standard, he added, "The existence of nonthermal effects is essentially denied by omission." (The text of the White Paper appears on p.12.)

Kanavy reiterated the need for a more stringent standard in a September 1, 1993, letter to the Environmental Protection Agency (EPA). "We have long felt that the athermal effects were real and that a [continuous wave]/thermal standard was not sufficient for human exposure protection," he wrote. Kanavy is hospitalized with a grave illness and was unavailable for an interview.

A spokeswoman at the Phillips Lab's Office of Public Affairs noted that the new RF/MW limits, codified in "Standard Operating Instruction No.1-93," apply only to the AWSD and not to other parts of the Air Force. A service-wide change would require a "Policy Directive," she said. She referred all other questions to the Armstrong Laboratory at Brooks Air Force Base (AFB) in San Antonio, which is responsible for the Air Force RF/MW exposure standards.

Neither John Mitchell, the director of the Occupational and Environmental Health Directorate, nor Dr. David Erwin, the chief of the RF Radiation Division, both at the Armstrong Lab, was available for comment, according to Lawrence Farlow of the Armstrong Office of Public Affairs.

Relations between the Phillips and Armstrong Labs have been strained since Kanavy began voicing concerns over the potential health threats to Phillips employees exposed to RF/MW radiation (see p.1).

In May 1991, the Ground Systems Group of the Hughes Aircraft Co. in Fullerton, CA, formally adopted the JHU-APL exposure standard. Eduardo Villaseca, until recently a senior scientist at Hughes' Fullerton RF/MW Laboratory, told *Microwave News* that the move was prompted by studies by JHU-APL's Henry Kues and the Food and Drug Administration's Jack Monahan on the effects of RF/MW radiation on the eyes. The Fullerton facility, where high-power military radars are developed and tested, had used the JHU-APL guidelines on an unofficial basis since 1988.

In a series of studies over the last ten years, Kues and Monahan have shown that RF/MW radiation at specific absorption rates below 4 W/Kg can cause persistent eye damage (see *MWN*, J/A83, S/O86, J/A87, J/A88 and S/O91). The ANSI/IEEE limits are based on the assumption that there are no adverse health effects of RF/MW radiation below 4 W/Kg. The IEEE subcommittee that drafted the 1992 standard largely ignored the Kues–Monahan work, as well as other research showing low-level effects (see *MWN*, M/A89).

Villaseca stressed that "the adoption of the Johns Hopkins recommendations has not resulted in any significant additional costs, while improving the personnel electromagnetic environment."

In an interview with *Microwave News*, Harvey Hall, the safety officer at JHU-APL, also said that the standard had not been hard to meet: "We can live with our operating standard." The lab's 100 $\mu W/cm^2$ limit can be exceeded under certain circumstances, he said, but it has never been necessary.

Late this summer, Villaseca was laid off by Hughes and it is not clear whether the 1991 standard will remain in place. "Things are changing," Eric Rowsey, a specialist in safety and environmental affairs at Hughes' Aerospace and Defense Sector in El Segundo, CA, said in an interview. "We are attempting to standardize exposure limits within our sector of the Hughes Aircraft Co." While he would not specify what the standard might be, he said that, "We may, by consensus, agree on a standard that is more stringent than the controlled environment guidelines adopted by the IEEE."

While many health standards specify different exposure limits for workers and for the general public, the IEEE standard takes a less conventional approach—it differentiates between "controlled" and "uncontrolled" environments.* This distinction has generated some controversy as a result of the Federal Communications Commission's (FCC) proposal to adopt the IEEE/ANSI standard for its own use (see *MWN*, M/A93).

In comments submitted to the FCC, Gerald Markey, the manager of the Spectrum Engineering and Policy Division at the

Phillips Lab's Instruction on RF/MW Radiation Exposures

The following is excepted from Standard Operating Instruction No.1-93, adopted on June 15, 1993, by the Advanced Weapons and Survivability Directorate at the Phillips Lab:

All experiments will be conducted in a manner which insures personnel exposure to ionizing and non-ionizing radiation is minimal. Laboratory experiment directors will limit human exposure to ambient laboratory environments unless authorized in advance by the Safety Review Panel. The ambient environment is defined as 0.1 mW/cm^2 (averaged over six minutes) for continuous wave (CW) and pulsed narrow band sources. In special situations, the Safety Review Panel can authorize exposures up to the ANSI standard. Exposures above the ANSI standard can only be authorized by Armstrong Laboratory. Pulsed narrow band sources are defined as having pulse rise times longer than 10 nanoseconds. The human exposure limit for pulsed wide band sources (pulse rise times shorter than 10 nanoseconds) will be determined by Armstrong Laboratory for each source. In cases where no limit has been provided, a default value of 0.025 mW/cm^2 (10 V/m), averaged over six minutes, and with a peak value of less than 1 kV/m, will be used. These human exposure guidelines/regulations will be strictly observed.

* The IEEE defines a "controlled environment" as a location where an exposure "may be incurred by persons who are aware of the potential for exposure as a concomitant of employment, by other cognizant persons or as the incidental result of transient passage through [certain] areas." For 100-300 MHz, the guidelines for uncontrolled exposures are five times more stringent than those for controlled environments. An "uncontrolled environment" is defined as a location "where there is the exposure of individuals who have no knowledge or control of their exposure."

Federal Aviation Administration (FAA) in Washington, said that he is refusing to apply the controlled environment limits to FAA employees, as would be stipulated by the ANSI/IEEE standard. In his August 20, 1993, letter, Markey wrote that, "The FAA objects to the establishment of two standards for the management of exposure to RF radiation and will continue to use the more conservative 'uncontrolled environment' criteria for all areas within the FAA's responsibility."

Staffers at the EPA will also be submitting written comments to the FCC (see *MWN*, J/A93), which, sources told *Microwave News*, will be sharply critical of the ANSI/IEEE standard. In early August, the FCC extended the comment period for its proposal until November 12, with reply comments now due by December 13.

In June, the city of Los Angeles adopted an ordinance limiting RF/MW radiation from satellite dishes owned and operated by the Fox Studios in West Los Angeles to 10 $\mu W/cm^2$ in publicly accessible areas. Shirley Linde, a founder of Citizens for Safer Electromagnetic Fields, had urged the Los Angeles Planning Commission to take a conservative approach in regulating RF/MW exposures, citing Villaseca's concerns over the inadequacy of the ANSI/IEEE standard. Linde now chairs the National EMF Advisory Committee (see *MWN*, M/A93 and J/A93).

U.S. Air Force v. U.S. Air Force *(continued from p.1)*

these effects "are produced at levels below the ANSI standard." (See p.12 for the full text of the White Paper.)

In his memo, Kanavy said that a "consensus" of RF/MW researchers outside of Armstrong called for establishing a national program "to investigate the biological effects of electromagnetic radiation under the auspices of an independent committee" and for "seriously" reviewing a Department of Defense decision to locate the non-ionizing radiobiology research center at Armstrong Laboratory (see *MWN*, J/A92).

Erwin, the chief of the Radiofrequency Radiation Division at the Armstrong Lab, responded that his team had reviewed and attempted to replicate claims "concerning athermal and other unsubstantiated bioeffects" of RF/MW radiation. "Although we still accept the possibility, we have not yet seen any good evidence for athermal bioeffects...much less that they adversely affect health." To use claims of such effects to revise U.S. health standards "would be alarmist," Erwin added in a January 11, 1993, letter to Dr. Brendan Godfrey, Kanavy's superior at the Phillips Lab. Erwin was not available for an interview.

Erwin and coworkers' views are well known. The Armstrong group was very critical of the 1990 EPA report that linked non-ionizing radiation to cancer. In detailed comments, they argued that the observations on which EPA relied could be attributed to heat-induced stress. Erwin even suggested that EMF effects on the pineal gland were heat-related (see *MWN*, N/D90).

Even before Kanavy, others have criticized the Air Force, and the Armstrong group in particular, for refusing to accept data showing nonthermal interactions. For instance, in a letter published in the February 1991 *Health Physics*, Dr. Dennis Hjeresen of Los Alamos National Lab in New Mexico wrote that, "The U.S. Air Force [Armstrong Laboratory] has consistently suggested to us that there are no effects of low-level microwave exposure despite evidence to the contrary presented in the peer-reviewed literature."

Dr. Ross Adey, a leading researcher at the VA Hospital in Loma Linda, CA, has also faulted the Air Force's views. At a hearing before a U.S. Senate subcommittee in August 1992, Adey testified that, "As a matter of policy, the Air Force denies existence of biological effects attributable to *athermal* fields. Nevertheless, evidence for athermal bioeffects is incontrovertible for both low-frequency and [RF] exposures" (see *MWN*, S/O92).

At the *1st World Congress for Electricity and Magnetism in Biology and Medicine*, held in Orlando, FL, in June 1992, Dr. Edward Elson of the Department of Microwave Research at the Walter Reed Army Institute of Research (WRAIR) in Washington also took on the Armstrong group. In the course of presenting a paper that challenged the adequacy of the ANSI/IEEE standard, Elson predicted that his research on high-power microwaves would be stopped if the responsibility for it were transferred to Erwin's lab in San Antonio—a move that is now under way (see *MWN*, J/A92).

Kanavy, the chief of the biological effects group at Phillips' Electromagnetic Effects Division, who holds both a medical degree and a doctorate, has been a major irritant to Erwin's group, at least in part because Kanavy knows his way around Washington. Over the last few years, Kanavy has briefed a number of U.S. Senate aides. One observer offered the following example of Kanavy's political clout: "A highly placed official at Kirtland tried to put Kanavy in a closet, but Kanavy went to his friends in the Senate and a message came back from a senior person at the Department of Defense to leave him alone."

Tensions between Kanavy and the Armstrong group reached a climax at a small seminar on the *Biological Effects of Microwave Radiation* held at the University of New Mexico, Albuquerque, on November 12, 1992. Only about 25 researchers were invited, including one representative of the Armstrong Lab. But when two members of Erwin's group, James Merritt and Johnathan Kiel, showed up instead, Kanavy insisted that they leave, according to a number of those present.

Dr. Michael Wilcox of the University of New Mexico School of Medicine, the organizer of the seminar, pointed out that Merritt and Kiel were able to hear essentially the same presentations at a classified briefing held the following day at the Los Alamos National Lab. Wilcox, who has been collaborating with Kanavy over the last three years, declined to reveal who from Armstrong had been invited originally.

Wilcox is working with Dr. Robert Kelley, the chair of the department of anatomy at the medical school, to establish a research consortium to study RF/MW bioeffects. "We want to clear the air about nonthermal effects," Wilcox said in a telephone interview, adding that, "I believe that they do exist." He said that preliminary experiments at the university support his view.

"There is no proof that the [ANSI/IEEE] standard is detrimental to health—if you want proof, you have to do the experiments," Wilcox said. He noted that he favored a conservative approach to protect health: "An ounce of prevention is worth a pound of cure."

One of the objectives of Kanavy's proposed national re-

Biological Effects of Microwave Radiation: A White Paper

The White Paper reproduced below was written by Dr. Cletus Kanavy, the chief of the biological effects group of the Phillips Laboratory's Electromagnetic Effects Division at Kirtland Air Force Base, NM, in October 1992. The references at the end of Kanavy's paper are omitted here.

The biological effects of microwave radiation on living organisms have been the subject of extensive research for the past four decades. The most comprehensive programs were conducted by the Soviet and Eastern Bloc nations. The U.S. has lagged behind badly in this area of research. Initially, the principal concern for human exposure to microwave radiation was that of thermal heating of the tissues. Permissive exposure limits were based on such criteria. Since the 1970s this limit has been progressively set at lower levels of average field power density for the classical six-minute time average period. These limits, which are published as the American National Standards Institute (ANSI) microwave standards, are actually derived by the Institute of Electrical and Electronics Engineers (IEEE). Under IEEE, a blue-ribbon panel of experts periodically reviews the research database and assesses the need to revise the standards. Until 1991, these standards did not consider the possible biological effects of "pulsed" microwaves. The 1991 standards do address the pulse condition (rather shabbily, I believe), place restrictions on the number of pulses per six-minute time period as a function of pulse width, and continue to use the continuous wave time averaging technique for thermal criteria. The existence of nonthermal effects is essentially denied by omission.

The U.S. research community was aware of the Soviet findings of deleterious biological effects at exposures well below the ANSI standards. The Soviet findings were rejected for various reasons. The principal reason was that U.S. attempts to duplicate the Soviet results were reportedly not successful. It was not until the mid-1980s that U.S. researchers began to successfully duplicate Soviet experimental results and began a research program to expand upon and further test the Soviet nonthermal theories.

Since March 1991, we have been conducting a comprehensive search of worldwide literature on the results of experimentation regarding biological effects produced by microwave radiation. The results of this search have been consolidated into a computerized database which we have shared with the Armed Forces Medical Intelligence Center and the Central Intelligence Agency. We attempted to share the database with the Armstrong Laboratory. A list of the holdings in the database was presented to Dr. Dave Erwin of Armstrong who proceeded to "line-out" the publications of researchers he believed not to be credible. These were researchers who were reporting the positive existence of nonthermal effects.

The literature published in the late 1980s is abundant with information on nonthermal effects which are produced at levels below the ANSI standards. These are essentially chronic exposure effects at low levels of average field power densities. Researchers stress the chronic, nonthermal nature of these effects as opposed to acute exposure thermal effects. Ample experimental evidence exists from credible researchers from well-established and highly regarded institutions, both government and university, to justify a national research program into the full spectrum of biological effects of electromagnetic radiation.

The principal electromagnetic biological effects of greatest concern are behavioral aberrations, neural network perturbations, fetal (embryonic) tissue damage (inducing birth defect), cataractogenesis, altered blood chemistry, metabolic changes and suppression of the endocrine and immune systems. The verification of blood–brain barrier suppression should have a high priority. The passage of normal blood-borne toxins into the brain could explain some previously observed early behavioral aberrations, loss of physical endurance and functional central nervous system and perceptual changes. A large amount of data exists, both animal experimental and human clinical evidence, to support the existence of chronic, nonthermal effects. The Soviet studies of humans under occupational conditions report marked functional changes, sometimes accompanied by histological and biochemical changes, under the chronic influence of microwaves at power densities ranging from fractions of microwatts to a few milliwatts per square centimeter. Research to date has concentrated on determining the psychological/physiological effects (changes) produced by electromagnetic fields of various power densities, carrier frequencies and modulation rates. These results are the macroscopic part of the issue. The microscopic part of the issue urgently needs to be addressed—namely the physical mechanisms behind the various observed biological effects. Various theories and interaction models exist to explain, in a limited way, some of these physical mechanisms for specific effects. None have yet been positively verified. This is believed to be a key issue which needs to be addressed as soon as possible....

Other areas of concern center on the uninvestigated human response to high peak, low average power, moderate to high pulse repetition frequency microwave fields. The relationships between these variables and specific human responses should be of prime importance to the directed energy weapon (DEW) development programs. The ability of certain modulation frequencies imposed on various carrier frequencies to affect (lock onto) circadian rhythms poses a formidable research problem. A principal question raised is the existence of "frequency windows" and resonances associated with certain physiological and psychological responses. The past several issues of *Bioelectromagnetics* have contained many articles by prominent U.S. researchers which report nonthermal effects. New concerns are also forthcoming, i.e., bioeffects of ELF and electromagnetic fields in close proximity to high voltage power lines and transformer banks. Thus the entire issue of human interaction with electromagnetic (RF & microwave) radiation is pushing forward as a major national population health concern.

search program is to monitor the health of Kirtland employees exposed to RF/MW radiation. Erwin, however, rejects this idea. In his January letter to Godfrey, Erwin appended four different memos—one from an epidemiologist, one from a lawyer and two from members of his research group—to counter Kanavy's arguments for a long-term health monitoring program of high-power microwave workers at the Phillips Lab. He concluded that, "The consensus opinion is that such a limited program would yield no legal or scientific benefit to the Air Force and might even have a negative impact."

Despite all the criticisms, Erwin's plan to consolidate all Department of Defense research on non-ionizing radiation is proceeding. The microwave lab at WRAIR has closed down and the equipment has been shipped to the Armstrong Lab. The Naval Aerospace Medical Research Lab in Pensacola, FL, is scheduled to move to San Antonio next summer.

JASONs on EMFs and Health

In January 1992, at the request of the Department of Energy (DOE), a team of scientists called the JASONs—best known for their work on behalf of the Department of Defense—held a seminar on electromagnetic fields (EMFs) in La Jolla, CA (see MWN, *J/F92). Following a second seminar in July 1992, Dr. Steven Koonin, a physicist at the California Institute of Technology in Pasadena, prepared a report for DOE's Dr. Robert San Martin in Washington.* Microwave News *obtained a copy of his October 15, 1992, report. It is reprinted below.*

Dear Dr. San Martin:

I am writing to convey to you the results of the JASON study on biological effects of EMFs. We heard one day of presentations on January 24 from Dr. D. Thomas (epidemiology), Dr. W.R. Adey (biological mechanisms) and Dr. T. Litovitz (whole animal experiments). On July 17, we heard from Dr. J. Kirschvink (magnetite in human brains), Dr. M. Walker (biomagnetic phenomena) and Dr. R. Adair (physical mechanisms). We have also done some reading in the original literature. Our thoughts on the subject follow. They should be read with the qualifications that we are almost all physical scientists (with no particular biological or epidemiological expertise) who are outsiders to the EMF community. It should also be clear that we have not, in any case, conducted an in-depth review.

Three conditions are required to establish that 60 Hz EMFs have a significant effect on health: A) A plausible coupling mechanism at the cellular level; B) The coupling must induce biochemical changes; and C) The biochemical changes must be detrimental (e.g., carcinogenic).

It is important to bear in mind that without all three of these conditions being satisfied, any scientific case for EMFs causing disease would be incomplete. Of course, significant positive results from well-controlled epidemiological or whole organism studies would provide a basis for action even in the absence of any or all of these three conditions; however, such results do not exist.

Magnetite in Biological Systems

The coupling of EMFs at the cellular level is the necessary first step in this chain. Electric fields are well shielded by conducting fluids of the body and are reduced to insignificant levels in the cellular interior.[1] This is not true of magnetic fields.

Magnetic fields are part of the natural environment and it would be surprising if nature did not take advantage of them in directing organisms. The earth's magnetic field is about 0.5 G. Fields from common anthropogenic sources range from 100 G near small motors (hand-held appliances) to a few mG from residential electrical wiring. Sensitivity to this lower level would be required for significant widespread biological effects of the EMFs from the electrical distribution system. Geomagnetic storms and associated magnetohydrodynamic activity result in ELF (0-5 Hz) fluctuations, sometimes reaching several mG in the 1-100 mHz range. However, low frequency (50-60 Hz) magnetic field variations of more than about 1 mG are uniquely due to human sources.

Several coupling mechanisms have been suggested and properly dismissed as physically implausible.[1] However, the recent discovery of magnetite in the human brain could change the picture in a very significant way. The magnetic properties of this material, which are very different from those of typical cellular constituents, provide a physically plausible mechanism by which magnetic fields might perturb biological systems.

A number of biological systems employ magnetite and some are sensitive to magnetic fields.[2] These include chitons, who make teeth out of this hard material, magnetotactic bacteria, which use the field's inclination to sense up/down, and the ethmoid bones of fish (whose use of magnetite, if any, remains a mystery, although navigation of some kind is a likely possibility).

The magnetite in bacteria and fish is in the form of magnetosomes. These are single-domain (50 nm) crystals arranged in long chains of 20-60 crystals. The magnetite is purer than any known geological material. Each crystal is encapsulated in a membrane and the magnetically easy axis (111) is consistent from crystal to crystal and oriented along the chain. Typical interaction energies of a single crystal with the earth's magnetic field are 5-10 times the characteristic thermal energy, kT.

There are also indications that magnetite crystals are present in human brains,[3] although there is, as yet, no independent confirmation. These look very much like the bacteria or fish magnetosomes. Concentrations in the brain are 100 ng/g and it is estimated that 0.1% of the cells contain such magnetosomes. It is plausible (but not yet established) that these human crystals are also encapsulated in membranes and organized into chains. Magnetite is also claimed to be in other human tissues (both normal and pathological), with similar high concentrations in meninges and some types of tumors.

There is considerable evidence that magnetosomes are coupled to the nervous system. Semm and Beason[4] have shown that units of the ophthalmic nerve and trigeminal ganglion of the bobolink are sensitive to changes in the magnetic field as small as 2 mG. Walker has some recent results on fish (brown and red trout) probing the firing of neurons in the anterior lateral line nerve passing by the ethmoid sinus.[5] There is a response to changes in the strength of the field (at the 1 G level), but not to the direction.

Magnetic fields have also been shown to influence behavior. The response of magnetotactic bacteria to applied magnetic fields is dramatic and well documented. More recently, Walker and Bitterman[6] and Kirschvink and collaborators[7,8] have performed a series of experiments claiming to demonstrate the effects of magnetic fields on the behavior of honeybees. The experimental controls were good, but not perfect. It appeared that bees can be trained reliably to associate the presence of a DC magnetic field (22 G) with sugar water. Better statistics and more variations in the experimental procedures would make the case for behavioral response to magnetic fields more convincing. It has been established that the magnetic sensor is in the bee's abdomen, where there is a known concentration of magnetite, and that small magnetic wires attached to a bee's abdomen make it untrainable.

Walker and Bitterman[6] explored the effects of decreasing the DC field intensity and showed that bees trained at high fields could be trained subsequently to respond to weaker fields. They claimed that bees could be trained to respond to fields as weak as 0.25 mG (some 0.1% of the earth's field!). Kirschvink et al.[8] explored the effect of AC fields and claimed that some bees could be trained to respond to 60 Hz fields. There has not been, as yet, a demonstration of response to magnetic fields that are simultaneously both weak *and* AC.

Kirschvink et al.[8] have constructed a simple model for the coupling of magnetosomes into the biochemistry. In this model, the AC torque associated with an AC field acting on a magnetite crystal in a static, background field is transmitted by the microtubules of the cytoskeleton to calcium channels in the cellular membrane. The Reynolds number of the intracellular medium is very small, so that viscous terms dominate inertial terms. The model shows a falloff of sensitivity with increasing frequency. In contrast to some other hypothesized coupling mechanisms—[as] summarized and criticized[1,9]—this model does not obviously contradict known physical or biological principles.

Adair has presented arguments that the ordinary perturbations of electric and magnetic fields at the cellular level are far smaller than the thermal noise.[1] However, magnetite changes the picture, and interaction energies for 1 G fields then become several times kT per magnetosome. Sensitivity to mG fields would require a signal averaging

mechanism to enhance sensitivity. Other sensory systems do exploit such averaging, but are highly specialized (e.g., the ear's cochlea). Adair admits to the possibility of such averaging, but asserts that it is highly unlikely. As discussed in a separate JASON report [JSR92-341], the nonlinear dynamics phenomenon of "stochastic resonance" could also increase the sensitivity of a single magnetosome.

The essential point to take away from all of this work is that a cellular-level coupling of magnetic fields to biological systems is physically plausible and does not violate any physical principles.

Whole Organism Studies

Laboratory studies exploring the biological effects of weak, low frequency EMFs on cultures or whole organisms might appear to be a productive route. In contrast to cellular-level studies, a complex biological system is being probed, yet, in contrast to epidemiology, conditions and exposure are, in principle, under control. Perhaps surprisingly, there is no body of reliable and reproducible experiments. Litovitz claims some teratogenic effects of EMFs in chicken eggs when other influences are properly controlled for,[10] but these results have not been reproduced independently.

In work supported by many sponsors, including DOE, Adey has reviewed the literature on the possibility that EMFs can contribute to cancer in humans.[11] He concludes that there is little evidence that these fields (electric, magnetic or both together) acting alone, initiate cancers. However, he finds some evidence that low frequency and radio-frequency fields with low frequency modulation can enhance certain effects of chemical carcinogens on cells, particularly in cell membranes.

Epidemiology

Epidemiological studies directly address the human health effects of EMFs. These studies have numerous pitfalls and drawbacks, and the work we have seen is of diverse quality. One must be careful to control for confounding variables (economics, proximity to other carcinogens, etc.). Samples are generally small and fields are rarely measured directly; a "wiring code" is often used as a surrogate, but it shows little correlation with measured fields. When fields *are* measured, other potentially important factors in addition to the magnitude of the electric and magnetic fields (such as direction, frequency or intermittency) are not measured.

The results of the best case–control studies are equivocal. (See, for example, [London, et al.].[12]) The multiplication of the risk due to EMF exposure (odds ratio) is typically 1-3, with a large uncertainty. (An odds ratio of 1 would imply no effect of EMFs.) Perhaps the most that can be said at present is that 60 Hz electromagnetic power use is not, by itself, a major factor in childhood leukemia.

Recommendations

It is important to understand the biological effects (if any) of weak low frequency EMFs and the role that natural magnetic fields may play in life processes. The discovery of magnetite in human brains, if confirmed, could be a major change in the picture that needs to be followed up and elaborated. At the very least, there is an interesting basic research question; more significantly, it could bear on the health effects of 60 Hz EMFs. At the moment, only a handful of people around the world are working in this field, so it is important to involve more researchers.

Because the biomagnetic work is in its infancy, there should be a substantial amount of basic biophysics, biochemistry, physiology, etc. done on magnetite in living systems. We should also determine how widespread the presence of magnetite in living systems is and how prevalent is sensitivity to magnetic fields. Nature tends to be clever in making use of circumstances. We already have seen *two* distinct uses of magnetite in the biosphere, separately dependent upon its magnetic properties (magnetosomes) and its mechanical properties (teeth). It therefore would not be surprising to find it used in other ways as well, and such other uses might shed light on its interaction with weak magnetic fields.

The following lists a few concrete research questions/suggestions, but we expect that there are many more equally good or even better ideas that will be generated by experts in the field.

I. Basic Studies Related to Biological Magnetite: A) Is magnetite produced in virtually every living organism? (Kirschvink and Walker assert that magnetite has been found in every species tested so far, but very few species have in fact been tested.) B) Within a single cell: How are magnetosomes produced and in what form do they reside in higher species (e.g., are they lined up in long chains as in magnetotactic bacteria)? C) Multicell questions: How is the magnetite coupled to the central nervous system of those higher species that respond to B-fields? Are there nonlinear mechanisms that enhance their sensitivity? Do magnetosomes (or chains of them) in adjacent cells act in concert? D) Evolutionary questions: Identify the magnetic organ in trout or birds. Examine whether analogous organs and nerves exist in amphibians, reptiles and mammals. If so, do they also show a neural response to magnetic fields?

II. Training Experiments: A) The bee experiments should be replicated and pursued until all ambiguities are removed. The success in training with sinewave AC at varying frequencies will determine the relaxation times involved; additional studies with a square waveform would show if there is sensitivity to the rate of change of the magnetic field. Reducing the amplitude of the AC field to determine the threshold (presently being done by Kirschvink) is important. B) Similar training experiments should be tried with higher animals (e.g., rats or mice).

III. General Recommendations: Studies aimed at the possible connection between EMFs and cancer, particularly for frequencies up to 60 Hz, should continue.

A focused, peer-reviewed program of tissue culture and whole organism studies makes sense. Its major goal should be the demonstration of reproducible effects (if any) at the cellular level at low field levels. As a general remark, funding for replication of claimed results is very important and should not be slighted, and collaborations between skeptics and believers should be encouraged and supported.

Epidemiology is worth pursuing as it addresses the actual situation in the field (after all, this is what people are concerned about). However, it is unlikely to be definitive. There should be an effort to develop "black boxes" for field measurement of various EMF parameters (spectrum, strength, direction, intermittency) in support of the epidemiology, and to provide simple dosimeters for direct recording of the EMF exposures to individuals....

Yours sincerely,
Steve Koonin

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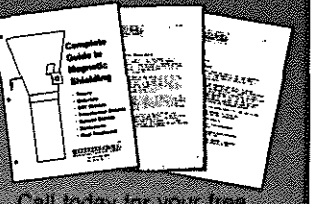
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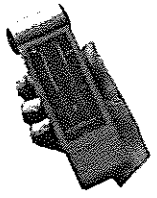
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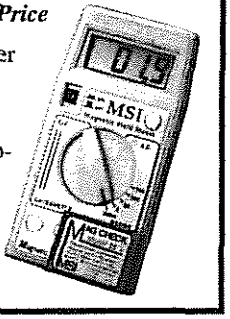


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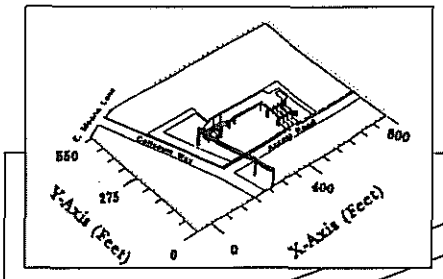
RADAR

ALS Cluster Prompts Study, Meeting... Dr. Richard Hopkins, an epidemiologist with Florida's Department of Health and Rehabilitative Services in Tallahassee, plans to investigate the apparent cluster of amyotrophic lateral sclerosis (ALS) in South Patrick Shores and adjacent neighborhoods, near a powerful FAA radar. In September 1992, Hopkins completed a study of a Hodgkin's disease cluster in this small residential area, finding that the incidence of the disease was as much as three times the expected rate (see *MWN*, J/F92). He told *Microwave News* that he will now try to determine "whether the incidence of ALS is indeed elevated." The cases of ALS, also known as Lou Gehrig's disease, and the possible link to the radar were first reported last April in a series of articles in *Florida Today*, a newspaper based in Melbourne (see *MWN*, M/J93). The investigation by reporter Marilyn Meyer, which uncovered eight people who had developed ALS since 1980, was "a valuable service," Hopkins said. But he cautioned that, "Our criteria for identifying a case of ALS are going to be quite different than a newspaper reporter's." He emphasized that there is no known cause for ALS and that any discussion of possible causes would be premature until the existence of a cluster is verified. Hopkins announced plans for the study, which will begin by next spring, at a September 16 community meeting in South Patrick Shores organized by Rep. Jim Bacchus (D-FL). Bacchus has since asked the FAA to shut down the radar sooner than the end of 1994, when it is scheduled to be replaced by a new radar at a different location. The replacement of the radar is part of a nationwide upgrade of the air traffic control system. "I believe we share the view that the relocation of the radar dome from close proximity to a residential community would be in the best interest of public health," Bacchus wrote in a September 27 letter to Ted Beckloff, FAA regional administrator in East Point, GA. The purpose of the meeting, according to Brian Faith, an aide to Bacchus, was to bring in government experts who could address community concerns over radiation from the radar. Several hundred people attended, Faith said, and they heard from a panel that included Ed Mantiply of the Environmental Protection Agency in Montgomery, AL, and Daniel VanderMeer of the National Institute of Environmental Health Sciences in Research Triangle Park, NC. Bacchus held a similar meeting later the same day in nearby Vero Beach, where residents are concerned about a proposed power line that would run through their community.

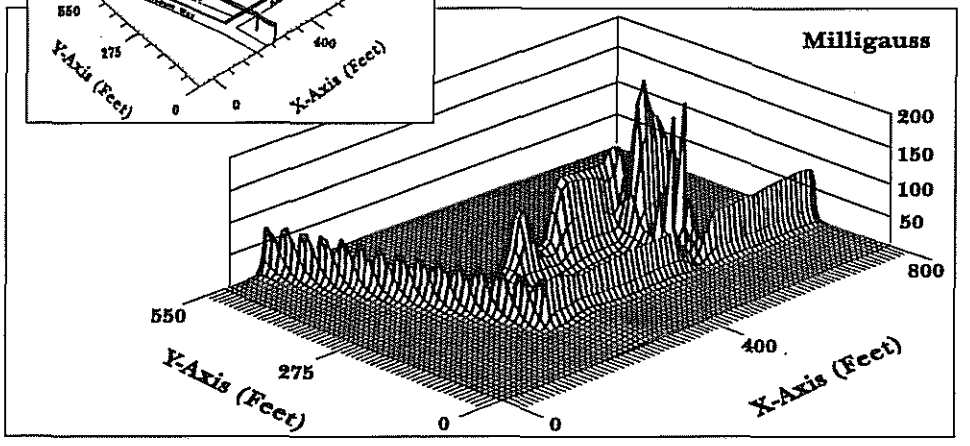
Phased Array v. Scanning... Replacement of a powerful military radar on the Yorkshire moors in the U.K. has added to the controversy surrounding the site. A new survey shows that, in some areas close to the Fylingdales facility, the new phased array radar has resulted in sharp increases in radiation exposures when compared with exposures from the scanning radar system used previously. Indeed, at Saltersgate Inn, the residence closest to the pyramid-shaped transmitter, average field strengths are now 0.5 V/m, with peak fields as high as 4.0 V/m, according to measurements taken by Elmac Services for the Nuclear Free Local Authorities (NFLA). In an area accessible to hikers, just under 1 km from the radar, the average and maximum fields are 1.74 and 10.0 V/m, respectively. The new radar operates at about 420

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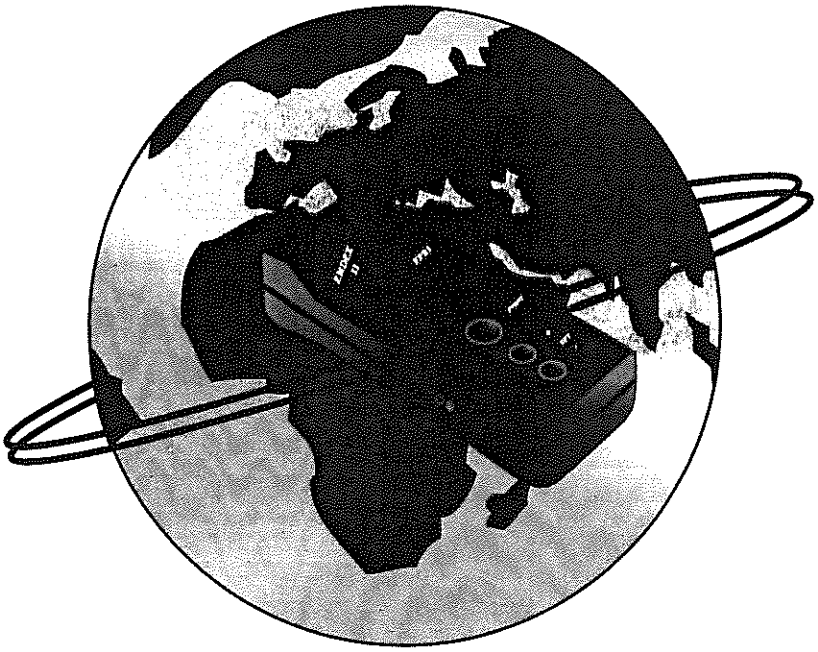
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MHz. A 1991 NFLA survey (see *MWN*, J/A91) did not include measurements taken at the Saltersgate site because radiation levels at that time were too low to be recorded accurately, the new report states. NFLA, a Manchester-based group that monitors the British military, warned at the time that the phased array system would increase exposures. This prediction was borne out by the recent survey, which showed as much as a tenfold increase in places where the old radars were not visible but where the new radar, in a slightly different location, is not blocked. At most measurement points, however, average field strengths are little changed and peak field strengths are lower than those found in 1991. A key concern raised previously was that peak fields posed an interference threat to the electronic components of automobiles on a highway about 1 km from the transmitter; that threat has "been reduced though not eliminated," according to the report. Fylingdales is part of the Ballistic Missile Early Warning System, which also has sites in Greenland and Alaska. NFLA suggests that, with the breakup of the Soviet Union, there is no justification for this powerful radar and that it should be shut down. For a copy of the report, which is dated August 2, 1993, contact: Stewart Kemp, Nuclear Policy and Information Unit, Town Hall, Manchester, M60 2LA, U.K. (44+61) 234-3324.

VDTs

EMF Workshop and Research Grants... Leading researchers from North America and Europe gathered in Baltimore on July 27 to exchange ideas for improving VDT EMF exposure assessments. Participants at the workshop, which was sponsored by the Center for VDT and Health Research, included Gert Anger of the Swedish Radiation Protection Institute in Stockholm, Dr. Maila Hietanen of the Institute of Occupational Health in Helsinki, Finland, Dr. Michele Marcus of Emory University in Atlanta and representatives from Apple Computer Inc., Compaq Computer Corp., IBM Corp. and Ontario Hydro. The goal of the meeting was to develop common approaches to assessing VDT EMF exposures, according to Dr. Patrick Breysse, associate director of the center, which is located at the Johns Hopkins University School of Hygiene and Public Health in Baltimore. He said that discussions focused on three areas: what to measure; how to assess exposures when VDTs are not the only source of EMFs; and how to use the data in the context of an epidemiological study. Breysse said that the center will submit a paper on the workshop for publication. Meanwhile, the center has funded three studies on VDT EMFs and cancer or reproductive risks—the same three it reviewed earlier this year (see *MWN*, M/A93). The projects will each receive about $50,000 a year for at least two years, Dr. Ronald Gray, director of the center, told *Microwave News*. The center has already received 70 preliminary requests for funding for next year and has asked for detailed proposals for 12 of them, Gray said. Final selections are expected by December. The center's research interests have not changed, but the nature of the proposals has, Gray said, noting that there have been more requests for ergonomics research than anticipated. The center, which plans to provide grants next year totaling $500,000, is funded by the VDT Health Research Foundation, which was set up by Apple, Compaq and IBM (see *MWN*, M/A92 and S/O92).

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MICRO WAVE NEWS

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National EMF Program Under Way: $15 Million in Research Awards

Two years after Congress ordered a national electromagnetic field (EMF) health research program, the National Institute of Environmental Health Sciences (NIEHS) has awarded 21 grants, committing a total of $15.5 million over the next four years for animal and cellular studies.

"This new program lays a sound scientific groundwork for mechanistic research—the basis for future studies," said Dan VanderMeer, NIEHS' program director for what has become known as the EMF Research and Public Information Dissemination (RAPID) Program. But the launch of the program has not been without delays and visible tensions between the NIEHS and the Department of Energy (DOE).

The projects cover four key areas—cell proliferation, gene expression, melatonin and signal transduction (see p.7 for a list of the grant awards). One study, by Dr. Charles Graham of the Midwest Research Institute, entails human EMF exposures to examine possible EMF-induced suppression of melatonin levels.

The NIEHS is not sponsoring any epidemiological studies with RAPID money. In August, NIEHS' Dr. Michael Galvin urged support of an epidemiological study of melatonin and breast cancer but was opposed by both the EMF interagency and advisory committees. VanderMeer said that the NIEHS will help fund the study, to be carried out by Dr. Stephanie London of the University of Southern California in Los Angeles, from its own budget.

Over one-third of the money is devoted to work on gene expression. "This could lead to the underlying mechanism of a cancer link," said

(continued on p.6)

EPA To Assess Health Impacts of Weak, Modulated RF/MW Radiation

The Environmental Protection Agency (EPA) has launched an effort to assess the possible health hazards of long-term exposures to low-level radiofrequency and microwave (RF/MW) radiation as part of its revived non-ionizing electromagnetic radiation (NIER) program. As a first step, the EPA has commissioned a two-year study by the National Council on Radiation Protection and Measurements (NCRP) on the potential role of weak, modulated radiation in human exposure limits. Existing guidelines are based on thermal effects.

In addition, the NCRP itself plans to revise its RF/MW exposure recommendations and may address low-level, modulated radiation (see p.12).

Separately, the EPA is back at work developing exposure limits based on known thermal effects—hazards from the heating of tissue due to acute radiation exposures. The agency tried for more than a decade to develop a formal RF/MW "guidance," which would have applied to all federal agen-

(continued on p.11)

EMF NEWS

« Power Line Talk »

EPA's long-awaited rewrite of its **EMF cancer assessment** has been drafted and sent out for review. The 240-page report, now titled *Relation Between Power Frequency Electric and Magnetic Field Exposure and Human Cancer,* clearly supports the view that EMFs play a role in cancer development: "The childhood cancer epidemiology studies consistently show repeated findings of a small excess relative risk of leukemia and brain cancer in children who live in homes near the electrical power distribution network." The EPA explains that "small" means an odds ratio of 1.5 to 3.5 with borderline statistical significance for individual studies (the link gets stronger when the studies are combined in a meta-analysis); and "near" means a home that would be classified as a "very high current configuration" residence under the Wertheimer–Leeper wire coding scheme or a home with an average historical magnetic field of 2-3 mG. The EPA analysts did not attempt to classify EMFs as a "probable" or "possible" carcinogen, as they did in the first draft (see *MWN,* M/J90 and N/D90). That 1990 draft was highly controversial and was sharply criticized by EPA's Science Advisory Board (SAB) (see *MWN,* J/A91 and J/F92). The new report concludes that the Scandinavian epidemiological studies put to rest the idea, long put forward by skeptics, that the EMF–childhood cancer link is due to bias in the selection of controls. "There is a real association that cannot be explained by improper epidemiologic methodology," EPA finds. Interestingly, the report also concludes that, "In many respects, there is a more complete set of data indicating a risk of breast cancer in male workers than for residential childhood cancer, although the dimensions of the potential hazard are still far from clear." Dr. **Robert McGaughy** of EPA's Office of Health and Environmental Assessment in Washington, who is in charge of writing the report, declined to comment on its findings, other than to say that they are "in flux." He said that once the ongoing review is completed, a revised draft will be sent to other federal agencies and, if there are no delays, will be released to the public in mid-February. After a comment period of at least 30 days, the report will be forwarded to the SAB for further review. McGaughy said that a new SAB panel will be assembled, pointing out that Dr. Genevieve Matanoski, the chair of the original review panel, has since become the chair of the entire SAB (see *MWN,* J/F 91 and N/D93). In addition to the EPA staff, there are four external reviewers for the August 1994 draft: Drs. Dean Astumian of the University of Chicago; John DiGiovanni of the M.D. Anderson Cancer Research Center in Smithville, TX; Kenneth McLeod of the State University of New York, Stony Brook; and Richard Stevens of Battelle Pacific Northwest Labs in Richland, WA.

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Does the **EPA** believe that EMFs increase the risk of childhood leukemia and does it favor a policy of prudent avoidance? It depends on whom you ask. A controversy is brewing in a Brooklyn, NY, neighborhood over the construction of an elementary school next to a Metropolitan Transportation Authority electrical substation. Betty Jean and Stanley Nelson are leading the fight to change the school site and have fired off letters to local and federal officials, including Vice President Al Gore. The letter to Gore ended up on the desk of Conrad Simon, director of the air and waste management division of **EPA Region II** in New York City, who replied, in part: "The EPA has reviewed the research in the potential health effects of [EMFs] and found the results of the studies to be inconsistent and sometimes even inherently contradictory. As such, we are unable to conclude that magnetic fields from power lines, substations and home and office appliances present a health risk." Some at EPA headquarters in Washington take a different view. When asked to comment on Simon's letter, Dennis O'Connor, a policy analyst at the **Office of Radiation & Indoor Air** (ORIA), told us that, "EPA continues to believe that there could be a risk posed by exposure to EMF," and that, "The Region II letter, while accurate, may have inadvertently underemphasized the scientific uncertainty that currently exists concerning this complex issue."

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Dr. **David Savitz**'s epidemiological study of EMF-exposed utility workers has been submitted to the *American Journal of Epidemiology,* after being rejected by the *New England Journal of Medicine*. Savitz and Dr. **Dana Loomis**, both of the University of North Carolina (UNC), Chapel Hill, examined the mortality rates from leukemia and brain cancer among 139,000 men from five large electric utilities. Savitz, who started work on the study in July 1987, declined to discuss his results prior to their publication. Meanwhile, a paper describing the exposure assessment used for the study has been accepted by the *Scandinavian Journal of Work, Environment and Health*. The lead author of this report is Dr. **Hans Kromhout** of Wageningen Agricultural University in The Netherlands, who was a visiting researcher at UNC.

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The **U.S. Navy** is set to begin building a housing development for enlisted personnel on a 41-acre site that has four **San Diego Gas & Electric** Co. (SDG&E) transmission lines running along one side. Plans call for buildings to be placed right up to the power line right-of-way (ROW), at the edge of which magnetic fields reach 23 mG, according to measurements taken by an SDG&E engineer. The survey, conducted for the Navy in December 1992, found field strengths of 5.7 mG 100 feet from the ROW and 3.5 mG 150 feet away. Of the 290 apartments planned, several dozen will be within 100 feet of the ROW; two children's play areas will be right next to it. The Navy is "putting these enlisted personnel and their families in harm's way," said Dr. Edwin Chelsea, vice president of the **Eucalyptus Hills Landowners Association**. In response to questions from Chelsea's group, the Naval Facilities Engineering Command, which is in charge of the project, consulted with researchers at the Navy's Bureau of Medicine and Surgery in Washington. The bureau responded in a Feb-

Will the DOE Bioeffects Research Program Continue?

The future of DOE's EMF biological effects research program is again in doubt. Congress' 1995 DOE appropriation, signed by the President on August 26, provides $6 million for the program in fiscal year 1995 but apparently leaves standing a Senate requirement that the DOE phase out its program by 1996 in favor of the RAPID program, which it administers jointly with the NIEHS (see p.1). The program's fate now hangs on further interpretation from Congress.

The budget saga began early this year when the President proposed $10 million for the RAPID program and $6 million for the DOE (see *MWN,* J/F94). On June 14, the House approved the President's request without comment.

The Senate looked less favorably on the DOE program, however (see *MWN,* M/A94). On June 30, the Senate cut the House recommendation, decreasing RAPID's funding to $6 million. It also gave the DOE $6 million but added the proviso that the program must be phased out in 1995. As a guarantee, the Senate prohibited use of DOE's 1995 money until a plan was in place to roll the DOE research into the RAPID program, asking for the plan to be completed by January 31, 1995. The Senate's language was unequivocal: "There is no point in having two overlapping and independent programs."

A conference committee compromise, approved in August, provided $8 million for the RAPID program—to be matched with $8 million from industry—in addition to the $6 million for DOE's ongoing work. But it did not resolve the differences between the House and the Senate on what should now happen to the DOE program.

The DOE has support for continuing its own program. "When we developed the strategic plan, our assumption was that the DOE program would continue," said Dr. Michael Marron, of the Office of Naval Research in Arlington, VA, and a member of the RAPID program's Interagency Committee. Rick Loughery of the Edison Electric Institute in Washington added, "We want the DOE program to go on."

"We are trying to get clarification of the congressional intent to know how to move forward," said DOE's Marvin Gunn. "We need both programs." The NIEHS, the DOE and other groups are hoping the matter will be clarified soon. "We don't want to independently interpret the law," said NIEHS' Dan VanderMeer, adding that the NIEHS was "absolutely not" trying to take over the DOE program. "We want to work with DOE to generate the health effects data to determine if there is a hazard from EMFs."

ruary 8, 1993, memo that there was "no compelling basis for modifying the site plan." Jeanne Light, a Navy public affairs officer in San Diego, said that EMFs on the site are "well below" ACGIH and IRPA guidelines. The landowners association is continuing to fight the project, however, and will soon file a suit alleging that the Navy has not complied with the National Environmental Policy Act (NEPA), Chelsea said. His group objects to the project for many reasons—including the impact on local schools and the density of the housing in the semirural surroundings. The suit will charge that these issues—and the EMF hazard—were not sufficiently addressed by the Navy in its original environmental review, and it will ask that a complete environmental impact statement (EIS) be prepared. Previously, the group voiced its concerns to the White House **Council on Environmental Quality** (CEQ), which monitors NEPA compliance. After discussions with navy planners, CEQ attorney Elisabeth Blaug responded that, "The Navy's decision not to prepare an EIS for the Eucalyptus Hills housing project is appropriate."

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When authors of the **CIRRPC** report contended that rising electricity use in this century would have led to an epidemic of childhood cancer *if* EMFs posed a cancer risk—a hypothesis advanced by particle physicist Dr. **David Jackson**, among others—many epidemiologists were openly skeptical (see *MWN,* M/J92, J/A92, N/D92 and J/F93). Now, a team led by Dr. **Allen Kraut** of the University of Manitoba in Winnipeg has found an association between the rates of leukemia and brain cancer in children and residential electricity consumption across Canada. Writing in the May/June 1994 issue of the *Archives of Environmental Health (49,* pp.156-159), Kraut reported that the higher a province ranked in electricity consumption, the higher were its rates of childhood leukemia and brain cancer. The trend was statistically significant. Kraut also observed a significant relationship between the increases in all types of cancers and electricity use—although the incidence of leukemia did not go up during the study period. He told *Microwave News* that while "ecological" analyses like his are not as powerful as other types of epidemiological studies, his results are another piece of the EMF puzzle. "This is consistent with there being an [EMF] effect," he said, pointing out that a major drawback, common to all ecological studies, is that individual exposures are unknown.

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While most utilities in the U.S. and Canada have an EMF policy and provide customers with information, few are taking steps to mitigate EMFs from transmission and distribution lines, according to a survey conducted for **Toronto Hydro**. The survey was included in a report responding to a **Toronto City Council** request for information about what mitigation methods are available and what steps are being taken in other North American cities. Of 39 utilities surveyed, all said that they make EMF literature available to customers and 95% offer household measurements on request. But, only 33% said that they are currently reducing EMFs from their facilities or are planning to do so in the future. "Utilities are not spending appreciable amounts of money to make changes in their distribution systems for the purpose of mitigating fields, except in isolated instances," concludes *Technologies Available To Mitigate Magnetic Field Exposure due to Distribution Systems*

(April 1994). The report was prepared for Toronto Hydro by **EMF-RAD Consulting and Engineering** Ltd. in Brampton, Ontario (see *MWN,* N/D93). Most of the utilities—77%—do provide advice on how to limit exposures. However, of 21 utilities that supplied copies of their EMF position statements, less than 40% specifically recommend prudent avoidance.

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The town of **East Greenwich, Rhode Island**, and a group of local home owners have lost a round in their fight to force **Narragansett Electric** Co. to bury a proposed 115 kV power line that will run through the town. In a 3-0 vote on August 31, the Energy Facility Siting Board approved the utility's plan to build above ground. Providence-based Narragansett intends to run the new line on the western edge of the ROW, farthest from any houses. The utility also agreed to move an existing 115 kV line from the eastern edge of the ROW to the same site and to dismantle a 34.5 kV line on the same ROW. The utility says that when the work is completed, magnetic fields near the houses will be 98% lower than they are now. Charles Moran, a spokesperson for Narragansett, said the utility was trying to accommodate customers concerned about EMFs. Governor Bruce Sundlun had presented this plan in a letter last year as a "remedy" for East Greenwich residents who were unhappy about his veto of a bill to bury all power lines over 69 kV in the state (see *MWN,* J/A93 and J/F94). In 1990 the town had declared a moratorium on all new power lines over 60 kV, but the ban was later overturned (see *MWN,* N/D90). Adrienne Southgate, general counsel for the board, told *Microwave News* that the siting board's decision was guided by prudent avoidance. Magnetic field levels at the eastern edge of the ROW are projected to be 0.1 mG if the line is buried and 0.4 mG if it is located close to the western edge. The board felt there was "no meaningful distinction" between the two alternatives, Southgate said. **William Harsch**, former chair of the state's PUC, who represented the town before the board, accused its members of "bending every way they could to find in favor of the company." In an interview, Harsch explained that East Greenwich believed burying the line would preserve scenic areas and prevent the erosion of property values, in addition to minimizing health effects from EMFs. "But the board did not adequately assess these issues," he said, a point he expects the town to raise in its appeal, filed September 30. Harsch said that the health issue is still a concern because the board "was ineffective in assessing questions of future loading of the line," which may increase EMFs. Linda Seiler, president of Rhode Islanders for Safe Power (**RISP**), said the board had "denied all the advantages of undergrounding" and predicted more lines would ultimately be built along the ROW. A group of 17 home owners, represented by David Bazar of Rappoport, Audette & Bazar in East Providence, appealed the board's decision on September 30, based on loss of property value. Bazar said that the case will be modeled after California "stigma suits," in which property bordering toxic waste dumps, even if uncontaminated, is considered "stigmatized." Siding with Narragansett, the *Providence Journal–Bulletin* ran a September 5 editorial stating, "We suspect that aesthetic and property-value considerations are really more at play here."

Feychting–Ahlbom's New Analysis of Adult Leukemia; Breast Cancer and Incubator Studies Are Next

The September publication of Maria Feychting and Dr. Anders Ahlbom's paper on adult leukemia and residential EMF exposures completes the first phase of their landmark power line–cancer studies, which were made public two years ago. A new analysis based on cumulative exposures adds weight to earlier estimates that showed a weak EMF–adult leukemia link. The companion childhood study, published last year, showed a stronger association between EMF exposure and leukemia.

The epidemiologists, from the Karolinska Institute in Stockholm, are now using their innovative exposure assessment technique to examine breast cancer in both women and men. In an interview with *Microwave News,* Feychting said that they expect to finish this effort by the end of 1995.

Writing in the September 1994 issue of *Epidemiology (5,* pp.501-509), Feychting and Ahlbom cautioned that while the adult study provides "some evidence for an association" between magnetic field exposure and leukemia, the number of cases was small and the risk estimates were "unstable." They reported for the first time that adults with the highest *cumulative* exposures to power line EMFs faced twice the risk of developing acute or chronic myeloid leukemia (AML or CML) compared to less-exposed adults, but the results are of only borderline statistical significance. The new exposure index—the sum of the estimates of magnetic fields in the homes of leukemia victims during the 15 years prior to diagnosis—differs from the estimates used in their 1992 report. Those results, which are also in the *Epidemiology* paper, show that adults exposed to 2 mG or more in the year closest to diagnosis were 70% more likely to develop AML or CML than those exposed to less than 1 mG (see *MWN,* S/O92).

One anomalous and as-yet-unexplained finding is why residents of single-family houses, particularly children, seem to be at a greater risk for leukemia than similarly exposed residents of apartment houses. At the June meeting of the Bioelectromagnetics Society in Copenhagen, Denmark, Feychting noted that power lines are not the only important source of magnetic fields in multiple-unit dwellings. Reinforcing this point, Dr. Lars-Erik Paulsson of the Swedish Radiation Protection Institute (SSI), also in Stockholm, said that measurements he had taken at the front doors of apartment houses—where spot measurements are often done—do not reflect the magnetic field exposures inside the apartments.

Feychting and Ahlbom did not distinguish between single-family houses and apartments in their *Epidemiology* paper. Dr. Nancy Wertheimer of Boulder, CO, told *Microwave News* that she wishes they had. In the original 1992 report, Wertheimer said, Feychting and Ahlbom "got their strongest odds ra-

tios for adults in the sample where exposure was most reliably assessed, that is, in single-family homes." In a 1982 study, Wertheimer and Ed Leeper found a relationship between exposure to power lines EMFs—entailing median exposures of 2.5 mG—and some types of adult cancer (see *MWN,* J/F83). Feychting explained that they had to limit the number of tables in the paper—omitting this and other analyses.

For their breast cancer study, Feychting said they will include only women living in single-family houses. As in the adult residential study, the women will have lived within the power line corridor in the year closest to diagnosis. The researchers will draw on the same database and apply the same techniques used in their earlier studies. But, because female breast cancer is more common than leukemia, they expect to have approximately 800-900 women—nearly three times the number of cases they had in the adult study. Twelve cases of male breast cancer, regardless of the type of housing, will also be included.

Much is riding on the outcome of the breast cancer study. Jaak Noü, technical director of the National Electrical Safety Board in Stockholm, has commented that if a link between EMFs and breast cancer is documented, the government will be more likely to set exposure limits (see *MWN,* M/J94).

Feychting and Ahlbom are also planning to study the risks to premature infants from EMFs in incubators. This effort was prompted by high readings found by Dr. Gert Anger of SSI. He measured magnetic field levels of up to 48 mG. Higher levels were found by Dr. Charles Polk of the University of Rhode Island, Kingston (see *MWN,* M/A94).

Feychting said this case–control study will include about 700 children with leukemia born between 1973 and 1989. Information on whether the children had been in incubators—as well as health factors that might confound an EMF–leukemia link—will be drawn from medical records, she said.

Rulings Set the Stage for Three EMF–Leukemia Trials

Pilisuk Decision Upheld

With one dissenting opinion, Washington state's three-member Board of Industrial Insurance Appeals has agreed with Industrial Appeals Judge Linda Williams's decision to reject the long-running pension claim brought by the widow of utility worker Robert Pilisuk (see *MWN,* M/A91, M/J92, J/F94 and M/J94). Mimi Handlin Pilisuk contends that on-the-job EMF exposures were responsible for the death of her husband from acute lymphocytic leukemia. The board's September 6 decision stated that Williams's April 14, 1994, proposed order was "supported by a preponderance of the evidence, and is correct as a matter of law."

However, dissenting board member Frank Fennerty Jr. argued that Pilisuk's exposure "more likely than not" was responsible for his leukemia. "The claimant is not required to disprove all speculative causes of the leukemia, or to establish how the heavy exposure to EMFs results in leukemia. The fact is medical science still cannot explain the biological mechanism by which asbestos causes mesothelioma, but that fact cannot act as a bar to allowance of claims for occupational disease" (see excerpt, p.14).

Pilisuk's attorney, Michael Withey of the Seattle firm of Schroeter, Goldmark & Bender, filed an appeal of the board's decision on September 14. A trial date has been scheduled for April 12, 1995. Mark Warnquist of LeBoeuf, Lamb, Greene & MacRae in Denver is representing Seattle City Light with city attorneys. Betty Ngan, an assistant city attorney for Seattle, said that she expects the April trial will be the last step in the saga: "I don't see any legal issues that can be appealed."

Judge: EMFs Inseparable from Power Lines

Power lines and the EMFs they generate are inseparable, according to a New Jersey Superior Court ruling in John Altoonian's cancer lawsuit against Atlantic Electric Co. The Pleasantville, NJ, utility had asked the court to separate the two when considering Altoonian's charge that an electrical cable and its EMFs were trespassing—one of several counts in his lawsuit. Atlantic Electric then asked the court to dismiss the EMF trespass charge.

"The court is not convinced, however, that such a separation of the electrical lines and the EMF is warranted....[E]xpert reports suggest that the EMFs associated with electricity [are] inextricably linked to the electrical flow in a way that differs from airborne pollution or other types of activity by-products," Judge Joseph Visalli wrote in his decision.

Altoonian claims that EMFs caused his chronic myelogenous leukemia (CML), diagnosed in October 1990 (see *MWN,* N/D93 and M/A94). Altoonian's deck and backyard are above an underground 69 kV power line operated by Atlantic Electric.

The trial date, January 23, 1995, is expected to be postponed because discovery has not been completed, explained Altoonian's lawyer, William Wolf of Bathgate, Wegener, Dugan & Wolf in Lakewood. Gerald Corcoran, whose Pleasantville law firm, Megargee, Youngblood, Franklin & Corcoran, represents Atlantic Electric, did not respond to telephone calls.

Glazer v. FP&L *Trial Date Set*

The trial of another CML–EMF claim—*Leonard Glazer v. Florida Power & Light Co. (FP&L)*—is scheduled to begin in Dade County Circuit Court, FL, on June 5, 1995. Glazer believes that the leukemia that killed his wife, Elsa, and now threatens his own life, was caused by the utility's power lines outside his bedroom (see *MWN,* J/F94). He contends that FP&L, based in West Palm Beach, should have warned them of the potential EMF dangers.

Glazer's attorney, Lawrence Marraffino of Boca Raton, FL, said that he is just beginning to review 140 boxes of material provided by FP&L during discovery. A delay of the trial is unlikely. Circuit Court Judge Maria Korvick has ordered that there will be no continuance, said Marraffino: "That indicates that the judge recognizes the uniqueness of the case."

"We're in the early stages of discovery," confirmed FP&L's attorney, Alvin Davis of Steel, Hector & Davis in Miami, but he referred all other questions to the utility. Stacey Shaw, a spokesperson for FP&L, said that while "we are very sympathetic...FP&L does not believe that EMFs are responsible for their illnesses."

VanderMeer. Six different labs will receive $5.5 million for such research, which has become highly controversial amid reports of failures to replicate some of the landmark experiments of Drs. Reba Goodman of Columbia University and Ann Henderson of Hunter College, both in New York City (see *MWN,* J/A94). Dr. Jeffrey Saffer of Battelle Pacific Northwest Labs in Richland, WA, whose attempts at replication have failed—and who has become one of Goodman and Henderson's sharpest critics—received one of the largest NIEHS grants for additional gene expression studies.

Ever since the Energy Policy Act of 1992 became law in October 1992 (see *MWN,* N/D92), the $65 million health research and communications program, also known as the NERP, has been mired in delays, bureaucratic infighting and allegations of bias in evaluating the proposals.

The DOE and the NIEHS, which are charged with jointly running the RAPID program, have missed all the deadlines specified under the law (see box below).

Some of the delays were due to rivalries between the DOE and the NIEHS—especially over funding. All RAPID appropriations are given to the DOE, which then passes some of the money to the NIEHS. While the tensions have been kept below the surface for the most part, they emerged publicly on September 21, days before the grants were to be announced. In a widely circulated letter, VanderMeer said that he was "distressed and outraged" that the DOE was not going to make funds available before October 1, thereby forcing the NIEHS to pay for $850,000 in program expenses out of its own budget and further delaying distribution of research awards. VanderMeer suggested that, "Responsible officials in the DOE do not support the NIEHS participation in the EMF program."

On receiving VanderMeer's letter, senior DOE officials scurried to correct an NIEHS–DOE interagency agreement and to supply the money. The following day, the NIEHS received $6.25 million from the DOE and VanderMeer sent out a second letter saying that the snafu had been resolved. What one close observer called a "crisis in faith" had passed. Marvin Gunn, who is responsible for the RAPID program at the DOE, told *Microwave News,* "I hope we can now move forward. We want to get this done right."

One of the most contentious issues has been the peer review of the proposals competing for research grants, which is handled by the National Institutes of Health (NIH) for the NIEHS. Critics charge that few members of the review committee have published in the field of EMF health effects, and of those, the majority are engineers or physicists, rather than biologists, or have ties to the utility industry. (The members of the peer-review committee are listed on p.7.)

"It is not *peer* review," Dr. Ross Adey of the VA Hospital in Loma Linda, CA, told *Microwave News.* "The review is being done by individuals who are asked to give their opinions on subjects beyond their professional competence." Battelle's Dr. Richard Lovely echoed Adey's concerns. "I don't see the expertise on the committee to deal with cutting-edge EMF issues," he said.

NIH's Dr. Paul Strudler, who assembled the peer-review panel, defended his selections. "I am very comfortable with the quality of the panel," he said in an interview. "I compose a study section to review the science—I don't do body counts." In an April 22, 1994, letter, Dr. Asher Hyatt of NIH's Division of Research Grants (DRG) assured Shirley Linde, the chair of the National EMF Advisory Committee, that the DRG management and the NIEHS senior staff "are very comfortable" with Strudler's choices. Linde had voiced concern about the makeup of the panel. Dr. Anthony Demsey, Hyatt's superior, told *Microwave News* that he is "satisfied" with the process. "Unless someone can tell me why it is broken, we will continue to do it as we are doing it now."

Four of those receiving grants—Luben, McLeod, Reiter and Saffer—will serve on the NIH committee for peer review of EMF proposals submitted under the existing NIH program announcement, scheduled for November 3-4. Three recipients—Luben, Reiter and Williams—are members of the National Academy of Sciences' EMF panel (see *MWN,* M/J93).

GAO Criticizes RAPID Delays

The DOE and the NIEHS have missed key deadlines for the $65 million RAPID program, the General Accounting Office (GAO) charges in a new report, "thus reducing the amount of information that can be obtained and reported to the Congress by March 31, 1997." This is the date set for submission of the program's findings.

In formal responses appended to the GAO report, the DOE and the NIEHS each pointed out that the NIEHS issued the first requests for applications for research grants in the fall of 1993 and that faster action was impossible, given the timing of congressional funding.

"It was a no-win situation," NIEHS' Dan VanderMeer told *Microwave News,* since funding decisions for 1993 had already been made when the law was passed. "Congress didn't appropriate any money [for the new EMF program] for over a year," he explained.

VanderMeer also said that the original request for a GAO investigation, by Rep. George Miller (D-CA), chairman of the House Committee on Natural Resources, did not address the RAPID program. Indeed, Miller's March 1993 letter asked only about the extent to which the public is exposed to EMFs from federally owned power lines. The response to this question fills a small part of the final report, with the GAO concluding that less than 1% of the population lives near enough to federal power lines to be exposed to their fields.

After considering Miller's request, the GAO suggested a broader investigation, including an examination of federal research efforts. Miller's staff agreed. "It is not unusual for GAO to take a narrow request and propose widening it," a congressional aide explained.

Copies of *Electromagnetic Fields: Federal Efforts To Determine Health Effects Are Behind Schedule,* June 1994, are available from: GAO, PO Box 6015, Gaithersburg, MD 20884, (202) 512-6000, Fax: (301) 258-4066. Single copies are free.

RAPID EMF Research Grants

Name/Institution	Type*	Award	Project
Dr. Dean Astumian University of Chicago	NIEHS	$434,000 (4 yr)	Interactions between low-frequency, AC electric fields and yeast membrane proteins.
Dr. Elizabeth Balcer-Kubiczek University of Maryland, Baltimore	RfA§2118	$702,203 (3 yr)	Effects of 60 Hz EMFs on the expression of genes associated with cancer in human cell lines, HL-60 and MCF-7.
Dr. David Binninger Florida Atlantic University, Boca Raton	RfA§2118	$379,838 (3 yr)	Molecular basis for the effects of 60 Hz EMFs on gene expression (transcription) in yeast.
Dr. Craig Byus University of California, Riverside	EPA	$441,408 (2 yr)	Animal cancer studies using a mouse skin model on copromotion by 60 Hz EMFs with the initiator DMBA and the promoter TPA.
Dr. Charles Graham Midwest Research Institute, Kansas City, MO	RfA§2118	$1,289,662 (4 yr)	Human studies on the effects of nighttime EMF exposures on melatonin, other hormones and the immune system.
Dr. Sek Wen Hui Roswell Park Cancer Institute, Buffalo, NY	RfA§2118	$667,940 (4 yr)	Role of 60 Hz EMFs on gene expression, cancer promotion and signal transduction.
Dr. Henry Lai University of Washington, Seattle	EPA	$732,411 (4 yr)	Effects of ELF magnetic fields on neurological function and behavior in rats with emphasis on cholinergic activity.
Dr. Robert Liburdy University of California, Berkeley	NIEHS	$833,279 (3 yr)	Role of various AC/DC field combinations in calcium signaling and cell proliferation and viability—a test of the Lednev hypothesis.
Dr. Richard Luben University of California, Riverside	NIEHS	$839,073 (4 yr)	Biochemical mechanisms of 60 Hz magnetic field effects in signal transduction and on membrane receptors in mammalian cells.
Dr. Rosemonde Mandeville University of Quebec, Laval, Canada	RfA§2118	$353,292 (3 yr)	Copromoting effects of 60 Hz, CW magnetic fields and subthreshold doses of ENU on brain tumors in rats; search for dose–response.
Dr. David McCormick IIT Research Institute, Chicago	RfA§2118	$1,233,548 (4 yr)	Influence of EMFs on the proliferation of human breast epithelial cells and on the expression of cancer-associated genes.
Dr. Kenneth McLeod State University of New York, Stony Brook	EPA	$350,967 (2 yr)	Role of frequency, intensity and duration of ELF electric field exposures and cell characteristics on the modulation of cell behavior.
Dr. Richard Miller Columbia University, New York City	RfA§2118	$778,129 (4 yr)	Effects of 60 Hz EMFs on the expression of oncogenes in cancer initiation and promotion in human and mouse cells.
Dr. Steven Miller SRI International, Menlo Park, CA	RfA§2118	$826,756 (4 yr)	Effects of 60 Hz EMFs on signal transduction *in vitro* and possible effects on reactive oxygen intermediates in tumor promotion.
Dr. Richard Nuccitelli University of California, Davis	RfA§2118	$921,336 (4 yr)	Changes in expression of proteins associated with differentiation of human skin cells resulting from 60 Hz EMF exposures.
Dr. Russel Reiter University of Texas, San Antonio	RfA§2118	$801,472 (4 yr)	Impact of sinusoidal magnetic fields on melatonin levels *in vivo*; search for critical exposure parameters and for role of pineal gland.
Dr. Clifford Rinehart University of North Carolina, Chapel Hill	RfA§2118	$666,381 (3 yr)	Effects of 60 Hz EMFs on expression of oncogenes, transcription factors and enzymes related to malignant transformation in cells.
Dr. Jeffrey Saffer Battelle Pacific NW Labs, Richland, WA	RfA§2118	$1,161,070 (3 yr)	Gene expression studies on the role of various ELF fields in copromoting neoplastic transformation of JB-6 cells.
Dr. Jerry Williams Johns Hopkins Oncology Center, Baltimore	RfA§2118	$1,444,601 (4 yr)	Cellular studies on the effects of EMFs on *myc* oncogenes, growth enzymes (ODC) and carcinogenic and cocarcinogenic processes.
Dr. Gayle Woloschak Argonne National Lab, Argonne, IL	RfA§2118	$467,086 (3 yr)	Identification of EMF-induced genes, the kinetics of their response and the mechanism of the modulation of gene expression.
Dr. Steven Yellon Loma Linda University, Loma Linda, CA	EPA	$156,745 (1 yr)	Effects of EMFs on melatonin production and on reproductive development in the Djungarian hamster.

*All research projects listed here are funded with monies from the RAPID program. Those marked "RfA§2118" were funded in response to the RAPID requests for applications (RfAs) issued in November 1993; those marked "EPA" were initiated with funds from EPA that were transferred to NIEHS (see *MWN,* J/F93); those marked "NIEHS" were in response to NIH's long-standing program announcements (see *MWN,* M/J91).

A special NIH panel, convened by Dr. Paul Strudler, met May 4-7 in Portland, OR, to evaluate proposals for research on cellular and *in vivo* effects of EMFs under the RAPID program. Requests for applications were first distributed in November 1993 at DOE's annual review (see *MWN,* N/D93). The members of the panel were: Drs. Joseph Roti Roti (chairman), Washington University School of Medicine, St. Louis, MO; Stuart Calderwood, Harvard Medical School, Boston, MA; Joseph Coggin, University of South Alabama College of Medicine, Mobile; Deborah Cory-Slechta, University of Rochester School of Medicine, Rochester, NY; Eugene Gerner, University of Arizona Health Sciences Center, Tucson; Nigel Greig, National Institute for Aging, National Institutes of Health, Bethesda, MD; Kenneth McLeod, State University of New York School of Medicine, Stony Brook; Martin Misakian, National Institute of Standards and Technology, Gaithersburg, MD; John Moulder, Medical College of Wisconsin, Milwaukee; Rodney Nairn, M.D. Anderson Cancer Center, University of Texas, Smithville; Leslie Redpath, University of California College of Medicine, Irvine; Robert Sack, Oregon Health Sciences University, Portland; Fred Stormshak, Oregon State University, Corvallis; Maria Stuchly, University of Victoria, Victoria, BC, Canada; Peter Valberg, Gradient Corp., Cambridge, MA; Lynn Wiley, Institute of Toxicology and Environmental Health, University of California, Davis.

HIGHLIGHTS

« Cellular Phone Notes »

Dr. **Om Gandhi** has notified the **FCC** that he made a number of errors in his much-publicized study on the amount of energy deposited in the brain from the use of hand-held cellular phones (see *MWN,* J/F94). In an August 19, 1994, letter to Thomas Stanley, the FCC's chief engineer in Washington, Gandhi said that the SARs he released last year were too low by a factor of 1.08 to 2.47 for the ten phones tested. The peak SARs are now "on the order of 0.26 to 0.69 W/Kg," he wrote. Gandhi, who is the chairman of the department of electrical engineering at the University of Utah, Salt Lake City, explained that he had made separate errors in his numerical calculations and in his experimental measurements. In a paper submitted to *IEEE Microwave and Guided Wave Letters* last year, Gandhi had reported "excellent agreement" between the two techniques. After making the necessary corrections, Gandhi once again found that the two yielded peak SARs that were "in general agreement." In a telephone interview, Gandhi pointed out that "agreement" is a relative term: "We don't expect to do better than a factor of two or three." He added that his experimental techniques are less detailed and precise than his computer model. In contrast to the media blitz that followed the release of the results Gandhi has now retracted, the industry has been relatively silent about these revelations. Interestingly, however, Gandhi's letter to the FCC first surfaced when the Cellular Telecommunications Industry Association gave it to CNN correspondent Steve Young, who reported it on the August 29 edition of *Moneyline*. Gandhi told *Microwave News* that he had first discovered the errors last January. When asked why he had waited so long to acknowledge them, he said that he was under no obligation to do so and, in any case, "The phones were still within the ANSI guidelines." At last June's *Workshop on the Safety of Mobile Communications,* held in Copenhagen, Denmark, Gandhi presented data showing higher SARs—up to 2.27 W/Kg, which exceeds the 1.6 W/Kg standard specified by ANSI/IEEE—than those reported last year (see *MWN,* J/A94). The highest SAR, he said, was not obtained with a cellular phone, but with an experimental antenna. "The smaller the antenna, the higher the SARs," Gandhi explained in September, adding that, "Antenna design is an important aspect of mobile communications and it ought to be done carefully because there can be substantial coupling to the head. It is possible to exceed the guidelines." He concluded by saying that, "We need more research." A paper detailing Gandhi's corrected data has been accepted by *Radio Science*. Meanwhile, he is updating the paper submitted to *IEEE Microwave and Guided Wave Letters*.

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Members of 16 research groups from all over the world will meet in **Rome**, Italy, November 18-19 to discuss computer models of energy absorption from hand-held cellular phones. "We will compare the techniques and assess to what extent they are applicable to modeling the absorption caused by the use of cellular phones," said Dr. **Niels Kuster** of the Swiss Federal Institute of Technology in Zurich, who is helping to organize the workshop. It is being held under the auspices of Working Group 3 on **Numerical Computations** of **COST 244**, the European Community's project on the biomedical aspects of EMFs.

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The **General Accounting Office** (GAO) report on cellular phone safety, requested almost two years ago by Rep. **Ed Markey** (D-MA), should be out in November, according to a GAO source. It will go to the House Energy and Commerce Committee's telecommunications and finance subcommittee, chaired by Markey, which will have up to 30 days to review the report. The investigation has covered both government and private sector research on the health effects of low-level RF radiation, along with federal regulatory actions. The GAO, the investigative arm of Congress, had previously predicted that the report would be completed last spring (see *MWN,* S/O93).

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Should cellular phones be **tested for compliance** with health standards? As we reported in our last issue, the **FCC** recently adopted rules that essentially require all PCS phones to be tested if their power outputs are 100 mW or more. Since hand-held cellular phones in the U.S. have power outputs of up to 600 mW, it seems likely that the commission will require them to be tested too. The FCC is still weighing its options and could decide to adopt the 1992 ANSI/IEEE guidelines, which exempt phones from testing if power output is less than approximately 700 mW and if a 2.5 cm distance is "maintained" between the user and the "radiating structure." Cellular phones are held right against the head, however, and there is no separation between the phone and the user's hand. **Ericsson GE Mobile Communications** Inc., a major manufacturer of cellular phones based in Research Triangle Park, NC, asked the IEEE Standards Coordinating Committee 28 (SCC28), which approved the 1992 standard, for clarification on how to interpret the exclusion clause. In a June 22 letter, Drs. **Eleanor Adair** and **Om Gandhi**, cochairs of SCC28 subcommittee 4 on safety levels, replied that they "did not intend to exempt from the exclusion clause hand-held devices where the radiating structure may be within 2.5 cm of the head some of the time." Rather, they wrote, the subcommittee had wanted to ensure the testing of devices "worn on the body." This opinion, Adair and Gandhi wrote, was approved by the subcommittee's Interpretations Working Group, whose members are Motorola's Quirino Balzano, FDA's Howard Bassen, GE's John Bergeron, Raytheon's John Osepchuk, AT&T Bell Labs' Ron Petersen, the VA's Carl Sutton, and consultants Jules Cohen, Bill Guy and Richard Tell, as well as Adair and Gandhi. At least two of the group, Balzano and Bassen, did not agree with the majority view. As Balzano told *Microwave News,* "It is my opinion that hand-held cellular phones should be tested and should not be excluded because you maintain them close to the head." In separate interviews, Petersen and Gandhi said that while they continue to support the new interpretation, they

both feel that the matter is moot because the FCC will not go along. "AT&T is not counting on the low-power exclusion. It's inevitable that we will have to test the phones," Petersen said. Gandhi agreed: "When the dust settles, it is very likely that the FCC will require testing." Ericsson is still hopeful, however. In a September 12 letter to the FCC, its attorney, David Jatlow of Young & Jatlow in Washington, asked the commission to adopt a rule that provides a categorical exclusion for low-power hand-held cellular phones from SAR testing.

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Electromagnetic interference (EMI) to critical **medical devices** from wireless technology continues to attract attention—this time from Congress. As we went to press, the House Government Operations Committee's subcommittee on information, justice, transportation and agriculture, chaired by Rep. **Gary Condit** (D-CA), had called a hearing for October 5. Those scheduled to testify included representatives from the FCC, Southwestern Bell Mobile Systems and Medtronic Inc. Recent reports of EMI to such devices as wheelchairs, pacemakers and critical hospital equipment prompted the hearings (see *MWN,* J/A93, N/D93 and J/A94). "We want to raise the issue and put some pressure on," said a congressional aide, "but we don't want to create an environment of hysteria."

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EMI from a **mobile phone** may have caused the crash of a Royal Air Force (RAF) **Chinook helicopter** in Scotland in early June, killing 25 top military intelligence officers and the four-person crew, according to the U.K. newspaper *Sunday Express*. "Aviation experts examining the wreckage have ruled out mechanical fault or pilot error," the paper reported in its July 31 edition. "Now they think a call to a mobile phone on the helicopter may have fatally distorted vital radio navigating signals." Though the deaths of the military officials represented a devastating blow to the intelligence services that are involved in the fight against the Irish Republican Army, the RAF announced immediately following the incident that there was no evidence of a terrorist attack. The *Express* outlined the following scenario: The helicopter, coming from Northern Ireland, was approaching the coast of Scotland in bad weather with the automatic pilot engaged and was relying on a Tacan UHF radio navigation system; a call came in to a phone carried by one of the officers; since the phone and the Tacan receiver use similar frequencies, the navigation system was disrupted when the officer answered the call; off course, the helicopter crashed into a hillside on the rugged coast. The paper quoted an RAF spokesperson as saying that "the RAF is very keen on the use of mobile phones" and that the officers would have been carrying them. But the spokesperson also said that the RAF prohibits the use of mobile phones in flight. The use of cellular phones and all types of mobile radios is prohibited on commercial airline flights in the U.K. and elsewhere. Jack Satterfield, a spokesperson for **Boeing** Co.'s helicopter division in Philadelphia, manufacturer of the Chinook, told *Microwave News,* "We do not know why it crashed." He added that the mobile phone scenario amounts to nothing more than "speculation." "It's interesting speculation, I'll admit," he said, but he emphasized that the only thing known for certain is that "it was raining and the visibility was very poor." The RAF, which is leading the crash investigation, has not said yet whether the pilot was even using instrument navigation, Satterfield pointed out. A final report on the crash will take many months. The helicopter carried the RAF designation HC-MkII Chinook. It had been completely rebuilt and upgraded at a Boeing factory and was delivered to the RAF just a few months before the accident. Two U.S. Army combat helicopters, the Apache and the Black Hawk, have reportedly suffered severe EMI—resulting in fatal accidents—when exposed to radiation from radars, communications equipment and other sources (see *MWN,* N/D 87, S/O88, N/D88 and S/O91).

Cellular Phone Industry Research Group Sees Need for "Basic Information in All Areas"; Proposals Under Review

The Scientific Advisory Group (SAG) on Cellular Telephone Research, charged by the Cellular Telecommunications Industry Association (CTIA) to develop a $15-25 million program on the potential health effects of radiation from cellular phones, has published its research agenda.

Actual requests for proposals (RFPs) have not yet been issued, however, except those for genotoxicity studies, which were released in December 1993. Dr. George Carlo, chairman of the SAG, said he expects that projects in genotoxicity and other areas will be under way—"with checks signed"—by the end of the year. To date, the SAG has spent $2 million.

In a review of the existing data, included as part of the research agenda, the SAG concludes that "basic information in all areas" is still needed: "Existing scientific literature encompassing toxicology, epidemiology and other data integral to health risk assessment, while providing useful information, is inadequate for drawing either the conclusion that wireless communication instruments present a public health threat or that they do not."

This marks a departure from the industry's stance as it launched the research program in January 1993, when media reports about a cellular phone–brain tumor lawsuit put the health issue in the spotlight. (A fifth suit has now been filed; see p.10.) CTIA President Thomas Wheeler said at the time that the program would "revalidate the findings of existing studies, which have found that the radiowaves from cellular phones are safe" (see *MWN,* J/F93 and J/A93). Asked about the SAG statement, CTIA's Ron Nessen said that the evolving views should help demonstrate that "the scientific program is working as it is supposed to."

Overall, the newly completed research plan "is in keeping with what we suggested 18 months ago," said Dr. Mays

Swicord, chief of the radiation biology branch of the Food and Drug Administration's (FDA) Center for Devices and Radiological Health in Rockville, MD. The FDA—initially asked by CTIA to run the industry's health research program but later dropped—has consistently maintained that the available data are inadequate for assessing whether cellular phones pose a hazard. "There is not enough evidence to know for sure, either way," the FDA concluded in a February 1993 statement.

Several guiding principles are articulated in the research plan. For example, appropriate exposure methodology will be given top priority, and animal studies will be given more weight than cellular research. In addition, the research plan calls for five "concept papers" on topics such as how to extrapolate animal and cellular studies to humans and how to assess exposures for epidemiological studies.

The actual types of research the SAG will fund fall into four general areas: dosimetry; genotoxicity; lifetime animal exposures; and epidemiology. Depending on the outcome of this work, "there may be a need to conduct *in vitro* or *in vivo* mechanistic and methodology studies," the plan states. The description of the research fills just eight pages, however, and does not identify past studies that should be followed up or replicated. "The plan does not address replication of existing studies head on," Swicord said. This is understandable, he added, since none of the relevant research involves exposures at cellular phone frequencies, but this omission is, nonetheless, "somewhat of a disappointment to us."

Carlo explained that his next set of RFPs—due in November—will cover several of the concept papers and will include a request for investigator-initiated proposals in response to the full research agenda. More detailed, project-specific RFPs will be issued next spring, Carlo said. These may describe past work that merits attention but will go further, requiring, for example, the incorporation of exposure methods that are currently being developed as part of the SAG program.

No proposals have yet gone through the formal review process and received funding. The SAG—consisting of Carlo, Dr. Bill Guy, emeritus of the University of Washington, Seattle, and Dr. Ian Munro of CanTox in Mississauga, Ontario, Canada—has spent $2 million developing the research agenda, conferring with more than 100 scientists and holding three symposia, Carlo said. The SAG has made laboratory site visits and completed a thorough review of the literature, he added. About 40 researchers have been paid as consultants, Carlo estimated, allowing preliminary work to be done that will form the underpinnings of the program.

CTIA, based in Washington, has committed $15-25 million to the effort. But Nessen told *Microwave News* in September that, "It's probably going to take more than $25 million. The industry has said it will spend whatever it takes."

Noting that CTIA was pleased with the work done so far, Nessen said Carlo has performed "a balancing act" between going too fast and too slow. "We'd like the program to move faster, but then we would run the risk of having people say that we're trying to rush out some quick results," Nessen said.

Some delays have been caused by the SAG's requirement that all its researchers follow good laboratory practices (GLPs) or good epidemiology practices, Carlo said. These are standards accepted by the federal government. "Most of the people who have submitted proposals have not been up to GLPs," he said.

The SAG announced last December that it had commissioned dosimetry studies from Dr. C.K. Chou of City of Hope National Medical Center in Duarte, CA, and from Dr. Om Gandhi of the University of Utah, Salt Lake City, along with an epidemiological study from Dr. Kenneth Rothman of Epidemiology Resources in Newton Lower Falls, MA (see *MWN,* J/F94).

The GLP requirement, among other things, has delayed funding of formal research proposals from Gandhi and Chou, Carlo said. Gandhi told *Microwave News,* however, that, "I

New Cellular Phone Brain Tumor Suit Filed

A new lawsuit filed in federal court in Tampa, FL, alleges that radiation from a hand-held cellular phone caused or aggravated the brain tumor that killed William Hartwig. Attorneys involved in this litigation say additional suits are likely soon.

The suit by Hartwig's widow against Nokia Corp. of Finland, and others, charges that the defendants should have warned that the device exposed users to "dangerous, hazardous and excessive microwave radiation." Filed September 6 in U.S. District Court in Tampa, the complaint also states that the phone should have been equipped with a shielding device and that it did not meet existing microwave radiation exposure standards. The defendants named in the suit include Nokia's U.S. subsidiary, Nokia Mobile Phones Inc. of Largo, FL, and a U.K. company, Technophone, which is owned by Nokia. The phone Hartwig used carried the Technophone name.

This is the fifth brain tumor suit filed against a cellular phone manufacturer—and the second filed by John Lloyd Jr., an attorney in St. Petersburg, FL. Lloyd also represents David Reynard, who charges that radiation from an NEC hand-held cellular phone caused his wife's death from a brain tumor. Publicity about the Reynard suit rocked the cellular phone industry in early 1993 (see *MWN,* M/J92 and J/F93). The other cases, filed after Reynard's, are a claim brought by a Motorola engineer, Robert Kane, who alleges that his cancer resulted from the testing of a prototype cellular phone antenna, and two claims that were begun as part of a class action and then refiled as separate personal injury cases (see *MWN,* J/A93, J/F94 and J/A94).

"William Hartwig used his phone right up until the day he died," Lloyd said, arguing that exposure to radiation from the phone hastened his death, even if it did not cause the initial formation of the tumor. Hartwig died in September 1992, at the age of 48, three months after he was diagnosed with an astrocytoma. For several years prior to that, he had been suffering from symptoms that could have been related to a brain tumor, Lloyd told *Microwave News,* but he had been diagnosed otherwise.

A Nokia spokesperson declined to comment on the case.

do not know whether to be optimistic about receiving funding from the SAG." He added that he has "no problem with GLPs." Chou was traveling and could not be reached for comment. Carlo said that the SAG has asked Chou to develop a head-only RF exposure system for animal studies. Gandhi has been asked to "work out the bugs" in his human dosimetry model, Carlo said (see p.8).

Rothman's work accounts for as much as $400,000 of the SAG's expenditures to date, according to Carlo. Rothman told *Microwave News* that he has collected billing data from cellular service providers covering several million users. He is now conducting "validation studies" to assess the usefulness of these data as a measure of actual exposure to cellular phone radiation. Rothman said he also expects to conduct a full-scale study and has been told that the SAG will fund it. Carlo noted that the protocol for such work must still go through the SAG's review process.

Seventeen proposals have been received in response to last year's RFPs for genotoxicity studies, and these applications are among those now being reviewed. The proposals must still be evaluated by the SAG to see how they fit with the newly published research agenda, Carlo said, and then they will be reviewed by the cellular telephone panel that has been established at the Harvard Center for Risk Analysis in Boston (see *MWN,* J/A94). The panel also reviewed the research plan. "The SAG was responsive to the comments made by our reviewers," said Dr. Susan Putnam, a research associate at the center.

The SAG's *Potential Public Health Risks from Wireless Technology: Research Agenda for the Development of Data for Science-Based Decisionmaking* runs 125 pages, with an additional 100 pages of references and close to 200 pages of charts, tables and appendices, including detailed descriptions of the three symposia. It is available from SAG, 1711 N St., NW, Suite 200, Washington, DC 20036, (202) 833-2800.

Two Collections of Papers on Biological Interactions

Hot off the presses are two new works about EMFs and biological interactions. The first, a two-volume set, is *Biological Effects of Electric and Magnetic Fields,* edited by Dr. David Carpenter, dean of the School of Public Health at the State University of New York, Albany, and Dr. Sinerik Ayrapetyan, a visiting scientist who worked with Carpenter and has now returned to the Armenian Academy of Sciences in Yerevan. The second is *On the Nature of Electromagnetic Field Interactions with Biological Systems,* edited by Dr. Allan Frey, chairman of Randomline, a research and consulting firm. The books deal primarily with the effects of power frequency EMFs, but also include reviews on RF/MW radiation.

The first volume of the Carpenter–Ayrapetyan collection synthesizes the work of prominent researchers, examining the sources and mechanisms of the interactions of EMFs and biological systems, and the second volume examines the beneficial and harmful effects of those interactions. "I am pleased that we have several chapters from scientists from the former Soviet Union," said Carpenter. "That work is relatively unknown in the U.S."

Frey's book presents readers with timely information in a rapidly changing area of science: It was written, edited and published in eight months, said Frey, who is based in Potomac, MD.

Published by Academic Press in San Diego, the Carpenter–Ayrapetyan set costs $198.00; each volume is more than 350 pages. To order, call (800) 321-5068, or fax (800) 336-7377. The 184-page Frey book is published by CRC Press in Boca Raton, FL. It costs $89.95 ($108.00 outside the U.S.). To order, call (800) 272-7737, or fax (800) 374-3401.

EPA on Low-Level RF/MW Radiation *(continued from p.1)*

cies, but abandoned this effort in 1988 (see *MWN,* S/O88). This time, EPA, with a new interagency working group, intends to write guidelines, which will not have the force of law.

The NCRP study may challenge the reliance in existing guidelines on specific absorption rates (SARs) as the fundamental dosimetric method of measuring RF/MW exposures. "[S]ome studies indicate that exposure to pulse-modulated radiation produces effects that are different from exposure to CW [continuous wave] radiation of the same carrier frequency and SAR," the NCRP states in its proposal to the EPA. Describing the study's objectives, the NCRP concludes that, "A likely result of this assessment will be a recommendation that addresses the inclusion of the modulation of RF radiation as a factor in establishing RF radiation maximum permissible exposure limits."

"Modulation may very well render the concept of SARs null and void," said Dennis O'Connor of EPA's Office of Radiation and Indoor Air (ORIA). He explained that the NCRP project could provide the EPA with a basis for assessing nonthermal effects and could help stimulate research. "We keep reassessing and reassessing a smattering of existing research," O'Connor noted, "when what we really need is more research."

Dr. Thomas Tenforde of Battelle Pacific Northwest Labs in Richland, WA, who is overseeing the NCRP project, agreed: "Research on this issue is sparse." Tenforde is forming a new committee under NCRP Scientific Committee 89, the NIER umbrella group that he chairs (see *MWN,* M/J92). The EPA is providing $150,000 over two years for the NCRP project, which will result in an NCRP "statement" or "commentary" on the health effects of pulsed or modulated radiation. The membership and chair of the new committee will be announced this fall, Tenforde said.

The new panel will review the literature on modulation and nonthermal effects, Tenforde told *Microwave News,* but it will also consider theoretical dosimetry models and related biological interactions. "We may have to make some extrapolations," he said. In this way, Tenforde added, the project may be similar to the National Academy of Sciences' (NAS) report on possible health risks from the U.S. Air Force's GWEN communications system, which Tenforde directed. Faced with a lack of research directly applicable to the operational frequencies of

the GWEN system, Tenforde's panel used a novel—and controversial—risk assessment method (see *MWN,* M/J93).

O'Connor and Tenforde both said the new focus on modulation was prompted by the advent of digital cellular phones and other wireless devices that generate RF signals that are pulsed at extremely low frequencies (ELF). "It's only prudent that we start thinking about the potential health effects of this new technology before we have spent billions putting it in place," O'Connor told *Microwave News.* Tenforde noted that the new cellular phone technology makes concerns over ELF modulation a "much more timely and important issue."

In 1986, the EPA formally proposed three possible RF/MW limits—SARs of 0.04, 0.08 and 0.4 W/Kg, which translate into power densities of 100, 200 and 1,000 ∝W/cm^2 for 30-300 MHz—and a fourth, "no regulatory action" option (see *MWN,* J/F86, M/J86 and J/A86). The limits were based on the conclusion that adverse health effects "begin to occur" at SARs of 1-4 W/Kg and reflected a safety factor of 10-100. The existence of nonthermal health effects from RF/MW exposures at SARs of less than 1 W/Kg was "not clear," the agency stated at the time. Two years earlier, the EPA was close to proposing a 100 ∝W/cm^2 guideline but backed off in the face of political opposition (see *MWN,* Jun84, J/A84 and S/O85).

After all but abandoning NIER work in 1993, ORIA announced last winter that it would return to the issue and design a new program (see *MWN,* J/A93 and M/A94). The agency also announced at the time that it would resume work on RF/MW exposure guidelines.

The Institute of Electrical and Electronics Engineers (IEEE) committee that drafted the latest version of the 1992 ANSI/IEEE C95.1 standard specifically excluded consideration of nonthermal effects, noting that "no reliable scientific data exist" to indicate that exposure to nonthermal levels of modulated RF/MW radiation may be "meaningfully related to human health" (see *MWN,* N/D91 and N/D92).

Whether the EPA will return to the proposed 100 ∝W/cm^2 limit is unclear. The 1986 options will be "a starting point" for the interagency working group, explained Gene Durman, deputy director of ORIA. "We will not ignore our past involvement in this."

Durman said the agency "is not in a position" to go beyond the approach, based on known thermal hazards, used by the NCRP and the IEEE. "But we will be quite explicit about the fact that the standard does not address possible low-level effects." The EPA recognizes that "new research in the next few years could cause us to reevaluate what should be in the guidelines," he added.

The members of the interagency panel that will oversee this work are Dr. Robert Cleveland Jr. of the Federal Communications Commission, Robert Curtis of the Occupational Safety and Health Administration (OSHA), Norbert Hankin of the EPA, Dr. Gregory Lotz of the National Institute for Occupational Safety and Health, Janet Healer of the National Telecommunications and Information Administration and Dr. Mays Swicord of the Food and Drug Administration (FDA).

Everything is in place to move quickly, O'Connor said. "We are simply going to complete the task that was laid at our feet some time ago" by EPA's Scientific Advisory Board (see *MWN,* J/A91). A draft of the guidelines could be ready for public review in about a year, Durman said.

As early as 1978, an interagency committee with representatives from the EPA, the FDA and OSHA was assembled to examine RF/MW bioeffects research and possible control measures; this group was disbanded in 1981 (see *MWN,* N81).

NCRP To Revise 1986 RF/MW Limits

The NCRP plans to revise its 1986 RF/MW exposure recommendations, Dr. Thomas Tenforde, chair of NCRP Scientific Committee 89, told *Microwave News.* He added that he has support from at least one sponsor but declined to name the organization.

The original NCRP limits, which are similar to the 1992 ANSI/IEEE standard, were based on known thermal hazards. The NCRP also advised that, "If the carrier frequency is modulated at a depth of 50% or greater at frequencies between 3 and 100 Hz, the exposure criteria for the general population shall also apply to occupational exposures" (see *MWN,* J/F86 and M/A86). A more direct examination of low-level exposures is likely in the revision, Tenforde said. "We might be in a position down the road to make stronger statements about modulation, but we don't know yet."

FROM THE FIELD

Latvia's Russian Radar May Yield Clues to RF Health Risks

On June 17-21 a conference on The Effect of Radiofrequency Electromagnetic Radiation on Organisms *was held in Skrunda, Latvia, under the sponsorship of the Soros Foundation (see* MWN, *M/A94). Skrunda is the site of a large phased array radar, built by the Soviet military in 1969 as part of its ballistic missile early warning system. The radar operates at 154-162 MHz. Each antenna in the array has peak and average powers of 2.5 MW and 50 kW, respectively. The radar has long drawn complaints from the over 14,000 people who live nearby—many of whom believe the radar has damaged their health. The Skrunda Support Foundation, which describes itself as an "independent, nonpolitical, open, nonprofit organization," was founded March 3, 1994, at the University of Latvia, Riga, to investigate the effects of over 30 years of radar exposures. (The address of the foundation is 11 Raina St., Skrunda, LV-3326, Latvia.) Dr. John Goldsmith of the Ben Gurion University of the Negev in Beer Sheva, Israel, formerly an epidemiologist with the California Department of Health Services, attended the meeting and filed the following report on his return.*

The rolling countryside around Skrunda is green. Pine and birch woodlots and farms checker the land. Skrunda has about 6,000 people and with its railroad and the Venta river nearby, it is the trading center for this peaceful agrarian region.

There is another Skrunda a few kilometers away that is surrounded by a barbed wire fence and guarded by soldiers. It was built by the Russians during the years they occupied Latvia to house a radiofrequency (RF) space probe and detector array. The radar installation is a massive complex that includes an 18-story building (with an additional four stories underground), which houses arrays of RF antennas configured to scan the northwestern sky. According to the terms of a recent treaty, Russia retains the right to occupy and operate the Skrunda complex until 1998, at which time the Latvians can decide its future.

At the conference, Latvian scientists reported adverse effects on tree growth and the health of both humans and cows living near the radar. Here are some highlights from the presentations of Latvian and visiting researchers:

• Dr. Valdis Balodis of the University of Latvia, Riga, who convened the conference, found a significant negative correlation between RF power density and tree ring growth. In 70 experimental and control plots in forests around the Skrunda radar, Balodis also investigated the possible role of geological, chemical and geographical factors, but none of these could explain the impaired tree growth.
• On the other hand, Dr. Paul Schmutz of the Federal Institute of Forest, Snow and Landscape Research in Birmensdorf, Switzerland, and his colleagues found no evidence of microwave-induced damage to spruce and beech trees exposed for long periods to power densities of 0.7 $\propto$W/cm^2 to 30 mW/cm^2, at a frequency of 2450 MHz. At the highest power levels, the temperature of sucrose solutions, suspended in the plots, increased by 4°C. Whether pulsed exposures with high peak powers—like those from the Skrunda radar—but with the same mean intensity would do any damage is not yet known, according to Schmutz.
• Zanda Balode, of the University of Latvia, Riga, and a coauthor of the Balodis paper, separately found evidence of chromosomal damage associated with the radar. Among 68 cows which had grazed for at least two years in fields in front of the radar array, Balode found significantly more red blood cell micronuclei than in unexposed cows. (Micronuclei are a sign of chromosomal damage.) Exposed cows had 0.6 micronuclei per 1,000 cells, compared to 0.1 per 1,000 in the blood of 105 cows from control fields.
• Dr. Vesma Robule and colleagues in Riga found significant increases in counts of white blood cells—including eosinophils, monocytes and thrombocytes—among 230 Skrunda residents compared to 297 controls. There were no differences in the incidence of cancer, however. Robule also reported increased headaches and sleep disturbances, among other symptoms. Significant health differences were found between exposed and unexposed children, including decreased lung function in exposed children.
• In an abstract prepared for the meeting, V. Ardanovich of the A.L. Minc Radio-Technical Problems Institute in Moscow pointed out that the 0.8 ms pulses of Skrunda-type radar make it difficult to evaluate or predict effects, most of which are estimated on the basis of time-averaged power densities. (No Russians attended the conference, although a number like Ardanovich sent abstracts.)
• Dr. Stanislaw Szmigielski of the Center for Radiobiology and Radiation Safety at the Military Institute of Hygiene and Epidemiology in Warsaw, Poland, reported that Polish military personnel exposed to radar had elevated rates of several cancers and blood disorders. Compared to controls, the increased risks for exposed personnel were 8.3 times for non-Hodgkin's lymphoma and lymphosarcoma, 7.8 times for acute lymphoblastic leukemia, 9.6 times for chronic myelocytic leukemia and 5.5 times for acute myeloblastic leukemia.
• Goldsmith reported on the genetic abnormalities previously disclosed among U.S. foreign service personnel exposed to microwave radiation at the U.S. embassy in Moscow. Of 35 employees whose white blood cell chromosomes were tested for abnormalities in 1966-1969, 6 were normal, 5 were questionable, 2 had growth failures, and the remaining 22 showed some degree of mutagenic activity. Dr. Cecil Jacobson of the George Washington University School of Medicine found in 11 cases a "clinical necessity" to follow personnel "for possible genetic consequences." Similarly, in his 1978 epidemiological study, the late Dr. Abraham Lilienfeld of the Johns Hopkins School of Hygiene and Public Health in Baltimore urged that the Moscow embassy population be restudied after a suitable interval. In light of the unresolved questions concerning the Moscow studies, Goldsmith argued that the blood samples from the human and bovine populations exposed at Skrunda are very important to our understanding of the possible health effects of RF radiation.

Bromley on EPA EMF Report

The following is excerpted from The President's Scientists: Reminiscences of a White House Science Advisor *by Dr. D. Allan Bromley. The book, which was published September 1, 1994, is available for $30.00 from: Yale University Press, PO Box 209040, New Haven, CT 06520. Note that the briefing on the EPA report was in 1990, not 1991 (see* MWN, *M/J90 and N/D90). For more on the CIRRPC report, see* MWN, *N/D92.*

Health risks of radiation of all kinds continue to be of immense public concern, often disproportionate to available scientific evidence. A longstanding FCCSET [Federal Coordinating Council for Science, Engineering and Technology] subcommittee, the Committee on Interagency Radiation Research and Policy Coordination (CIRRPC), has been meeting regularly to deal with these issues and to work toward standardizing rational regulatory policies across agencies.

In recent years there has been growing public concern about possible hazardous effects of the low-intensity, low-frequency electromagnetic radiation emitted by power lines, appliances, electric blankets, and, in particular, television receivers, computers, and video terminals. The magazine *Macworld* bound a preaddressed postcard to me at OSTP [Office of Science and Technology Policy] in one of its issues and invited its readers to sign and mail the card to indicate their concern about this newly recognized supposed health hazard.

I became involved in this matter because in 1991 I had received a requested briefing on a report about to be issued by the EPA [Environmental Protection Agency] and had been shocked by what I heard. The study was a detailed survey of all the published research on the subject of electromagnetic radiation in this intensity and frequency range. Much of the research was of poor quality and with questionable control studies, but the EPA review was a valid report of what had actually been published. What concerned me was the fact that the executive summary of the report painted a substantially more coherent picture than did the report itself, and—much worse—the vugraphs used in the briefing suggested that the correlation between exposure to low-frequency, low-intensity electromagnetic radiation and childhood leukemia was too great to be attributed to chance. In no way did the reviewed research support such a conclusion, and I insisted, as the senior scientist in the Bush Administration, that these vugraphs be changed. I specifically did *not* request any changes in the report or its executive summary.

The staff of the EPA involved in this work promptly leaked to the media and to Congressional staffers, without [EPA Administrator William] Reilly's knowledge, that I was censoring their efforts to protect children, and a minor fire storm developed. There were claims that I had attempted to stack Reilly's review committee within EPA because I had responded to his request for names of people who had expert credentials in the area by listing a number of individuals. One of the

people I recommended was Robert Adair, a Yale colleague who also happened to be the Chairman of the Physics Section of the National Academy of Sciences and had devoted considerable time and effort to studying the electromagnetic field (EMF) question.

I found myself called by two Congressional committees to defend myself against the assertions of censorship and—even more seriously—callous disregard for the health of children!

Public sentiment was fanned by articles in *The New Yorker* by Paul Brodeur. He is a very persuasive writer, but the weight of scientific opinion does not always agree with his conclusions.

Clearly something had to be done to put this issue back on a proper scientific basis, so I turned to Al Young, the Chairman of CIRRPC, with the request that he put together a blue-ribbon panel—without any input from me or from OSTP, to avoid any possibility of perceived improper influence—to undertake a detailed examination of the possible health-related aspects of EMF.

In 1992 the CIRRPC study was released as an FCCSET-commissioned publication. The report, prepared by an independent, nationally recognized group of experts assembled by the Oak Ridge Associated Universities (ORAU) organization, concludes that available evidence fails to document health risks of EMF in nonoccupational settings. A research agenda was proposed to explore the field further, but the committee concluded that an expansion of research efforts on this topic does not command high priority....

...It is safe, however, to conclude that the EMF risk issue will continue to be contentious and of immense potential economic importance; the current best estimate is that prior to 1993 it has cost the American public more than $23 billion to respond to public worries about EMF—particularly in connection with the placement of high-voltage power lines.

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Clippings from All Over

If fields of two milligauss really are a serious threat in Denver, Los Angeles and Sweden, then commuters on East Coast electric trains—where the fields at power line frequencies can be hundreds of times larger—ought to be dying like flies. So much for the electromagnetic hoax. To grasp how much damage it's caused, consider what useful developments in cancer research, in education, or in any other field, could have been accomplished with the $23 billion already squandered on this scare. That ought [to] be more shocking to people than any electromagnetic field.

—"Power Lines Are Homely, Not Hazardous," Dr. William Bennett Jr., Yale University, *Wall Street Journal,* p.A8, August 10, 1994

At one extreme, we reject the assertion that there is nothing to be concerned about. Enough evidence exists to lead us to conclude that dismissing concerns about EMF is unwarranted. At the other extreme, we are discouraged by both the quality and quantity of the evidence available to us and thus cannot claim to know the nature nor the magnitude of the risk with any certainty. Thus, relying solely on the data currently available is also unwarranted.

—Edward Washburn et al., "Residential Proximity to Electricity Transmission and Distribution Equipment and Risk of Childhood Leukemia, Childhood Lymphoma and Childhood Nervous System Tumors: Systematic Review, Evaluation, and Meta-Analysis," *Cancer Causes and Control, 5,* pp.299-309, September 1994

They [CTIA] claim that they are being careful in getting a full review from everybody involved before moving ahead. I think they need to speed things up, though. They're moving too slowly.

—Dr. Om Gandhi, University of Utah, Salt Lake City, quoted in "Lone Study Refuting Cancer–Cellular Phone Link Raises Questions," Bloomberg Business News, August 31, 1994

It is clear that, at present, regulation is simply not a workable possibility of dealing with all of the problems of [EMFs]. However, given the weight of the evidence of human health hazards, the consistency of these observations, and the seriousness of the disease implicated, it is also unacceptable to take no action. We do, of course, need more research, both in areas in which human health is evaluated in relation to [EMF] exposure and in animal and cell systems in which one can determine mechanisms of action responsible for the human health effects. Much more engineering research is critically needed to allow us to distribute and utilize electricity without undue hazard to health. Both governments and individuals have difficulty dealing with uncertainty, and this is particularly so when health is involved. The concept of prudent avoidance by [Dr. Granger] Morgan is, in my judgment, an appropriate and wise approach to dealing with uncertainty.

—Dr. David Carpenter, "The Public Health Implications of Magnetic Field Effects on Biological Systems," in *Biological Effects of Electric and Magnetic Fields,* Vol.2, David Carpenter and Sinerik Ayrapetyan, eds., San Diego: Academic Press, p.328, 1994 (see p.11)

By adopting the Proposed Decision and Order, the majority has stated that medical science has only advanced to a stage where electromagnetic field (EMF) exposure is a *possible* rather than a probable cause of leukemia. But under what circumstances? When the evidence, relative to Mr. Pilisuk's exposure, is examined in light of the burden placed on the claimant, it is eminently clear that Mr. Pilisuk's exposure placed him at a significantly higher risk of contracting leukemia, and that if not for that exposure, it is not likely that he would have developed the leukemia....The claimant is not required to disprove all speculative causes of the leukemia, or to establish how the heavy exposure to EMFs results in leukemia. The fact is medical science still cannot explain the biological mechanism by which asbestos causes mesothelioma, but that fact cannot act as a bar to allowance of claims for occupational disease. The evidence in this record clearly establishes that a statistical association exists between exposure to magnetic fields and the development of cancers. Mr. Pilisuk's exposure placed him in a group with a significantly greater risk of contracting leukemia, a risk he would not have borne, but for the distinctive conditions of his employment. More likely than not, this exposure caused his leukemia.

—Frank Fennerty Jr., dissenting opinion, Board of Industrial Insurance Appeals, Washington State, *In re: Robert Pilisuk* (see p.5), pp.2-4, September 6, 1994

Amid growing awareness of the potential hazards associated with [EMFs], leading U.K. insurers are saying their general liability policies do not cover injuries or damage arising from EMF exposure. The concern also is prompting at least one insurer to withdraw from the market for utility company excess liability coverage. The decision by Iron Trades Insurance Co. Ltd. to pull out of that market indicates that U.K. insurers are increasingly worried about the potential liability exposure associated with the [EMFs] around power lines.

—"Insurers Emit Liability Concerns," *Business Insurance,* p.17, September 12, 1994

BREAST CANCER

New Papers from Germany... Two recent reports from Dr. Wolfgang Löscher of the School of Veterinary Medicine in Hannover and colleagues shed more light on the possible link between breast cancer and EMFs. In one paper—whose preliminary results were originally presented in June 1992 at the *1st World Congress for Electricity and Magnetism in Biology and Medicine*—Löscher reports that rats treated with the chemical carcinogen DMBA and then exposed for 90 days to 50 Hz magnetic fields of 3-10 mG had significantly lower nocturnal melatonin levels. Although there were trends toward accelerated development, and higher incidence, of mammary tumors in the exposed rats, these results were not significant. The researchers play down the importance of the findings. They conclude that the exposure conditions did "not induce significant tumor promoting or copromoting effects" and that "modest changes in melatonin secretion in response to [EMF] exposure are not associated with gross effects on DMBA mammary carcinogenesis." In earlier work using 1 G fields and DMBA, Löscher found a significant increase in tumors (see *MWN,* J/A93). On the other hand, in the second paper, which reviews work on a number of cancer types in addition to breast cancer, Löscher and his coworker Dr. Meike Mevissen write that, "There is accumulating evidence that exposure of laboratory animals to power frequency [EMFs] induces a carcinogenic response." The German researchers examine models of spontaneous tumor development as well as cocarcinogenesis. This paper features two useful tables: one on *in vivo* studies of the carcinogenic effects of EMFs and a second on studies of the cocarcinogenic effects of EMFs on chemically initiated tumors. See: Löscher et al., "Effects of Weak Alternating Magnetic Fields on Nocturnal Melatonin Production and Mammary Carcinogenesis in Rats," *Oncology, 51,* pp.288-295, 1994, and Löscher and Mevissen, "Animal Studies on the Role of 50/60 Hertz Magnetic Fields in Carcinogenesis," *Life Sciences, 54,* pp.1531-1543, 1994.

INTERNATIONAL

Brain Hemorrhage Report..."Everyone in the town can name off five people who have had brain hemorrhages." That's how Dr. Mary Allen describes the cluster of brain hemorrhages that she has been investigating in the town of Crossmaglen, where she works as a general practitioner. Located in Northern Ireland on the border with the Republic of Ireland, the town is dwarfed by a British Army/Royal Ulster Constabulary base, and Allen blames non-ionizing radiation from military radars and communications equipment for the health problems (see *MWN,* S/O92). Now a study by Roger Coghill, a radiation researcher and activist based in Gwent, Wales, adds detail to her allegations. Released in August, the report lists 24 people who have suffered brain hemorrhages, pointing out that "a noticeable proportion are younger persons." Rough calculations by Coghill suggest that the 19 cases he could confirm in Crossmaglen, which has a population of 1,800, are at least ten times the expected number based on incidence data for Northern Ireland as a whole. His report points out that

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low levels of RF/MW radiation have been shown to cause leakage through the blood–brain barrier (see *MWN,* J/A92) and concludes that "the possibility that MW radiation is responsible for these cases cannot be ruled out." To date, no one has documented the radiation exposures of area residents, and the military has not disclosed the exact types of equipment in use. Allen points out, however, that there are four observation posts in the immediate vicinity, in addition to the main compound in the center of town. "You're always near one of the posts," Allen said in an interview with *Microwave News* in August. The border with the Republic of Ireland in this area is "a microwave border." Many of the people who have had brain hemorrhages lived or worked close to the military facilities, she said. These include a woman who worked in the town's fish and chips shop and two managers of the same bank—businesses that are on the town square in the shadow of the military base. Health fears related to the military presence date back to the mid-1980s, when the base was established. Though Allen, who is the founder of a local group called Campaign Against Radiation Emissions, has been trying to publicize the local health problems for five years, Coghill's report has resulted in the most attention yet for her cause—with accounts in many Irish and U.K. newspapers and on the local television news.

OCCUPATIONAL HEALTH

AIHA's NIER Guides... The American Industrial Hygiene Association (AIHA) has completed the second edition of *Radiofrequency and Microwave Radiation,* a 33-page booklet that covers sources, bioeffects, standards and measurements. The guide, which includes a long list of references and a short glossary, was written by Timothy Hitchcock of IBM Corp. in Research Triangle Park, NC, under the auspices of the AIHA Non-Ionizing Radiation Committee. Dr. Zory Glaser, formerly with the FDA and now a consultant based in Laurel, MD, was elected the chair of the committee in May. Glaser told *Microwave News* that the AIHA will publish a booklet on ELF EMFs in mid-1995, written by Hitchcock, Dr. Shari McMahan of the University of California, Irvine, and Gordon Miller of the Lawrence Livermore National Lab in Livermore, CA. The AIHA issued its first NIER guide, *General Concepts,* in 1977, which was followed by the earlier edition of the RF/MW booklet in 1988 and *Ultraviolet Radiation* in 1991. Copies of the new RF/MW guide are $12 each for AIHA members and $20 for others. Contact: AIHA, 2700 Prosperity Ave., Suite 250, Fairfax, VA 22031, (703) 849-8888.

PEOPLE

Dr. **Thomas Budinger** of the University of California, Berkeley, has stepped down as the chair of IEEE's SCC28, which wrote the 1992 ANSI/IEEE C95.1 RF/MW exposure standard. No replacement has yet been named....Dr. **Leonard Sagan** has retired from EPRI but will continue to consult for the institute....Dr. **Dennis Hadlock** has left SAIC to form Innovative Technical Analysis Corp., a consulting firm based in Rockville, MD....**Kyle King** has joined the East Coast office of

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Enertech Consultants in Lee, MA. He was formerly at the EPRI High Voltage Transmission Research Center.

RF LITIGATION

Family's Second Cancer Claim... In a replay of an earlier lawsuit, Scott Main alleges that RF radiation from an FM transmitter near the square dance camp his family ran for many years caused his malignant melanoma, which was diagnosed in 1992. In the previous case, Scott's parents, Beryl and Maelma Main, claimed that Beryl's non-Hodgkin's lymphoma was caused by the same broadcast tower, operated by KYGO-FM, a Denver station owned by Jefferson-Pilot Communications Co. The parents' claim was settled in 1990 for an undisclosed sum (see *MWN,* M/J90). Beryl Main was diagnosed in 1986; he died in 1991. In a 1986 survey, engineers from the FCC and the EPA documented RF radiation levels at the Lighted Lantern Square Dance Camp: On a patio/deck area at the camp, fields reached 300 $\propto W/cm^2$; indoors, fields were as strong as 100 $\propto W/cm^2$ (see *MWN,* M/A87). In a publicly accessible area at the base of the KYGO tower, which was just 100 ft from the camp, fields exceeded 10 mW/cm^2. Even before the parents began their lawsuit, their attorney, Bruce DeBoskey of Silver & DeBoskey in Denver, negotiated an agreement with KYGO to operate at reduced power and to fence off all areas near the tower where fields exceeded 10 $\propto W/cm^2$ (see *MWN,* M/J87). The company later moved its transmitter. "The cases are very similar, though not identical," said DeBoskey, who now represents Scott. In his complaint, Scott, who is 38 years old, states that he played or worked at the camp between 1966 and 1990. Jefferson-Pilot, the defendant, has moved to dismiss a portion of Main's complaint, including a charge of extreme and outrageous conduct. Even if Main proves his allegations of negligence and failure to warn, "there is nothing on the face of the plaintiff's complaint that will support a claim of extreme and outrageous conduct," the company argues in its brief. The defendant also maintains that the charges come too late to satisfy Colorado's statute of limitations and that they are preempted by federal law. Michael Montgomery of the Denver firm of Montgomery, Green, Jarvis, Kolodny & Markusson, who is representing Jefferson-Pilot, declined to discuss the case other than to say that it "is without merit." Scott Main's complaint was filed May 27 in state court and has been transferred to U.S. District Court in Denver.

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Jamail Drops Childhood Cancer Suit—No Explanation Given

Others Cite Changes in Texas Legal System

Famed Texas attorney Joe Jamail and his cocounsel John Tyler Jr. have withdrawn their lawsuit against Houston Lighting & Power Co. (HL&P) on behalf of 11 families with children who had contracted cancer. Originally filed last December, the suit prompted widespread concern within the utility industry because of Jamail's success in winning large awards—once as high as $11 billion (see *MWN,* M/A95).

The plaintiffs' motion for "nonsuit" was granted on September 11 by the Harris County District Court. The case was dismissed without prejudice, meaning that the plaintiffs can refile their claims in the future.

Jamail, of Jamail & Kolius, and Tyler, of Tyler & Das, both in Houston, refused to return phone calls asking for comment. No one at either firm would discuss any of the reasons for dropping the lawsuit.

Neither would the plaintiffs themselves reveal the basis for the withdrawal. "I have no interest in talking about this at all," said Alma Villarreal of Missouri City, TX, whose daughter Valerie had been diagnosed with a soft-tissue cancer. Her neighbor and fellow plaintiff David Iniquez, whose son died from leukemia at the age of seven, referred all questions to their lawyers.

Some observers have suggested that the suit may have been dropped in response to recent changes in Texas laws and the makeup of the Texas Supreme Court. Indeed, the October issue of *Texas Monthly* calls Jamail's decision to abandon the case "a sure sign of just how much the high court—and

(continued on p.7)

Swedish Occupational Study Finds Small Risk for Many Cancer Types

Dr. Birgitta Floderus and coworkers at Sweden's National Institute for Working Life (NIWL) in Solna have reported a small, but significant, increased risk of a host of different types of cancer among men and women exposed to electromagnetic fields (EMFs) on the job.

"The associations are weak, but if the results reflect causal relationships between EMFs and cancer, we have to talk about hundreds of cases—not tens of cases—per year due to EMFs in Sweden," Floderus told *Microwave News* in an interview at the Bioelectromagnetics Society (BEMS) annual meeting held June 18-22 in Boston.

When asked if she thought EMFs can influence the development of cancer, Floderus replied: "I think so. I was very hesitant in the beginning because of the low risk estimates, but I changed my mind because most of the hormonal-dependent sites were linked, including testicular, prostate and breast cancer."

(continued on p.8)

« Power Line Talk »

The **National Academy of Sciences-National Research Council** (NAS-NRC) EMF health study is nearing completion, and a draft will be ready for internal review in October, according to Dr. **Larry Toburen**, the project director. The study, which was mandated by Congress in 1991, took more than a year to get under way, and was further delayed by budget problems (see *MWN,* S/O91, M/J93 and M/A95). Although any member of the academy can ask to review the report, Toburen said that he expects at most eight or nine reviewers. But, he cautioned, "It can still take a reasonably long time to complete the process." Nevertheless, he predicted that the final report will be out "early next year." Meanwhile, the NAS-NRC progress report on the EMF Research and Public Information Dissemination (RAPID) program, required under the Energy Policy Act of 1992, is almost done and should be ready for release in October (see *MWN,* M/A95). Toburen himself has left Washington to teach physics at East Carolina University in Greenville, NC. He is continuing to work with the NAS-NRC Board on Radiation Effects Research until these two reports are completed. Toburen noted that, for the present, the board is not planning to replace him. "I'm doing as much as I can to help keep the reports on track from a distance," he said.

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When it comes to EMFs, "recommendations such as prudent avoidance should be prudently avoided." Dr. **Richard Wilson**, a professor of physics at Harvard University in Cambridge, MA, took this position in a paper distributed at a course on *Electric and Magnetic Field Health Research: State of the Science,* held August 21-23 at the Harvard School of Public Health in Boston. "In order to take any responsible action on a risk, it is necessary to have some idea [of] how big it is," contended Wilson, who held that prudent avoidance makes sense only if the potential risk is "well-defined and large." He stated that this is not the case for a possible EMF–cancer connection. Making an argument favored more by physicists than by epidemiologists, Wilson noted that while the use of electricity has risen sharply since 1940, there has been no corresponding increase in the rate of cancer (see *MWN,* M/J92 and J/F93). Wilson was a featured speaker at the Harvard course, but originally prepared the paper for discussion at the *2nd Annual Michaelson Research Conference* in Kalispell, MT (see also p.8). In 1991, Wilson served on the committee that sharply criticized a draft Environmental Protection Agency (EPA) report citing EMFs as a possible human carcinogen (see *MWN,* J/F91 and M/J91). The Harvard course was sponsored by several northeastern utility companies, including Boston Edison Co. and Consolidated Edison Co. of New York City, as well as EEI, EPRI and the DOE.

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The next EMF personal injury case is scheduled to begin in Miami on October 23 when attorneys for **Leonard and Elsa Glazer** will try to convince a jury that **Florida Power & Light Co.** (FP&L) is responsible for their chronic myelogenous leukemia (CML). In court papers originally filed on January 20, 1994, in Dade County Circuit Court, the Glazers claimed that FP&L power lines, situated outside the couple's bedroom in Coral Gables, FL, led them to develop CML, an extremely rare form of cancer (see *MWN,* J/F94). Elsa died in 1988 at the age of 48. "We are looking forward to taking the case to trial because we feel we can present the evidence in a new way," said **Howard Talenfeld** of Colodny, Fass & Talenfeld in Ft. Lauderdale. Talenfeld and cocounsel **Larry Marraffino** of Marraffino & Roth in Boca Raton will call Dr. James Kornberg, an occupational and environmental physician in Boulder, CO; Dr. Howard Ozer, an oncologist at Emory University in Atlanta; Dr. David Ozonoff of Boston University School of Public Health; and Dr. Vichate Ungvichian, the director of the EMI Research Facility at Florida Atlantic University in Boca Raton. FP&L is being represented by a number of attorneys, including **Carlos Alvarez** of Tallahassee and **Mark Warnquist** of LeBoeuf, Lamb, Greene & MacRae in Denver. They will call: Dr. John Bennett, an oncologist at the University of Rochester Medical Center in New York; Dr. Peter Cassileth, an oncologist and hematologist at the University of Miami School of Medicine; Dr. Philip Cole, an epidemiologist at the University of Alabama, Birmingham; Dr. Steven Collins of the Fred Hutchinson Cancer Research Center in Seattle; Dr. Paul Leaverton of the University of South Florida College of Public Health in Tampa; and Dr. John Moulder, a radiation biologist at the Medical College of Wisconsin in Milwaukee. An attorney for FP&L declined to comment.

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Nebraska's **Julie Larm**, founder of Omaha Parents for the Prevention of Cancer, and **Phyllis Gorski**, founder of Parents Against Cancer Plus in Troy, MI, have been awarded scholarships by the Department of Energy (**DOE**) to cover the costs of attending its *Annual EMF Research Review,* November 12-17 in Palm Springs, CA. Larm's son Kevin was diagnosed with leukemia in 1992, and his brother Patrick questioned President Clinton on the EMF issue during an ABC special in March 1994 (see *MWN,* M/A94). The Larms met privately with Clinton a week later. A leader in local struggles over power lines, Larm was recently featured on *Frontline* in its report on EMFs and public health (see *MWN,* J/A95). Gorski's son David was diagnosed with non-Hodgkin's lymphoma ten years ago. Her organization has campaigned for state authorities to do more detailed geographic mapping of cases of childhood cancer and birth defects over a five- or ten-year period, and then to investigate possible correlations with siting of power lines and toxic-waste dumps. Gorski told *Microwave News* that the group is now focused mainly on public education, and that she hopes to share what she learns at the Palm Springs meeting by speaking "to the Rotary, professional women's groups, and so on."

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On Sunday afternoon November 12, before the opening of DOE's EMF meeting in Palm Springs, there will be a workshop on ***Magnetic Sensory Perception***. Among the scheduled speakers are:

Dr. **John Phillips** of Indiana State University, Bloomington, Dr. **Peter Semm** of German Telekom in Darmstadt and Dr. **Dennis Willows** of the Friday Harbor Lab, associated with the University of Washington, Seattle. "We are going to discuss the limits of magnetic field perception in animals and their implications for the question of EMF bioeffects," said **Paul Gailey** of the Oak Ridge National Lab in Oak Ridge, TN, who provides support for the DOE program. For more information, contact Gailey at (615) 574-0419.

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A Snow Hill, NC, woman is suing **Pitt & Greene Electric Membership Corp.**, claiming that the utility racially discriminated against her in the late 1980s by buying property and easements from her white neighbors—but not from her—to build a substation and associated power lines. **Emma Hill**, who is 62, claims that she and her family are suffering permanent damages "associated with being exposed to a potential health hazard, i.e., an EMF in the 2.36 mG range and below," according to her March 31, 1995, complaint filed with the Wilmington Division of the U.S. District Court for the Eastern District of North Carolina. Pitt & Greene, headquartered in Farmville, NC, "contracted and purchased land and easements from each of plaintiff's white neighbors but refused to contract for the purchase of an easement over plaintiff's land solely because plaintiff is black," the complaint states. Hill also is charging that three high-voltage transmission lines are illegally crossing her property. On August 11, U.S. District Court Judge Malcolm Howard denied Pitt & Greene's motion for dismissal. Pitt & Greene spokesperson Mark Suggs said, "The matter is in the hands of the judge and the attorneys, so we're not in a position to make any comment." But, he added, "I don't know of any discrimination whatsoever." Also named in the suit is the U.S. Department of Agriculture and the Rural Utilities Service.

Ground Currents and Transients: Clues to Residential Cancer Risk

What kinds of EMFs are people exposed to in residential environments? New studies on ground currents and transients shed some light on this question, and researchers feel they are making progress towards identifying the basis of the EMF–cancer connection.

Dr. Nancy Wertheimer, Dr. David Savitz and Ed Leeper have found that in homes where ground currents are present, people are up to four times more likely to contract leukemia.*

High-frequency transients—sudden, brief EMFs that result from switching electrical loads on or off—have also been cited as a possible culprit in the EMF–cancer equation. A recent study by Enertech Consultants† found that transients from outside the home occur more often in houses with a very-high-current-configuration (VHCC) wire code—the wire code linked to the highest cancer rates in past epidemiological research. Enertech's Dr. Jeffrey Guttman, who led the study, said he believes that "transients merit a closer look."

Guttman's team explains that, "The driving force [behind] most residential magnetic field exposure assessment research is the desire to understand...why wire codes are more strongly associated with disease risk than are measured magnetic fields."

The Enertech researchers describe three hypotheses that have been advanced to explain this apparent discrepancy: 1) that past EMF exposure is not well assessed by "a magnetic field measurement made long after the exposure of interest has occurred"; 2) that there is "some aspect of magnetic field exposure that is not captured by the simple field measurements...made in previous studies"; and 3) that "the wire code–disease association is either the result of a confounder or is an artifact of some sampling bias."

The first hypothesis is supported by the 1992 study by Drs. Anders Ahlbom and Maria Feychting of the Karolinska Institute in Stockholm, Sweden. They noted that electric current loads had changed over the years, and so contemporary spot measurements might not be a good indication of past exposure. Using Swedish state power company records, they reconstructed historic EMF exposures for children living close to high-voltage transmission lines. While present-day measures of EMF intensity did not correlate with the incidence of leukemia, exposures experienced prior to diagnosis showed a clear and significant link.

No one has yet applied Ahlbom and Feychting's approach in the U.S, probably because comparable data are not available. But in any case, most residential exposures come from distribution lines, not transmission lines, and electrical current levels in distribution systems fluctuate with everything from air-conditioner use to grounding practices. Past U.S. epidemiological studies have focused on distribution lines, and it is hard to assess past exposures from this source of EMFs.

The recent Enertech project, sponsored by the Electric Power Research Institute (EPRI), based in Palo Alto, CA, focused on the second hypothesis: the idea that the biologically significant part of EMFs may be a field characteristic not captured in spot measurements of 60 Hz fields—like transients.

The first two hypotheses are not mutually exclusive, and the paper by Wertheimer, Savitz and Leeper is consistent with both. "Measuring ground currents is not in opposition to other metrics," Savitz said in an interview. "In some ways it just represents an attempt to do a better job of capturing the average magnetic field exposure."

"We know there are other determinants of magnetic fields besides the existence of outside power lines, but some are hopelessly erratic," added Savitz, a professor at the University of North Carolina School of Public Health in Chapel Hill. "Ground currents may be one of the few that we can capture in a way that would help us reconstruct past exposures."

"The most important aspect of our paper was that in looking at ground currents, we identified a type of EMF measurement that is significantly associated with the incidence of both childhood and adult cancer," Wertheimer told *Microwave News* from Boulder, CO. This does not mean that ground currents cause cancer while power line fields do not—ground

currents may pose different health risks than power line fields, or they may just be easier to describe accurately.

"If there's a risk here, it would be a lot easier to fix than would be the case with power line fields," Wertheimer said, explaining that changes in grounding practices could eliminate most of this type of magnetic field.

In any case, both Wertheimer's study and the Enertech report underscore the importance of looking at the complex interactions between different parts of the electrical system.

Ground Currents and Cancer

The Wertheimer-Savitz-Leeper paper on ground currents is the first major collaboration between researchers whose landmark work first indicated a connection between power lines and cancer. Wertheimer and Leeper's 1979 study of childhood leukemia in the Denver area was followed by Savitz's paper in 1988, which reproduced and extended their findings (see *MWN,* N82, N/D86 and N/D87).

Writing in *Bioelectromagnetics,* they explain that grounding connections to conductive plumbing—common throughout the U.S.—can create strong, localized EMFs in the home. If household wiring is grounded to plumbing that includes a section that is nonconductive, little current is diverted and the flow of electricity in the "hot" and neutral wires remains balanced. In this case, the magnetic fields around the two wires will largely cancel each other out. But grounding to conductive plumbing often allows a significant amount of electricity to escape through water mains from one house to another. The result is that the flow of current is unbalanced, producing substantial magnetic fields in both plumbing and house wiring.

In order to look at the possible role of ground currents, the researchers examined data from Savitz's 1988 Denver study. Evaluating the homes of 347 cancer cases and 277 controls, they found that conductive plumbing was associated with an elevated risk of cancer—as much as three times the risk for children living with nonconductive plumbing.

The three researchers also found a way to examine the issue of ground currents more directly. The 1988 Denver study not only measured the intensity, but also the angle, of magnetic fields in the subjects' homes. They explain that if a substantial magnetic field is relatively horizontal, this is "a good indicator that the...field comes from a ground current source active enough to dominate the measurement."

Examining the Denver data for these elevated non-vertical (ENV) fields, they found that such fields were even more strongly associated with cancer than conductive plumbing in general. They report that the presence of ENV fields is linked to "a high and significant cancer risk," elevated as much as fourfold.

They also examined a second set of data—from a Seattle study of adult leukemia by Dr. Richard Severson (see *MWN,* N/D86; the study was published in 1988). Here again, they found an association between ENV fields and cancer, in this case with an apparent doubling of the risk. But they note that the actual connection is probably stronger.

"One of the major problems in epidemiologic studies of magnetic field exposure," they write in *Bioelectromagnetics,* "is that, in modern society, there is no truly unexposed referent group." In the Seattle study, about half of the subjects used electrically heated beds—a practice that was rare among the children studied in Denver. When users of electrically heated beds were removed from the Seattle reference group, ENV fields were associated with a cancer risk that was quadrupled instead of doubled (see also *MWN,* M/J88).

"We have some confidence in these results because the elevated risks appear across a range of possible definitions of an 'elevated' or a 'non-vertical' field," Wertheimer told *Mi-*

Meter To Record Transients in Development

Dr. William Kaune of EM Factors in Richland, WA, has contracted with EPRI to develop a meter that can measure and record magnetic field transients. Kaune is designing the device with John Niple of Enertech Consultants in Campbell, CA. "Our goal is to have a prototype by the end of the year," Kaune told *Microwave News*.

"Interest has intensified in magnetic field transients as a possible way of explaining the wire code–cancer association," Kaune explained. He noted that "recent laboratory studies with rats and humans indicate that living organisms may respond to rapid changes in magnetic field strength."

In a recent study of transients in residential settings, Enertech recorded the waveforms of hundreds or even thousands in a day (see p.5). But the size and expense of the instruments involved, as well as the sheer quantity of data, would be unwieldy for use in a large-scale field study.

The new meter will not measure each transient in as much detail as did the system that was custom-built for the Enertech study. Instead, it will have two counters, recording how many transients exceed either a "high" or a "low" threshold. The "low" threshold will be set so that the majority of transients will register, while the "high" counter will be triggered only by the stronger ones.

Kaune's planned three-axis device will count all transients falling within the 2-100 kHz band, and will give an approximation of the field's overall strength.

"Ultimately the instrument is going to look a little different from the original specs," Kaune said. "The actual sensors will be in a separate housing from the rest of the electronics, which means it's going to be a bit bigger. At this point our first prototype will not be portable enough for personal exposure measurement."

A different kind of transient meter was developed two years ago by Ed Leeper of Monitor Industries in Boulder, CO. Leeper's meter is a small, portable device designed to locate the sources of transient fields. It measures the peak strength of a transient along a single axis, providing directional information, as well as the transient's rise time. While not designed to record information, it has an output that can be connected to a data storage device.

crowave News. She emphasized that the same trend exists in both the Denver and the Seattle data sets. "We need others to look for this in future residential studies," she said.

As for mechanisms through which ground currents might play a role in raising the risk of cancer, the paper by Wertheimer, Savitz and Leeper suggests several possibilities (using their emphasis):

• They create "a source within the house [that] provides opportunity for frequent...encounters with 'hot spots' of *unusually high intensity* fields."

• Field *angle* may be important, "especially if resonance with the earth's steady magnetic field is in some way involved in biological effects."

• Exposure to fields from ground currents "is likely to be *intermittent* and relatively weighted with *high harmonics."*

• Currents in household plumbing may have "an effect on the constituents of *drinking water."*

Transients, Wire Codes and Electrical Noise

The Enertech study was conducted by Guttman in Campbell, CA, Dr. Luciano Zaffanella in Enertech's office in Lee, MA, and Gary Johnson of EPRI's High-Voltage Transmission Research Center in Lenox, MA. Noting that prior to their study there were little data on transients in residential environments, they report that, "VHCC residences...showed a significantly larger proportion of magnetic field transients generated outside the residence." The transients in the Enertech study were not rare events: They numbered from 84 to over 2,000 in a given 24-hour period.

Guttman and Zaffanella told *Microwave News* that their measurements were not designed to identify the source of these external transients. Large transients can be generated by the switching of electric loads in primary distribution lines. However, external transients can also be caused by appliances being turned on or off in a neighboring residence.

"I oscillate between being excited and being skeptical about transients," said Zaffanella, adding that more research is essential. He expressed interest in whether transients are generated by sewing machines, which have been linked to higher rates of Alzheimer's disease and childhood leukemia (see p.6 and *MWN,* J/A94 and J/A95).

Dr. Antonio Sastre, a consultant based in Suffern, NY, called the association between wire codes and external transients "the single most interesting and intriguing finding" in the study by Guttman, Zaffanella and Johnson. Sastre has been working on a related EPRI-sponsored effort.

Sastre's work deals with the question of whether the EMFs found in residential environments could possibly be large enough to be detected by biological systems. Dr. Robert Adair of Yale University in New Haven, CT, and other skeptics have argued that the EMF "signal" would be far smaller than the noise created by the normal activity of living cells (see *MWN,* J/A95). But Sastre and others have observed residential transients that would create signal-to-noise ratios far greater than unity. "The objection that environmental fields are too weak...to induce changes in cells does not apply to these transients," Sastre told *Microwave News*.

Senate Panel: No EMF Work at EPA

The Senate Committee on Appropriations has cut $350,000 from the Environmental Protection Agency's (EPA) EMF budget, because, "The committee believes EPA should not engage in EMF activities."

In a September 13 report (No.104-140), the committee also stated: "Section 2118 of the Energy Policy Act of 1992 established a federal program to investigate and report on human health effects from [EMFs]. Congress mandated that this program of research and public communication be managed jointly by the Department of Health and Human Services and the [DOE]. No programmatic role was assigned to EPA, yet EPA has pursued a number of unintegrated activities on EMFs that are of questionable value."

The House committee has already announced plans to cut EPA's low-priority radiation programs, which would include its work on EMFs (see *MWN,* J/A95).

Meanwhile, the EPA is reorganizing; effective October 1, the EMF program is moving to a new division, and Dennis O'Connor, the current EMF team leader, has been reassigned to work on the disposal and cleanup of radioactive waste. No replacement has yet been named.

Working with a mathematical model of isolated cells, Sastre, Guttman, EPRI's Dr. Robert Kavet and Dr. James Weaver of the Harvard-MIT Division of Health Sciences and Technology in Cambridge, MA, showed last year that large residential transients could induce changes in the cells' transmembrane voltage that would be larger than the thermal noise associated with the cells' normal activity. They reported signal-to-noise ratios that frequently exceeded ten to one.

At last June's meeting of the Bioelectromagnetics Society in Boston, Sastre, Johnson and Kavet presented more recent work, in which they examined residential transients generated by capacitor-bank switching in simplified primary distribution power lines at the EPRI research center. They described how they measured transients in a variety of test configurations, from a simple clean line to others involving complex interactions between power lines, grounding systems, residential wiring and appliances. Signal-to-noise ratios greater than unity occurred in every type of test scenario. Sastre told *Microwave News* that the power configurations closest to those found in daily life showed the highest signal-to-noise ratios, running as high as 70-80 to 1.

"You only need classical physics to build our mathematical models," said Sastre. He cautioned, however, that, "Conventional biology and conventional physics tell me a signal could be detected. But that does not mean that the cell is listening to that signal."

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* Nancy Wertheimer, David Savitz and Ed Leeper, "Childhood Cancer in Relation to Indicators of Magnetic Fields from Ground Current Sources," *Bioelectromagnetics (16,* pp.86-96, 1995).

† J.L. Guttman, L.E. Zaffanella and G.B. Johnson, *Survey Measurements and Experimental Studies of Residential Transient Magnetic Fields,* Report TR-104532, Palo Alto, CA: EPRI, December 1994.

Electric Blankets Can Lead to Birth Defects

Use of electric blankets during pregnancy is associated with a greater risk of birth defects among babies born to women with low fertility, according to a study from Washington state.

Writing in the September issue of *Epidemiology* (*6,* pp.485-489, 1995), Dr. De-Kun Li of the Kaiser Permanente Medical Group's Division of Research in Oakland, CA, and Drs. Harvey Checkoway and Beth Mueller of the University of Washington School of Public Health in Seattle report on 118 mothers of children with congenital urinary tract anomalies and 369 controls. For women who had been trying to become pregnant for more than a year, electric blanket use was associated with a four times greater risk of this birth defect in their children.

There was a significant tenfold increase in risk when electric blankets were used by low-fertility women during the first trimester of pregnancy. "The first trimester is the most sensitive period for almost all birth defects," Li told *Microwave News,* "so this supports the hypothesis." The risk also grew with the length of time that electric blankets had been used.

Women of normal fertility showed no increased risk, leading the researchers to suggest that "a woman with a compromised reproductive system [may be] more vulnerable to environmental insult," and thus more likely to be affected by EMFs.

"Ours was the first study to look at EMFs in terms of identifying a more susceptible population," said Li. "We think that's the key as to why results of past studies look inconclusive. Since EMFs seem to have a weak effect, if any, probably only the most susceptible population will show it. Biologically it's very logical."

"We were particularly interested in this birth defect not because of an interest in EMFs, but because of some anecdotal reporting that it was linked to cocaine use," Li explained. Other possible risk factors, such as smoking, vitamin use and EMF exposure, were included in the study.

Besides electric blankets, the researchers also investigated exposure to electrically heated water beds and to video display terminals (VDTs). Neither was associated with any increased risk of urinary tract defects for children of women with either normal or below-average fertility. Li's team noted that electric blankets are much closer to the developing fetus, and cause higher EMF exposures than water beds or VDTs.

"It seems likely that EMFs would also have an effect on other birth defects," commented Li. "That's speculation, but I don't have any biological reason to think that an EMF effect would be specific to this one particular birth defect."

Li advised that pregnant women should avoid the use of electric blankets. "This is a first study, the numbers are small, and it needs to be confirmed," he cautioned. "But although the proof of the relationship is not final, I don't see any downside to not using electric blankets—even if in the future it turns out that this was just a fluke. You can just add two more blankets, or turn up the heat instead."

Li's group is the first to show that electric blankets may increase the chances of birth defects. A 1990 study by Dr. David Savitz of the University of North Carolina, Chapel Hill, linked prenatal exposure to electric blankets with a significant rise in children's brain tumors (see *MWN,* M/J90). Studies by Dr. Nancy Wertheimer and Ed Leeper in Boulder, CO, have found an association between problem pregnancies and electric blanket use (see *MWN,* N/D88 and M/J86), while Dr. Michael Bracken of Yale University School of Medicine in New Haven, CT, reported that his EPRI-sponsored research found no effect on the rate of fetal growth (see *MWN,* M/J95).

EMF Exposures: Garment Workers Top Utility Employees

Sewing machine operators have some of the highest EMF exposures ever found in the workplace, according to a paper that will be presented this November at the Department of Energy's (DOE) annual EMF research review in Palm Springs, CA. EMF levels varied widely with the type of machine, showing up to a tenfold difference among the various brands.

In a study of workers at three clothing factories in Finland, one type of sewing machine was consistently found to produce EMFs above 200 mG at the operators' knees, with some readings ranging over 600 mG. Spot measurements of 64 machines led to an estimate of a mean whole-body exposure of 20.5 mG, while personal dosimetry measurements of two machine operators indicated a mean whole-body exposure of 30.2 mG. Motorized hand-guided fabric cutters and heat press units also generated significant EMFs, with the fabric cutters exposing operators' hands to over 1.8 G.

"We believe that we found an occupation with higher average exposures than any studied so far, with the exception of aluminum potroom workers," Dr. Bary Wilson of Battelle Pacific Northwest Laboratories (PNL) in Richland, WA, told *Microwave News.*

"Finding this highly exposed group is especially important because we don't yet have much information on exposures for occupations with primarily women workers," said Lynne Gillette, manager of DOE's EMF RAPID program, who also worked on the study. "With such striking exposures, these women would be a very interesting group to study for female breast cancer, among other diseases."

A previous study of Finnish and U.S. garment workers by another member of the research team, Dr. Eugene Sobel of the University of Southern California School of Medicine in Los Angeles, found a strong association between EMF exposures and the likelihood of Alzheimer's disease (see *MWN,* J/A94). This past summer, Dr. Claire Infante-Rivard of McGill University in Montreal, Canada, pointed to Sobel's study and said EMFs could have been responsible for a rise in leukemia rates she had detected in an earlier investigation. In 1991, Infante-Rivard had reported an increase in leukemia among children born to women in Spain who had worked with sewing machines during pregnancy (see *MWN,* J/A95).

The sewing machine operators examined in Finland were found to have higher exposures than utility workers for almost all metrics, including time-weighted averages, transients, intermittency and time above a given threshold. The one exception was for metrics related to field stability over time.

The variation in exposure by type of machine was "large and very predictable," according to Wilson. The researchers attributed the wide range in field strengths to differences in the kind of motor used in each brand.

"We brought sewing machines into the lab here to develop measurement protocols," Wilson added. "However, lab data proved to be a poor predictor of what we found in the workplace. The take-home lesson here is that if you want to know what is in the workplace, you have to go there."

DOE's Gillette noted that the data acquisition and reporting scheme developed by another team member, Norman Hansen of Battelle PNL, "worked very well and will help the EMF RAPID program meet its goal of setting a new standard for exposure assessment and reporting."

Jamail Drops Childhood Cancer Suit *(continued from p.1)*

Texas law—has changed."

HL&P's attorney, Irvin Terrell of Baker & Botts in Houston, told *Microwave News,* "Having tried a case with and against Joe, I am delighted to see him go. Joe is a great trial lawyer, but his problem here is that he had a weak case." Terrell added, however, that, "He did not tell me so."

"There were no settlement discussions between HL&P and the plaintiffs which led to this dismissal," according to a statement from HL&P. "We welcome the voluntary dismissal of this lawsuit by the plaintiffs. There is no consensus in the scientific community as to the health effects, if any, associated with EMFs and therefore no reason to put the plaintiffs and their families through the stress of litigation. Our hearts go out to these families who have been touched by childhood cancer and we commend them for taking this responsible action." The company said it will continue supporting research on possible EMF health effects and will keep its customers informed about the issue.

Nine of the children involved in the suit developed leukemia; two others contracted other forms of cancer. Three have died. The suit charged that magnetic fields from power lines, which "were many times stronger than the level proven to cause childhood cancers," invaded their homes "secretly and silently." While there has been much EMF litigation in recent years, this was the first case in the U.S. to focus on childhood leukemia.

The action was also the first to name the Electric Power Research Institute (EPRI) as a defendant, according to EPRI spokesperson Barbara Klein. Jamail and Tyler had charged that EPRI and HL&P "conspired to falsely persuade plaintiffs, the public at large and the responsible governmental entities that magnetic fields present no cancer danger."

EPRI is "extremely pleased" that the plaintiffs have withdrawn the suit, Klein said in an interview. "Had the case proceeded to trial," she added, "we believe that our attorneys would have been successful in defending EPRI and obtaining a judgment in our favor."

Texas is well known as being friendly to plaintiffs. The October 16 *Fortune* magazine reported in a cover story on "Fatal Litigation" that the state is "a plaintiffs' mecca," where "judgments are higher than they are practically anywhere else in the country" and where "the standards for evidence are far more favorable to the plaintiffs."

But that may be changing. In an October 3 profile of Dallas-based John Cracken—who, like Jamail, is referred to as "one of the most feared personal injury attorneys in Texas"—the *Wall Street Journal* noted that, "The Texas legislature recently adopted a raft of tort-law changes that tightened venue laws, capped punitive damages and limited the liability of defendants found to bear less than half the fault." The *Journal* pointed out that, "Many plaintiffs' attorneys will suffer."

The new laws only apply to cases filed after September 1, 1995, so they do not directly affect Jamail's EMF lawsuit. But they do reflect a change in attitudes towards tort litigation.

One key change came last June when the Texas Supreme Court voted in *E.I. du Pont de Nemours & Co. Inc. v. C.R. Robinson* to adopt the restrictive *Daubert* rule used by the federal courts to determine what kind of scientific evidence is admissible (see also pp.11-12). *Texas Monthly* observed that this decision "makes it almost impossible to win a groundbreaking health-related lawsuit in Texas if the scientific evidence is in dispute, as is the case with EMFs."

In this case, decided by a vote of 5-4, Justice Bob Gammage was one of the dissenters. On August 24, Gammage announced that he would retire on September 1. "It was a total surprise to the public," Gammage's assistant, Linda Smith, said in an interview. Gammage's replacement on the court will be appointed by Republican Gov. George W. Bush, elected last fall.

On September 1, plaintiffs in the suit against HL&P, *Bicki et al. v. Houston Industries Inc. et al.,* asked that their case be dismissed.

Chief Justice Thomas Phillips of the state Supreme Court is a former partner at Baker & Botts, HL&P's attorneys. In the September 4 *Texas Lawyer,* Robert Elder Jr. wrote that Phillips had been accused of being "a corrupt lackey for his former firm" by Richard Laminack, a lawyer in the breast implant class action suit against Dow Chemical Co. "Houston plaintiffs' lawyers have been grumbling about the alleged Baker & Botts connection all summer, but Laminack has been the only one bold—or careless—enough to put it in writing," *Texas Lawyer* reported. Dow Chemical lawyer Richard Josephson told Elder that these charges were "just ridiculous," pointing out that Phillips left Baker & Botts 15 years ago.

A Houston attorney who has been following the Jamail case noted that under Texas law the statute of limitations for the complaint brought against HL&P does not begin to run until the children reach the age of 18.

Jamail is listed in the *Guinness Book of World Records* for an $11.12 billion verdict against Texaco on behalf of Pennzoil. His reputation is not based on this case alone, but on a whole series of multimillion-dollar settlements and jury awards. Observers credit Jamail with a special talent for converting complicated legal issues into clear-cut battles between right and wrong. With a personal fortune estimated at $700 million, Jamail would have had the deep pockets required for the protracted expense of battling an electric utility in a landmark case.

Floderus analyzed cancer records for 1971 to 1984 for nearly 1.6 million male and more than 800,000 female workers 20-64 years of age. The rates of brain, breast, colon, kidney, liver, lung, prostate, skin and testicular cancers were all elevated by 5-35% among those believed to be exposed to EMFs at work. In addition, the incidence of all cancers combined was 5-10% higher than expected for both men and women. EMF exposures were estimated based on job titles.

One notable exception was leukemia. Although the incidence of chronic lymphocytic leukemia was up to twice the expected rate for women, there was no parallel increase among men.

The new Swedish results complement those of Dr. Genevieve Matanoski of the Johns Hopkins University public health school in Baltimore. In 1989, she reported that telephone cable splicers had higher rates of colon, lung and prostate cancers, as well as leukemia and lymphoma (see *MWN,* N/D89).

Both Floderus's and Matanoski's findings are consistent with a hypothesis put forward by Dr. Russel Reiter of the University of Texas Health Science Center in San Antonio that magnetic fields may promote cancer by suppressing the production of the hormone melatonin (see *MWN,* N/D93). This would result in higher rates of a variety of different cancers, according to Reiter.

"The wide variety of tumors represented [in Floderus's data] suggests the mechanism is a basic one—for example, involving free radicals and melatonin," Reiter told *Microwave News* at the BEMS meeting.

Floderus had already presented her results in Sweden before the BEMS meeting and the Swedes who came to Boston were well aware of them. Rolf Lindgren, the EMF manager at Vattenfall, the state power company, in Göteborg, commented that, "The most striking result is that she found elevated rates of cancers for the types of cancers that have been increasing in Sweden."

Dr. Yngve Hamnerius of the Chalmers University of Technology, also in Göteborg, said that, "The message is that we should look at other types of tumors, not just leukemia and brain tumors."

Floderus's new study has been widely covered in the Swedish press. For instance, on August 24 the tabloid *Aftonbladet* featured Floderus on the front page along with the headline, "The Jobs That Can Give You Cancer." Inside, a headline announced in bold letters: "Alarming New Report: Magnetic Fields Can Cause Cancer."

Floderus estimated worker exposures with data she collected for her earlier major occupational study, released in 1992 (see *MWN,* S/O92). She noted that she had more confidence in her new results for men than for women because the exposure measurements were done for men—not for women.

The NIWL was formerly known as the National Institute of Occupational Health (NIOH).

Swedish Government Agencies To Issue New EMF Policy

On October 9, the five Swedish government agencies with responsibility for EMF health and safety will issue a new policy on exposures to magnetic fields. Although Swedish officials would not disclose the planned recommendations, knowledgeable sources told *Microwave News* that a policy of prudent avoidance will be endorsed.

Also on October 9, an NIWL working group, chaired by Dr. Bengt Knave, will issue *Magnetic Fields and Cancer—A Criteria Document,* which summarizes current thinking on the EMF problem in the Swedish work environment, according to Dr. Ulf Bergqvist, the secretary of the working group and a researcher at NIWL. He declined to say what the group has concluded.

HIGHLIGHTS

« Cellular Phone Notes »

For better health, "eat a low-fat diet, exercise and use a cellular phone." That was the advice given by Dr. **Robert Park**, director of information for the Washington-based American Physical Society (APS), in the August 18 edition of his news bulletin on the Internet. Park played a key role in the recent APS statement on EMFs, which argues that magnetic fields pose no health hazard (see *MWN,* M/J95). This time, Park announced preliminary results from 260,000 subjects in "a massive study" of cellular phone use—though he did not say who was doing the research. "The most striking finding is that age-specific mortality of cellular-phone users is significantly below that of the overall U.S. population," he said. "So skip the broccoli, and spend a little extra time with your cellular phone." When *Microwave News* asked Park which study he was referring to, he said he had heard it described by Dr. **Don McRee**, director of extramural research for **Wireless Technology Research** (**WTR**), in a presentation at the *2nd Annual Michaelson Research Conference* this August in Kalispell, MT. As for the data behind the "striking finding," Park provided only a syllogism: "McRee pointed out the obvious: Cellular phone users tend to be affluent, and the affluent always have lower mortality rates." Who was actually conducting this research? Park still did not say. McRee said in an interview that Park was talking about results that were displayed on a single slide, which had been provided by WTR's chair, Dr. **George Carlo**. But even McRee was not familiar with the study's details, and he referred further questions to WTR, the research arm of the Cellular Telecommunications Industry Association in Washington. WTR spokesperson **Mike Volpe** expressed displeasure with Park's commentary, calling it "pretty irresponsible." Volpe added: "It sounds like he's playing fast and furious with a serious public health issue." As it turns out, the cellular phone

study mentioned by Park is the one being sponsored by WTR at Epidemiology Resources Inc. in Newton Lower Falls, MA (see *MWN,* J/F94). Dr. **Nancy Dreyer**, the company's president and CEO, said that her team had submitted its first paper for peer review and publication, but added, "I'd prefer not to comment on the results. I think the role of a responsible scientist is to put her results through the peer-review process." Asked why Carlo would then be making their data available to the Michaelson conference, Dreyer offered no explanation. "I can only speak for the research that's being conducted by Epidemiology Resources," she said. When asked the same question, Volpe said only, "The WTR policy is not to comment on research before it's been peer-reviewed."

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How soon can epidemiology tell us anything about the safety of cellular phones? Since they have only recently become a part of daily life, useful answers may well be years away, according to Dr. **Stan Barnett** of Australia's **Commonwealth Scientific Industrial Research Organization**. He questions the priority that WTR has placed on this line of research in a recent report: "The type of studies described by Carlo as important may not be the most appropriate....His program has identified epidemiology studies as important, while the common opinion is that there is negligible chance of identifying a risk, certainly within the next ten years" (see pp.13-14).

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First it was cardiac pacemakers—now implantable cardiac defibrillators have also been found to be vulnerable to interference from some digital cellular phones. An implantable defibrillator monitors the user's heart 24 hours a day. When it senses an irregular heartbeat (fibrillation), it sends a jolt of electricity to stabilize heart function. But interference from digital cellular phones can cause defibrillators to fire their full 750-volt charge needlessly, according to **Howard Bassen** and **Paul Ruggera** of the FDA in Rockville, MD, and Dr. **Hans Moore** of George Washington University Medical Center in Washington. They will present their findings at the *68th Scientific Sessions of the American Heart Association,* to be held November 13-16 in Anaheim, CA. "The effect would not be fatal or damaging," Bassen told *Microwave News*. "It would be painful, and could knock you down. It is undesirable and could cause unnecessary risk to the user." He said that the problem may be more serious than that of interference to pacemakers (see *MWN,* J/A94 and M/J95). Bassen, Ruggera and Moore observed the effect in laboratory testing when the base of the antenna of certain phones was held within 5 cm of the defibrillator's pulse generator. The researchers feel that their work should be repeated with devices actually implanted in users, and Moore is developing a protocol that would ensure the safety of participants during testing.

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In July, **WTR** issued ***Potential Public Health Risks from Wireless Technology, Risk Evaluation Research: Progress, Priorities and Request for Proposals,*** which prompted a number of scientists to scratch their heads. Of particular concern is a "special requirement" that all *in vitro* research be carried out in a single exposure facility. "It's ridiculous," commented one researcher who asked not to be named. "This is an expensive and unproductive way to do research. In addition, the variety of studies that can be done at the facility will obviously now be limited." Another scientist, who also asked for anonymity, commented that, "Using one lab makes no sense because the whole purpose of replication is to repeat an experiment in different labs in order to eliminate possible artifacts." In an August 22 "Dear Colleague" letter, WTR's Dr. Ian Munro sought to explain the rationale behind the group's decision: "A single site will open the program to investigators who do not have access to appropriate dosimetry systems or [RF] engineering expertise. Additionally, a single exposure system will guarantee that all work will be conducted under the same conditions." Munro did leave the door open for WTR to sponsor those "who do have the expertise to develop an appropriate exposure system at their own site." Proposals were originally due by October 1, 1995, but the deadline has been extended to November 1.

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In addition to the reports on cellular phone safety recently issued in Australia and in Denmark (see pp.12-14), the **International Commission on Non-Ionizing Radiation Protection**

WTR Gives Gandhi $185,000 for Cellular Phone Dosimetry

Dr. Om Gandhi of the University of Utah, Salt Lake City, has been awarded a $185,000 contract from WTR to determine the accuracy of the finite difference time domain (FDTD) method for predicting the distribution of energy from cellular phones inside the human head.

"Our computer models will help us develop tools that will in turn help industry design hand-held phones that have desirable radiation patterns while assuring compliance with health standards," Gandhi told *Microwave News*. This work will lead to the development of a certification program for the next generation of portable phones. Gandhi said the project should be completed by the end of the year.

WTR, the Washington-based research arm of the cellular phone industry, first announced its intention to sponsor work in Gandhi's lab in December 1993 (see *MWN,* J/F94). As the negotiations dragged on, Gandhi grew more and more frustrated (see *MWN,* J/F95 and M/J95), but he did not offer an explanation for the long delay.

A second WTR dosimetry contract, also announced in December 1993, was awarded this spring to Dr. C.K. Chou of the City of Hope National Medical Center in Duarte, CA (see *MWN,* M/J95). Neither Chou's nor Gandhi's proposal was reviewed by the advisory committee on cellular phones at the Harvard Center for Risk Analysis in Boston, according to the center's Dr. Susan Putnam.

WTR Goes International; November Meeting in Rome, Italy

WTR has formed the International Committee on Wireless Communication Health Research (ICWCHR) with a mission similar to that of WTR: "To identify and coordinate research and to communicate research findings on the potential health effects of wireless communication technology."

According to WTR spokesperson Mike Volpe, the new organization "has no formal structure" and has "no chairman." He explained that it "evolved from a desire of scientists to have a forum to exchange information about their various programs." Susan O'Donnell in WTR's Washington office is the contact person for the ICWCHR.

WTR and the ICWCHR are jointly planning a *State of the Science Colloquium* to be held November 13-15 in Rome, Italy. Space is limited to 200 participants; and the registration fee is $250. A written proceedings will be published and a video summary is planned.

Among those scheduled to present invited papers in Rome are: Drs. David Brusick, Alessandro Chiabrera, C.K. Chou, Om Gandhi, David Hayes, Kenneth Joyner and Kenneth Rothman.

The members of the ICWCHR are: Dr. Jørgen Bach Andersen, Center for Personkommunikation, Aalborg University, Aalborg, Denmark; Drs. Paolo Bernardi and Guglielmo D'Inzeo, Dept. of Electronic Engineering, "La Sapienza" University of Rome, Italy; Dr. George Carlo, WTR, Washington, U.S.; Gerd Friedrich, Forschungsgemeinschaft Funk (FGF), Bonn, Germany; Dr. Zlatko Koren, Faculty of Electrical Engineering and Computing, University of Zagreb, Croatia; Dr. Alastair McKinlay, Head, Non-Ionizing Radiation Dept., National Radiological Protection Board, Oxfordshire, U.K.; Dr. Michael Repacholi, Royal Adelaide Hospital, Adelaide, Australia; Dr. Masao Taki, Dept. of Electronics and Information Engineering, Tokyo Metropolitan University, Japan (invitation under consideration); Dr. Paolo Vecchia, National Institute of Health, Dept. of Physics, Rome, Italy; Dr. Gary Williams, Chief, Div. of Pathology and Toxicology, American Health Foundation, Valhalla, NY, U.S.

For more information, contact O'Donnell at (202) 833-2800, Fax: (202) 833-2801.

(**ICNIRP**) will soon issue its own statement, *Health Issues Related to the Use of Hand-Held Radiotelephones and Base Transmitters*. ICNIRP's Scientific Secretary, **Roger Matthes** of the German Institute for Radiation Hygiene in Neuherberg, said that the statement will be published in *Health Physics,* but he would not reveal any other details about its contents. The statement has been under discussion for years. A draft obtained by *Microwave News* in 1992 recommended the rejection of the 7 W exclusion clause, which would exempt essentially all cellular phones from safety guidelines (see *MWN,* M/J93).

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WTR has published a report, *Laying the Foundation,* on the completion of "Phase One" of its research program. "Today, 25 months into what was projected as a 60-month program, we have achieved significant understanding of the key scientific issues," writes WTR's chair, Dr. **George Carlo**, in the introduction. "We have moved forward with Phase Two: Extramural Research, where specific hypotheses will be tested in independent universities and laboratories around the world." Future phases are outlined in a pyramid-style chart titled "Getting to the Answers":

1998: Informed Judgments
1997: Long-Term Study Findings
1996: Short-Term Study Findings
1995: Extramural Research
1994: Laying the Foundation

The report describes WTR's four program areas and how much was spent on each during 1994: risk evaluation research ($2,036,000); risk management research ($160,000); surveillance of ongoing research in order to spot any potential public health concerns ($269,000); and outreach to "interested parties in the scientific community, government, industry, and the public" ($370,000). Within risk evaluation research, $489,000 was spent on dosimetry, $814,000 on toxicology, $637,000 on epidemiology and $96,000 on electromagnetic interference.

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The Congressional **Office of Technology Assessment** (**OTA**) released its report on ***Wireless Technologies and the National Information Infrastructure*** on August 7, with a section on health issues that reflects significant changes from an earlier draft. When the April 4 version of the report was leaked (see *MWN,* M/J95), it was criticized for unsupported statements such as, "Cellular telephones...put out little power and skin proves to be a fairly effective shield for much of the radiation a typical cellular phone puts out." This does not appear in the final document, nor does the assurance that "there appears to be little cause for concern" that cellular phones might cause cancer. Also missing is the draft's assertion that brain cancer rates have not gone up in the last ten years, which contradicted National Cancer Institute statistics. The final report says simply that the debate over possible health effects is "intensely polarized," and that "both sides have evidence...they believe supports their case." Like the draft, it states that questions raised by the General Accounting Office about possible bias in WTR's industry-funded research (see *MWN,* N/D94) "appear to have been addressed." Gone, however, is the assertion that WTR "and its research process appear to meet the criteria for unbiased and open scientific research." Copies of the OTA report can be obtained for $19.00 each from: New Orders, Superintendent of Documents, PO Box 371954, Pittsburgh, PA 15250; or by calling (202) 512-1800.

Two Courts Differ on Evidence in Cell Phone–Cancer Cases

Two judges are interpreting the admissibility of scientific evidence alleging a cellular phone–cancer link differently. A federal court judge in Florida dismissed a case in May for lack of evidence, but, in August, a Georgia state court judge decided there was enough evidence to send the case to a jury. Both decisions are being appealed.

In Georgia, Richard Ward is suing Motorola Inc., which is headquartered in Schaumburg, IL. Ward, who is in his mid-40s, is claiming that he developed an astrocytoma on the right side of his head from holding a cellular telephone in his right hand (see *MWN,* N/D94). He bought his cellular phone in June 1989 and was diagnosed in February 1991.

The Florida lawsuit, the first cellular phone–brain tumor case in the U.S., was brought by David Reynard on behalf of his wife Susan, who died in 1992 (see *MWN,* M/J92, J/F93 and M/J95). Susan Reynard had used a hand-held cellular phone for two years prior to her diagnosis, according to her husband. Reynard is suing Melville, NY-based NEC America Inc. and GTE Mobilnet of Tampa.

"The rules for accepting scientific theory and evidence from an expert are much stricter in federal court," noted attorney Bruce Goodhart of Holstein, Mack & Klein in Chicago. Goodhart's firm is representing several clients with brain tumors, including Robert Kane and Debbra Wright, who are suing cellular telephone manufacturers (see *MWN,* J/F94 and M/A95).

In denying Motorola's request to dismiss the Ward case, Fulton County, GA, Judge Jerry Baxter found that, "There are genuine issues of material fact remaining." But he signed a Certificate of Immediate Review, the first step in a process that allows his decision denying the defendants' motion for summary judgment to be appealed. The appeal was filed September 18.

President Clinton To Facilitate Siting of Cellular Phone Antennas on Federal Property

The memorandum reprinted below on Facilitating Access to Federal Property for the Siting of Mobile Services Antennas *was sent by President Bill Clinton to the heads of all federal agencies on August 10, 1995. The memo follows a March 22 letter from Thomas Wheeler, president and CEO of the Cellular Telephone Industry Association (CTIA) in Washington, who asked the President to issue an executive order directing federal agencies to facilitate the use of property they control (see* MWN, *M/J95). The CTIA is clearly pleased with the outcome. "It's a win-win situation," CTIA spokesperson Mike Houghton told* Microwave News. *"It's good news for the government because carriers have to pay, so there is new revenue. It's also a win situation for carriers because it gets us access to locations that often are the largest buildings in town."*

Recent advancements in mobile telecommunications technology present an opportunity for the rapid construction of the nation's wireless communications infrastructure. As a matter of policy, the federal government shall encourage the efficient and timely implementation of such new technologies and the concomitant infrastructure buildout as a means of stimulating economic growth and creating new jobs. The recent auctioning and impending licensing of radio frequencies for mobile personal communications services presents the federal government with the opportunity to foster new technologies and to encourage the development of communications infrastructure by making federal property available for the siting of mobile services antennas.

Therefore, to the extent permitted by law, I hereby direct the administrator of General Services, within 90 days, in consultation with the Secretaries of Agriculture, Interior, Defense, and the heads of such other agencies as the administrator may determine, to develop procedures necessary to facilitate appropriate access to federal property for the siting of mobile services antennas.

The procedures should be developed in accordance with the following:

1. (a) Upon request, and to the extent permitted by law and where practicable, executive departments and agencies shall make available federal government buildings and lands for the siting of mobile service antennas. This should be done in accordance with federal, state, and local laws and regulations, and consistent with national security concerns (including minimizing mutual electromagnetic interactions), public health and safety concerns, environmental and aesthetic concerns, preservation of historic buildings and monuments, protection of natural and cultural resources, protection of national park and wilderness values, protection of National Wildlife Refuge systems, and subject to any federal requirements promulgated by the agency managing the facility and the Federal Communications Commission, the Federal Aviation Administration, National Telecommunications and Information Administration and other relevant departments and agencies.

(b) Antennas on federal buildings or land may not contain any advertising.

(c) Federal property does not include lands held by the United States in trust for individual or Native American tribal governments.

(d) Agencies shall retain discretion to reject inappropriate siting requests, and assure adequate protection of public property and timely removal of equipment and structures at the end of service.

2. All procedures and mechanisms adopted regarding access to federal property shall be clear and simple so as to facilitate the efficient and rapid buildout of the national wireless communications infrastructure.

3. Unless otherwise prohibited by or inconsistent with federal law, agencies shall charge fees based on market value for siting antennas on federal property, and may use competitive procedures if not all applicants can be accommodated.

This memorandum does not give the siting of mobile services antennas priority over other authorized uses of federal buildings or land.

All independent regulatory commissions and agencies are requested to comply with the provisions of this memorandum.

This memorandum is not intended to create any right, benefit or trust responsibility, substantive or procedural, enforceable at law or equity by a party against the United States, its agencies or instrumentalities, its officers, or any other person.

This memorandum shall be published in the *Federal Register*.

EC Report Calls for More Cellular Phone Safety Research

"The general public should have the best possible assurance that there are no health risks involved in using wireless, portable phones....Scientific data of a high quality are essential in order to provide a basis for determining the potential health risk. These data are lacking at the moment." That is the conclusion of a report on cellular phone safety sponsored by the European Community (EC) (see *MWN,* N/D94).

Prepared by Professor Jørgen Bach Andersen and colleagues at the Center for Personkommunikation at Aalborg University in Aalborg, Denmark, and the Danish Cancer Society at the request of the EC's telecommunications directorate, the report states that its goal was "to collect in one small document the most relevant information concerning the exposure from European systems," providing "an overview enabling decision-makers to better understand the issues."

"Near the turn of the century a major part of all telephones will be wireless," the document states, "and it is in this respect that environmental issues come to the forefront."

In a short summary of existing research, the report cites many experiments that demonstrate both EMF and RF/MW bioeffects. However, it explains, "Most often power levels, modulation spectra, carrier frequencies, etc. are different from the ones of interest" relative to cellular phones. In calling for more research, it suggests that "especially the modulated systems should be studied further."

In discussing GSM phones, which are widely used in Europe, in contrast to the U.S., the report states that if the antenna is held too close to the head, ANSI/IEEE guidelines on power density can be exceeded. It notes that this standard is based only on possible thermal effects.

Although it states, "There is no evidence of any health risks related to the use of a mobile hand-held phone," the report finds that "the data are inadequate for drawing any conclusion that cellular phones...present a public health risk or not." It concludes that, "The subject matter still needs a great deal of robust research."

For more information about *On the Possible Health Effects Related to GSM and DECT Transmissions: A Tutorial Study,* contact: Dr. J. Bach Andersen, Center for Personkommunikation, Aalborg University, Fredrik Bajers Vej 7, DK-9220 Aalborg, Denmark, (45) 9815 8522, Fax: (45) 9815 1583.

Ward's attorneys see Baxter's decision as a clear-cut victory and his subsequent signing of the appeal procedure form as routine. "Contrary to the [cellular phone] industry's position, a growing bank of evidence from multiple scientific disciplines exists that electromagnetic emissions from portable cellular telephones can have biological and carcinogenic effects on humans," said William Gray of Dennis, Corry, Porter & Gray in Atlanta. "The court...simply confirmed that there was sufficient evidence of causation to create a jury issue."

Motorola has a different view. "Our position is that the allegation at the heart of this case is absolutely baseless and the other side has failed to produce any scientific evidence, credible or otherwise, to back up its claim," said Norm Sandler, a spokesperson for Motorola.

One of Ward's expert witnesses is Dr. David Perlmutter, a Naples, FL, neurologist, who reviewed Ward's medical records and concluded that his use of a cellular phone "did in fact cause, exacerbate and/or promote the growth of [the plaintiff's brain] tumor." Ward is also using testimony from Dr. Andrew Marino of the Louisiana State University Medical Center in Shreveport, who similarly concluded that Ward's use of a cellular phone "caused or exacerbated the plaintiff's malignant brain tumor." Sandler referred to Perlmutter's and Marino's testimony as "personal opinions."

Interestingly, Perlmutter had previously provided testimony in Reynard's case, which was dismissed on May 17 by U.S. District Court Judge Ralph Nimmons Jr. on the grounds that Perlmutter's testimony on medical causation was inadmissible. Nimmons cited the U.S. Supreme Court's 1993 decision in *Daubert v. Merrell Dow Pharmaceuticals Inc.,* which lets the trial court determine the admissibility of expert testimony.

Nimmons wrote that Perlmutter had given no indication that he examined Susan Reynard or reviewed her medical records and that "the conclusions of the affidavit are not supported by any objective source, such as a treatise or a published article in a reputable scientific journal."

"We feel that the judge erred in, among other things, his application of the superior court's ruling in the *Daubert* case," said Reynard's attorney, John Lloyd of St. Petersburg, FL. Lloyd filed a notice of appeal on August 17.

NCRP To Revise Report on Bioeffects of RF/MW Radiation

The National Council on Radiation Protection and Measurements (NCRP) has formed a committee to update the agency's *"Report No. 86: Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields."* The eight-member group is expected to meet for the first time in November. The revision should take at least three years, according to the committee's chairman, Dr. James Lin of the University of Illinois, Chicago. The committee's vice chairman is Dr. C.K. Chou of the City of Hope National Medical Center in Duarte, CA.

The original radiofrequency and microwave (RF/MW) radiation report, issued in 1986, took nine years to complete and was based on research published through 1982 (see *MWN,* M/J 86). The revision will update the literature database and reevaluate the report's conclusions in light of new laboratory findings and human health studies. "Certainly, research has been ongoing over the past decade, so this report will take that into account," said Dr. Tom Koval, an NCRP senior staff scientist

assigned to work with the committee. The NCRP is based in Bethesda, MD.

The report will include sections on: molecular, cellular and tissue interactions; effects on blood, endocrine, immune, nervous and reproductive systems; behaviorial and ocular effects; epidemiology; and medical applications. It will address both thermal and nonthermal responses, continuous and pulsed fields, as well as exposure criteria.

An NCRP committee on RF/MW radiation has recently been criticized for its lack of biological expertise (see *MWN,* M/J 95). Asked why neither the chairman nor the vice chairman of this new committee is a biologist, Dr. Thomas Tenforde of Battelle Pacific Northwest Laboratories in Richland, WA, a vice president of the NCRP, said, "The best understanding in the field is more on the physical science-engineering end than on the biology end."

The other committee members are: Drs. Eleanor Adair of the John Pierce Laboratory Inc., New Haven, CT; Patricia Buffler of the University of California, Berkeley; George Harrison of the University of Maryland Medical School, Baltimore; Gregory Lotz of the National Institute for Occupational Safety and Health, Cincinnati; Richard Luben of the University of California, Riverside; and Jan Stolwijk of Yale University School of Medicine, New Haven, CT.

Australian Report on Cellular Phone Risks: More Questions Than Answers

Australia's Commonwealth Scientific Industrial Research Organization (CSIRO) has concluded that the safety of cellular telephones (CTs) cannot be resolved "in the near future." But very little RF/MW radiation research is being done in Australia to resolve the uncertainties, according to Dr. Stan Barnett, a principal research scientist at CSIRO's Division of Radiophysics, who prepared the report.

"My goal is to establish a national committee to approach this problem by coordinating relevant and focused research," Barnett told *Microwave News.* "We need to know whether bioeffects are repeatable, before we spend too much effort trying to determine a mechanism." He added that, "Important issues are clearly those which suggest effects on the central nervous and sensory systems, such as the Lai-Singh report of single-strand DNA breaks, changes in the permeability of the blood-brain barrier and lesions in the cornea." Barnett said that this problem is a global one and that he is exploring the feasibility of forming international liaisons. He estimated that with a budget of $3 million over a three-year period, some "valuable answers" would probably emerge.

The report, *Status of Research on Biological Effects and Safety of Electromagnetic Radiation [EMR]: Telecommunications Frequencies,* was commissioned by the Spectrum Management Agency (SMA) of the federal Department of Communications. Although completed in June 1994, the report was not released until March 30, 1995. Copies are available at no charge from: Roger Smith, SMA, Purple Bldg., Chan St., Belconnen, ACT 2617, Australia, (61+6) 256-5555, Fax: (61+6) 256-5200.

Reprinted below are excerpts from the report's executive summary.

...Digital technology has allowed unexpectedly rapid growth in the CT industry worldwide....Research on biological effects and development of safety standards always lags many years behind technological development, due to the limited availability of funding. However, public acceptance can be easily damaged if the safety issues are not satisfactorily resolved. A small proportion of the massive manufacturing benefits would fund substantial research programs.

To answer the question of safety of CT is a tall order....The main topic of concern seems to be whether or not a real risk exists for the development of cancer. This is doubtlessly due to the continuing uncertainty about power line frequencies....Many laboratory studies show abnormal cell growth and gene expression when exposed to ELF or RF modulated with an ELF component....

In the present climate of scientific uncertainty it is difficult to see how the situation can be suitably resolved in the near future. There is no scientific basis to support initiation of cancer by RF radiation and most human cancers take many years to develop. The latency factor is an important issue. Meaningful animal studies require exposure throughout the normal lifetime and therefore require many years to properly plan, exercise and evaluate. There is no evidence that low levels of EMR at frequencies up to 300 GHz can directly alter the DNA genetic material of cells and initiate cancer. However, there is some evidence that EMR alters enzyme synthesis in ways similar to known chemical cancer promoters.

The thermal mechanism is most commonly accepted, and there is a tendency to assume that physiological effects cannot occur in conditions where the expected temperature increase is less than 1°C ....The attitude of physical scientists is, generally, to disregard reports of effects for which a known physical mechanism cannot be readily attributed. However, the mechanisms are inadequate to explain all of the observed biological responses. Radiation biologists have reported a number of changes in various biological systems following exposure to EMR that produces insignificant or undetectable temperature increase. These effects range from alteration of ion concentration in cells [to] increased rate of DNA synthesis to enhancement of the rate of tumor growth in experimental animals....Mechanisms for many of these biological effects have not been identified or proposed and this lack of scientific explanation has, not surprisingly, led to a reluctance to accept the effects as "real." The difficulty is compounded by the fact that as there is limited research activity, particularly at RF, much of the work has not been replicated in independent laboratories. There is often no attempt to establish a dose–response for reported effects. This is difficult to explain or justify.

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Whilst researching the scientific database in the preparation of this report, it has become evident that subtle changes in cell structure and biochemistry have been frequently reported at exposure levels where gross thermal change could not be attributed as a cause. The effects involve a number of phenomena from cell membrane permeability to altered gene expression....

A number of effects have been reported from reliable research groups of *in vivo* effects resulting from exposure to pulsed MW radiation. Reported low-level *in vivo* effects that have received little notice involve the impairment of short-term memory function in rats exposed to 2.45 GHz at 1 mW/cm^2 or a whole-body SAR of 0.6 W/Kg for 45 minutes. The effect was produced with both CW and pulsed waveforms and is thought to be due to MWs activating endogenous opiods in the brain, thereby causing a decrease in cholinergic activity in the hippocampus. The effect is similar to that caused by stressors.

Degenerative changes have been reported in ocular tissues in primates exposed to pulsed (1.25-2.45 GHz) MWs where an SAR of 2.6 W/Kg has produced lesions in the cornea and iris. Application of the glaucoma drug timolol maleate reduced the threshold for MW-induced damage to 0.26 W/Kg (below the ANSI safety standard)....

SAR measurements in human tissue phantoms in the brain and cheek have been shown to exceed the ANSI uncontrolled safe exposure levels. Furthermore, modeling studies have shown that for CTs operating at the level of [the] occupational standard the SAR in the fetus has been shown to exceed the uncontrolled level.

Problems in studies of human populations published to date include imprecise estimates of exposure. As a result, such epidemiological studies may underestimate any real risk. The likelihood of epidemiological studies providing useful information is questionable, particularly if the biological end point cannot be predicted. Its value in the short term (<10 years) must be negligible unless there was an enormous increase in the rate of cancer growth. Interestingly, the incidence of brain tumors in the EC countries has increased substantially in recent years....

[RF] safety cannot be assessed in the absence of reported serious effects when so little research has been aimed at the problem. It is somewhat surprising, and rather disappointing, to find that although the literature contains many hundreds of publications, there are very few areas of consensus....At low levels the absence of clear thresholds and [the] presence of intensity and frequency windows have created questions rather than provided answers....

In many respects, the effects of exposure to RF from CTs should be relatively easy to determine because the radiation is emitted from the antenna close to the skull. Although the field becomes complicated due to interference by the head, numerical methods to estimate local SARs are improving....*In situ* SAR values on the order of 3 W/Kg averaged over 10 gm of tissue have been estimated in brain tissue close to a CT operating at 900 MHz and maximum output. Under the same conditions the maximum SAR value averaged over 10 gm of tissue was 4.6 W/Kg at 1.8 GHz.

It is difficult to envisage an epidemiological survey that would effectively discriminate amongst the other environmental variables. ...As a number of cellular responses have been associated with low-level [power] frequency, this may also be a potential confounding variable. The development of cancer is a slow process taking many years before it is positively diagnosed in humans....It is most unlikely that retrospective studies will provide any useful information for recently developed technology, such as CTs. Prospective studies will have [a] negligible chance of showing any effect, if present, in less than 10-20 years.

There is no doubt that the interpretation of bioeffects data has been clouded by a preoccupation with thermally mediated processes. In fact, development of the ANSI/IEEE standard is based only on well-established thermal effects, and ignores the more subtle nonthermal processes that are more difficult to interpret and apply to human health. The inappropriate exemption from standards by the 7 W exclusion clause is due to be removed from the ICNIRP standard.

FROM THE FIELD

Clippings from All Over

In late 1889, a series of horrible electrical accidents gripped the city with fear....As a result of the electric wire panic, New Yorkers in the 1890s had a profoundly ambivalent view of electrical technology. They had great hopes and, at the same time, great fears of the new technology. They hoped that electrification would help bring about the moral and physical regeneration of the city, but also feared that it brought with it unexpected, random dangers. It was not simply the fear of death from overhead wires that terrified New Yorkers, but also the mysterious nature and randomness of this [kind of] death. The electric wire panic fixed in the public's consciousness the idea of electricity as a mysterious force that could suddenly and unexpectedly strike down members of the public....This tension between technological enthusiasm and pessimism manifested itself as a deep anxiety about electricity, and the new urban world it was creating.

—Joseph Sullivan, "Fearing Electricity: Overhead Wire Panic in New York City," ***IEEE Technology and Society,*** **pp.8-16, Fall 1995**

EMF exposure may therefore ultimately be implicated in neuronal degeneration. This, in turn, may have important implications with respect to the etiology of Alzheimer's disease....As a working hypothesis, we suggest that EMF exposure may result in the initiation of an inflammatory process that may in part be responsible for creating a cascade of pathologic processes resulting in selective neuronal cell death. An inflammatory process may result, for example, from various parts of the body receiving high levels of EMF exposure, thus activating microglial or other cells that migrate to the brain and initiate attacks on selected neurons. Alternatively, an inflammatory process may result from direct brain tissue exposure to EMF, which disrupts calcium ion homeostasis, causing neuronal damage or death. Once initiated, the pathologic process need not require additional EMF exposure for its continuation.

—Dr. Eugene Sobel et al., "Occupations with Exposure to Electromagnetic Fields: A Possible Risk Factor for Alzheimer's Disease," ***American Journal of Epidemiology, 142,*** **p.522, September 1, 1995**

As a nation, we suffer from a syndrome of paranoia and neglect. We are paranoid in the sense that we devote large amounts of resources to alleged dangers that are probably small or even nonexistent. At the same time, we neglect many large, well-proven dangers. We're caught up in a "risk of the month" mentality. One month, it's Alar in apples; the next, it's brain cancer from cellular telephones....Few citizens realize that many government regulations of "toxic substances" address risks that are no greater than what people routinely incur from drinking a cup of coffee each day or eating a peanut butter sandwich for lunch.

—Dr. John Graham, quoted in "Risks & Public Policy" by William Crain, ***The Lamp*** **(published by Exxon Corp.), pp.9-10, Summer 1995**

Reports from Pushchino and Copenhagen

Dr. Abe Liboff, a professor of physics at Oakland University in Rochester, MI, sent Microwave News *the following reports on two recent meetings:*

EMF Workshop in Pushchino, Russia

A workshop on *Interaction of Electromagnetic Fields with Biological Systems* was held May 15-18, 1995, at the Russian Academy of Sciences Institute of Cell Biophysics (ICB) in Pushchino. It was sponsored by the European Bioelectromagnetics Association and the Russian Academy of Sciences' Problem Commission on Bioeffects of Electromagnetic Exposure. Participants included individuals from Kiev, Moscow, Pushchino, Rostov-on-Don and St. Petersburg, as well as the U.K. and the United States.

The two well-known ion cyclotron resonance models developed at Pushchino were presented by Mikhail Zhadin of the ICB in Pushchino and by Valery Lednev of the Institute of Theoretical and Experimental Biophysics (ITEB—also in Pushchino). Zhadin's model involves Larmor precession, while Lednev's focuses on parametric resonance. A number of ELF magnetic field cyclotron resonance experiments were reported on, including: changes in the rate of planaria regeneration (Lednev with H. Tiras of the ICB), reduction of the mass of implanted tumors in mice (V. Novikov, A. Kachan, N. Novikova, all of the ICB), and stimulation of heartbeat fluctuations in daphnia (N. Chemeris and V. Safronova, both of the ICB).

In each of these cases, the combination of AC and DC magnetic fields that was employed corresponded to the calcium ion charge-to-mass tuning condition. Zhadin and O. Deryugina (ICB) were one of two groups reporting replication of the work on rat behavior originally performed by Richard Lovely and coworkers at the Battelle Pacific Northwest Labs in Richland, WA, in which magnetic field combinations tuned to Ca^{2+} and Mg^{2+} resulted in slower and faster learning, respectively, when compared to controls. E. Lyskov of the Institute of the Human Brain in St. Petersburg found that not only do rats learn more slowly when exposed to calcium ion resonance combinations, but they also exhibit a range of behavioral changes including a marked reduction in aggressiveness.

A.R. Liboff of Oakland University reported on the effects of pure AC linearly polarized magnetic signals in the range 3-16 Hz on hippocampal theta rhythms in rats, demonstrating that coupling to the hippocampal oscillator occurs for magnetic intensities as low as 400 mG. Frank Barnes of the University of Colorado, Boulder, discussed his theoretical model that predicts changes in chemical reaction rates in the vicinity of cell membranes exposed to ELF magnetic fields. Roger Coghill, a consultant based in Wales, U.K., suggested that one cause of childhood leukemia in England may be the higher levels of electric fields around the beds.

The meeting was attended by the two "elder statesmen" of bioelectromagnetism in Russia: Yuri Kholodov and Yuri Grigorjev, both at the Institute of Neurophysiology and Higher Nervous Activity in Moscow. Kholodov reported on adaptive reactions to magnetic fields, and Grigorjev reviewed the many physiological effects he has observed and the possible mechanisms connected to weak ELF magnetic exposures.

An extensive set of measurements at 915 MHz has been conducted by the ICB's O. Kolomytkin on changes in concentration for the two most common types of synaptic receptors found in the brain, GABA and glutamate. Significant changes, relative to controls, were observed for intensities ranging between 10 and 1000 $\propto w/cm^2$ for exposures as short as one minute. He has determined that the hippocampus is the most sensitive to such exposures and the cerebellum the least sensitive. Zhadin's group, working at 900 MHz, has observed that changes in conductivity in hippocampal slices are maximized at a modulation frequency of 16 Hz. The latter group has also made clinical use of a millimeter-wave device (55 GHz) (designed by O. Betsky, in Moscow) to treat hospitalized alcoholics. The members report that short, repetitive application of this type of device to the limbs results in profound changes in the EEG. Still another group (V. Geletyuk, V. Kazachenko, N. Chemeris and E. Fesenko, all of the ICB) exposed single activated potassium channels to 42.25 GHz radiation, and found changes in the affinity for Ca^{2+}, measured using patch clamp techniques. A resonance phenomenon was observed by A. Gapeev, N. Chemeris, and E. Fesenko of the ICB, and R. Khramov of the ITEB, with changes in motility in paramecia following exposures to 42.25 GHz modulated at 0.0956 Hz.

E. Kvakina and L. Garkavi, both of the Rostov Oncological Institute, argued that living things are somehow stressed by magnetic field exposure to the point where adaptational reactions are observed.

A number of new theoretical approaches were presented, two of which specifically attacked the unusual electrical properties associated with ion channels. First, G. Ovtchinnikova of Moscow suggested that the phenomenon of super-ionic conductivity may be connected to channel function, such that enhanced charge transport might result from electromagnetic absorption. Second, V. Bystrov of Pushchino presented what he called a "nontraditional" model of channel conduction, in which channel proteins display ferroelectric properties similar to liquid crystals.

EM Sensitivity Conference in Copenhagen, Denmark

The *2nd Copenhagen Conference on Electromagnetic Hypersensitivity* was held May 22-23, 1995, at the University of Copenhagen in Denmark. Program Cochairmen Jyrki Katajainen of the University of Copenhagen and Bengt Knave of Sweden's National Institute of Occupational Health (NIOH) in Solna organized the meeting into scientific papers, case histories and invited lectures.

The five invited lectures included an overview by Knave, who suggested that there are three aspects to EMF effects on humans. Apart from the potential for cancer and for adverse pregnancies, there are a host of neurobehavioral symptoms, including headaches, depression and hypersensitivity (which presents mainly as skin problems and neurasthenia, and, to a lesser extent, difficulties in vision). William Rea, an MD who runs an electromagnetic and chemical sensitivity clinic in Dallas, TX, and who also holds a chair at the University of Surrey, U.K., reviewed the case histories of five highly electrosensitive patients, one of whom died. These individuals were sensitive to telephones, VDTs, TVs, radios, fluorescent lights, electric power lines and electric tools. He also described techniques for discriminating electromagnetic from chemical sensitivity, and potential methods for de-adaptation. Monica Sandström of the NIOH in Umeå, Sweden, outlined experiments to determine possible differences between electrosensitives and controls in their neurophysiological responses to light stimulation at various flicker frequencies. Jean Monro of Breakspear Hospital in Hemel Hempstead, 20 miles outside of London, spoke on the possible connection between homeopathic mechanisms and ELF sensitivity. Still another possible connection, namely to heavy metals, was made by Mats Hanson of the Swedish Association of Dental Mercury Patients in Veberöd.

A number of individuals were present who had been clinically judged as suffering from electromagnetic sensitivity. Two such patients, both from the U.S., Marija Hughes of Washington, DC, and

Ruth Swisher-Schultz from the Elkhorn, WI, area (with her husband James Schultz speaking for her), described their personal medical histories, and especially the great difficulties they encountered with employers and medical insurers. The symptoms mentioned by these two individuals, as well as others at the conference, included "brain fog," skin rashes, involuntary muscle twitching, "sand" in the eyes, hair loss, nausea, headaches, pain and numbness, nosebleeds, and "drop attacks," i.e., a sudden loss of consciousness, often leading to auto accidents and broken limbs.

Dr. Roy Fox, a physician at Dalhousie University in Halifax, Canada, who has treated hundreds of patients who became temporarily dysfunctional due to incidents of chemical sensitivity, described an individual in this cohort who also became highly sensitive to computers. Further evidence for such effects was provided by Clas Tegenfeldt of the Department of Electrical Engineering at Sweden's Linköping University, who urged the revision of computer standards to accommodate electrosensitive individuals. G. Oftedal of SINTIF UNIMED in Trondheim, Norway, reported on a double-blind study involving 20 individuals working with VDTs. Martin Andersson of the Department of Technical Research of Liberel AB in Skellefteå, Sweden, described two case histories, one connected to VDT use and the other to telephones, and the approaches taken to isolate the causes of these problems. A. Wennberg of Solna's NIOH reported on the failure to isolate a causative electric or magnetic field parameter in studying 13 electrosensitive workers.

A number of investigators have designed surveys to attempt to sort out this question. Sweden's Bengt Arnetz, of the Department of Clinical Neurosciences at the Karolinska Institute in Stockholm, discussed "technostress" in the electrical industries and his examination of stress-reduction training, especially as it involves the stress-sensitive hormone prolactin. Cecilia Wadman, also of Solna's NIOH, used questionnaires to examine a cohort of 111 people self-identified as electrosensitive. She found the most common complaints to be dry skin and headaches. Jörg Fachner, Jörg Reissenweber and Eduard David, all of the University of Witten, Germany, described the results of a survey which they claimed indicates that the phenomenon of electrosensitivity is more sociological than medical.

Two Swedish investigators, Per Sjöberg of Ellemtel Telecommunications in Älvsjö and Yngve Hamnerius of the Chalmers Institute in Göteborg, reported on a double-blind study involving seven VDT operators who suffer from electromagnetic sensitivity. They were unable to "reject the zero hypothesis that the subjects cannot distinguish between exposure and sham exposure."

A. Peel of U.K.'s Salford University reported on cell culture prostaglandin response to a variety of magnetic field frequencies at 1 mT exposures. Alf Riggs, a resident of Waltham Abbey in the U.K., spoke on "The Biological Effects of Earth Radiation." G. Markarov of Hospital 83 in Moscow found an increased sensitivity to ELF frequencies in the 20-80 Hz range for hospital patients who had been otherwise treated with ionizing radiation. E. Komarova of the Russian Research Center of Rehabilitation and Physical Therapy in Moscow discussed the use of low-frequency transcerebral currents, far less than the excitation threshold, to affect various physiological parameters in the rat brain.

A. Vidybida of the prestigious Bogolyubov Institute for Theoretical Physics in Kiev, Ukraine, spoke of the possibility that hypersensitivity to weak electromagnetic signals exists in cooperatively acting biomolecules, notwithstanding the thermal noise field.

UPDATES

COMAR

HDTV and RF/MW Radiation Exposures... The Institute of Electrical and Electronics Engineers' (IEEE) Committee on Man and Radiation (COMAR) has issued a statement on *Public Exposure to Radiofrequency Fields from High Definition Television (HDTV) Broadcasting*. COMAR's broadcasting subcommittee, chaired by Richard Tell, a consultant based in Las Vegas, NV, reports that the HDTV digital signals alone result in lower public exposures to RF radiation than do the current analog TV signals. But because the FCC has mandated that TV stations will have to broadcast both the new HDTV and the current signals for 15 years, the addition of HDTV "will slightly increase ambient environmental RF fields from the TV service," although this change does not entail any increased public health risk. The COMAR statement appears in the September/October 1995 issue of *IEEE Engineering in Medicine and Biology Magazine*. The May/June issue of the magazine presented COMAR's report on *Human Exposure to Microwaves and Other RF Electromagnetic Fields*. This report concluded that, "There is no cause for concern regarding the environmental levels of RF [electromagnetic energy] fields to which the general population [is] routinely exposed. Based on present knowledge, human exposure at or below the permissible levels recommended by the IEEE and other organizations is not harmful to human health."

MEETINGS

EPA on RFR... The EPA has published two volumes of the proceedings of its *Radiofrequency Radiation Conference,* held in Washington, April 26-27, 1993 (see *MWN,* M/J93). The first volume, a review of seven panel discussions at the meeting, presents information on a variety of topics, including bioeffects, dosimetry, epidemiology and standards. Recommendations made by the panels after surveys of the existing data include a call for more research to replicate disputed findings. Dr. Charles Susskind, a professor of engineering at the University of California, Berkeley, and an elder statesman of the RF community, stated in his closing remarks that the most notable result of the conference "was the overwhelming consensus that it was imperative for EPA to proceed promptly to provide guidelines on public and occupational human exposure to RF radiation by issuing the requisite federal guidance or, preferably, by endorsing the existing 1992 guide developed and promulgated by the Institute of Electrical and Electronics Engineers [IEEE] and approved by the American National Standards Institute [ANSI]." Still, Susskind continued, all guidelines should state their limitations, and one limitation of the ANSI/IEEE guide is the specific absorption rate, which, he said, "is based on thermal effects, whereas effects that may be due to mechanisms other than heating have been reported, although they have not been unequivocally shown to have adverse health

consequences." Among the papers in the second volume are discussions of epidemiology by Dr. Genevieve Matanoski, cellular effects by Dr. Stephen Cleary and shocks and burns by Dr. Om Gandhi. To order *Summary and Results of the April 26-27, 1993, Radiofrequency Radiation Conference, Volume 1: Analysis of Panel Discussions* (PB95-240537, $19.50) and *Volume 2: Papers* (PB95-253753, $27.00), contact: National Technical Information Service, 5285 Port Royal Rd., Springfield, VA 22161, (800) 553-6847, (703) 487-4650, Fax: (703) 321-8547.

MELATONIN

Sleep Better... The quality of sleep improved for 12 elderly subjects after they were given controlled-release doses of melatonin, according to a study published in the August 26 *Lancet* (*346,* pp.541-544, 1995). Total sleep time, however, was not affected. Conducted by Dr. D. Garfinkel of the Wolfson Medical Center in Bat-Yam, Israel, and others, the study suggests that insomnia among the elderly may be treated effectively with melatonin replacement therapy. A similar study by Dr. Iris Haimov of the Technion-Israel Institute of Technology in Haifa, Israel, and others (*Sleep, 18,* pp.598-603, 1995) found that both the initiation and maintenance of sleep improved with melatonin. Dr. Nava Zisapel of Tel Aviv University in Israel is a coauthor of both studies.

MICROWAVE OVEN TESTERS

Let the Buyer Beware... As microwave ovens proliferated throughout the 1970s and early 1980s, so too did concerns about radiation leakage. Meters and other devices soon became available for consumers to measure their ovens' emissions. But as early as 1978, the FDA reported that several such units were unreliable. Now, another device, the SMW-2A, is being marketed by A.W. Sperry Instruments Inc. in Hauppauge, NY, at the eye-catching price of $7.95, a far cry from the hundreds of dollars charged for the standard models. Donald Witters, a physicist who was one of the authors of the 1978 FDA report and who is still with the agency, expressed some doubt about the new meter, saying, "We've never found these inexpensive instruments to be very accurate." When asked to distinguish his company's product from those that the government deemed unreliable, Kevin Basso, Sperry's engineering manager, could not provide any test results or other data. Like the FDA, major meter manufacturers are also skeptical of the low-cost testers. "Usually what happens is that the devices don't work at all, or are so inaccurate that they end up costing the consumer more money," said Edward Aslan of Loral Microwave-Narda, also in Hauppauge. He explained that many cheaper meters tend to give high readings, prompting owners to seek unnecessary, but expensive, service. Aslan added that the array of diodes needed to make a dependable detector would cost hundreds of dollars alone. Dave Baron, vice president of marketing at Holaday Industries Inc. in Eden Prairie, MN, agreed with Aslan, saying that most of the home models are inaccurate. Holaday's lowest-priced microwave meter, the HI-1801, sells for $329. So what should concerned oven owners do? Nothing, said Baron, unless there is reason to believe that their ovens have been damaged.

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PERSONAL RADAR

Small, Cheap Devices for Every Need... New low-power radars that are inexpensive and that can fit in the palm of the hand may soon be a common part of daily life, according to an article by Ruth Flanagan in the August 12 *New Scientist*. Called micropower impulse radar (MIR), the new technology relies on short RF pulses to detect objects within a six-meter range. MIR devices, developed at the Lawrence Livermore National Laboratory in Livermore, CA, cost only about $10 to build. The first products incorporating MIRs are expected to reach the market in two years and may well proliferate in a seemingly endless list of applications—including burglar alarms, parking meters that reset themselves when cars drive away, sensors that trigger air bags before a collision and devices that detect fluid levels in pipes or tanks behind walls. MIRs could also be trained on a sleeping baby to monitor breathing patterns and thus safeguard against sudden infant death syndrome. Health issues would not seem to be a concern, since, as Flanagan reports, "The power of the pulses is so low that the device produces only one-millionth as much electromagnetic radiation as a cellular phone." She adds, however, that "more challenging applications will bring new sets of problems. Air bag deployment, for instance, might require a radar with greater range and power, which could in turn increase the cost and size of the system."

POLICE RADAR

NIOSH Recommendation Redux... As late as last May, drafts of NIOSH's police radar report included unequivocal support for a broad study of police officers' occupational health risks. But when the final report came out in June, that language was dropped, replaced by a lukewarm endorsement of such a study (see *MWN,* J/A95). The five earlier drafts were obtained through a Freedom of Information Act request filed by Gary Poynter, research officer of the National Fraternal Order of Police in Cincinnati, who has been instrumental in focusing public attention on the possible link between radar guns and cancer. A detailed budget for the proposed research was included in the first through third drafts, and even the fifth draft took a strong position: "We recommend such a study." But the final report stated only that the study "is feasible and needs to be conducted," with the addendum that "this study is not within the scope of available fiscal year [FY] 1995 funds and no additional funds are requested by the Administration in [FY] 1996." Dr. Gregory Lotz of NIOSH in Cincinnati, one of the report's authors, told *Microwave News* that NIOSH was concerned that the stronger language would entail "the risk that Congress will tell us, 'You said it was a good idea, now go and do it'—without providing any additional resources." To some extent, Lotz said, that had happened already with his report, which Sen. Joseph Lieberman (D-CT) asked NIOSH to develop without a specific appropriation to pay for the study. The House Appropriations Committee recently passed a 25% cut in NIOSH's budget, the first step in the House budget resolution's call for a four-year phaseout of the agency. "For me, it's aggravating knowing that the federal government says they can't find $2.6 million to study the health of police officers, yet the military spends $900 for a hammer," commented Poynter. "Chances are that epi study will never happen."

CLASSIFIEDS

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Female Breast Cancer Linked to EMFs for the Third Time

Association Still Viewed Cautiously

A third epidemiological study has linked electromagnetic fields (EMFs) to female breast cancer. The finding has sparked renewed interest in the association, but researchers are hesitant to draw any firm conclusions. Nevertheless, the new study has put magnetic fields firmly on the list of possible risk factors for breast cancer.

Writing in the September issue of *Epidemiology (7,* pp.459-464, 1996), Dr. Patricia Coogan and coworkers at the Boston University School of Public Health reported a 43% increase in breast cancer among women with a high *potential* for occupational exposures to magnetic fields, notably those working with mainframe computers.

"This study lends credence to the idea that EMFs might influence breast cancer risk," Coogan told *Microwave News*. She warned, however, that there were only a small number of women in the "high potential for exposure" category, and thus the reported risk estimates are "somewhat imprecise." Nevertheless, Coogan believes that the findings represent a step forward in understanding the relationship between EMFs and breast cancer.

"It's a tantalizing finding," said Dr. Richard Stevens in a telephone interview from his office at the Battelle Pacific Northwest Labs in Richland, WA. "This is the strongest female breast cancer occupational study done so far." Dr.

(continued on p.5)

FAA Is Again Urged To Restrict Use of Portable Electronics on Board Aircraft

For the second time in eight years, an advisory committee has issued a report that calls on the Federal Aviation Administration (FAA) to impose consistent, industry-wide restrictions on the use of portable electronic devices (PEDs) aboard aircraft. But the FAA has failed to enforce its existing rules on PEDs and may not respond to the new call for action, according to John Sheehan, the committee's chair.

"Although interference from PEDs is extremely rare, the very fact that it can *possibly* occur should give the FAA and airlines pause about their unrestrained use," said Sheehan, chair of Special Committee 177 (SC-177) of RTCA Inc. Formerly known as the Radio Technical Commission for Aeronautics, RTCA is a nonprofit industry group whose advice has formed the basis for many of FAA's technical standards.

Similar recommendations from an RTCA committee in 1988 (see *MWN,* N/D88) were never implemented by the FAA, and Sheehan is not optimistic

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« Power Line Talk »

"It's been one fiasco after another." That is how one close observer described the process surrounding the long-delayed report on EMF health effects from the **National Academy of Sciences-National Research Council** (NAS-NRC). The report was mandated by Congress in 1991, but the panel assigned to prepare it was not selected until 1993. Since then, the NAS-NRC has variously predicted the report's release by 1995, "early" 1996 and late April, July and early September of this year (see *MWN,* S/O91, M/J93, M/A95, S/O95, J/F96, M/J96 and J/A96). As we went to press, the NAS-NRC news office said that the report's release is now scheduled for **October 31**. However, only prepublication copies will be ready then. The actual published report will not be available until the end of the year. The most recent delays have been due to a failure by the **Department of Energy** (DOE) to pay the NAS-NRC for the committee's work. DOE's Dr. **Imre Gyuk** told *Microwave News,* "Our procurement office has taken a long, long time for reasons known only to them." In September, Gyuk said that he had authorized a $24,000 payment last March. The NAS-NRC confirmed that it received this money on September 30—the last day of the federal government's fiscal year.

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Florida Power & Light (FPL) wants **Leonard Glazer** to pay for the costs of defending itself against Glazer's EMF–cancer lawsuit. The utility won a dismissal in May, a decision which is now under appeal (see *MWN,* M/J96). Taking advantage of Florida's "loser pays" statute, FPL secured the order for reimbursement as part of the ruling dismissing the case, explained an attorney for Glazer, **Howard Talenfeld** of Colodny, Fass & Talenfeld in Ft. Lauderdale. A headline in the September 14 *Miami Herald* read, "FPL Sues Dying Man for Legal Fees," but the action was just "standard procedure," according to FPL spokesperson **Kathy Scott**. "If we didn't try to recover those costs, they would have to be paid by our customers," she emphasized. "As we have always said," Scott added, "we are very sympathetic to Mr. Glazer over his illness. It's very unfortunate that he has leukemia. But it's always been our position that this was not caused by FPL equipment." The utility is demanding payment of $268,000—an amount that FPL's court papers describe as "only a fraction" of its total expenses, since not all costs are recoverable under the law. For example, court papers indicate that FPL spent $402,000 on its expert witnesses, but is only asking to be reimbursed for $174,000 of that amount. FPL's expert witness fees include: $29,000 for Dr. **Philip Cole** of the School of Public Health of the University of Alabama, Birmingham (at $400/hr); $127,000 for **Fred Dietrich** of Electric Research and Management in Pittsburgh (at $200/hr); $65,000 for Dr. **Paul Leaverton** of the College of Public Health of the University of South Florida in Tampa (at $200/hr); $33,000 for Dr. **John Moulder** of the Medical College of Wisconsin in Milwaukee (at $130/hr); and $116,000 for **Michael Silva** of Enertech Consultants in Campbell, CA (at $185/hr). Asked if FPL would drop its payment demand if Glazer agrees to drop his appeal, FPL's Scott declined to comment. "That's something they'd probably want my client to think about," said Talenfeld, "but I don't think it would matter. Leonard believes in what he's doing." Glazer's wife, Elsa, died of leukemia in 1988. The order to pay costs is on hold until Glazer's appeal is resolved. Oral arguments in the case are scheduled for November 4 in the Third District Court of Appeal in Miami.

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"It was time to do something different and improve the quality of my life." So said **Mark Warnquist** after leaving his full-time lawyering job in the Denver office of **LeBoeuf, Lamb, Greene & MacRae**. He will continue to consult on EMF issues for LeBoeuf, Lamb on an exclusive, part-time basis. Warnquist has helped utilities win two high-profile leukemia cases: the *Glazer* personal injury suit in Florida (see above and *MWN,* M/J96) and the *Pilisuk* workers' compensation claim in Washington state (see *MWN,* M/J95). Before joining LeBoeuf, Lamb in 1993, Warnquist worked with Tom Watson at Crowell & Moring for nine years. Warnquist said that he had grown tired of touring the country, living out of a suitcase and taking depositions.

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Dr. **Asher Sheppard** was the keynote speaker at the ***3rd Annual Michaelson Research Conference,*** held in Colorado Springs, CO, August 10-11. Sheppard, a consultant based in Redlands, CA, spoke on models of interaction. Dr. **Linda Erdreich** of Bailey Research Associates in New York City was invited to address risk assessment for RF radiation health effects other than cancer. The organizers of the conference, named after Dr. Sol Michaelson, who died in 1992, were formerly known as the "Circle of Friends" and began as a splinter group of BEMS. At one point, there were suggestions that they might break off from BEMS, but this never happened (see *MWN,* M/J93).

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Sage Associates, an environmental consulting firm, is offering a comprehensive **guide to the EMF epidemiological literature**. Two color-coded, multipage charts detail the health risks noted in the 96 occupational and 40 residential papers that were completed between 1979 and the present. Sage also included, when provided by the authors, other key information, such as types of exposures, job descriptions, dose–response relationships and the levels of statistical significance. "We hope these charts will be helpful in putting knowledge of EMFs into the hands of decision-makers in a concise and understandable format, so that they can independently assess the weight of the evidence," said Cindy Sage, who designed the charts. To order, send a check or money order ($37.00 for *Residential Epidemiologic Studies* and $84.00 for *Occupational Epidemiologic Studies)* to: Sage Associates, 1225 Coast Village Rd., Suite G, Santa Barbara, CA 93108. Add $10.00 for orders outside North America. For questions, contact Sage at: (805) 969-0557, Fax: (805) 969-5003, E-mail: <sageassoc @aol.com>.

California Supreme Court Stops EMF Property Claims; Landmark Decision May Also Limit Personal Injury Suits

In a unanimous ruling, the California Supreme Court has held that EMF property devaluation lawsuits cannot be considered by the state courts because such cases fall only within the jurisdiction of the state's Public Utilities Commission (PUC).

The decision means that California home owners can no longer seek compensation if their houses have declined in value due to nearby power lines. The PUC does not have the power to award such damages, according to Art Mangold of the PUC's Environmental Division, and with this ruling a home owner can no longer file a lawsuit in the state courts.

The high court's opinion deals only with property values, but the court may well apply the same logic to personal injury cases in the future. "I think this is the end of EMF litigation in California," said attorney Joel Lamp of the San Francisco firm of O'Connor, Cohn, Dillon & Barr, which represents San Diego Gas & Electric Co. (SDG&E).

"This decision is a frontal attack on the fundamental right to private property in California," declared plaintiffs' attorney Michael Withey in a statement to the press. "We will look to the federal courts to vindicate the important notion that private property should not be taken without just compensation."

Withey represents Martin and Jean Joyce Covalt in a suit charging that power lines owned by SDG&E lowered the value of the Covalts' home in San Clemente, CA (see *MWN,* M/A95 and N/D95). Withey, of Schroeter, Goldmark & Bender in Seattle, indicated that he is considering appealing the case to the U.S. Supreme Court. A final decision on an appeal must be made by mid-November.

"The supposed judicial conservatives on the court have sided with big government and the monopolies to the detriment of the little guy," Withey contended. But Lamp has a different view of the decision's political context: "It was written by Stanley Mosk, one of the court's most senior members, who tends to lean to the liberal side in his opinions. Mosk's positions have not always been favorable to business in California, and the fact that he authored this opinion is significant."

Annee Della Donna of the Santa Ana, CA, firm of Wylie Aitken said in an interview that, "At this point in time we do not think that *Covalt* applies to personal injury actions." But Della Donna, who represents plaintiffs in the *Younkin* and *Johsz* EMF–cancer cases (see *MWN,* M/J95, J/F96 and J/A96), conceded that *Covalt* has changed the legal landscape in favor of the utilities. "There are a lot of statements in it that are very disconcerting," she said.

"The decision will definitely apply to personal injury," responded Lamp, who is also involved in the *Younkin* and *Johsz* cases as counsel for Southern California Edison Co. (SCE). "The clear reasoning of the opinion," he told *Microwave News,* "is that allowing *any* EMF litigation to go forward in the civil courts will interfere with the PUC's jurisdiction." Lamp predicted that no new EMF lawsuits would be filed in California.

The Supreme Court's decision, issued on August 22, starts with an 11-page review of the basic physics of EMFs. This section begins with a quote from a 1989 report from the U.S. Congress's Office of Technology Assessment: "Although 'electric and magnetic fields' may sound mysterious or ominous to some people, scientists have had a good understanding of them since the nineteenth century."

The opinion then defines the scope of the PUC's authority, emphasizing that California law provides very few opportunities for judicial review of PUC actions. It cites a 1974 state Supreme Court decision, which allows lawsuits against public utilities only if "an award of damages would not hinder or frustrate the commission's declared supervisory and regulatory policies." In that case, a real estate broker had sued Pacific Telephone, claiming that poor phone service had caused her to suffer a major financial loss. PUC policy limited the phone company's liability to the amount that it charged the customer for phone service, and the Supreme Court rejected the broker's attempt to sue for damages above and beyond that amount.

The *Covalt* opinion finds that the PUC acted within its authority in developing a policy on the regulation of EMFs. The Supreme Court cites a 1993 PUC decision in which the commissioners stated that the existing evidence "had not led them to believe that an EMF health hazard actually existed"—but that "public concern and scientific uncertainty remain" and "the body of scientific evidence continues to evolve." This "Interim Opinion" by the PUC ordered utilities to fund a state-sponsored EMF health research program, and to take no-cost and low-cost measures to reduce EMFs on new power lines (see *MWN,* N/D93). The *Covalt* ruling concludes that for a court to award damages to the plaintiffs "would plainly undermine and interfere with" this interim PUC policy.

The Covalts' appeal did not seek to prove that EMFs cause cancer, but only that, because of public fear of EMFs, SDG&E's lines had reduced the value of their property. The Supreme Court ruling rejects the claim that such a loss would constitute a "damaging" of the Covalts' property, entitling them to compensation. The judges point out that zoning decisions often affect the market value of property, but that this does not entitle owners to compensation.

"The court was very impressed by the fact that no physical damage to the property was cited," said Curtis Renner of Watson & Renner in Washington, whose firm has represented utilities in many EMF lawsuits, including the *Altoonian* case (see *MWN,* N/D93, N/D95 and M/J96). But Michael Rikon of Goldstein, Goldstein & Rikon in New York City, who represents New York property owners in several EMF devaluation cases (see *MWN,* J/A94 and N/D94), contended that, "There is a physical invasion when any excess EMFs come onto the land."

It is unclear how much effect *Covalt* will have in the rest of the country, according to Renner. "It's likely that other state courts will take note of it," he said. But Renner also pointed out that a recent ruling in the *Glazer* case in Florida "runs directly contrary to the *Covalt* decision." In April, before that suit was dismissed on other grounds (see *MWN,* M/J96), an appellate court rejected the argument that Florida's Public Service Commission

(PSC) had exclusive jurisdiction over EMF issues.

"It was very important to the California Supreme Court that the California PUC had taken an active role in developing a policy around EMFs," Renner told *Microwave News*. "But the Florida PSC has also been very active. It's a good indication of how you can get different results in different states."

"Maybe *Covalt* will prompt the Florida Supreme Court to overturn the appellate court on this point," Lamp, SDG&E's attorney, speculated. "Certainly a unanimous opinion from the California Supreme Court is something that other state courts will take a look at."

But in Rikon's opinion, *Covalt* will have little influence in the rest of the country. "I'm not even sure it precludes the right kind of personal injury case being won before a California jury," he said in an interview. "In, say, a juvenile leukemia case, the scientific evidence is there." The question in California, however, is now whether such a case could even be presented to a jury—or only to the PUC.

Office Worker Cancer Cluster Shows Dose–Response Trend

An epidemiological analysis of a real estate office at the center of two EMF–cancer lawsuits shows that the longer employees worked there, the greater their odds of developing cancer. Dr. Samuel Milham, a consultant in Olympia, WA, reports this finding in an article slated to appear in the December issue of the *American Journal of Industrial Medicine*.

"If you can equate duration of employment with exposure, then you've got a remarkable dose–response relationship," Milham said in an interview. Formerly with the Washington state Department of Health, Milham served as an expert witness for plaintiffs in the two lawsuits, *Johsz v. Koll* and *Younkin v. SCE*. The two suits were brought by different groups of workers who contracted cancer after working in an Orange County, CA, real estate office with high EMF exposures.

The Covalt *Decision and the State of the Science*

Below are excerpts from the California Supreme Court's ruling in the Covalt *case, dealing with the state of scientific knowledge about EMFs and the policy of the California PUC. The full text of the 74-page decision is available on SDG&E's EMF Litigation Home Page, <http://www.sdge.com/emf/>.*

[T]o award such damages...the trier of fact would be required to find that reasonable persons viewing the matter objectively (1) would experience a substantial fear that the fields cause physical harm and (2) would deem the invasion so serious that it outweighs the social utility of SDG&E's conduct. Such findings, however, would be inconsistent with the commission's conclusion, reached after consulting with [the Department of Health Services], studying the reports of advisory groups and experts and holding evidentiary hearings, that the available evidence does *not* support a reasonable belief that 60 Hz electric and magnetic fields present a substantial risk of physical harm, and that unless and until the evidence supports such a belief, regulated utilities need take no action to reduce field levels from existing power lines....

A superior court determination that essentially the same evidence *is* sufficient to [conclude] that such fields are in fact dangerous would plainly undermine and interfere with that policy.

Apparently seeking to show that the scientific evidence before the superior court would be significantly different from that reviewed by the commission, plaintiffs claim, "There have been many positive studies of EMF–cancer (i.e., epidemiological studies finding a 'positive association' between such fields and cancer) reported in the scientific literature since the 1993 PUC order." Plaintiffs cite only one such study, however—a study reported in 1995 that found an increased incidence of brain cancer (but no increase in leukemia) among electric utility workers.*

While interesting, the report of a single positive epidemiological study (or even a number of such studies) in 1995 has not changed the broad scientific consensus on which the commission predicated its policy decision in 1993: For example, in the same year (1995), at least three noteworthy expressions of that consensus reiterated the view that the scientific evidence is still insufficient to establish that electric and magnetic fields are a health hazard.

First, a report prepared by the Oak Ridge National Laboratory and published by the [NIEHS] and the [U.S. DOE] stated that, "We do not know at this point whether EMF exposure from power-frequency sources constitutes a health hazard. Therefore, we cannot determine levels of exposure which are 'safe' or 'unsafe'."†

Second, the APS recently issued a formal statement declaring that, "The scientific literature and the reports of reviews by other panels show no consistent, significant link between cancer and power line fields....While it is impossible to prove that no deleterious health effects occur from exposure to any environmental factor, it is necessary to demonstrate a consistent, significant and causal relationship before one can conclude that such effects do occur. From this standpoint, the conjectures relating cancer to power line fields have not been scientifically substantiated."‡

Third, [the] AMA likewise adopted a policy statement declaring that the association "will continue to monitor developments and issues relating to the effects of electric and magnetic fields, *even though no scientifically documented health risk has been associated with the usually occurring levels of electromagnetic fields....*"◊

[Footnote to the above:] The same conclusion is expressed in an *amicus curiae* brief filed in this court by 17 prominent physicists, epidemiologists, biochemists and physicians, including among their number six Nobel laureates.¤

*David Savitz and Dana Loomis, "Magnetic Field Exposure in Relation to Leukemia and Brain Cancer Mortality Among Electric Utility Workers," *American Journal of Epidemiology, 141,* pp.123-134, January 15, 1995. See *MWN,* J/F95.

†National Institute of Environmental Health Sciences (NIEHS) and the U.S. Department of Energy (U.S. DOE), *Questions and Answers About Electromagnetic Fields Associated with the Use of Electric Power,* January 1995. See *MWN,* M/A95.

‡Council of the American Physical Society (APS), *Power Line Fields and Public Health,* April 1995. See *MWN,* M/J95 and J/A96.

◊American Medical Association (AMA), *Effects of Electric and Magnetic Fields,* 1995 (California Supreme Court's emphasis). See *MWN,* J/F95 and J/A95.

¤ Robert Adair et al., *Brief of* Amici Curiae *in Support of Petitioner San Diego Gas & Electric Co.* (prepared by Atlantic Legal Foundation, Attorneys for *Amici Curiae),* 1995. See *MWN,* N/D95 and M/A96.

Named as defendants were Southern California Edison Co. (SCE), building owner Koll Co. and the Grubb & Ellis real estate firm (see *MWN,* M/J95, J/F96 and J/A96).

From 1980 through October 1994, a total of 410 workers were employed in the office, which was located directly above three 12 kV electrical transformers. Milham reports that before 1992, magnetic fields were as high as 190 mG on the office floor, and 90 mG at four feet above floor level. After some of the electrical equipment beneath the office was moved in 1992, peak magnetic fields were reduced to 32 mG at floor level, and 12 mG at the level of the workers' chairs, according to Milham.

Over this period of time, 8 invasive cancers developed among the real estate firm's employees—including melanoma and cancers of the brain, breast and colon. Milham's calculations indicate that within this group only 4.2 such cancers would normally be expected.

Milham then compared those who had worked in the office for less than two years to the rest of the workforce. Of the 8 cases of cancer, only 1 occurred among the 254 people who had worked in the office for less than two years. Milham found that people who had worked for two to five years were nine times more likely to develop cancer than those who had worked there less than two years—and those who had been in the office for more than five years had a fifteen times greater cancer risk.

"Since many buildings are designed with internal electrical substations," Milham writes, "the exposure situation described here may be fairly common." He notes that in epidemiological studies that use job titles as the basis for EMF exposure assessment, these office workers would be classified as "non-exposed." "This exposure misclassification," Milham argues, "leads to [an] underestimation of risk" (see also *MWN,* J/A96).

An expert witness for SCE had analyzed data for these same workers and found no increased cancer risk. Milham said that one point of disagreement between the two analyses was whether it was legitimate to look at the combined incidence of different types of cancer together.

The *Johsz* suit was dismissed in June and is currently on appeal. Oral arguments are not expected before next spring at the earliest. The next hearing in *Younkin* will come in January, when an appellate court reviews sanctions imposed on the plaintiffs' attorneys after one of the defense's expert witnesses refused to testify (see *MWN,* J/A96; see also p.3).

Female Breast Cancer Linked to EMFs for the Third Time *(continued from p.1)*

Scott Davis of the Fred Hutchinson Cancer Research Center in Seattle commented that, "I find it quite interesting as another small piece of evidence in support of the EMF–breast cancer link."

Coogan's is the second U.S. study to find an association between breast cancer in women and EMFs. In 1993, Drs. Dana Loomis and David Savitz of the University of North Carolina, Chapel Hill, announced a 40% higher breast cancer mortality rate among female electrical workers than among the general female population (see *MWN,* N/D93). In a 1995 study, Dr. Kenneth Cantor, an epidemiologist at the National Cancer Institute in Bethesda, MD, used the same data set as Loomis and Savitz, but analyzed it differently and observed no breast cancer link (see *MWN,* M/A95). To date, several studies have shown a connection between EMFs and male breast cancer.

"The hypothesis of an association with magnetic fields remains quite speculative and no firm conclusions can be drawn at present," Dr. Tore Tynes of the Cancer Registry of Norway in Oslo told *Microwave News*. In 1994, Tynes found that female radio and telegraph operators had a breast cancer risk almost twice as high as that of controls (see *MWN,* J/A94). Tynes reported that women who had their licenses for up to nine years had an 80% higher breast cancer risk than did controls, while the risk for women certified for over 20 years was more than twice that of controls.

In an editorial accompanying Coogan's paper *(Epidemiology, 7,* pp.457-458), Dr. Susan Preston-Martin, an epidemiologist at the University of Southern California in Los Angeles, stressed that the possibility of a magnetic field–breast cancer association "has an edge over other hypotheses." She pointed to the melatonin hypothesis, which holds that the pineal gland's production of cancer-inhibiting melatonin is reduced by magnetic fields.

To be sure, Preston-Martin is still far from convinced that the link is proven. She called the findings "the latest in a series of ambiguous epidemiologic studies that indicate, weakly, that occupational exposure to magnetic fields increases breast cancer risk."

"I think [the melatonin hypothesis] is the most intriguing specific mechanistic hypothesis that we've got going now," Preston-Martin said in an interview, "because in other areas [of EMF research] nobody's really quite clear what the effect is due to, whereas this is something that is really quite specific and, therefore, more promising to investigate."

Preston-Martin noted that, as with many epidemiological studies, Coogan's report raises as many questions as it answers: For example, "Does it mean that there is something else in these occupations that actually does relate to breast cancer risk?"

Dr. Thurman Wenzl, a member of Coogan's team, also interpreted the results with caution. "This study indicates that we should believe that there is some aspect of electrical or electronic work that seems to be associated with breast cancer risk, but it's not clear whether it's EMFs or not," said Wenzl, who is now a research industrial hygienist at the National Institute for Occupational Safety and Health in Cincinnati.

Wenzl stressed that Coogan's use of incidence—rather than mortality—data was a crucial improvement. He noted that the incidence of breast cancer is not always accurately revealed in a mortality study and that, more importantly, Coogan was able to interview the study subjects and ascertain pregnancy history—which is critical to breast cancer risk.

Dr. Stephanie London of the National Institute of Environmental Health Sciences in Research Triangle Park, NC, agreed. "Certainly, in a female occupational study going back maybe 30 or 40 years, you have to consider that having any full-time occupation for a long time probably correlated with not having children, having few children or having children late," she told *Microwave News*. "In this study, they had all these variables." Lon-

don's own report is due in the year 2000 (see table below).

Cantor pointed out that Coogan and coworkers collected more detailed data than his team did on a number of potential risk factors. "They included age at the birth of the subject's first child and age at menopause. All this is very important in assessing breast cancer risks and needs to be looked at."

Coogan also found that the rate of breast cancer among premenopausal women with high potential for exposures was twice as high as for controls. Postmenopausal women with high potential for exposures had only a 33% increase. "It is interesting that the highest risk was shown for premenopausal breast cancer," Tynes said. "Loomis and Savitz found the highest risk in the 45-55 age group, and in our radio and telegraph operator study we found the highest risk in the 45-54 age group."

Coogan's data were taken from a larger case-control study on breast cancer and various health risk factors. In her study, which served as her doctoral dissertation at Boston University, she investigated 6,888 women with breast cancer and 9,529 controls, all under 75.

The subjects' "usual occupations" were coded into three categories—low, medium and high potential exposure to 60 Hz magnetic fields—based on 25-minute interviews about their work histories. "These exposure categories are quite imprecise," Wenzl said. "But the jobs with high potential for EMF exposure are thought to have average exposures more often above 3 mG."

In contrast, Loomis-Savitz and Cantor relied on death certificates for estimating exposures. Coogan "had better information on the nonoccupational risk factors for breast cancer and may have done a somewhat better job of determining the women's occupations," Loomis conceded.

Coogan asked each woman to name a "usual occupation" representative of her work history. Davis, who is completing an EMF–breast cancer study (see table), believes the generality of this question avoided potential bias. "There was no indication at all to the people answering this question that EMFs were the interest," he said. "So that's good, and the fact that it's direct interview information from the participants themselves is also very good."

Nevertheless, Coogan and her coauthors cited misclassification of magnetic exposure levels as "the major limitation" of the findings. "Although workers in electrical occupations have higher exposures to magnetic fields than nonelectrical workers," they stated, "there is considerable variation in exposures between occupations included in the same aggregate exposure category, and also within the same occupation." They concluded, however, that these limitations most likely led to an underestimation of the EMF risk.

But, as Preston-Martin stressed, this study was not intended to investigate an EMF–breast cancer link. "It just happened that they had information on both breast cancer and usual occupation in another study designed for something else entirely," she cautioned. "I don't think you ought to hang your hat on these results at all."

The association between EMFs and breast cancer is stronger among men—especially young men—than among women. Dr. Genevieve Matanoski of the Johns Hopkins University School of Hygiene and Public Health in Baltimore was the first to observe excess male breast cancer—a very rare disease—in young telephone employees in 1989 (see *MWN,* N/D89 and M/A91). A year later, Dr. Paul Demers of the Hutchinson Cancer Research Center found a sixfold increase in risk among young electrical workers (see *MWN,* J/A90 and S/O91).

Also in 1990, Norway's Tynes and Dr. Aage Andersen found that the breast cancer risk among electrical transport workers was twice that expected (see *MWN,* J/F91). Loomis saw a doubling of breast cancer deaths in his 1992 study of male electrical workers younger than 65 (see *MWN,* J/A92). A 1994 railway worker study by Dr. Birgitta Floderus of the National Institute for Working Life in Solna, Sweden, revealed an eightfold increase in male breast cancer among engine drivers and a fivefold increase for drivers and conductors combined (see *MWN,* M/J94).

Ongoing Breast Cancer–EMF Studies

Institution	Principal Investigator(s)	Sponsor	Study Type: No. of Cases/Controls	Approx. Date of Completion	Comments
Fred Hutchinson Cancer Research Center, U.S.	Dr. Scott Davis[1]	NCI	CC: 800/800	Spring 1997	Focus on both magnetic fields and light-at-night
Karolinska Institute, Sweden	Drs. Maria Feychting & Anders Ahlbom[2]	Swedish Cancer Society	Nested CC: 700/700	May 1997	Based on a 500,000-person cohort of Swedes living in a 300-meter transmission line corridor
SUNY Stony Brook, U.S.	Drs. Cristina Leske & Elinor Schoenfeld[3]	NCI & NIEHS	CC: 600/600	1999	EMF exposure assessment based on interviews and measurements
USC, U.S.	Drs. Stephanie London & John Peters[4]	NIEHS & DOD	Nested CC: 500/500	2000	Subjects mainly African-American and Latina women in Los Angeles

1. See *MWN,* J/F87 and J/A93; **2.** See *MWN,* J/A93; **3.** See *MWN,* N/D93; **4.** See *MWN,* N/D94.

Abbreviations: **CC:** Case-control; **DOD:** Department of Defense, Breast Cancer Research Program; **NCI:** National Cancer Institute; **NIEHS:** National Institute of Environmental Health Sciences; **SUNY:** State University of New York; **USC:** University of Southern California.

« Cellular Phone Notes »

Local governments across the country have been scrambling to work out their role in antenna siting in light of the new telecom law, which preempts them from adopting RF/MW standards stricter than those set by the FCC (see p.9 and *MWN,* M/A96 and J/A96). **Greenburgh, NY**, has passed an ordinance that institutes a multitiered system designating levels of preference for locating antennas. "We do not prohibit transmitting antennas anywhere in town; we simply encourage them to be sited in areas more acceptable to the community," **Francis Sheehan**, a Greenburgh resident and coauthor of the ordinance, told *Microwave News.* For example, cellular phone companies must first consider commercial locations for their antennas. If the applicants reject these sites, a public hearing follows before they can look at other sites. By forcing cellular providers to go through separate hearings at each level, Greenburgh officials hope to discourage telecommunications providers from building antennas on sites in the bottom tier—within 350 feet of schools and day care centers. When asked why schools were put in the most sensitive level of the system—even below residences—Sheehan said, "There are other health issues involved with antenna sites, and the 350-foot setback from areas where children commonly play protects against those issues, such as the antenna tower becoming a climbing challenge for the children." Under the new rules, a five-member advisory board will review the status of the antennas and, if necessary, amend the ordinance. In addition, all permit and rental fees from cellular phone companies will be used for future zoning enforcement....

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...Meanwhile, several communities have followed the lead of **Medina, WA**, and have passed moratoriums that give them more time to amend existing zoning laws. In mid-September, **Eugene, OR**, and the **San Juan Islands, WA**, banned new applications for periods of four and six months, respectively. Four cellular and PCS providers had threatened to sue Eugene over its moratorium, but agreed not to when the city exempted their 13 pending applications. On September 20, **US West**, which had been seeking to install antennas on the San Juan Islands for a year, filed a lawsuit in federal court. On September 26, **San Francisco** (see p.10) passed a moratorium that halts antenna siting in residential areas for 18 months. **Spokane, WA**, had a moratorium in place, but lifted it in early September in favor of an ordinance allowing antennas to be placed without a special permit if they are put on existing support structures. Medina adopted its six-month ban just five days after the telecom law was signed (see *MWN,* M/J96). The city won a lawsuit brought by Sprint Spectrum when a federal judge ruled that the six-month period constituted "a reasonable period of time," as stated in the telecom law. In August, Medina passed an ordinance that calls for wireless facilities to be set back from property lines at a distance equal to the height of the tower and the antenna.

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Many **New York City** residents have been reluctant to lease their rooftop and apartment property to support the influx of PCS systems. The situation prompted **Charles Hoffman** of Sprint Spectrum to tell the *New York Times* (August 19; see also p.12) that, "New York is the toughest market in the world." The wireless industry has discovered, however, that some of the posh Central Park West and Fifth Avenue penthouses it had been surveying may no longer be needed, since Mayor **Rudolph Giuliani** has allowed the PCS antennas to be put on 3,000 lampposts and traffic lights throughout the city. Phone companies will pay monthly fees of $100 per lamppost and $200 per traffic light. With each provider allowed 3,000 sites, the city could bring in upwards of $3 million annually. In spite of this windfall, the announcement brought harsh criticism from some residents, one of whom, **Arthur Firstenberg** of Brooklyn, contends that the antenna placement would transform the city streets into "cancer alleys." Firstenberg, chairman of the Cellular Phone Taskforce, an organization of electromagnetically hypersensitive New Yorkers, told *Microwave News,* "There has never been this concentration of sources of electromagnetic energy in the public streets before.... It's just frightening" (see p.9). Since the emissions from PCS antennas are about 1,000 times lower than the FCC's standards for public exposures, the city is unable to regulate them, **Sunny Mindel**, a spokesperson for the city's Department of Informa-

New Zealand Bans Cellular Antennas at Public Schools

New Zealand's Ministry of Education has issued a policy statement preventing cellular phone antennas from being built at public schools.

"Of paramount importance to the ministry is the provision of an environment where boards of trustees, parents, teachers, pupils and other occupants of the school site can feel comfortable. For this reason the ministry has decided cell phone transmitters will not be sited on Crown-owned school sites in the future," John Simpson, the ministry's national property manager, wrote in the one-page statement. The ban does not apply to private schools or to antennas that are already in place on school property.

A knowledgeable source called it "one of the most bizarre policy statements in terms of its tone and presentation." In particular, the source noted that the directive immediately follows quotes from the National Radiation Laboratory, which state that cellular transmitters operate below the New Zealand RF/MW radiation standard, that residents living near antennas are exposed to less than 1% of the limits for the general public set in the New Zealand standard and that there is no evidence that exposures at low levels are harmful.

The ministry cited safety concerns from the public as the impetus for the new policy. Antenna siting was the focus of a symposium held last November in Christchurch, at which attendees urged a "precautionary approach on the most vulnerable groups in our society" (see *MWN,* N/D95).

Last year, the California Public Utilities Commission reached a similar decision, advising cellular telephone companies not to build antennas near schools or hospitals (see *MWN,* N/D95).

tion Technology & Telecommunications, said in an interview. "The other thing to remember is that these things are already out there. There are landlords renting space for them," she added.

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Professor **Paolo Bernardi** of the **University of Rome "La Sapienza"** has added a new layer of complexity to the task of estimating the energy absorbed by the head of a cellular phone user. In a paper published in the August 1996 issue of the *IEEE Transactions on Electromagnetic Compatibility,* he shows that the presence of a nearby reflecting wall can radically change the specific absorption rates (SARs). Computer calculations show that a vertical reflecting wall can increase SARs, while a horizontal one can decrease them—in each case, the change in the SAR can be larger than a factor of two. The effect depends on what the wall is made of: A metal structure produces a major change, while a glass wall has only a minor effect. "When a portable phone is used inside a car, scattering surfaces are present and become important in determining the SAR distribution in the exposed head," according to Bernardi.

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Mobile phone towers, which, reportedly, are being built at a rate of three to five a week in the U.K., are increasingly drawing the ire of local residents. The proliferation of transmitters in Britain—where there are now more than 7,600—was made easier in the 1980s by legislation that allows four companies to put them anywhere they choose, according to the September 1 ***Independent on Sunday*** (U.K.). Many communities have balked at the prospect of the four providers each building a separate communications system. The *Independent* detailed the failure of one of these companies, **Mercury One 2 One**, to demonstrate to residents of a town in Kent the importance of a 77-foot tower in filling a void in its network. During a presentation by Mercury to the local opposition, a public relations staffer's mobile phone began to ring. "That inopportune call made it clear to us that the tower was not really necessary at all," **John Gandon**, an environmental campaigner, told the *Independent*. As a result, the local council rejected the permit. "The phone company has now left us in peace and has apparently decided not to lodge an appeal," Gandon said.

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The **Communications Workers of America** (CWA) and the **EMR Alliance** are preparing a manual on how communities can oppose the siting of cellular towers. The introduction states that due to the cellular industry's "mad frenzy" to build antennas, the handbook is being written "to help communities mobilize against the placement of cell sites or facilities where they believe placement would adversely affect their health, safety, property values and the aesthetics of their community." **David LeGrande**, the CWA's health and safety director in Washington, told *Microwave News* that one goal is to increase awareness of RF/MW radiation exposures and bring more attention to potential risks faced by the CWA's members who work near transmitters. "I'm especially concerned about the exposure from other kinds of devices besides cellular antennas," LeGrande said, adding, "Some transmitters on these towers may entail even more potentially harmful RF/MW exposures." He said that a lack of accurate information on health effects from RF/MW radiation made the document necessary: "I'm not convinced that all the data from these cellular companies—the CTIA in particular—are incredibly accurate."

Safety of Cellular Phones: The View from Harvard School of Public Health

On August 20, Dateline, *an NBC television news magazine, aired a segment on cancer risks that focused on cellular phones. Among those interviewed by Robert Bazell, NBC's science correspondent, was Dr. John Graham, director of the Center for Risk Analysis at the Harvard School of Public Health in Boston. Graham's work on cellular phones is sponsored by the Cellular Telecommunications Industry Association through Wireless Technology Research, a fact not mentioned by Bazell. Here is an excerpt from their exchange:*

Graham: In the media, you're looking for the mysterious, the novel, the unfamiliar story, and what better than exotic theories like brain cancers and cellular telephones? Unfortunately, the media doesn't always focus on big killers. They focus on the little ones and the speculative ones that the surgeon general would regard as insignificant.
Bazell: And once something has been flagged as a possible cancer risk, it is almost impossible to dispel the fear, no matter what studies are done. You remember what happened with saccharin? First, fears that it could cause bladder cancer, and then studies saying, "Don't worry, it won't." Well, 33% of the people we polled say they still consider saccharin a risk factor for cancer. So, what about the scientists themselves? Do they play a role in creating our misconceptions?
Graham: A lot of us scientists have motivations as we build our careers to exaggerate a particular possible cause of cancer that we're advancing as our own scientific hypothesis.
Bazell: But you're saying that scientists would exaggerate the cancer-causing danger of a chemical to advance their own career?
Graham: Bob, if I'm the person trying to prove that cellular phones cause...brain cancer, imagine what it does for my career to be the first person to show definitively that cellular phones cause brain cancer.

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While cellular antenna height has long been an aesthetic concern for communities across the country, it has increasingly drawn attention from the aviation industry as a potential safety hazard. On August 12, the **Federal Communications Commission** (FCC) fined **Centel Cellular Co. of North Carolina** $2 million for building a 187-foot tower in 1993, which, it contended, posed a "serious hazard" to aircraft traffic for the Greensboro/Piedmont Triad International Airport. The FCC had originally sought $3 million for not notifying the Federal Aviation Administration (FAA), for not installing safety lighting and for not obtaining FAA approval, but after an appeal Centel Cellular had the third violation dropped and the fine reduced. "This decision underscores the commission's concern for public safety. Every licensee should heed the message that a license is a public trust that carries a high duty to serve the public and to operate safely," said Beverly Baker, chief of FCC's Compliance and Information Bureau. Earlier this year, the Helicopter Association International began a campaign to give the FAA "uncompromised authority" in cellular tower siting cases (see *MWN,* J/A96).

Industry, Activists Challenge FCC's New RF/MW Rules

Seventeen petitions have been filed with the Federal Communications Commission (FCC) asking it to reconsider the new radiofrequency and microwave (RF/MW) radiation regulations that it approved on August 1. A dozen criticize the new rules as too restrictive, while the rest assert that they are too lenient. Parties on both sides of the issue are considering lawsuits if the commission does not bend in their particular direction.

"We'll respond to most or all of the petitions by late October or November," said FCC's Dr. Robert Cleveland, who led the agency's effort to draft the new rules. The period for public comment on the petitions runs through October 13.

The FCC is again being asked to preempt local and state regulation of the siting of *all* RF/MW transmitters. The Telecommunications Act of 1996 requires such federal preemption for cellular phone and personal communications services (PCS) facilities, but the FCC has so far rejected calls to extend this preemption to other RF/MW sources—such as radio and TV stations (see *MWN,* J/A96). The renewed requests come in petitions from the Electromagnetic Energy Alliance (EEA)—whose members include AT&T, General Electric, Motorola, Raytheon and the National Association of Broadcasters—and from the American Radio Relay League, the amateur radio group.

Ameritech Mobile Communications is calling on the FCC to preempt "state and local regulation of the *operation* of [personal wireless] facilities" (Ameritech's emphasis), and to rule on the issue of liability for "the environmental effects of RF emissions." These two steps would protect wireless operators against any lawsuits as long as the companies comply with federal standards (see p.12).

The Cellular Phone Taskforce, a citizens' group in New York City, argues that the FCC standard fails to protect electrosensitive individuals. Its petition asks the commission to set a 10 $\propto W/cm^2$ standard above 100 MHz. According to a September 19 statement, the group is raising money to fund a class action lawsuit "on behalf of the electrically sensitive and others, with the goal of keeping transmitters out of residential neighborhoods."

Much industry criticism is aimed at the FCC's decision to combine elements of two standards, one from the National Council on Radiation Protection and Measurements (NCRP) in 1986, and the other from the American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE) in 1992. For example, US West asserts that "it appears the commission made a decision to ignore science" in choosing the hybrid, and insists that the FCC must "adopt an unadulterated 1992 ANSI standard." The Department of Defense's petition also criticizes the FCC for not sticking with the ANSI rules.

In their attacks on the hybrid standard, the EEA and US West cite the opinions of specialists such as Drs. Eleanor Adair, C.K. Chou and Bill Guy, all of whom lobbied hard for the ANSI criteria (see *MWN,* M/A96).

Most observers think it is very unlikely that the FCC will reverse itself. But by filing objections now, industry maintains its right to challenge the FCC in court in the future.

The Cellular Telecommunications Industry Association (CTIA), which had previously been very active on behalf of the ANSI standard, chose not to file any objections to the FCC's new rules. "We feel it's a workable plan," said CTIA spokesperson Tim Ayers in Washington, even if there is still room for improvement. "In the give-and-take atmosphere of rule-making," he told *Microwave News,* "you don't always get 100% of what you want—but you get to a point where it's acceptable." Ayers would not comment on which particular changes were important to the CTIA, but added that, "Certainly there'll be no problems meeting these standards."

The new FCC limits are above levels that have been shown to cause adverse health effects contends a petition from the Ad Hoc Association of Parties Concerned About the FCC's RF Health and Safety Rules in Olympia, WA. It cites effects ranging from cancer to sleep abnormalities, and it calls on the FCC to cut its limits to 40% or less of the current figures. In general, the group proposes, emissions should be mandated to be "as low as reasonably achievable."

A petition from the nonprofit Ergotec Association in Arling-

Advice from U.K.'s Sir Richard Doll: Need for EMF Research Is "Urgent"

Sir Richard Doll, the U.K.'s leading epidemiologist—in 1992 the New Scientist *called him "the greatest epidemiologist ever"—is once again stressing the need for continued research to determine whether power frequency EMFs entail a cancer risk. (For some of his past comments, see* MWN, *M/A94, J/A94 and J/F95.) Excerpted below is Doll's advice on EMFs and RF/MW radiation in his commentary, "Nature and Nurture: Possibilities for Cancer Control," from the February issue of* Carcinogenesis (17, *pp.177-184, 1996).*

Whether the radiation from other parts of the electromagnetic spectrum [other than ionizing and UV radiation], or the individual electrical and magnetic fields produced, cause any risk of cancer is currently a subject of intensive research. Experimentally, there is no reason to think that they do, or even, in the case of the extremely low frequency electric and magnetic fields, that they produce any biological effect that could be related to cancer, though claims of such effects have been made by individual investigators, as yet unconfirmed in other laboratories. Nor is there any epidemiological evidence of cancer production from the use of cellular telephones, the claim for the production of brain cancer being based on the occurrence of single cases.

There is, however, some good-quality epidemiological evidence that residence near high-power electricity cables producing magnetic fields in houses of the order of 0.2 $\propto T$ [2 mG] and above (the average in houses in this country being of the order of 0.05 $\propto T$) may approximately double the risk of childhood leukemia and perhaps also cause a somewhat smaller increase in childhood brain cancer, and there is some evidence that occupational exposure to similar levels may increase the risk of leukemia and brain cancer in adults. The numbers of cases in the best studies are small, but we must, I think, conclude that the possibility of a risk from such exposures exists, and that we urgently need research to determine whether it does exist or not. The fields concerned are almost wholly man-made and, if the risk is real, there will certainly be an opportunity of reducing them, though at considerable social cost.

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ton, VA, asserts that the FCC rules are too lenient, especially given the nationwide proliferation of antennas. This point is also raised by New York's Cellular Phone Taskforce: "A person at a given location may be exposed to the cumulative...emissions of numerous transmitter [sites]. Combined exposure from all could well exceed [FCC's] limits."

Dr. Marjorie Lundquist of Milwaukee faults the FCC limits for "lack of a sound scientific basis." She contends that the rules do not give adequate weight to nonthermal bioeffects. Lundquist wants the FCC to establish a "forbidden zone" around transmitters of all types.

Industry petitions raise a variety of issues on how to ensure compliance at sites where several companies have antennas located together. The FCC ruled that the providers are jointly responsible, but Ameritech, BellSouth and Paging Network argue that responsibility should rest with the site owner.

Several petitions from the telecom industry complain that the grace period before new transmitter rules are enforced should be pushed back from January 1, 1997, given that an FCC technical bulletin on compliance will not be completed until November or December of this year.

The petition from Hewlett-Packard (HP) focuses on the issue of "new, unlicensed millimeter-wave technologies," in which HP is making a substantial investment (see *MWN,* M/A96). HP asks the FCC to relax some of its restrictions on these applications (e.g., wireless computer networks) and to "remain flexible in its environmental regulation of millimeter-wave radiation."

San Francisco Grapples with Siting of Wireless Facilities

On September 26, the San Francisco planning department passed an 18-month moratorium on placing any new wireless transmitters in residential districts.

The ban gives time for the city's general plan to be amended to include guidelines for siting wireless facilities. It was passed shortly after the Board of Supervisors adopted an ordinance establishing a commission to review the city's telecommunications policy, including specifics on the siting of wireless antennas.

"There has been massive opposition from industry to this plan," June Gutfleisch, a staff member with the Board of Supervisors, told *Microwave News*. The primary reason for the commission—which has been in the works for three years—was health, she said.

Other moratoriums, such as those in Medina, WA, and on the San Juan Islands, WA, have led to lawsuits from industry (see p.7 and *MWN,* M/J96).

The commission's five voting members, who will be appointed by the mayor, must include at least two public representatives. Of the other members, one must have a background in public, educational or government access to new technology and another in telecommunications management or engineering. Each will serve a three-year term. The directors of public works, health and planning will attend commission meetings as nonvoting members. Current or former employees of telecom providers that seek to bring their services to the city cannot sit on the commission.

Exposures from PCS Antennas

The greatest RF/MW exposure from a PCS antenna located 40 feet off the ground is not next to the base, but 107 feet away. Hammett and Edison Inc., a consulting firm based in San Francisco, estimated the power density at this location to be 6.2 $\propto W/cm^2$ for three antennas (sectors) with a combined effective radiated power of 400 W per sector.

Hammett and Edison arrived at this figure using its own proprietary computer program, "RFR.Ground". The calculation was included in an August 24, 1995, report the firm produced for Pacific Bell to win approval for its antennas in San Francisco.

Last year, Pac Bell, which was recently given the go-ahead to install more than 30 PCS antennas in San Francisco (see *MWN,* M/A96), hired Hammett and Edison to determine whether their PCS antennas comply with FCC standards. The company wrote about ten such reports in the last year for several wireless service providers, according to Robert Weller of Hammett & Edison.

On August 15, the planning department adopted siting guidelines that encouraged service providers to install antennas on public facilities, such as police and fire stations, and on industrial or commercial structures.

In June, the Board of Supervisors, responding to public outcry, voted 6-3 not to allow two Pacific Bell PCS antennas in residential neighborhoods in exchange for allowing three in commercial areas. Pac Bell had earlier been given approval to install more than 30 antennas as part of the $1.5 billion PCS system it is building in California and Nevada (see box above and *MWN,* M/A96).

The "New" ICNIRP

The International Commission on Non-Ionizing Radiation Protection (ICNIRP) has new leadership and some new members.

Dr. Jürgen Bernhardt of the Institute for Radiation Hygiene (IRH) in Neuherberg, Germany, has taken over the chairmanship from Australia's Dr. Michael Repacholi. Dr. Alastair McKinlay of the U.K.'s National Radiological Protection Board in Chilton has been appointed the vice chair of the commission. Rüdiger Matthes of the IRH continues as the ICNIRP's scientific secretary.

Repacholi, who is currently on leave from the Royal Adelaide Hospital to coordinate the World Health Organization's project on the health effects of EMFs and RF/MW radiation (see *MWN,* J/A 96), has become the chairman emeritus. "I don't have a vote anymore," Repacholi told *Microwave News.*

Dr. Henri Jammet, the first ICNIRP chairman emeritus, died on August 19 at the age of 76 in Tripoli, Libya. He began his 35-year medical career at the Curie Foundation in 1950 as an assistant in radiotherapy. Eight years later, he took part in the first human bone marrow transplant—on victims of a radiation accident in Yugoslavia. In 1976, Jammet became director of the Radiation Protection Branch of France's Institute of Radiation Protection and Nuclear Safety. He was instrumental in founding the International Radiation Protection Association's International Non-Ionizing Radiation Committee, which he chaired from 1977 to 1988. In 1992, the committee became the ICNIRP (see *MWN,* J/A 92). At the time of his death, Jammet was an adviser to the

Atomic Energy Commission, as well as chairman of the International Center of Radiopathology outside of Paris.

In addition to Bernhardt, Matthes and McKinlay, the current voting members of the ICNIRP are: Drs. Anders Ahlbom, Karolinska Institute, Stockholm, Sweden; Ulf Bergqvist, National Institute for Working Life, Solna, Sweden; Jean-Pierre Césarini, Rothschild Foundation, Paris, France; Martino Grandolfo, National Institute of Health, Rome, Italy; Maila Hietanen, Institute of Occupational Health, Vantaa, Finland; 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.; Laszlo Szabo, National Research Institute for Radiobiology and Radiation Hygiene, Budapest, Hungary; Masao Taki, Metropolitan University of Tokyo, Japan; and Thomas Tenforde, Battelle Pacific Northwest Labs, Richland, WA, U.S.

Exposed to Russian Radar for Years, Latvians Now Study Effects

A number of groundbreaking papers on the biological effects of radar and other RF/MW signals appear in a special issue of *The Science of the Total Environment,* published by Elsevier in Amsterdam, The Netherlands. The papers are among those presented at *The International Conference on the Effect of RF Electromagnetic Radiation on Organisms,* held in Skrunda, Latvia, in June 1994 (see *MWN,* S/O94). They appear in the journal's February 2, 1996, issue; publication was delayed by a backlog at the printer.

Most of the papers focus on the effects of a military radar station in Skrunda, which was put into operation by the Soviet Union in 1971. Now run by the Russian government, the station is scheduled to cease operation in 1998 under an agreement between the two nations. In the meantime, it has given rise to "a unique study area," in the words of Dr. Guntis Brumelis of the University of Latvia in Riga, guest editor of the special issue. Brumelis explains that the location of the Skrunda radar makes it unusual: "Due to the military nature of these types of radar, they are usually located in remote areas, closed to residents [and] scientists."

The Skrunda station consists of two phased-array radars designed to track missiles and satellites, each operating with a peak power of 1.25 MW with 0.8 ms pulses at 156-162 MHz. A paper by Dr. T. Kalnins and coworkers at the Latvian Academy of Sciences' Institute of Physics in Salaspils states that although the average intensity of the radar's signal is within both IEEE and former Soviet limits, the maximum intensity of each pulse exceeds those limits by a factor of 50.

Children who lived in the path of the Skrunda radar's signal had "less developed memory and attention, slower reaction times, and decreased [neuromuscular] endurance," write Drs. A.A. Kolodynski and V.V. Kolodynska of the Latvian Academy of Sciences' Institute of Biology in Salaspils. The two scientists administered tests for reaction time, memory and switching and focusing of attention, evaluating 609 children 9 to 18 years old who lived within 20 km of the Skrunda station. Of these, 224 lived in areas directly exposed to the radar. A separate group of 357 children in a different area (with similarly low pollution levels) served as controls.

Those who lived in the Skrunda area generally did worse on the tests than the control group. But when only those children living in exposed areas were considered, the observed differences were more significant. These differences showed a weak correlation with distance from the radar station. The researchers note that exposure does not correlate exactly with distance, due to changes in the shape of the terrain, tree cover, etc.

A study of the growth rings in pine trees in the path of the Skrunda radar beam showed a significant reduction in radial growth, which correlated with the strength of the signal. "The most conclusive evidence...may only be available when the Skrunda [radar] station terminates operation in 1998," write Dr. Valdis Balodis and colleagues at the University of Latvia. "Then it will be possible to determine if radial tree growth recovers."

Needles and cones in pine trees showed increases in the production of resin or its predecessor chemicals, according to Drs. Turs Selga and Maija Selga of the Institute of Biology in Salaspils. They note that "resin formation and secretion are metabolically active responses of pine trees to injury," and point out that related reactions have been observed in pine trees after exposure to gamma radiation.

Other papers report more abnormalities and a shorter life span in exposed duckweed, and more ambiguous results in a study of chromosome damage in exposed cows.

The landmark 15-year study of Polish military personnel and RF/MW exposure (principally from radar) is reported by Dr. Stanislaw Szmigielski of the Center for Radiobiology and Radiation Safety at the Military Institute of Hygiene and Epidemiology in Warsaw, Poland. Szmigielski examined records for 128,000 people per year, and found that the overall cancer risk doubled for exposed personnel. Their risk of leukemia and lymphoma was six times higher than expected—and eight times higher for exposed personnel ages 20 to 49 (see *MWN,* Mr85, J/F87, S/O90 and M/J95).

Dr. John Goldsmith of the Ben Gurion University of the Negev in Israel reviews the relatively sparse literature studying radar, and other, RF/MW effects on humans. Goldsmith suggests that epidemiological studies of radar should not only focus on cancer, but must also look at "hematological or chromosomal reactions." He emphasizes that these can occur earlier and may be reversible.

The February 2, 1996, issue of *The Science of the Total Environment,* 93 pages long, can be ordered for $62.00. In the U.S., contact: Elsevier Science, Customer Service Department, PO Box 945, New York, NY 10159, (212) 633-3750, Fax: (212) 633-3764, E-mail: <usinfo-f@elsevier.com>. In Europe, contact: Elsevier Science, Customer Service Department, PO Box 211, 1000 AE Amsterdam, The Netherlands, (31+20) 4853757, Fax: (31+20) 4853432, E-mail: <nlinfo-f@elsevier.nl>.

Clippings from All Over

"With this decision, the state's highest court has sent a clear signal to plaintiff lawyers that peddling paranoia for profit doesn't pay."

—Gregory Barnes, assistant general counsel for SDG&E, on the California Supreme Court decision (see p.3), quoted in a company press release, August 22, 1996

"There isn't a strong [EMF health] effect, and no one is saying there is. So that means there must be a weak effect, or no effect."

—Dr. Kenneth Rothman, editor of *Epidemiology,* quoted by John Dorschner in "The Power in the Blood," *Tropic* magazine, *Miami Herald,* p.19, August 4, 1996

"We have power lines about 150 feet from our house. I like to think that electromagnetic radiation is just the latest scare."

—James Plosia, an attorney living in Liberty Corner, NJ, who, with his wife, Pat, recently closed on a four-bedroom, 3,000-square-foot colonial for $245,000, about $40,000 less than similar houses in the neighborhood, quoted by Jay Romano in "Warning to Sellers: Let the Buyer Be Aware," *New York Times,* Real Estate Section, p.6, September 1, 1996

"Clearly the biological research and the scientific evidence [on mobile phones are] just not there. There is the question of subjective symptoms such as headaches. The structure we are setting up is independent. Industry would have no influence on the work being done."

—Dr. Alastair McKinlay of the U.K.'s National Radiological Protection Board in Chilton and chair of the European Commission's export group on possible effects of mobile phones on human health, quoted by Marie Woolf in "Mobile Users May Run Cancer Risk," *The Observer* (U.K.), September 1, 1996

Cellular towers emit about as much radiation as a clock radio.

—Tim Ayers, spokesperson for the CTIA in Washington, cited by Hugh McDiarmid Jr. in "Towers Tough To Beat," *Detroit Free Press,* p.1B, August 13, 1996

"Manhattan is so hard partly because of the people who live there. There are people who own lots of stock in our company who won't let me use their buildings for cell sites."

—George Schmitt, president of Omnipoint Communications, a PCS-service provider, quoted by Mark Landler in "Yipes! Invasion of the 9-Inch Antennas," *New York Times,* p.D6, August 19, 1996

"People are starting to look at power lines as a hidden asset. They are an area that's ripe for creative thinking."

—Richard Henry, former president of the New Hampshire Audubon Society and now president of Solutions Collaborative, a company that mediates between environmental groups and industry, quoted by Royal Ford in "Wildlife's Power Play: Nature Flourishes Beneath Region's Electric Cables," *Boston Globe,* p.A23, August 4, 1996

"The [FCC] should specify a federal rule of liability for torts related to the environmental effects of radiofrequency emissions, so that licensees can avoid unnecessary and conflicting lawsuits by ensuring that they comply with the commission's guidelines, as they are amended from time to time. As the record in this proceeding has shown, there can be differences of opinion within the scientific community as to what constitutes a harmful environmental effect, and at what level, distance, etc. radiofrequency radiation causes such effects. Therefore, providers of telecommunications services face the danger of liability based on a study which is not necessarily consistent with the standards adopted by the commission. In order for the wireless industry to move ahead with capital-intensive advanced telecommunications services in a highly competitive environment, it is vital that the industry have a single standard to follow, and that it can steer clear of liability by following this standard."

—From *Petition for Reconsideration and Clarification,* filed by attorneys for Ameritech Mobile Communications Inc. with the FCC, September 6, 1996; see p.9

FAA Is Again Urged To Restrict Use of Portable Electronics on Board Aircraft *(continued from p.1)*

about how the agency will respond this time. "It's hard to believe that they would be truly sympathetic and take great action on this," he told *Microwave News*. "That may sound cynical, but I've worked very closely in FAA regulatory affairs for 16 years now. It'll probably take some action on Capitol Hill to get them to move."

The FAA did not respond to repeated requests for comment. SC-177 was formed at the FAA's request—but only after Congress directed the agency to do more to investigate the issue of electromagnetic interference (EMI) from PEDs.

In 1993, shortly after SC-177 was established, a flurry of media attention led airlines to begin adopting voluntary PED restrictions. But Sheehan called the result "a hodgepodge." While most U.S. airlines now have PED rules in place, and while they often approximate the RTCA recommendations, Sheehan said, "No two sets of rules are the same. The problem is that they're not consistent, and they're not mandatory."

"Our committee's main recommendation is that the use of PEDs be banned during critical phases of flight, such as takeoff and landing," said Sheehan, who is also president of Professional Aviation Inc., a consulting firm in Frederick, MD. "During non-critical phases, you have time to check and see what might be causing a problem. In critical phases you can't do that." Cases of EMI from laptop computers, portable video games, CD players and other PEDs are analyzed in the report from the RTCA.

Some committee members wanted the report, which was issued in August, to be stronger. An article in the September 1996 *IEEE Spectrum* quotes SC-177 member Finbarr O'Connor as saying, "If it were up to me, I would shut PEDs down, period." O'Connor, electromagnetic compatibility manager at R&B Enterprises in West Conshohocken, PA, added, "I would feel better if they were not allowed in the passenger compartment at all....The potential for them to be turned on accidentally is high." But the report, a consensus document, does not go this far, reflecting the views of representatives of major airlines, aircraft and computer makers, the cellular phone industry, the U.S. Air Force and others.

Current FAA regulations forbid onboard use of a PED unless "the operator of the aircraft has determined [that it] will not cause interference with the navigation or communication system." But, Sheehan asserted, "The airlines have never performed those tests. Nobody has been complying with this regulation, and the FAA knows it." Although the FAA is required by law to enforce this regulation, Sheehan said, "It's now more or less ignored because interference is so rare."

The reason the FAA's rule has not been followed, in Sheehan's view, is that it is just too difficult. "I have to sympathize with the airlines on that," he said, explaining that it would be "a gargantuan task" to test all types of PEDs. "We found that to be a near futile activity anyway," Sheehan added, "since two devices of the same model may give different readings." This is especially true once a device has been in use for a few years. Dropping a CD player or performing an upgrade on a laptop computer can drastically change the device's electromagnetic signature.

Michael Rioux, who represented the Air Transport Association (ATA) on SC-177, said that a few years ago the ATA had looked into organizing a program through which its member airlines might test PEDs together. "But the cost would have been prohibitive," he told *Microwave News*. "There are far too many kinds of devices out there, and the airlines aren't set up to do this kind of testing."

EMI from PEDs has been not only extremely rare, but also hard to reproduce. The RTCA report notes that, "The likelihood [of reproducing an incident of EMI] is low since it has been impossible to duplicate the original conditions with the same device, aircraft, location, RF environment and the airborne system's settings."

But the committee found a number of cases in which PEDs were clearly at fault. Of the 137 cases of suspected PED interference examined by SC-177, in over 46 the interference disappeared when the PEDs were turned off. In ten of these cases, the PEDs were then turned on again and the interference reoccurred.

The growing use of satellite-based electronics in civil aviation raises the odds of EMI, according to the report: "Aircraft receivers for these systems, such as those of the Global Positioning System, necessarily operate at a very low level of received power, and consequently can be more susceptible...to RF interference." It also points out that new opportunities for interference are created by the "proliferation" of new personal communications devices.

Airborne use of cellular phones is banned by the FCC, but for reasons unrelated to flight safety. FAA regulations do not specifically address them, and SC-177 wants the FAA to prohibit all in-flight use of "intentional radiators" of electromagnetic energy.

But as *IEEE Spectrum* points out, "Soon the ability to access satellites directly...will be an integral part of laptops and other personal communications assistants." Sheehan expressed concern that passengers might use such intentional emitters unintentionally: "Many users just don't know what they have." This underlines the importance of another recommendation from SC-177: a campaign "to educate the flying public" about EMI.

If interference from a PED ever did contribute to an accident, would we know it? "I guess it's common knowledge that after [Commerce] Secretary Brown's crash, a special team of investigators was dispatched to look at that very thing," Sheehan said, "especially at whether somebody might have been using a cell phone. But it would be very difficult to know if a PED was being used or not." However, Sheehan stressed that in almost every past accident, the cause has been traced to other factors, and there has never been any particular reason to blame PED interference.

Portable Electronic Devices Carried on Board Aircraft (Document No.RTCA/DO-233) can be ordered for $60 in the U.S. and $75 elsewhere (with a $5 shipping fee in either case) from RTCA Inc., 1140 Connecticut Ave., NW, Suite 1020, Washington, DC 20036, (202) 833-9339, Fax: (202) 833-9434.

Canada Adopts Rules for PEDs on Airplanes

Canada has just adopted its first air traffic regulations on the use of PEDs. The new rules, which take effect October 10, allow onboard use of PEDs only with permission of the airline, and then only if the device will not "impair the functioning of the aircraft's systems."

Standards that detail how to comply with the new rules have not yet been issued. But Donna Richard of Transport Canada in Ottawa, the agency responsible, said that the standards are expected to ban use of PEDs during "critical phases of flight" such as "takeoff, climb and landing." Richard told *Microwave News* that this language, similar to RTCA's recommendations to the FAA, is currently found in advisory material that the Canadian government issued to air carriers in March 1993. The standards will be issued in the near future, but Richard could not say exactly when.

The new regulations are part of a larger overhaul of the Canadian air traffic code. The sections affecting PEDs are regulations 602.08, 703.38, 704.33 and 705.40. For more information, call Transport Canada's Communications Group at (613) 990-2309. The text of the new rules can be found on Transport Canada's Web site at <http://www.tc.gc.ca>.

Game Called on Account of EMI

Below is an excerpt from "Do Portable Electronics Endanger Flight? The Evidence Mounts" by Tekla Perry and Linda Geppert in the September 1996 issue of IEEE Spectrum, *describing one incident reported in the Aviation Safety Reporting System database of the National Aeronautics and Space Administration.*

In January 1993, on a flight from Denver, CO, to Newark, NJ, the aircraft lost all directional gyros [electromechanical devices that indicate orientation] at cruise altitude. The captain instructed the flight attendant to go through the cabin and tell all passengers to turn off their electronic devices. She reported back that about 25 passengers with portable radios had been listening to a football game and one passenger was using a laptop.

After five minutes, the gyros still failed to operate properly. On rechecking, the flight attendant found that the radios were still on. Using the loudspeaker system, the captain immediately told all passengers using such devices to turn them off because they were affecting the navigation equipment. After 90 seconds, the gyros corrected themselves to the proper heading. But 20 minutes later, they "began moving off the correct heading by as much as 20-30 degrees."

The captain then picked up the mike and told the passengers that if they did not turn the radios off, he would have the flight attendant go through the cabin and confiscate all radios until they reached Newark. Within two minutes, the gyros began to swing back toward the correct heading. No further incidents occurred.

Letters: Electric Fields, Exposure Assessment, Motorola Research

September 23, 1996

To the Editor:

Most EMF studies have used magnetic fields as a measure of exposure. Often, however, both electric and magnetic fields are present together, if independent, by the nature of near-field properties. For instance, this is true for distribution lines.

The Scandinavian residential studies are examples of situations where electric fields are present and elevated but are discounted because of the shielding effect of buildings. I am not certain how valid this assumption is, when children, in particular, may play outside the home.

Miller et al.'s results[1] show that elevated electric fields bear on carcinogenic effects beyond the action of radon daughter products. In our recent paper,[2] we pointed out that the concentration of radon daughters was simply an illustration of aerosol behavior in high electric fields. Whether these fields are alternating or static may be irrelevant if they concentrate carcinogenic aerosols. A simple illustration: When water drips past a metallic conductor that is charged to a high potential, the droplets are attracted to the conductor, whether the field is static or time-varying.

The electric field exposures in Miller's study are indeed high—measured in 100s of V/m/years—so it is uncertain whether his results could be extrapolated down to domestic levels, which tend to be in the tens of V/m (with an associated reduction in relative risk).

Much of the critical discussion of our paper missed the point we were making. This was that in seeking an association between EMFs and cancer, a biophysicist feels uncomfortable with the concept of direct biological tissue-EMF interaction because of the exceedingly low quantum energy of power frequency EMFs. The notion of electric fields redistributing physical particles, i.e., aerosols, bacteria and viruses, is a much easier concept, which can, and has been, demonstrated in the laboratory. This contrasts sharply with the poor reproducibility of biological *in vitro* experiments.

I look forward to further reinterpretation and analysis of EMF epidemiological studies using electric fields as one of the metrics.

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

2. D.L. Henshaw et al., "Enhanced Deposition of Radon Daughter Nuclei in the Vicinity of Power Frequency Electromagnetic Fields," *International Journal of Radiation Biology, 69,* pp.25-38, January 1996. See *MWN,* M/A96 and M/J96.

September 24, 1996

To the Editor:

Your commentary on Dr. Anthony Miller's EMF exposure assessment techniques (*MWN,* J/A96) points to a few instances in which less-than-best EMF exposure assessments obliterated useful epidemiological information.

The commentary overlooked an important earlier example. In 1992, Finland's Lindbohm and Hietanen[1] reported an increased risk of miscarriages among workers exposed to more than 0.9 ∝T (peak-to-peak) or 0.3 ∝T (average) [3 mG] ELF radiation, based on lab measurements of the types of computer terminals (VDTs) that the workers used. Most previous studies had not observed such a risk, but they had estimated exposures on the basis of hours worked at a computer—with no information on magnetic field levels.

Lindbohm and Hietanen explicitly recommended assessing the exposures of VDT operators in their actual working environments to confirm or refute the observed miscarriage risks.

The message for EMF dosimetry is clear. Survey methods applicable to volatile chemicals, for example, may not be sufficiently precise for assessing EMFs from man-made devices and environments. Peculiarities can heavily influence the levels of exposure if the subjects are in close proximity to a complex field pattern, or if physical structures can contribute effective shielding. Also, for the most part, chemicals leave minute molecular residues *in vivo* after exposures stop. When EMF exposures stop, however, physiological systems relax without a trace of the agent. This makes EMF dosimetry fundamentally more difficult.

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1. Marja-Liisa Lindbohm et al., "Magnetic Fields of Video Display Terminals and Spontaneous Abortion," *American Journal of Epidemiology, 136,* pp.1041-1051, November 1, 1992. See *MWN,* M/A92, M/J92 and N/D92.

September 26, 1996

To the Editor:

We welcome your detailed discussion of the study recently completed in [Ross] Adey's laboratory that assessed possible brain tumor promotion by digital cellular phone fields in a rat model [*MWN,* J/A96]. Your comprehensive review has undoubtedly reached many scientists and engineers now engaged in this and related fields of biomedical and radio engineering development and application, including some who might not otherwise have been aware of details of this study.

For that reason, we feel that it is necessary to emphasize that this study was designed to explore the possibility of tumor-enhancing effects in exposed animals. No such effect was found. As reported at the Bioelectromagnetics Society meeting and announced by Loma Linda, the data included suggestions of a possible tumor-inhibiting effect. As also stated at the time, we have taken a conservative approach, avoiding statistical overinterpretation of quite limited data that lies beyond constraints imposed by our experimental design.

We consider it unfortunate that you have chosen to build a scenario implying a less than collegial, even adversarial, relationship between the investigators and the Motorola corporate research team, with whom the investigators have had a continuing series of strong collaborations over the past six years.

For the investigators, there has been an unfettered opportunity to pursue options in experiment design, based on consultation with world leaders in a broad spectrum of frontier topics in biology, biophysics and bioengineering; and more specifically at the cutting edge of key areas of medical research in the field of cell growth regulation and cancer, and in environmental biomedicine. For Motorola, there is the need to determine whether a risk to human health may exist from the great and growing use of existing and proposed mobile radiotelephone technologies. Motorola is therefore supporting a worldwide research program that covers major scientific issues related to the safety of these RF exposures.

For obvious reasons, the products of this research are treated by the Motorola Corp. as the intellectual property of the researchers. Their quality and credibility must therefore be determined first by their scientific peers.

Thus, as a matter of practice, Motorola allowed the principal investigator to announce and describe his findings. Motorola commented on the research when asked to do so and was confident the significant central outcome—a lack of evidence of tumor promotion—would speak for itself. Again, this decision was consistent with past practice and cannot be described as "a desire to play down the results" or "avoid publicity."

All parties to this work hope that you will continue to favor us with your insightful and informative summaries. Thank you for your interest.

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UPDATES

ELECTROMAGNETIC HYPERSENSITIVITY

RF/MW Radiation and Asthma... Exposure to RF/MW radiation at frequencies commonly used by cellular phones can permanently alter the shape and structure of cells responsible for allergic reactions, according to researchers in Australia. Drs. Peter French and M. Donnellan of St. Vincent's Hospital in Sydney and Dr. John Holt of the Microwave Therapy Center in Perth bathed human mast-cell cultures in 835 MHz microwaves at 9.6 mW/cm^2, for 20-minute intervals, three times a day for seven days. On the fourth day they noticed an increase in the cells' DNA synthesis and replication. In an abstract of a paper to be presented at the *36th Annual American Society for Cell Biology Meeting* in December in San Francisco, the researchers explain that the exposure "may alter signal transduction events in these cells via effects on the cell membrane." Holt believes the results suggest a connection between RF/MW radiation and asthma. "There is no question that factors such as air pollution and other antigens are involved. But I think our findings show that electromagnetic radiation has made it ten times worse," Holt told *The Times* (U.K.). "[U]nder the influence of these radiowaves, steroids and antihistamines do not work," he added. French contends that it is premature to connect RF/MW exposure with asthma. "It should be understood that it can only be speculation at the moment. More research will be needed to identify a connection," he wrote in a letter to Dr. Ken Joyner of Telstra Research Labs in Clayton, Australia. French is currently seeking support from Australian funding groups to continue his studies. "This is a fascinating area for further research and one which may yield many benefits in addition to identifying possible health risks," he told Joyner.

Is It All in the Mind?... Electromagnetic hypersensitivity can be treated effectively with psychological methods similar to those used for headaches and asthma, according to a new study by a team of Swedish researchers from the Karolinska Institute in

"MICROWAVE NEWS" FLASHBACK

Years 15 Ago

• Dr. Gregory Lotz and coworkers at the Naval Aerospace Research Lab in Pensacola, FL, report that exposure to 225 MHz radiation at SARs of 1.5 W/Kg causes greater tissue heating than would be expected based on current interpretations of dosimetry studies.

• OSHA Administrator Thorne Auchter lists RF/MW radiation—which he calls a "serious hazard"—as a second-level priority for the group's health standards staff.

Years 10 Ago

• When ELF bioeffects experts are asked if they would buy a house near a power line—even at a $25,000 discount—Dr. H.B. Graves, a consultant, responds, "Yes. No question about it," while Dr. Richard Phillips of the EPA says, "No."

• Thomas DiLuzio of Spokane, WA, sues an AM radio station, charging that RF/MW radiation from the station caused the leukemia that killed his wife.

• Dr. Sam Koslov of the Johns Hopkins University Applied Physics Lab (JHU/APL), who believes that Alzheimer's symptoms in a monkey were due to leakage through the blood–brain barrier (BBB) after exposure to microwave radiation, says that BBB research "should not have been abandoned."

• Women protesting the deployment of cruise missiles at the U.S. Air Force base in Greenham Common, U.K., claim that the military is trying to drive them away by using non-ionizing radiation, which they claim causes menstrual cycle and sleep disturbances, irregular heartbeats, head and chest pains, anxiety and nausea.

Years 5 Ago

• The U.S. Congress appropriates $600,000 for an NAS-NRC committee review of possible health effects from EMF exposure.

• Pulsed RF/MW radiation with SARs of less than 4W/Kg can cause eye injuries, according to studies by JHU/APL's Henry Kues and FDA's Jack Monahan.

• In a letter to Dr. Tom Budinger of the Lawrence Berkeley Lab, Sue Donaldson of the Seattle City Council expresses concern about the adequacy of the IEEE C95.1-1991 RF/MW guidelines.

Stockholm. The team also reported that the 17 electromagnetically hypersensitive subjects they tested could not consistently determine whether they were in the presence of an EMF source. The subjects were put in a room for 30-minute sessions in which the 5 Hz to 2 kHz EMF source was either on or off. Each subject was tested at least four times, and only one answered correctly every time. On average, the patients were right about half the time. After the test, nine subjects were immediately treated using "cognitive behavioral" methods consisting of a series of weekly one-hour sessions. The other eight were given the same test about 20 weeks later, followed by the psychological therapy. Those treated immediately reported reduced symptoms, while the others who were waiting reported no change prior to their treatment. The authors of the paper, which was published in the *Journal of Occupational and Environmental Medicine (38,* pp.752-758, August 1996), included Drs. Bengt Arnetz, Mats Berg and Sture Lidén, all of whom have long favored "technostress" as an explanation of symptoms others claim are associated with EMFs and VDTs. For example, they argued at the *Work with Display Units '94* conference held in Milan, Italy, that workers claiming to be hypersensitive differ from others in that they are more stressed at work and tend to feel underused (see *MWN,* N/D94). Last May, Arnetz spoke at the *2nd Copenhagen Conference on Electromagnetic Hypersensitivity* on stress-reduction training, specifically that involving the role of the stress hormone prolactin in hypersensitivity cases (see *MWN,* S/O95).

MEDICAL DEVICES

OrthoLogic Answers FDA Complaints... OrthoLogic Corp. will change its promotional materials in response to FDA charges of issuing "misleading" information (see *MWN,* J/A96). "OrthoLogic believes that it has reached a satisfactory resolution with the FDA on all issues raised in the May 31, 1996, FDA letter. We further believe that the accommodations reached with the FDA will not have a material adverse effect on the company's business," George Oram, OrthoLogic's president, said in a press release. The company announced that it will report a success rate for the device as 60.7% with an average treatment time of six months rather than 78% over 4.1 months as it had previously claimed. In addition, OrthoLogic will not promote its model 1000 Bone Growth Stimulator for uses not approved by the FDA and will not refer to the IGF-II growth factor data in its advertising. "It was our intention solely to use the IGF-II data to explain our magnetic field treatment," Oram told *Microwave News.* "The FDA was concerned that in making those types of claims for non-union fractures, orthopedic surgeons would use it to treat a host of other things." The company will, however, continue to distribute reports containing IGF-II information to anyone who requests it, Oram said.

PEOPLE

Lynne Gillette, who has been managing the RAPID engineering programs at the DOE, is currently on special assignment at the National Academy of Sciences' (NAS) policy office. Gillette will not be working on EMF issues at the NAS. She returns to the DOE at the end of January....Dr. **James Melius**, a member of the National EMF Advisory Committee, has become the direc-

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tor of the New York State Laborers' Health and Safety Trust Fund, which has offices in Albany and New York City. Most recently, Melius was with the Center to Protect Workers' Rights in Washington....Dr. **Dina Simunic** of the University of Zagreb, Croatia, is on a roll. This summer she won a young scientist prize at the International Union of Radio Science's (URSI) meeting in Lille, France, for her paper on the "Side Effects of Magnetic Resonance Imaging." Simunic won a similar award at last winter's European Bioelectromagnetics Society meeting....Dr. **Mary Ellen O'Connor** has been appointed the new editor of the *Bioelectromagnetics Society Newsletter.* O'Connor, a professor of psychology at the University of Tulsa,OK, takes over from **Carol Jordan Evans** of SAIC with the November/December issue. ...**Deborah Weil** has left Bailey Research Associates, but is continuing to do EMF consulting from Bala Cynwyd, PA....**Joseph Jamail**, who has made a fortune as a trial lawyer, is giving a few of his millions back to his native Texas. The 70-year-old attorney recently donated a total of $17 million to seven Texas universities and museums. Last year, Jamail filed—and then abandoned without explanation—a suit against Houston Lighting & Power Co. and EPRI, in which he was to represent the families of 11 children with cancer (see *MWN,* M/A95 and S/O 95)....**Kim Besly**, a tireless antiwar activist, died on July 14. Besly and other women set up a camp outside the U.S. Air Force base at Greenham Common, U.K., to protest the deployment of cruise missiles. Based on her experiences—and those of others—she became convinced that the women were being harassed with electromagnetic radiation. Military and civilian officials "have tried every way to move us away since the camp was set up more than five years ago," she told *Microwave News* a decade ago (see p.16 and *MWN,* S/O86)....**Shay Cullen** is a missionary with more than one mission. The Irish priest, who was arrested last June for protesting high-voltage power lines near a home for destitute children in Olongapo, the Philippines (see *MWN,* M/J96 and J/A96), recently helped secure the arrest of a German tourist suspected of sexual abuse of a child while visiting the Philippines, the U.K. *Times* reported on August 31.

RESOURCES

EC on Non-Ionizing Radiation... The European Commission's Directorate-General for Employment, Industrial Relations and Social Affairs has published *Public Health and Safety at Work: Non-Ionizing Radiation—Sources, Exposure and Health Effects* (ISBN 92-827-5492-8). The report was written by an ad hoc group from Germany, Italy and the U.K, and was edited by Dr. Alastair McKinlay of the U.K.'s NRPB. It reviews occupational exposure issues from EMFs to lasers, and recommends further research "in two important areas: UV radiation, where adverse health effects including cancer are well established, although there is little public concern; and EMFs...where the evidence for carcinogenesis is weak and inconclusive, but conversely there is considerable public concern." Available in the U.S. for $30 plus $4 shipping from: UNIPUB, 4611-F Assembly Drive, Lanham, MD 20706, (800) 274-4888, Fax: (800) 865-3450. For ordering information for other countries, contact: Office des Publications Officielles des Communautés Européennes, 2 rue Mercier, L-2985 Luxembourg, (35+2) 29291, Fax: (35+2) 488573.

VIEWS ON THE NEWS

With this issue, we begin a new regular feature in which the editors offer their comments on the news. Our readers are welcome to respond and to express their own opinions.

Physicists and Brass Balls

Nature put them on the cover of its August 29th issue and the *New York Times* ran two different stories about them. They're called oscillons and they're created when grains of sand or brass are put in a box and vibrated. It's a simple system—little more than balls banging into each other—with an extraordinary result. The picture on the cover of *Nature* is of a precarious-looking peak of brass balls. It looks as if they're being held up by a magnet, but that's not what's going on.

What is? It's a good question, and so far no one seems to know the answer. As *Nature*'s own commentator explained: "In fact, despite much active research, no underlying theoretical description for these [granular] materials yet exists."

Sandbox physicists can't say how complex structures emerge from such a simple system, but many of their colleagues feel compelled to tell anyone who will listen that they understand the infinitely more complex processes associated with life. Dr. Robert Adair, for instance, told Jon Palfreman of PBS' *Frontline* that, "There's probably nothing on earth, or in the universe, that we understand as well as EMFs and the interaction of EMFs with matter, including biological matter" (see *MWN,* M/A96).

Clearly, that statement is preposterous. In a newsletter that arrived in our office just before we went to press, Sweden's National Board of Occupational Safety and Health ran the following in bold type: "At times, the debate [over EMF health hazards] has been both intensive and emotional. One reason for this is that still little is known about the potential effects on humans and other living beings of EMFs in their surroundings."

Adair and Palfreman should know better. The fact that they pretend such certainty might be laughable if these politico-physicists weren't selling their very own brand of junk science to the courts.

The California Supreme Court cited both the statement issued by the American Physical Society (APS) last year and the friend-of-the-court brief filed by a group of scientists organized by Harvard University physicist Dr. Richard Wilson in its rationale for dismissing the *Covalt* EMF lawsuit (see p.3).

Lawyers often act as if they are certain their clients are right, even when they know the truth is more complicated. Lawyers are paid to behave that way, but scientists have higher motives—or so they say.

The World Leaders in Radar Health Research

Anyone interested in the health effects of radar radiation should order the collection of papers in the special issue of *The Science of the Total Environment* on the Skrunda radar in Latvia (see p.11).

A quick scan of the papers will convince you that Latvian scientists are among the world leaders in this field. They join the Croatian team at the University of Zagreb's Institute for Medical Research and Occupational Health that has published a comprehensive series of papers on the genetic effects of radar (see *MWN,* M/J92).

Taken together, the Latvian and Croatian studies dwarf the American effort. The U.S. government has never been interested in radar health risks and never will be as long as the military controls RF/MW health research.

If there were a commitment to public health, it would not be hard to find some areas in which to begin to do some work: a serious look at the alleged link between handheld police radar and cancer, and studies of those who live in the shadow of powerful radars—for instance, the phased array radar (PAVE PAWS) on Cape Cod, MA.

A few years ago, some police officers took their concerns to the U.S. Senate and begged for a cancer study. Practically everyone at the hearing agreed that it would be a good idea. "Senator Dodd and I are going to stick with this until we get some answers," promised Sen. Joseph Lieberman (D-CT) (see *MWN,* S/O92). Sen. John Glenn (D-OH), who, as a former astronaut, knows something about life-threatening risk, said that he was "extremely disturbed" about the problem.

Nothing ever happened.

When it comes to environmental and occupational health, the U.S. does not mind taking a back seat to two of the smallest countries in the world.

Stop That Car or We'll Zap You!

They're the sexiest gadgets in this year's action movies: EMP weapons, which use electromagnetic pulses to zap electronics. They have starring roles in *Goldeneye,* the latest James Bond movie, as well as in *Broken Arrow, Escape from LA* and *Eraser.* And soon they may be coming to a police car near you.

Law Enforcement News (September 30) reports that the U.S. Army and the National Institute of Justice are running a $500,000 field test to see if EMP guns can force a car to stop by disabling its electrical systems. The plan is to use EMP to do away with high-speed chases (another Hollywood staple). This is another example of the growing interest in using nonlethal weapons developed by the military.

In 1990, Boeing Co. agreed to pay $500,000 to settle Robert Strom's lawsuit, which alleged that he had developed leukemia after being exposed to EMP radiation (see *MWN,* S/O90). As part of the settlement, Boeing agreed to set up a medical monitoring program for 700 employees who had worked with EMP. The results of this surveillance effort may play a key role in assessing the impact of EMP guns on police officers—who are likely to be sensitive on this point after years of controversy over radar guns.

Will the next Hollywood production featuring EMP be a courtroom drama?

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European SAR Wars: Marketing Low-Radiation Phones

"Low radiation is better." So says Hagenuk, a German manufacturer of mobile phones. Hagenuk's new advertising campaign pitches the advantages of its GlobalHandy, which "directs radiation away from the head, thereby providing optimal performance in transmission and reception."

Hagenuk, based in Kiel, is the first company to seek a competitive advantage by touting a hand-held phone that produces low specific absorption rates (SARs) of microwave radiation in the user's head. Hagenuk publicized its low-radiation phones in Germany and elsewhere in Europe this summer (for example, in the London *Times* on September 16). In Asia, its advertisements have run in Indonesia and Singapore.

While Hagenuk's ads compare the SARs from its phones to those of other manufacturers, which have different types of antennas (see p.12), the company does not mention the names of its competitors.

But on August 13, the Norwegian newspaper *Dagbladet* named names. It reported that the Nokia 2110 caused the highest SARs, followed closely by the Motorola 8200 and the Ericsson 337. *Dagbladet* ran the story under the headline THE BESTSELLER GLOWS THE MOST. The same day, the Swedish tabloid *Expressen* picked up the story with an article titled THE PHONES WITH THE WORST RADIATION.

Finland's Nokia referred questions from *Microwave News* to the Swedish

(continued on p.12)

Electromagnetic Anti-Theft Devices Interfere With Pacemakers

The most popular electronic anti-theft system in the U.S. caused interference with over 96% of implanted cardiac pacemakers in recent tests by a Florida cardiologist. In response, the U.S. Food and Drug Administration (FDA) recommended in September that people with pacemakers not linger near the entrances to stores and malls, where anti-theft devices are typically located.

Meanwhile, a German physician reported in August that electronic security systems pose "a potential risk for pacemaker patients."

"Anti-shoplifting systems are safe for people with pacemakers," Sensormatic Electronics Corp. of Boca Raton, FL, declared in the wake of the Florida study. "We have to relate this to what actually happens in the real world," communications director Debbie Coller told *Microwave News*. "This is not a new product. Even the newest technology has been in place for over ten years, and there have been no reports of problems." Sensormatic is a leading supplier of electronic security systems around the world.

In a September interview, Dr. Michael McIvor of the Heart Institute of St. Petersburg in Florida said that an acousto-magnetic anti-theft device caused

(continued on p.13)

« Power Line Talk »

In a recent commentary, Sir **Richard Doll**, the U.K.'s best-known epidemiologist, stresses the potential importance of studies that find weak associations. Writing in the August issue of *Radiological Protection Bulletin,* published by Britain's **National Radiological Protection Board** (NRPB), Doll notes that associations with low odds ratios still "may be socially of great importance," and can "offer major opportunities for the improvement of public health." He cautions that weak links are most often due to chance, bias or confounding and usually do not reflect anything important. But he warns that this fact "is grist to the mill of propagandists who, for a variety of reasons, [may] seek to discredit a weak association that suggests that a particular product may be hazardous." Doll is still reluctant to draw firm conclusions on the EMF–cancer issue (see *MWN,* M/A94 and S/O96). But he does praise an **EPRI** meta-analysis of occupational studies (see *MWN,* J/F 96), which he cites as pointing to an increase of about 10% in the risk of brain cancer, as "a model of what can be done with published epidemiological data." If a few more large occupational studies based on measured exposures show an increased risk, Doll suggests, this "might enable a sufficiently firm conclusion to be reached for action to be taken, even in the absence of any plausible mechanism by which the fields might reproduce disease." In the 1950s, Doll was the first epidemiologist to link tobacco smoking and lung cancer, years before the biological basis of that connection was discovered. On childhood leukemia, Doll's commentary points to four large-scale Scandinavian studies as the most reliable. While this research found associations between EMFs and cancer, Doll believes that the evidence was "not compelling" because of the small numbers of cases. But, he adds, "similar unbiased data for several times as many cases" could be convincing. The article was written before the release of the large-scale National Cancer Institute (NCI) study in the U.S. this past July (see *MWN,* J/A97 and p.6). In September, *Microwave News* asked Doll for his opinion of the NCI study; he replied that he had nothing to add to the July 15 statement from the NRPB's Advisory Group on Non-Ionizing Radiation, which he chairs. That cautiously worded release states that the NCI's results "do not establish" a link between EMFs and childhood leukemia, but adds that the "possibility of an elevated risk cannot...be ruled out."

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Germany's Federal Ministry for Environment, Nature Conservation and Reactor Safety has agreed to fund a nationwide study of childhood leukemia and EMF exposure. The investigation will build on smaller studies in Lower Saxony and in Berlin conducted jointly by Drs. **Jörg Michaelis** and **Joachim Schüz** of the University of Mainz and Dr. **Karl Brinkmann** and coworkers at the Technical University of Braunschweig, which suggested a weak association between EMF exposure and childhood leukemia. However, the regional results suffered from low statistical power because of the small numbers of subjects with high exposures (see *MWN,* J/A97). The national effort will be carried out by the same researchers, who will make a formal announcement of their plans at a press conference in Mainz later this fall. Schüz told *Microwave News* that he and his colleagues will start with data from a study of childhood cancer by the German Children's Cancer Registry, which has now been going on for three years. "We already have access to the residential histories of about 800 leukemia cases and 2,000 non-diseased children," he stated, "and we will start EMF measurements at the end of this year." Schüz's team took the same approach in Lower Saxony and in Berlin, drawing on cancer registry data for both cases and controls. This kept certain costs to a minimum and made it possible to spend more money on a careful exposure assessment. "We conducted 24-hour measurements at the residence where the child lived longest before the date of diagnosis," Schüz explained, adding that the team will use the same method for the national study. The Berlin study and the combined data were both presented in June at the *2nd World Congress for Electricity and Magnetism in Medicine and Biology* in Bologna, Italy. These findings were originally scheduled for publication in the November issue of ***Epidemiology***, but will now appear in January instead.

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The results of two long-awaited epidemiological studies on the possible link between EMFs and female breast cancer are expected at the end of this year or in early 1998. Dr. **Maria Feychting** of the Karolinska Institute in Stockholm, Sweden, will present the results of her and Dr. **Anders Ahlbom**'s study at this year's DOE EMF review, to be held November 10-13 in San Diego. Feychting will give an encore performance at the National Action Plan on Breast Cancer workshop in Bethesda, MD, November 18-19 (see p.18). As for the second study, Dr. **Scott Davis** of the Fred Hutchinson Cancer Research Center in Seattle told *Microwave News* it is "unlikely" that he will announce his findings in November, but he added that they should be ready early next year. Two other epidemiological studies on breast cancer are in progress—one at the State University of New York, Stony Brook, and the other at the University of Southern California in Los Angeles (see *MWN,* S/O96).

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The California Court of Appeal has overturned sanctions imposed on the law firm of **Wylie Aitken** in Santa Ana, CA, ruling that the lower court "abused its discretion" by ordering the "excessive and unjustified" penalties. Wylie Aitken represents plaintiffs in the ***Younkin*** and ***Johsz*** EMF–cancer lawsuits against **Southern California Edison Co.** (SCE), and had been ordered to pay for all of SCE's past, present and future expert witness costs in *Younkin* (see *MWN,* J/A96). The firm was hit with the sanctions after one of its attorneys, **Annee Della Donna**, wrote a letter accusing one of SCE's experts of unethical conduct. The expert then refused to testify, which left SCE unable to use a report that the expert had prepared. The Court of Appeal found that it was reasonable for the trial court judge to order that SCE be allowed to use this report as evidence, even without direct testimony to support it. But the other sanctions "grossly outweigh the damage done," it concluded. The court noted that there was no "evidence of secret scheming on the part of Della Donna to de-

liberately deprive defendants of their chosen expert." Instead, it held, "At worst...Della Donna overreacted to what was otherwise a comedy of errors." The appellate panel wrote that to force Wylie Aitken to pay for SCE's experts "could result in defendants spending more on experts than they ordinarily would since they have a 'free ride.'" Moreover, the monetary sanctions "have put defendants in a better position than they would have been [in] had these events never occurred." Thus, it ruled, these sanctions "were purely punitive additions and cannot remain." Della Donna told *Microwave News* that she left Wylie Aitken in the fall of 1996.

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The **NIEHS** is putting the finishing touches on the second of its three **science review** symposiums. The meeting, slated for January 12-14, 1998, in **San Antonio** will address **epidemiological studies**. The first symposium, held last March in Durham, NC, was on *in vitro* biological effects. At that meeting, physicists and biologists clashed over the possibility of low-level EMF effects (see *MWN,* M/A97). A site and date for the third symposium, on *in vivo* effects, has not yet been set. The final product of these reviews will be the NIEHS's report to Congress on EMF health risks. A brochure with more information on the January conference will be available soon. Contact: Dr. Mary Wolfe, EMF RAPID, NIEHS, PO Box 12233, MD ED-16, Research Triangle Park, NC 27709, (919) 541-7539, Fax: (919) 541-0144, E-mail: <wolfe@niehs.nih.gov>.

«« »»

EMF Keeptrack folded on September 1. The newsletter was published by the Center for Energy Information (CEI), a division of **Central Maine Power** in Winthrop, ME. In an August letter to subscribers, Publisher Alan King wrote that, with the release of the NCI study and the NAS–NRC report, "our mission to bring you objective and timely news on important EMF developments now comes to a close." Highleen Roberts, a CEI staffer, explained to *Microwave News* that there had been "declining interest" now that "this problem has more or less been solved." The CEI's "consumer" newsletter, ***Between the Lines***, closed down last year (see *MWN,* J/A93).

EMF–Leukemia Test Lawsuits Discontinued in U.K.

The key lawsuits over electromagnetic fields (EMFs) and childhood leukemia in Britain were withdrawn by the plaintiffs in mid-September. All publicly funded EMF litigation in the U.K. has now come to a halt.

"I am very disappointed to have to discontinue the two lead actions in the U.K., but following the publication of the study by the U.S. National Cancer Institute, it has become clear that we would have very great difficulties in succeeding in court," solicitor Martyn Day told *Microwave News*. (On the NCI study, see *MWN,* J/A97 and p.6.)

The National Grid Co. and Norweb, the utility defendants in the suits, welcomed the move in a joint statement. The NCI study "adds strong weight" to the view that EMFs do not pose a human health hazard, the utilities declared. They asserted that the lawsuits were dropped because the plaintiffs' experts had come to a similar conclusion.

A major study of childhood cancer by Britain's Coordinating Committee on Cancer Research, based in London, is scheduled to be published next year (see *MWN,* J/A91). If the results of that large-scale effort support an EMF–cancer connection, noted Day, "we may be able to return to the legal fray." "But for the time being," he concluded, "we have no option but to drop the claims against the electricity industry here in the U.K."

Legal deadlines required a decision by October on whether to proceed with the two cases. By putting them aside for now, Day and his clients preserved the option of reactivating the suits if they decide that the climate has become more favorable. Last year, Day observed that, "In Britain, the courts are unlikely to consider this issue seriously more than once" (see *MWN,* J/F96).

Day, of Leigh, Day & Co. in London, won funding from the Legal Aid Board in 1993 for his work on the *Studholme* case. Objections from Norweb and the National Grid Co. prompted the board to reverse itself in 1995, but this decision was appealed and funding was restored (see *MWN,* J/F96). British utilities then discussed the establishment of an £8 million ($13 million) legal fund to combat EMF lawsuits (see *MWN,* N/D96).

The Studholme family's lawsuit charged Norweb with responsibility for the 1992 death of their 13-year-old son Simon from leukemia (see *MWN,* J/A93 and M/A94). Simon's head was exposed to particularly high EMFs, since he slept with his head on the other side of the wall from the electric meter, through which passed all the electric current used in the home. A 47-year-old neighbor whose bedroom was similarly located had died of leukemia in 1989 (see *MWN,* S/O93). Besides the household electric wiring, the suit also blamed exposure from nearby power lines and an electrical substation.

The second test case was a suit brought by the parents of Tom Loxton, a 12-year-old with leukemia. Their home in the south Birmingham area was located 20 meters away from a 275 kV power line. Day had at first been granted legal aid funding for two other childhood leukemia cases, but he subsequently agreed with the Legal Aid Board not to pursue those until the *Studholme* and *Loxton* lawsuits were resolved. He also represented families in two EMF–brain tumor cases in Wales (see *MWN,* J/A94), but agreed not to proceed with these actions unless his clients in the leukemia cases were successful. With the two lead cases now discontinued, these other suits are in limbo as well.

Day's firm is heavily involved in environmental cases, and the *Financial Times* described him as bringing "fear to British boardrooms by pioneering American-style aggressive litigation" (see *MWN,* J/F96). A 1994 *Guardian* article described his wife as joking that she could not give the police much help if he were murdered: The list of potential suspects would be too long. But unlike U.S. litigators, when Day wins money for his clients, he himself gets none of it. His only financial reward comes from public legal aid funding.

In Germany, Support for Prudent Avoidance: A New EMF Law Aims for "Reasonable" Reductions

Under Germany's new EMF law, children and the infirm must never be exposed to power-frequency magnetic fields above 1 G, or electric fields above 5 kV/m, from new or substantially modified EMF sources.

These limits also apply everywhere that members of the general public remain for "several hours." This broader standard may be exceeded, however, for brief periods and in some outdoor spaces, as long as peak field strengths remain under 2 G and 10 kV/m and the averages under 1 G and 5 kV/m. Existing facilities must comply with these limits within three years.

By prohibiting peak fields in the 1-2 G and 5-10 kV/m ranges near schools, homes, hospitals, day-care centers and playgrounds, the German law ensures that average fields remain "below or at least not substantially in excess" of 100 mG, according to the Federal Ministry for Environment, Nature Conservation and Reactor Safety. The ministry said that it included the restriction "in the interests of precaution"—to protect against "possibly unsafe biological effects" of EMFs below 1 G.

Ordinance 26 of the Federal Emission Control Act, the nation's principal air-quality statute, was adopted on December 16, 1996. When the law took effect on January 1, 1997, Germany became the first country with national, legally binding standards for public exposures to power-frequency EMFs.

The 50 Hz limits follow the recommendations issued by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) in 1989 and reaffirmed in 1993 (see *MWN,* M/J89, J/F 90 and M/J93). The ICNIRP guidelines "reflect the recognized and scientifically secure state of knowledge at this time," Environment Minister Dr. Angela Merkel asserted in a July 10, 1996, statement to the German parliament.

Setting limits below ICNIRP-recommended levels "would entail much greater expense without any tangible benefit," Merkel maintained. In her view, those who raise the issue of "alleged health effects" at levels below the ICNIRP guidelines are motivated by "diffuse fears and a nebulous skepticism toward technological innovation."

The environment ministry drafted the new standards in consultation with the German Radiation Protection Office. Dr. Jürgen Bernhardt, who heads the office's medical radiation effects department, has long been a member of the ICNIRP and is currently its chair.

In a commentary published with the text of Ordinance 26, the environment ministry's Wolfgang Kemmer noted that "there are indications" that EMFs have nonthermal biological effects. But Kemmer considered it "at least doubtful" that such effects are significant, and added that a number of "international bodies" have concluded that "there is no connection between everyday exposures to EMFs and an increased incidence of cancer."

Kemmer concluded that the purpose of the EMF law is not to lower exposure limits that already protect public health, but to bring previously fragmented provisions for EMF safety together in a single statute.

The desire to avoid a patchwork of EMF limits in the various German states provided an important impetus for the new ordinance, according to Dr. Hans-Ulrich Paul, an engineer with RWE, an electric utility. Some states were considering limits that were "frighteningly low—1 mG, for example," Paul told his audience at a conference hosted by the *EMC Journal* in Frankfurt in April.

According to the environment ministry, the German Radiation Protection Commission considers 100 mG to be the lower limit of "reasonable" EMF mitigation. The environment ministry estimated that EMF compliance costs will be about 100 million marks (approximately $70 million) over the next few years.

"The new ordinance has started a discussion on possible reduction techniques," Dr. Hauke Brüggemeyer of the Ecology Office of Lower Saxony told *Microwave News*. "It turns out that a lot of these reductions, especially for transformer installations, can be made with very little extra cost."

The new rules apply to power lines with voltages above 1 kV and to transformers that step down voltages between 1 kV and 220 kV (transformers for voltages above 220 kV are already covered by a different ordinance). They do not cover noncommercial installations or household appliances. Occupational exposures of electrical utility workers are also outside the scope of the regulations and are covered by occupational health and safety laws.

Ordinance 26 also sets limits for the 16.67 Hz fields generated by electric railways: 3 G for magnetic fields and 10 kV/m for electric fields. Guidelines for high-frequency radiation are also specified.

The largest opposition party in the federal parliament, the Social Democratic Party (known by the German acronym SPD), introduced a resolution last January 15 calling for the prohibition of peak fields above 100 mG near hospitals, residences, schools, day-care centers and playgrounds. The resolution reiterated the SPD's call for the minimization of EMFs "according to the state of science and technology."

According to the newsletter *Elektrosmog-Report* (December 1996), based in Cologne, a legislative attempt to lower the limit for average field strengths to 100 mG in sensitive areas did not succeed, due in part to resistance from electric utilities and railroads.

Citing a dearth of "solid and undisputed" scientific findings on the health hazards of EMFs, the SPD also asked the government to establish an independent panel of experts to direct an intensified research effort. In his commentary, Kemmer dismissed the notion of a scientific split on EMF health effects: "Scientific opinion holds that there are thresholds for radiation intensity below which no damage is possible."

The SPD has long maintained that addressing "long-term biological effects such as have been demonstrated in many studies" should be "the chief regulatory task" of the EMF ordinance.

The SPD resolution was referred to the parliament's environment committee, where it awaits further action. The resolution's prospects for adoption are dim, unless it can win support from Chancellor Helmut Kohl's Christian Democrats or their coalition partners, the Free Democrats.

Personal Injury Suits Over Power Lines Declining; EMF Plaintiffs' Lawyers' Group Now Dormant

EMF–cancer litigation has dropped off markedly from the level of a few years ago, according to lawyers for both plaintiffs and electric utilities. The Electromagnetic Radiation Case Evaluation Team (EMRCET), formed in 1990 to assist EMF plaintiffs, is now all but defunct. Only a few important EMF lawsuits are still pending.

"EMRCET was very useful for those of us involved in EMF cases," said Denver attorney Bruce DeBoskey of Silver & DeBoskey. "It hasn't been active lately because few of us are doing this kind of work." DeBoskey represented Nancy Jordan, whose EMF–lymphoma lawsuit was withdrawn in May due to her declining health (see *MWN,* J/A97).

"We came very close in *Jordan,"* DeBoskey told *Microwave News*. "It's very challenging to prove cancer causation. That's just as true for EMFs as it is for any other carcinogen, from chemicals in the workplace to tobacco." DeBoskey said, "If someone came to me with an EMF case, I'd take a good look at it"—but he is not now involved in any EMF litigation.

"It's pretty quiet," said Southern California Edison (SCE) staff attorney John Tinker in Rosemead. "And it seems to be getting quieter and quieter the more scientific information comes out." Tinker remarked that, "Plaintiffs' lawyers are just not interested in pursuing EMF litigation. It doesn't seem worthwhile to them."

SCE currently faces three EMF personal injury cases, but the *Younkin* and *Muir* cases have both been continued, pending the outcome of the third case, *Johsz v. SCE* (see p.2). *Johsz,* which is on appeal, grew out of a cluster of cancer cases in a real estate office in Southern California, and Tinker does not expect oral arguments to begin before March 1998.

"EMRCET still exists as an informal network," said Seattle attorney Michael Withey, EMRCET's founder. But he conceded that as an organization it has been inactive for nearly two years. Withey recently left Schroeter, Goldmark & Bender to start a new firm, Stritmatter, Kessler, Whalen, Withey. He told *Microwave News* he has no EMF plaintiffs at present.

Withey said he now receives two or three times as many calls about cellular phone towers as he does about power lines. But he argued that public concern about power-line health effects has not gone away: "It's not like nobody cares if they put up a new transmission line in a neighborhood—just the opposite. They're not building power lines next to schools anymore." Withey pointed to EMF–property cases as an area of continued legal activity, citing ongoing lawsuits in New York (see *MWN,* J/F97).

"No one joined EMRCET to make a pile of money," attorney Aaron Simon said in an interview. "It was not seen as the pot of gold at the end of the rainbow." Simon, of Kazan, McClain, Edises, Simon & Abrams in Oakland, CA, worked with Withey on the *Zuidema* case (see *MWN,* J/A91 and M/J93). This lawsuit focused on a child with Wilms' tumor, a type of cancer that had not been specifically linked to EMFs. "I never had any illusions about winning a Wilms' tumor case in San Diego," observed Simon, "but we did raise a lot of people's consciousness about the issue, and I feel very proud of that."

Former EMRCET member Kieron Quinn of Baltimore told *Microwave News* that he withdrew from the EMF field about a year and a half ago. When asked about EMF litigation today, he answered, "You'd have to talk with someone who's closer to it."

"It's been several years since a new EMF personal injury case was filed," commented Tom Watson of Watson & Renner in Washington, who represents many utility companies. "I think the results in court have been consistent, and that has sent a fairly clear message to the plaintiffs' lawyers that this is not a fruitful area to pursue." His firm is now involved in only one EMF personal injury lawsuit, *Runge v. Indiana-Michigan Power Co.,* a miscarriage case.

An EMF lawsuit is "an expensive undertaking," noted Watson, "particularly when you have defense firms like ours with substantial resources and experience." Indeed, concerns about potential costs were cited by Leonard Glazer when he recently withdrew his suit against Florida Power and Light (see *MWN,* J/A97).

Watson also pointed to the importance of scientific developments, particularly the recent National Cancer Institute (NCI) study of childhood leukemia (see *MWN,* J/A97). The research review by the National Academy of Sciences-National Research Council (NAS–NRC) was also "helpful from an industry perspective," Watson said, "but the content of it was not that different from what had gone before" (see *MWN,* N/D96). The NCI study was cited by a British attorney in the decision to drop two test EMF cases in the U.K. (see p.3).

Milham Honored in Italy

Dr. Samuel Milham Jr. will receive the Ramazzini Award on October 25 from Italy's Collegium Ramazzini in Carpi for his epidemiological studies on EMFs and cancer.

The collegium is a nonprofit group that addresses environmental and occupational health and safety issues. It was founded in 1982 by the late Dr. Irving Selikoff of the Mt. Sinai School of Medicine in New York City—a pioneer in the study of asbestos and cancer. Dr. Cesare Maltoni of the Institute of Oncology in Bologna, Italy, is the collegium's secretary general.

Each year, the collegium honors a scientist who has made "the greatest contribution to the progress of occupational and environmental medicine." Milham, formerly at the Washington State Department of Social and Health Services, was the first to observe elevated rates of leukemia mortality among EMF-exposed workers (see *MWN,* J/A82).

Past winners include Drs. David Hoel, Alice Stewart and Arthur Upton, as well as Dr. David Rall, the former head of the U.S. National Institute of Environmental Health Sciences (NIEHS), who is serving as the collegium's treasurer.

The day after Milham accepts his award, talks will be given by Canada's Dr. Gilles Thériault, Sweden's Dr. Anders Ahlbom and the U.S.'s Dr. Genevieve Matanoski at an epidemiology workshop chaired by the collegium's president, Dr. Philip Landrigan of Mt. Sinai, and Rall.

NCI EMF Study: The Letter BEMS Would Not Send

In July, Dr. Martin Blank of Columbia University in New York City, president of the Bioelectromagnetics Society (BEMS), asked the BEMS executive committee for permission to send the letter reprinted below to the New England Journal of Medicine. *The letter criticizes the* Journal*'s handling of the NCI study of power-frequency magnetic fields and childhood leukemia by Dr. Martha Linet and coworkers.*

Dr. Betty Sisken of the University of Kentucky, Lexington, BEMS president-elect, told Microwave News *that the BEMS Executive Committee withheld its approval because the letter did not go through "the appropriate committee—the Public Policy Committee." The chair of that committee, Dr. Richard Luben of the University of California, Riverside, declined to comment. Luben is also on the executive committee.*

Microwave News *has learned that the six-member executive committee was split evenly on sending a letter. Besides Blank, Drs. Paul Gailey of the Oak Ridge National Lab in Oak Ridge, TN, and Robert Liburdy of the Lawrence Berkeley Lab in Berkeley, CA, were in favor, while Dr. Ben Greenebaum of the University of Wisconsin-Parkside in Kenosha was opposed, as were Luben and Sisken.*

To: The Editorial Board
New England Journal of Medicine

Publication of the Linet article (July 3, 1997) has raised concern about the quality of the *New England Journal of Medicine (NEJM)* peer-review process in this instance.

Results of the Linet study have been eagerly awaited by the scientific research community, many of whom are members of the Bioelectromagnetics Society. BEMS is an internationally recognized professional organization with an established record of excellence in the publication and conduct of peer reviews of scientific work in this area. As expected, the Linet paper has been the subject of close scrutiny. I can attest to widespread criticism among mainstream EMF researchers of your conclusion that the paper decisively negates a link between childhood cancer and EMFs, when the reverse appears to be true. The study should report an increase in childhood leukemia at 3+ mG (of 72%). The p-value of the trend has been described in the article as nonsignificant based on a two-sided analysis, when the more appropriate one-sided analysis yields 0.045, or a statistically significant result.

Apparent misinterpretation of the data has resulted in false assurance to readers. The findings yield further support for an association between EMF exposure and childhood leukemia, not the opposite, as reported in the paper.

Competent peer review is essential to maintain confidence in the scientific process. The *NEJM* may wish to reexamine the adequacy of its pool of peer reviewers for EMF papers, and in particular its choice of author for the commentary. Dr. [Edward] Campion's inexpert grasp of basic bioelectromagnetics is evident, and has cast further doubt upon the integrity of the article's scientific worth, the *NEJM*'s review process and the validity of its own conclusions.

Sincerely yours,
Martin Blank, PhD
President (1997-98), Bioelectromagnetics Society

Watson noted that in mid-September in London, U.K., he was a featured speaker at a private conference for British insurance underwriters on the lessons of EMF litigation and their relevance to other environmental lawsuits. "There were over 200 registrants," said Watson, "and maybe that's some indication that this issue is not completely closed." His firm is "very busy dealing with cellular telephone issues," he said, including "providing advice to cellular phone manufacturers."

One important EMF–cancer case that is still pending is Melissa Bullock's lawsuit against Connecticut Light and Power Co. (see *MWN,* J/F92). Bullock lives on Meadow Street in Guilford, CT, the site of a cancer cluster described in Paul Brodeur's article, "Calamity on Meadow Street," which appeared in the July 9, 1990, *New Yorker.* Bullock's attorney, James Horowitz of Koskoff, Koskoff & Bieder in Bridgeport, CT, said that the *Bullock* case is expected to go to trial in about a year.

"Clearly some of the studies that are coming out—and even more, the way they're reported in the popular press—look like they're saying there's no evidence of a connection" between EMFs and cancer, Horowitz said. "But the executive summaries often differ dramatically from what's in the substance of the reports." He contended that, "When you get into the substance, it's clear that epidemiologists are saying there's something going on here," and added, "You continue to get study after study that shows an association."

Postscripts to the NCI Study

The National Cancer Institute's (NCI) epidemiological study of power lines and childhood leukemia continues to be a hot topic (see *MWN,* J/A97 and box at left):

• A commentary by the Standing Committee on Epidemiology of the International Commission on Non-Ionizing Radiation Protection (ICNIRP) concludes that the NCI's findings for measured fields "are suggestive of a positive association" between exposure to EMFs and leukemia risk: "They are in the direction of a positive result but not convincingly so." In contrast to the *New England Journal of Medicine* editorial that accompanied the NCI paper, the ICNIRP panel states that the NCI results "provide some justification for further studies." The committee is chaired by Dr. Anders Ahlbom of the Karolinska Institute in Stockholm, Sweden. Other members include Drs. Elisabeth Cardis, David Savitz, Jan Stolwijk and Anthony Swerdlow. The commentary can be found on the ICNIRP's Web site at: <www.sz.shuttle.de/dm1001/icnirp.htm>.

• Details of the NCI study's exposure assessment effort appear in a paper by a team led by the NCI's Ruth Kleinerman in the September 1997 issue of *Epidemiology (8,* pp.575-583). A paper on the use of wire codes by the NCI's Dr. Robert Tarone is forthcoming, as is a report on static magnetic fields by Dr. William Kaune, a consultant based in Richland, WA.

• The *New England Journal* has accepted a number of letters on the NCI study—including those from Dr. Richard Stevens of the Battelle Pacific Northwest Labs in Richland, WA, and from Dr. Daniel Wartenberg of the Environmental and Occupational Health Sciences Institute in Piscataway, NJ (see *MWN,* J/A97).

« Wireless Notes »

On August 25 the largest telecommunications company in Belgium, **Belgacom**, announced that "major results...are now available" from two cellular phone safety studies that it has sponsored. "The conclusion of all this," stated Belgacom's press release, "appears to be that research based on the most authoritative and independent sources has yet to prove the negative consequences of GSM phones on human health." A **Reuter** dispatch on the press conference, held in Brussels, reported that cellular phones "probably do not cause physical harm, according to a Belgian study." And the trade journal ***RCR*** told its readers that "a new study" had found that GSM phones "are unlikely to cause brain cancer." But one of the Belgacom-funded researchers, Dr. **Luc Martens**, told *Microwave News* that, "It is a little bit too early to give definitive conclusions." Martens, of the Department of Information Technology at the University of Gent, has been working on dosimetry, and he noted that his team does not yet have any quantitative results. "We will certainly have some definitive conclusions at the end of this year when we have finished our study," he promised. "I think that the most important (best dosimetry and probably the most 'in-depth' work) still has to be written," stated Dr. **Luc Verschaeve** of the Flemish Institute for Technological Research (VITO), leader of the other Belgacom study. Some of the research his group has done for Belgacom has been published, while other work is "being submitted or in press or not yet submitted," Verschaeve explained. Though he has yet to conduct a statistical analysis of his results, Verschaeve indicated that they did not appear to point to any synergy with a chemical mutagen, in contrast to his earlier study of close-range exposures from a simulated base station (see *MWN,* N/D96). Martens reported that, "The mobile phones mostly satisfy the limits proposed by CENELEC [the European standards organization]. However, we are not so sure about the accuracy" of the initial results. Last May, Finland's State Technical Research Center (VTT) issued a press release with the headline NO HEALTH HAZARDS FROM MOBILE PHONES. Only later did it emerge that the VTT experiment on whether cellular phone radiation promotes the growth of cancer in mice did not yet have any cancer results, and that the dosimetry had just begun (see *MWN,* J/A97).

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The magazine ***2600****,* which bills itself as "The Hacker Quarterly," has two interesting articles on the cellular phone front in its Summer 1997 issue. "**Omnipoint** in New York City" *(14,* pp.25-29), by **Syringe**, is a listing of every antenna of the Omnipoint **PCS** system in New York City, including street addresses and site identification numbers. It is unclear whether this list was obtained by dumpster diving, via computer or by some other method. Inquiries to *2600* by phone, fax and even E-mail all went unanswered. "**GSM** Comes to North America" *(14,* pp.8-13), by the famed **Phiber Optik**, is described by the author as "a primer on GSM," though he concedes it is "a little technical for a primer." Four- and six-letter acronyms hurtle across the page as Optik gives a whirlwind description of how the GSM cellular phone system works. The section on caller authentication announces itself as "The part you've been waiting for!" This might make cellular service providers nervous. But the staff at *2600* argues that while "you can use knowledge in evil and stupid ways, stopping the flow of that knowledge isn't the way to prevent" such abuses. The issue can be ordered for $6.25 ($7.50 overseas) from: *2600,* Subscription Dept., PO Box 752, Middle Island, NY 11953.

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Stamford, CT, has a way of ensuring that new PCS antennas comply with the FCC's RF/MW radiation standards. It has drawn raves from the community but has the industry running to the state legislature for relief. The key is an RF/MW monitoring program, which, under a 1991 ordinance, is the job of the Stamford Department of Health and a panel of three experts paid for by the applicant. The health department chooses the first expert, the applicant picks the second and these two together select the third. The ambient RF/MW levels at the proposed site are measured, as are the levels at similar nearby sites. Later, the results are presented at a public hearing. If the antennas are approved, the measurements are repeated by the health department four times a year to ensure compliance. "Everybody feels that the process is good," **Phyllis Mazik** of the Stamford health department told *Microwave News*. "It's absolutely fantastic," **Philip Berns**, president of the Environmental Council of Stamford, a citizens group, said in an interview. "It should be implemented all over the country." The industry, however, is flinching at the length and the financial costs of the process. "It's cumbersome and I don't think it's necessary for all of these sites," said **Ronald Petersen** of Lucent Technologies in Murray Hill, NJ, who has twice served as an expert. Several companies, including Bell Atlantic NYNEX, MCI and Sprint, successfully lobbied the Connecticut legislature for a bill to bring PCS transmitters under the jurisdiction of the state's Department of Public Utility Control, which already has authority over cellular antenna siting, according to state Rep. **Janet Lockton**. In June, the bill was defeated, but Lockton expects it to be reintroduced in February at the next session. Mazik, **Henry Kues** of the Johns Hopkins University Applied Physics Laboratory (JHU–APL) in Laurel, MD, and **John Monahan** of the FDA in Rockville, MD, described the Stamford review process in a recent article in the *Johns Hopkins Applied Physics Laboratory Technical Digest (18,* pp.288-294, 1997). "Overall, this process offers a current scientific base that allays many fears and concerns of both the general public and the local government," wrote Kues, who served as an expert on two Stamford cases, and his coauthors. For a copy, contact: Kues, Research & Technology Development Center, JHU–APL, Johns Hopkins Rd., Laurel, MD 20723, Fax: (301) 953-6904, E-mail: <hak@aplcomm.jhuapl.edu>.

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Two September conferences on opposite sides of the globe had wireless safety as their topic. PERM-IT '97, held September 8-11 in **Adelaide**, Australia, was jointly organized to address radiation issues by four Australian medical and bioengineering societies. One day of the conference was devoted to ***Mobile Phones***

and Other Communication Devices: Health Issues and Current Research. Speakers included Australia's Drs. Ken Joyner and Peter French, the U.K.'s Dr. Alastair McKinlay and the U.S.'s Dr. Mays Swicord. Five days later and half a world away, an industry conference on ***Mobile Phones—Is There a Health Risk?*** convened in **Brussels**, Belgium, September 16-17. Featured scientists included France's Dr. Bernard Veyret, Germany's Dr. Gerd Friedrich, the U.K.'s Dr. Camelia Gabriel and the U.S.'s Drs. C.K. Chou, Henry Lai (see p.14), James Lin and James Trosko, as well as U.S. attorney Curt Renner. The collection of papers from this conference can be purchased for £249 ($400) from: Bookings Dept., IBC Technical Services, 57-61 Mortimer St., London W1N 8JX, U.K., Fax: (44+171) 636-1976.

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While the wireless telecommunications industry impatiently waits for the FCC to rule on moratoriums (see p.10), **Palm Beach County, FL**, has elected to ban new towers from school property. The county school board enacted a 90-day moratorium in March to determine how other counties have handled applications for cellular and PCS towers near schools. The board renewed it in May for another 90 days and on September 3 voted 6-1 to extend the ban "indefinitely." There are eight towers already on Palm Beach County school property that will remain operational for the remainder of their leases. What was surprising to some was that the dissenting voter, **Diane Heinz**, had been an outspoken opponent of towers at the schools. Heinz did not respond to calls for comment, but observers believe that she was protesting the failure to remove the eight existing towers. The board had initially supported putting the towers on schools, but was apparently swayed in part by the efforts of **Families for Appropriate Cellular Tower Sites** (FACTS), a citizens group based in Boca Raton. "I think we really hit on the health aspect pretty well. We bombarded the school board with health studies," **Candice Brown** of FACTS told *Microwave News.* Brown pointed out that the Palm Beach County school district is one of the largest in the country, serving 130,000 students. "For God's sake, don't put this potentially dangerous technology over the kids," she said. "The burden of proof should be on the industry." One of the companies seeking tower space at Palm Beach County schools, **Sprint PCS**, seems unfazed by the ban. "The moratorium is a moot point for us, because we have already decided to locate at other sites," Dan Wilinsky of Sprint PCS in Boca Raton said in an interview. The Palm Beach County ban follows the California Public Utilities Commission's 1995 advice to keep antennas away from schools and hospitals (see *MWN,* N/D95). Last year, New Zealand's Ministry of Education issued a policy statement preventing towers from being built at public schools (see *MWN,* S/O96).

COST 244's Koren Dies

Dr. Zlatko Koren, a former Croatian Minister for Science and the founder and chairman of COST 244, the European EMF and EMR research initiative, died suddenly on August 6 from head injuries sustained in a car accident on the Adriatic coast.

Born on August 18, 1942, Koren was educated at the universities of Zagreb and Stockholm. After receiving an appointment at the University of Zagreb, he rose quickly to become a professor of electrical engineering and a vice-dean.

In 1992, Koren led the drive to organize COST 244 on the "Biomedical Effects of Electromagnetic Fields." At the end of the five-year project, a second effort was launched—COST 244bis. In addition, Koren was a member of a University of Zagreb research team that found *in vitro* chromosomal damage due to radar radiation. This finding corroborated a parallel epidemiological study that found genetic abnormalities among radar technicians (see *MWN,* M/J92).

At the time of his death, Koren was directing a Croatian Ministry of Science project on the bioeffects of EMFs and EMR. He was also leading a group that was in the process of drafting a national non-ionizing radiation law for Croatia.

Norwegian Investigation of Birth Defect Cluster Focuses on RF/MW Radiation from Electronic Warfare Systems

The Norwegian navy's investigation into the cause of a cluster of birth defects is centered on exposures to radiofrequency and microwave (RF/MW) radiation from electronic warfare systems. RF/MW radiation is "the one thing we are looking at," said Dr. Jan Helge Halleraker, the chief medical officer at the Haakonsvern Naval Base in Bergen, who is leading the inquiry (see *MWN,* J/A96).

Between 1987 and 1994, 11 children were born with defects—including five with clubfoot—to seamen who served on the *Kvikk,* a motor torpedo boat, Halleraker said. In an interview with *Microwave News,* he pointed out that while the Norwegian navy has 30-40 similar torpedo boats, the *Kvikk* was a "very special ship" because it was the only one with high-power electronic warfare equipment on board.

The Norwegian navy hosted a NATO conference, August 26-28, to discuss the possible role of RF/MW radiation in the cluster. Among those at the meeting were representatives from the Dutch, U.K. and U.S. navies. The conference, which was held in Bergen and in Trondheim, was closed to the press.

"A lot of [RF/MW] measurements have been made," Halleraker said, "and there are a lot more to come." He declined to discuss specific numbers, however. The *Kvikk* was damaged some time ago, but a copy was built in order to measure the radiation levels from radar and communications equipment "all over the ship," according to Halleraker.

While Halleraker is leading the health study team, Helge Olsen, a senior engineer in the technical department of the Royal Norwegian Navy's Materiel Command, is in charge of the mea-

surement effort.

Two epidemiological studies are under way at Haukeland Hospital in Bergen, which, Halleraker stressed, is "an independent institution not linked to the Norwegian navy." The first will try to see if the *Kvikk* cluster could have occurred by chance: The families of all those who served on navy ships over the last 30 years will be matched with data from the national birth defects registry. The second study is of 300-400 children who were born with clubfoot at the Haukeland Hospital.

Meanwhile, there is renewed interest in another cluster, in which six children with clubfoot were born to employees of the Værløse airport, near Copenhagen, Denmark, between 1989 and 1994. No cause of that cluster was ever found, but Halleraker said that this investigation "did not look at electromagnetic radiation."

The *Kvikk* cluster has also drawn attention to a clubfoot cluster, first reported by Dr. Peter Peacock, among children of helicopter pilots at Fort Rucker, AL, in 1969-70. Although there were suspicions that the cluster was linked to radiation from radar, the U.S. Army blocked access to medical records, stymieing the investigation (see *MWN,* J/A96). Halleraker said that he knew the Peacock study "very well."

Some results of the measurement and epidemiological studies will be made public in November, Halleraker said. For the present, he does not want to speculate about any conclusions. "It's still a question mark," he said.

Cell Phone-Brain Cancer Suit by Industry Insider Is Withdrawn

The brain cancer lawsuit brought against Motorola by Debbra Wright was withdrawn on August 8. A former manager with Bell Atlantic Mobile and US West Cellular, Wright had used only Motorola cellular phones. She filed the suit in March 1995 (see *MWN,* M/A95).

"She can't afford to get the experts to pursue the case, and we can't afford to put out that money ourselves," said Wright's attorney, Robert Holstein of Holstein and Associates in Chicago. "It's a shame, because she really deserves to have her case heard," he told *Microwave News.*

"This is the latest in a series of developments exposing the hollowness of this type of claim," Motorola spokesperson Norman Sandler said in an interview. "In cases up to now, plaintiffs have either been unable to produce witnesses to support their claims, or the witnesses they've offered have been unable to withstand judicial scrutiny."

Wright said her lawyers had told her that to continue with the case, she would have to come up with between $400,000 and $500,000, an amount that she could not afford. "I don't *think* we said that," responded Aron Robinson of Holstein and Associates. When asked if any other figure had been cited, Robinson said, "I can't disclose attorney-client conversations."

Speaking in a September 9 telephone interview, Wright expressed surprise that Holstein's firm had moved to drop the case. "They never told me," said Wright. She explained that her attorneys had discussed withdrawal as one possible option, "but there wasn't any final decision. We had discussed some stuff, but they hadn't gotten back to me." She said she only learned of the action when called by *Microwave News.*

The motion to withdraw the case was filed on August 6 and granted two days later. Asked why Wright was never informed, Robinson answered, "I can't comment on that."

"There were no settlement discussions," said Sandler. "We would never have engaged in them, because we were determined to see this thing through on the facts." As to whether Motorola had received settlement proposals from Wright's attorneys, Sandler said, "One-way offers do not constitute discussion. I can't be adamant enough about that."

Wright's lawsuit was notable for coming from a former industry insider, someone who was twice named salesperson of the year for US West's Southwest region. Shortly after filing suit, she told *Microwave News* that many people in the industry told her they supported what she was doing. Wright described herself as having been "a heavy user" of her cellular phone, and noted that her tumor is located "exactly where I'd been holding the phone."

The complaint not only charged that phones made by Motorola are responsible for Wright's brain tumor—it also accused the Cellular Telecommunications Industry Association (CTIA) and its research group, Wireless Technology Research (WTR), of conspiring to mislead the public into thinking that cellular phones had been proven to be safe. As one example, the complaint cited a 1993 CTIA statement that, "There have been thousands of studies that have shown these phones to be safe." But the trial judge dismissed the claims against the CTIA and WTR last May, leaving Motorola as the sole defendant (see *MWN,* M/J97).

Sandler emphasized that, "Wright was one of four Illinois cases that were withdrawn in August. The others were *Hoffman, Pogue* and *Crist,"* all personal injury lawsuits that blamed Motorola phones for causing or aggravating cancer (see *MWN,* J/A93, J/F 94 and N/D94). According to Sandler, "That means that out of eleven lawsuits beginning with *Reynard,* only two survive" (on Reynard, see *MWN,* M/J92, J/F93 and M/J96). He named the two active lawsuits as the *Rittmann* case in Texas (see *MWN,* M/J 96) and the *Busse* class action suit in Illinois (see *MWN,* J/F96). There have been no new cellular phone-cancer claims against Motorola since *Busse* was filed in October 1995, Sandler added.

Sandler's count does not include the lawsuit filed by engineer Robert Kane against Motorola, his former employer. Kane charges that his brain cancer is due to RF/MW exposure from the testing of a new cellular phone unit that was under development (see *MWN,* J/F94, M/A94, J/A94, M/A95). "The *Kane* lawsuit is a somewhat different matter," Sandler stated. "We have never considered that a cellular phone case *per se."*

"We're going ahead with the Bob Kane case," said Holstein. "The experts are in place, and we're gearing up for trial." While there is no firm trial date yet, he expects it to be in the spring of 1998. "If this industry thinks they're any better off than tobacco, they should think again," Holstein contended. "The expertise for cell phones is here right now." Holstein did not respond to repeated requests for his list of expert witnesses in Kane's lawsuit.

FCC Reaffirms Health Rules Based on NCRP Limits

The Federal Communications Commission (FCC) is standing by its decision to base its radiofrequency and microwave (RF/MW) limits mainly on those recommended by the National Council on Radiation Protection and Measurements (NCRP) in 1986. The FCC held its ground in the face of an intense lobbying campaign by the electronics and communications industries and the U.S. military.

In a decision released on August 25, the FCC stated that the limits, which it adopted last year, "are appropriate," because they address both safety concerns and the "growing marketplace demand for communications services" (see *MWN,* J/A96).

Industry had urged the FCC to adopt the 1992 ANSI/IEEE standard in its entirety (see *MWN,* M/J94 and M/A96). Among those favoring this approach were the Cellular Telecommunications Industry Association (CTIA), the Electromagnetic Energy Association (EEA), the National Association of Broadcasters (NAB), US West and the Department of Defense. In contrast, the federal health agencies objected to provisions of the ANSI/IEEE standard (see *MWN,* J/F94).

"We are not a health and safety agency," the FCC's Dr. Robert Cleveland told *Microwave News.* For this reason, he said, "We have based our guidelines on the recommendations of the Environmental Protection Agency, the Food and Drug Administration and the National Institute for Occupational Safety and Health." Cleveland is leading the commission's effort to address RF/MW radiation safety concerns.

The FCC used the same argument to answer activists who want the commission to adopt even stronger regulations. "It would be impractical for us to independently evaluate the significance of studies purporting to show biological effects, determine if such effects constitute a safety hazard and then adopt stricter standards than those advocated by federal health and safety agencies," the FCC stated in its August 25 decision.

In a major change, the FCC is now requiring that *all* existing facilities be in compliance with its RF/MW rules by September 1, 2000.

A number of communications companies asked the FCC to reinstate its previous blanket exclusion of all paging and cellular base stations. Last year, the commission decided to require routine evaluation of cellular and PCS antennas mounted lower than 10 meters above the ground and with a total output power over 1 kW. It noted that its decision was based on its own calculations, which showed that in some cases there was the potential for overexposures. "Nothing in the petitions provides new information to indicate that these calculations or analyses are incorrect," according to the FCC.

A major company to come up empty-handed was Hewlett-Packard, which sought a categorical exclusion for certain millimeter-wave devices (see also *MWN,* M/A96 and M/J97). The FCC did bend a little, however, and will now require an evaluation for a device operating above 1.5 GHz only if its effective radiated power is 3 W or more.

The complete text of the FCC's revised rules can be found on the World Wide Web at: <www.fcc.gov/oet/>.

FCC Guidelines for Evaluating RF/MW Radiation Compliance

The FCC's Office of Engineering and Technology (OET) has released guidelines for evaluating whether transmitters comply with its RF/MW emissions limits. The 129-page bulletin consists of techniques for measuring RF/MW radiation, calculating field levels for proposed antennas and controlling exposures.

According to the FCC, "This bulletin is intended to enable an applicant to make a reasonably quick determination as to whether a proposed or existing facility is in compliance with the limits."

A supplement dealing with radio and TV broadcasters is currently available while a second, for amateur radio, will be issued later.

Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields (OET Bulletin 65, Edition 97-01) can be downloaded from the FCC's Web site at: <www.fcc.gov/oet/rfsafety>; or it can be purchased for $35.95 plus postage from: International Transcription Service Inc., 1231 20th St., NW, Washington, DC 20036, (202) 857-3800, Fax: (202) 857-3805.

FCC Nixes Broad Federal Preemption of Moratoriums

The FCC has denied an industry request for a blanket preemption of antenna moratoriums and has instead sought comments on whether to ban those of an "unspecified or unlimited duration." In a July 28 public notice, the commission's Wireless Telecommunications Bureau (WTB) explained that the 1996 telecom law does not prohibit all moratoriums, contending that those with a "fixed duration" are "legitimate exercises of local land use authority."

As the wireless industry seeks sites for more than 100,000 new antennas, tensions have grown between the industry and local officials protecting their zoning authority as well as community interests.

The WTB asked for advice on what the maximum length for a moratorium should be, whether to prohibit moratoriums based on health concerns about RF/MW radiation and whether to ban those that prevent new antennas from being installed but allow existing ones to be modified. The deadline for responses was September 26.

Meanwhile, on August 25, the FCC issued a notice of proposed rule-making along with its new RF/MW radiation compliance rules (see above), asking for comment on the types of information local authorities can request regarding emissions.

In December 1996, the CTIA petitioned the FCC to ban all moratoriums directed at antennas for wireless communications.

Industry Asks for Federal Preemption for Digital TV

The broadcasting industry wants to stop state and local governments from blocking digital television (DTV) antennas that meet the FCC's RF/MW radiation standards—that is, it is seeking an exemption similar to the one won by the wireless industry in the 1996 telecommunications act (see *MWN,* M/A96 and M/J96).

On August 19, the commission asked for public comment on a May 30 petition from the NAB and the Association for Maximum Service Television (AMST) seeking federal preemption. The FCC has set a December 1 deadline for responses.

In addition, the NAB and the AMST asked the FCC to ensure that state and local authorities act on DTV siting applications within 21 to 45 days. The commission has already ordered the four TV networks to begin DTV broadcasting in the top 10 U.S. markets by May 1, 1999.

The FCC's LSGAC does not support the industry's proposal, arguing in a July 25 statement that it "far exceeds the scope of any problem the NAB and AMST allege and is based on 'facts' that are misleading." In particular, the committee pointed to what it called the "ridiculously short time" for local authorities to handle siting applications.

The CTIA also asked that the FCC, not the courts, have jurisdiction over moratorium disputes. The petition received significant support from the industry, including AT&T Wireless, the Personal Communications Industry Association, Prime Co. Personal Communications, Sprint Spectrum and US West Inc.

The FCC's Local and State Government Advisory Committee (LSGAC) has a different outlook. In a July 15 submission, Kenneth Fellman, chairman of the LSGAC, stated that moratoriums are necessary to give local authorities time to amend their zoning rules or adopt new siting policies.

Not surprisingly, the CTIA was disappointed with the FCC's indecision. "Further comment spells further delay....Now is the time for action, not inquiry," CTIA President Thomas Wheeler said in a prepared statement.

Fellman, too, was unhappy that the FCC is still seeking comment, though for different reasons. "We're disappointed that it's still pending," he said in an interview. "We think the statute is very clear that these disputes should be handled in the courts. We're not denying that there is a problem and that some of these moratoriums are too long. Preemption is not the answer."

Susan Potts, mayor of Medina, WA—which enacted a moratorium five days after the telecom act was signed in February 1996 (see *MWN,* M/J96)—also criticized the FCC for not shelving the CTIA petition. "The courts have the ability to determine if moratoriums are unreasonable or were not enacted in good faith," she wrote in a September 9 letter to the FCC. "This is adequate protection for the wireless industry."

Sprint Spectrum challenged the Medina moratorium in court but lost when the judge ruled that the six-month period constituted a "reasonable period of time." Medina adopted an ordinance on siting issues in July 1996 and two months later followed up with a second moratorium to evaluate impacts on property values (see *MWN,* N/D96). The second moratorium expired, and this May Medina amended its ordinance to require that towers be set back 500 feet from property lines.

On September 10, Concerned Communities, a group of 160 cities and counties representing 9 million people in 11 states, also asked the FCC to deny the CTIA petition. The group agrees with the LSGAC and Medina, and asked that the FCC not retain the authority to determine whether moratoriums violate the rights of wireless service providers.

The moratorium issue has been a contentious one since the telecom act was passed. This February, a year after it was signed into law, the FCC held a public forum on siting issues, which was attended by both industry and citizens groups (see *MWN,* J/F97). In July, the CTIA counted 226 cities and counties with moratoriums in place, but the association reports that the number has recently dropped to 165.

Russians Find MW Exposure Leads to Memory Failure

Exposure to 10 GHz microwaves can cause memory failure in chicks, according to a study led by Dr. Yuri Grigoriev of the Institute of Biophysics at the State Research Center of Russia in Moscow. Grigoriev also found a dose-response effect on the chicks' ability to imprint, a process in which young animals learn behavioral patterns.

"The results are very important for estimating the influence 10 GHz radiation can have on the nervous system, especially among fetuses and newborns," Grigoriev told *Microwave News.* Very little research has been done at these microwave frequencies.

Grigoriev did three sets of experiments, all run blind. The incubating chicken embryos were exposed for 30 minutes to power densities ranging from 0.4 to 10 mW/cm^2. Some 20-24 hours after hatching, the chicks were given an imprinting stimulus—either a flashing light or a moving object.

The first group of chicks was exposed to power densities of 1, 8 or 10 mW/cm^2 beginning on the fifth day of incubation. Four of the seven chicks exposed to 1 mW/cm^2 imprinted, compared to nine out of ten controls. None of the 15 chicks in the 8 and 10 mW/cm^2-exposed groups imprinted, while all 17 of their control counterparts did so successfully.

In a second series of tests, Grigoriev exposed the chicken embryos to 1 mW/cm^2 beginning on the 16th day of incubation. Only ten of 17 exposed embryos imprinted, while 17 of the 19 controls did so. A third group was exposed to 0.4 mW/cm^2, beginning on the 19th day. In this case, 17 of 18 controls imprinted, compared to 13 of the 18 exposed chicks.

Grigoriev believes that imprinting studies are useful for investigating memory function. "Both 8 and 10 mW/cm^2 radiation suppress the possibility of imprinting almost completely," he explained. "Power densities of 0.4 and 1 mW/cm^2 can influence the formation of memory." Grigoriev, who is also studying the effects of modulated signals, presented his results in June at the *2nd World Congress for Electricity and Magnetism in Biology and Medicine* in Bologna, Italy (see *MWN,* J/A97).

Mobile Telecommunications Association in Stockholm. An association statement noted that: Small differences in the measured radiofrequency (RF) radiation emissions among various manufacturers and among models made by the same manufacturer "do not mean there are differences in safety." It added that, given the "large safety factor" used to set safety standards, "the small differences between products have little practical relevance."

The Forschungsgemeinschaft Funk (FGF) in Bonn, Germany, which sponsors health studies on RF from wireless devices (see *MWN,* N/D94), did not respond to a request for comment.

"The rankings lack any relevance to health. The way they have been presented may mislead or confuse consumers," Norman Sandler, director of global strategic issues at Motorola in Schaumburg, IL, told *Microwave News.* "We take strong exception to any suggestion that our phones are unsafe or that other phones are safer—as long as they all meet recognized exposure standards."

Dagbladet did not cite specific SAR numbers. Indeed, the newspaper highlighted the omission with its headline NEW REPORT ON MOBILE PHONES IS KEPT SECRET.



"Low Radiation Is Better," says Hagenuk.

Dr. Niels Kuster of the Swiss Federal Institute of Technology (ETH) in Zürich, made the SAR measurements for Hagenuk, but he declined to reveal his findings. "I am bound by a nondisclosure agreement and I cannot discuss our test results," Kuster told *Microwave News.*

Hagenuk commissioned a second set of measurements from the Institut für Mobil- und Satellitenfunktechnik (IMST) in Kamp-Lintfort, near Düsseldorf, Germany. The IMST's Matthias Rittweger would only say that the test results were proprietary and therefore could not be released. Hagenuk did not respond to a request for the test data.

But the first set of SARs from currently marketed wireless phones will be available soon. On October 14, *Kassensturz,* a Swiss television consumer magazine show, will disclose the SARs from 15 hand-held phones. The measurement results come from Kuster's Laboratory for EMF and Microwave Electronics at the ETH. Simultaneously, these same SAR results will be featured in the Swedish newspaper *Aftonbladet.*

Hagenuk's brochure features measurement data from two different types of hand-held phones, as well as its own, in four different positions (see below). Note that the "touch use" position occurs when the phone touches the user's cheek.* Kuster explained that, "If high currents flow in the device, then the maximum SARs will occur in the touch position, but if the device is current-free, the highest SARs are found in the 100Υposition."

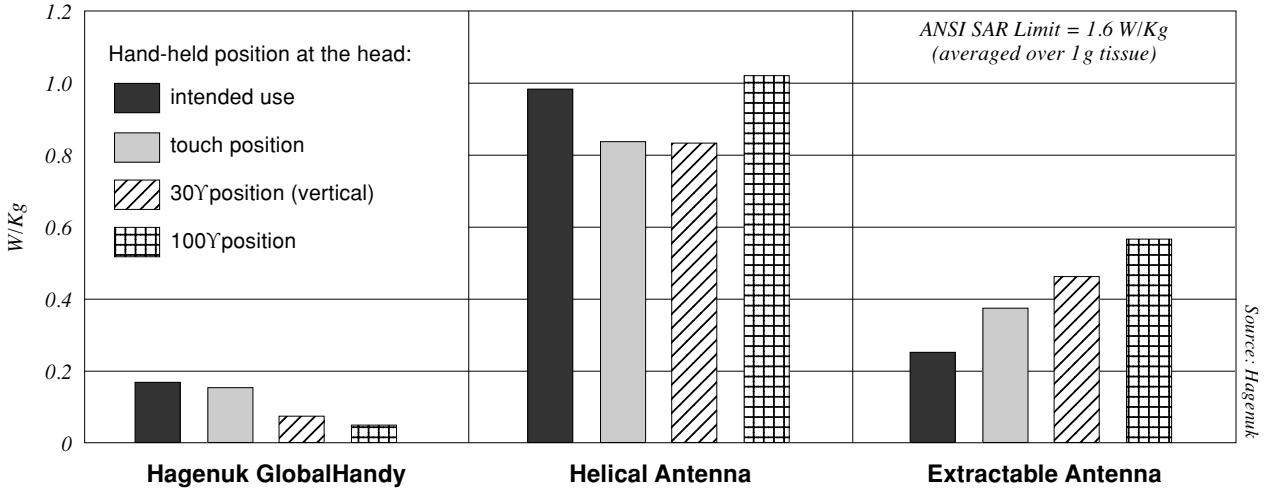
In contrast to phones with helical or extractable antennas, the Hagenuk antenna is built into the handset—a so-called planar inverted-F antenna, a design pioneered by Dr. Jørgen Bach Andersen of the Center for Personkommunikation at Aalborg University in Denmark (see *MWN,* J/F95).

Many other companies are known to be working on low-SAR phone designs. Hitachi and Mitsubishi, for instance, have each won patents for phones that reduce users' exposure to radiation (see *MWN,* N/D96).

The symbol of Hagenuk's new advertising campaign—"Antenna? No Thanks"—is a play on a German antinuclear slogan: "Nuclear Power? No Thanks." The nuclear industry responded to that with its own slogan: "Stone Age? No Thanks."

* For a detailed description of these test positions, see the chapter on "Experimental and Numerical Dosimetry," by Drs. Niels Kuster and Quirino Balzano, in *Mobile Communications Safety,* edited by Kuster, Balzano and Dr. James Lin, published by Chapman & Hall, 1997.

Maximum SARs of GSM-Hand-Helds Relative to ANSI Standard



electromagnetic interference (EMI) with the pacemakers of 48 of 50 people, the highest rate of all the security systems tested. A different magnetic-based system caused EMI in four out of 50, while radiofrequency devices caused no interference at all.

"The good news," said McIvor, is that implanted defibrillators appeared immune to EMI from all security systems. McIvor's team did not test metal detectors or a microwave anti-theft system made by 3M Co. and used in bookstores and libraries.

Joanne Barron, a radiation protection officer at the FDA's Center for Devices and Radiological Health (CDRH) in Rockville, MD, noted that "serious extended symptoms" were not observed in McIvor's study. "But to be on the safe side," she told *Microwave News,* "we suggest that people with pacemakers, especially those dependent on the devices, take some simple precautions." The FDA recommends walking directly through anti-theft systems, without pausing between the transmitter columns, and advises against standing near or leaning on the columns. Barron noted that anti-shoplifting systems may be hidden behind walls, so the FDA urges people with pacemakers "not to linger near the entrances and exits of commercial establishments."

McIvor said that EMI from security systems may become more common, since there is now a trend towards more powerful anti-theft systems that can cover wider areas—"like the 20-foot-wide entrance to a mall, or the 40-foot stretch across a loading dock."

"We live in an ocean of electromagnetic radiation," McIvor told *Microwave News.* "Most of the time it just passes through our bodies, but the pacemaker is like a pillar on a pier, where the waves crash up against it."

The most serious type of EMI with pacemakers, McIvor explained, occurs when the pacemaker mistakes an outside signal for a heartbeat. "If that happens, it'll turn itself off, and that's a particular problem if you're pacemaker-dependent," he said. "We saw this in a few patients, and when it happened they would get dizzy." The problem disappeared when people moved out of the anti-theft system's field. "But if the pacemaker stopped," he added, "the natural tendency was for people to reach out and steady themselves—by holding on to the anti-theft device. That's exactly what you don't want to do." He cited the case of a woman in Germany who passed out when she was delayed in the field of an anti-shoplifting system, due to crowding at a store entrance.

John Casamento of the CDRH's electrophysics branch said that he recently spoke with the doctor of a Phoenix woman who repeatedly encountered EMI at a local K-Mart. Whenever she passed through the store's anti-theft system, her pulse sped up to 175. McIvor explained that this type of interference occurs in a dual-chamber pacemaker when it speeds up to keep pace with an outside signal.

Acousto-magnetic anti-theft devices are prone to cause EMI for two reasons, according to McIvor. First, they use a 58 kHz signal, which pacemakers are not programmed to detect as interference: "When EMI standards were set for pacemakers in Europe, that frequency was left out." The U.S. has no formal standards in this area, but U.S. manufacturers have followed European norms. "The other thing that creates a problem for acousto-magnetic systems," he said, "is that they're pulsed at 60 Hz, a frequency that's especially likely to confuse the pacemaker."

"The acousto-magnetic devices are the number one seller," McIvor commented. "There are 90,000 of them in the U.S., so there's lots of potential for interaction." Roughly 1 million people in the U.S. have implanted pacemakers. "You can't tell whether a device is an acousto-magnetic system by looking at it," said Judith Reddinger of the Heart Institute, who also worked on the study.

Sensormatic is the only company that makes acousto-magnetic devices, though it also produces systems that use other technologies. The company's press release on McIvor's study was headlined RESEARCH STUDY CONFIRMS SAFETY OF ANTI-SHOPLIFTING SYSTEM. Sensormatic's Coller said the press release "was approved by Dr. McIvor."

"What I remember telling them is that everything they said is true—but it isn't the way I would have said it," McIvor told *Microwave News.* "Their focus is, 'Did anyone die?' No, but we wouldn't let our patients sit in the field long enough to even get close to that. That wasn't the point. The point was, is there an interaction or not—and there were lots of interactions."

Sensormatic did not, however, disagree with the FDA's new recommendations. In fact, Coller said that the company had encouraged pacemaker manufacturers to use similar advice in patient education. But she stressed that, "All of our systems meet government standards worldwide. We've also sponsored independent testing that shows there is not a problem, either in the lab or in the real world."

McIvor's advice parallels that of the FDA, and he said people with pacemakers need not avoid anti-theft systems altogether. "If I were pacemaker-dependent, I'd still feel comfortable walking through one of these systems, as long as I didn't stop," he said. "I'd feel *more* comfortable," he added, "if it wasn't an acousto-magnetic device."

The CDRH's Barron stated that from 1987 to 1995, the FDA received 12 formal reports of anti-theft systems interfering with pacemakers. She called this a low number, but added that since the effects were transient, a large number of reports would not be expected. Howard Bassen, chief of the CDRH's electrophysics branch, said he is mapping the fields created by different types of anti-theft systems and plans to publish the results. Bassen's Web site, devoted in part to medical-device EMI, can be found at: <http://home.att.net/~hibatt>.

McIvor presented his initial results on May 10 in New Orleans at the *18th Annual Scientific Sessions of the North American Society on Pacing and Electrophysiology,* and at the *Europace'97* conference, held June 8-11 in Athens, Greece. The completed study has now been submitted for publication (On earlier studies, see *MWN,* M/J95.)

On August 29, at the *18th Congress of the European Society of Cardiology* in Stockholm, Sweden, Dr. Andreas Wilke of Marburg University in Germany described how he exposed 53 people with implanted pacemakers to a range of security systems. Wilke observed EMI in as many as 13% of the subjects in the "real-world" tests. "Unconsciousness can result" when a pacemaker mistakes EMI for "a physiologic heart action" and switches itself off, Wilke stated. He noted that this did not occur in his study, "as the pacemaker inhibitions...were only short."

Wilke recommends that people with pacemakers "avoid close proximity" to electronic security systems. He told *Microwave News* that he has submitted his study for publication.

FROM THE FIELD

Clippings from All Over

"We've gotten heavily into religion. We're building church steeples across the country."

—Tim Ayers, spokesperson for the CTIA, on the increasing number of cellular phone towers being built on tall buildings, including churches, quoted by Lorilyn Rackl in "High-Tech Dandelions," *Daily Herald* (IL), p.6, July 10, 1997

Why not just build more transmission lines? "It's easier to get permission to build a new generating plant than a new transmission line," says Jack Feinstein, a Con Ed vice president. Cheaper too: Running a new 345,000-volt power line underground from Yonkers to midtown Manhattan would cost $650 million [$32 million per mile], Feinstein says.

—Brian O'Reilly, "Transforming the Power Business: The Bloated, 120-Year-Old Electric Power Industry Isn't Just Being Deregulated—It's Being Revolutionized. The Impact on Business Will Be Huge," *Fortune,* p.152, September 29, 1997

"It's unnatural to use a wired phone."

—Hermann Bluestein, head, MCI wireless strategy and development, quoted in "Airborne: Within Five Years Almost One in Three Telephones Will Be Mobile," in *A Survey of Telecommunications—A Connected World, The Economist,* p.19, September 13-19, 1997

"The wireless industry has exerted far more interest and seriousness in looking into this than the broadcasters ever did. Many broadcasters yawn and roll over. The wireless industry has really snapped to, even though they are considerably lower-powered systems."

—Richard Tell, consultant and former chief, electromagnetics branch in EPA's Office of Radiation Programs, on the wireless industry's efforts to comply with FCC rules on RF emissions, quoted in "Remarkable," *Wireless Week,* p.171, September 8, 1997

EPA on RF/MW Policy

July 31, 1997

To the Editor:

I would like to comment on an item in the May/June 1997 issue of *Microwave News* (p.7) in which a reference is made to an article in the trade publication *RCR* about a "deal" which supposedly assured the wireless industry that "EPA would remain in the background on RF safety issues."

First of all, the thought that EPA would agree to "remain in the background" and not speak out on any safety issue relevant to public health (and RF radiation exposure is a legitimate public health issue) is an affront to EPA and personally insulting to me and, I would think, to all EPA employees.

Secondly, there should be no confusion about EPA's position with regard to RF exposure issues. The EPA position was clearly stated in the agency's November 1993 comments to the FCC [see *MWN,* J/F94], and they remained consistent throughout the period during which the FCC completed its regulatory process. My letter to David Fichtenberg, cited in your May/June 1997 issue, did nothing more than repeat statements in EPA's November 1993 comments to the FCC.

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Headline Bonanza

"Even a temporary change in neural functions after RFR [RF radiation] exposure could, depending on the situation, lead to adverse consequences. For example, a transient loss of memory function or concentration could result in an accident when a person is driving. Loss of short-term working memory has indeed been observed in rats after acute exposure to RFR.*"

—Excerpt from "Neurological Effects of Low-Level Microwave Radiation," a presentation by Dr. Henry Lai, University of Washington, Seattle, at *Mobile Phones—Is There a Health Risk?,* Brussels, Belgium, September 16-17, 1997 (see pp.7-8)

*** H. Lai, A. Horita and A.W. Guy, "Microwave Irradiation Affects Radial-Arm Maze Performance in the Rat," *Bioelectromagnetics, 15,* pp.95-104, 1994**

MOBILE PHONES ARE BLAMED FOR LOSS OF MEMORY

—Headline from *The Daily Mail* (U.K.), September 22, 1997

MOBILE PHONES ARE A FORGETTABLE EXPERIENCE

—Headline from *The Sunday Times* (U.K.), September 21, 1997

NEXT THING IS, YOU'LL FORGET YOUR NUMBER

—Headline from *The Independent* (U.K.), September 22, 1997

"I don't know what it is, but it works. I figure it can't hurt me, and it may help me."

—Steve Atwater, Denver Broncos safety, on his use of magnet therapy, quoted by Sal Ruibal in "Ironclad Cures for Pain? Athletes Put Their Faith in Power of Magnets," *USA Today,* p.3C, August 20, 1997

"It is downright shocking that the FCC has moved to assist broadcasters to site antennas to deliver *I Love Lucy* reruns, but has done nothing to assist wireless consumers to call 911 or tell a family member they're running late. Not only has this commission's inaction had an impact on delaying competition, it is affecting people's lives."

—Thomas Wheeler, president and CEO, CTIA, on the FCC's position toward local cellular phone tower moratoriums, quoted in a CTIA press release, September 11, 1997

RF PERFORMANCE OF A 418-MHZ RADIO TELEMETER PACKAGED FOR HUMAN VAGINAL PLACEMENT

—Title of a paper by researchers at the University of Ulster, Northern Ireland, published in *IEEE Transactions on Biomedical Engineering, 44,* pp.427-430, May 1997

"We can't all just turn the lights off. Let's be grown-up about it and agree that there might be a risk here. We need to get away from this trench warfare between industry and science."

—Alan Fisher, attorney, Dibb Lupton Alsop, London, U.K., quoted by Janina Clark in "Polarised Views on EMF: Might Electromagnetic Fields Be the Insurers' Nightmare of the Next Century," *Reinsurance* (U.K.), p.14, August 1997

Ostensibly, the concern is that the towers could cause cancer by emitting low-level microwave radiation—a premise for which there is no solid evidence. But it doesn't take a clairvoyant to see the real driving force behind the protests is much more practical: property values.

—John Grogan, "Cellular Addicts Must Pay Towering Price," commentary, *Sun Sentinel* (FL), September 5, 1997

UPDATES

BROADCAST RADIATION

Infertility Near TV and FM Transmitters... Living near a broadcast antenna farm can cause irreversible infertility in mice, according to a study by a Greek research team. Writing in *Bioelectromagnetics (18,* pp.455-461, 1997), Drs. Ioannis Magras and Thomas Xenos of Aristotle University in Thessaloniki report on 18 breeding pairs of mice—12 pairs situated at different locations in the vicinity of an antenna farm in Thessaloniki and 6 control pairs about 6 miles away. The exposed mice were divided into two groups, 6 pairs close to the antennas and 6 pairs about 1 mile away, in the village of Chortiatis. Nearly 100 television and FM-radio transmitters are located at the antenna farm, with a total power output of about 300 kW. The researchers state that RF/MW power densities for the exposed groups ranged from 0.17 ∝W/cm^2 to 1.05 ∝W/cm^2, but they do not cite specific measurements for each location. The controls, the authors note, were exposed to RF/MW levels that were about 10,000 times lower. Each pair of exposed animals was bred four times and then moved to the control site for a fifth mating. The authors saw a "progressive decrease" in the average number of offspring per litter among both sets of exposed mice. The 6 pairs that were a mile from the antenna farm were infertile by the third breeding and never recovered. The 6 pairs closest to the antenna farm had a decreased number of offspring in the third and fourth attempts and had none in the fifth breeding. For reasons Magras and Xenos do not explain, the controls were bred only *once,* yielding an average of 8 offspring per litter. Nor do they discuss the apparent lack of a dose-response relationship: The mice that were a mile from the farm became infertile faster than those that were closer. Magras and Xenos state that because the 12 pairs had no issue after being moved to the control site, the effect on fertility appeared to be irreversible, and they speculate that the infertility could be "attributed to an intrauterus death of the irradiated embryos in the early stages of the prenatal development." Interestingly, the offspring of the exposed animals were generally longer and heavier and had more vertebrae than those of the controls. The findings complement those from a laboratory study on rats conducted by Dr. Santi Tofani more than ten years ago. Tofani, of the Public Health Laboratory in Ivrea, Italy, and his colleagues found that rats exposed to 100 ∝W/cm^2 of 27.12 MHz radiation had reproductive problems and their offspring had developmental defects (see *MWN,* N/D86).

DOPPLER WEATHER RADAR

DEIS for NYC Airports...A terminal doppler weather radar (TDWR) planned for New York City would directly irradiate apartment towers less than three miles away. Raytheon Co. of Lexington, MA, will build the radar, designed to serve both JFK and La Guardia airports, at a U.S. Coast Guard air station on the southern edge of Long Island. According to the draft environmental impact statement (DEIS) for the facility, prepared by SRI International in Menlo Park, CA, and issued by the FAA in August, the TDWR generates a narrowly directed beam at 5.60-5.65 GHz, and its transmitter has a maximum pulse power of 300 kW. High-rise apartment buildings in Rockaway Park in Queens, some 13,000 ft. from the antenna, would stand in the path of the beam, as would the control tower at JFK. The beam's energy is concentrated in 1.1 ∝sec pulses, with a repetition rate of 1,066-1,672 pulses per second in normal operation and a maximum frequency of 2,000 Hz. The radar's duty cycle is 0.22%. The peak power of the pulses is orders of magnitude greater than the average power density of the signal. The DEIS does not specify the peak power density at the Rockaway location, but it estimates that it would be 10 mW/cm^2 at a distance of 11,770 ft. from the antenna. Averaged over six minutes, as allowed under the 1992 ANSI/IEEE standard, the power density of the signal at the apartment towers would be 0.016 ∝W/cm^2. The draft contains some sweeping statements that do not receive further substantiation. For instance, it asserts that, "The results of many experimental investigations indicate existence of threshold levels above which

"MICROWAVE NEWS" FLASHBACK

Years 15 Ago

• ANSI approves a new safety standard for RF/MW radiation based, for the first time, on SARs. In the 30-300 MHz range, the new exposure limit is 1 mW/cm^2—ten times below the old limit.

• The broadcasting and communications industries ask the FCC to set an interim guideline for RF/MW exposures to stop the adoption of a patchwork of state and local standards.

Years 10 Ago

• On October 6, a congressional subcommittee holds hearings on the possible health risks of power lines. In his opening statement, Dr. Robert Becker, author of *The Body Electric,* charges that most EMF animal experiments have been "designed, deliberately in advance, to yield negative results and any positive results obtained have not been reported or their release has been long delayed."

• The Portland, OR, City Council adopts a 200 ∝W/cm^2 standard for RF/MW exposure—a limit five times more stringent than the one endorsed by ANSI in 1982.

• Dr. Robert Birge of Carnegie-Mellon University in Pittsburgh finds that a family of compounds present in the eye can absorb some specific frequencies of RF radiation. The research is quickly classified by the military due to its implications for "stealth" technology.

Years 5 Ago

• Responding to epidemiological studies by Drs. Anders Ahlbom, Maria Feychting and Birgitta Floderus, the Swedish government announces that it "will act on the assumption that there is a connection" between power-frequency EMFs and childhood cancer.

• Congress authorizes $65 million for an EMF research and public information program, later to be called EMF RAPID.

• Reports from the Hawaiian Department of Health and from the EPA support earlier findings that a leukemia cluster near the Navy's Lualualei antenna farm on Oahu was not due to chance.

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biological effects occur." It also maintains that, "Because of the ubiquitousness of RFR [RF radiation] in the environment from natural and man-made sources, exposure of humans to RFR cannot be easily measured or controlled." A review of RF/MW bioeffects, contained in an appendix to the DEIS, is largely identical to that of a DEIS prepared by SRI on digital television (DTV) broadcasting from Sutro Tower in San Francisco (see *MWN,* J/A 97), even though the DTV waveforms are quite different from those of doppler radar. SRI's principal bioeffects consultants are Dr. Peter Polson and Louis Heynick. TDWR detects low-altitude wind shears, which are blamed for a number of fatal crashes of commercial aircraft. The projected installation is one of 45 such facilities commissioned by the FAA for airports around the U.S. As of May 1997, 24 were in service and 16 were under construction. The FAA shelved an earlier plan to build a separate doppler radar for each New York airport in response to opposition from communities near the preferred sites and from their elected officials, including Sen. Alfonse D'Amato (R–NY). The new plan has also run into opposition. Roberta Sherman, who resides in nearby Mill Basin in Brooklyn, told a local newspaper that, "We have nothing against the tower or airplane safety, but we do not want the radar near our children." Public hearings on the New York radar were held in New York City September 17 and 18. The FAA will accept comments on the DEIS until October 10. For further information on the planned facility and to obtain a copy of the statement, contact: FAA Office of Public Affairs, Federal Bldg. No.111, JFK Airport, Jamaica, NY 11430, (718) 553-3010, Fax: (718) 995-5710.

EUROPEAN COMMISSION

Report on NIR and Health... The EC's *ad hoc* working group on public exposures to non-ionizing radiation (NIR) has issued a report on potential health effects of EMFs and RF/MW, optical, IR and UV radiation. The panel, chaired by Dr. Alastair McKinlay of the U.K.'s National Radiological Protection Board (NRPB), includes four other NRPB members, as well as Germany's Dr. J. Bernhardt and R. Matthes, and Italy's Drs. G. Mariutti, M. Grandolfo and P. Vecchia. Epidemiological studies "point to an association between cancer and electromagnetic field exposure" that merits further research, the report states, but they "fall short of determining causation." (This was written prior to the release of the U.S. NCI study.) The group recommends further research on health effects in all NIR frequency bands. The 163-page report, *Non-Ionizing Radiation: Sources, Exposure and Health Effects,* is available in the U.S. from: Unipub, 4611-F Assembly Dr., Lanham, MD 20706, (800) 274-4888, Fax: (800) 865-3450. Or contact: Office for Official Publications of the European Commission, L-2985 Luxembourg.

ICNIRP–WHO

RF Seminar... The ICNIRP and the WHO have published the proceedings of their *International Seminar on Biological Effects of Non-Thermal Pulsed and Amplitude Modulated RF Electromagnetic Fields and Related Health Risks,* held in Munich, Germany, November 20-21, 1996. The proceedings, edited by Dr. Jürgen Bernhardt and Roger Matthes, the chair and secretary, re-

spectively, of the ICNIRP, and Dr. Michael Repacholi, head of the WHO EMF Project, include 20 papers on biophysical mechanisms and health studies. A consensus statement that called for more epidemiological and *in vitro* studies, while noting that there is "scant" evidence for an RF/MW–cancer link, was drafted by the 44 attendees and submitted to *Bioelectromagnetics* in April. The statement was later revised, following the release of the Repacholi study showing an increase in lymphoma among GSM-exposed mice (see *MWN,* M/J97). The volume, which costs $40.00 plus shipping, is available from Matthes at: Institute of Radiation Hygiene, Federal Office for Radiation Protection, Ingolstädter Landstraße 1, D-85764 Oberschleißheim, Germany, (49+89) 3160-3288, Fax: (49+89) 3160-3289, E-mail: <rmatthes@bfs.de>. For more information, look up the ICNIRP on the World Wide Web at: <www.sz.shuttle.de/dm1001/icnirp.htm>.

Risk Seminar... The ICNIRP is gearing up for its next seminar, *Risk Perception, Risk Communication and Its Application to EMF Exposure,* slated for October 22-23 in Vienna, Austria. The seminar is intended to help government officials deal with public concerns over EMFs through risk assessment. The WHO, the Austrian Ministry of Health and Consumer Protection and the German Federal Ministry for Environment, Nature Conservation and Nuclear Safety are providing support for the meeting. More information and a registration form are available on the ICNIRP's Web pages or by contacting Roger Matthes (see above).

MEDICAL APPLICATIONS

Pulses for Tremors... The FDA has approved a surgically implanted device that electrically stimulates the brain to reduce the shaking caused by Parkinson's disease and "essential tremor," another nervous disorder. The device, produced by Medtronic Inc. in Minneapolis, uses an electrode placed in the thalamus, the region of the brain that controls movement. The electrode is connected by a thin wire to a pulse generator, which is placed near the collarbone. A stream of pulses from the electrode jams tremor-causing signals from the thalamus. Operating parameters vary from patient to patient, Don Harkness, a clinical program manager at Medtronic, told *Microwave News*. Typically, the pulses are 90 ∝sec wide, with a voltage of 2.5-3.0 V. In most patients, the pulses are repeated at either 130 Hz or 185 Hz. Each half of the thalamus controls one side of the body, and therefore a two-electrode system is needed to calm all tremors. The FDA, however, did not approve the use of twin electrodes. The agency is requiring Medtronic to further study their safety, as well as the long-term effects of the electrical pulses on brain tissue. According to Medtronic's Jessica Stoltenberg, both single-electrode and bilateral versions of the pulser have been approved for use in Europe, Canada and Australia.

Microwaves for Hair Removal... Microwave Medical Corp. in Simi Valley, CA, has received the go-ahead to begin clinical safety tests of a procedure that it claims can permanently remove unwanted hair with microwaves. Dr. Robert Spertell, the company's chief scientist, told *Microwave News* that the technique uses pulsed radiation above 2 GHz, but declined to be more specific while patents are pending. In a press statement, Spertell did report that he observed "complete destruction" of hair follicles in

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"Leak Links Power Lines to Cancer"

New Scientist (U.K.), October 7, 1995

MWN

Microwave News, July/August 1994

"Digital Cellular Phones Can Disrupt Implanted Pacemakers"

"Cellular Phones May Affect Use of Pacemakers"

Wall Street Journal, April 28, 1995

MWN

Microwave News, November/December 1995

"Higher Leukemia Rates Among Those Living Near Australian TV Towers"

"Living Near TV Towers a Leukemia Risk for Children, Claims Researcher"

Sydney Morning Herald (Australia), December 10, 1996

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preclinical tests. Independent Review Consulting in San Anselmo, CA, which evaluates clinical testing in the institutional review board system in the U.S., gave permission to Microwave Medical to run clinical trials. Microwave Medical hopes to market the system in Europe, South America and Canada, as well as in the U.S.

MEETINGS

Breast Cancer Workshops... The National Action Plan on Breast Cancer (NAPBC) is organizing two November workshops on radiation and breast cancer in the Washington, DC, area. *A Workshop on Electromagnetic Fields, Light-at-Night (LAN) and Human Breast Cancer* will be held November 18-19. Sweden's Dr. Maria Feychting will present the results of her long-awaited epidemiological study (see p.2). The cochairs of the workshop planning committee are Dr. Robert Liburdy of the Lawrence Berkeley Lab in Berkeley, CA, and Dr. Richard Stevens of the Battelle Pacific Northwest Labs in Richland, WA. Immediately preceding the EMF–LAN workshop, on November 17-18, the NAPBC will sponsor *A Workshop on Medical Ionizing Radiation and Human Breast Cancer.* Attendance at each meeting is free but will be limited to 125 people. For more information, contact: NAPBC, U.S. Public Health Service's Office on Women's Health, 200 Independence Ave., SW, Room 718F, Washington, DC 20201, (202) 401-9587; or look up the NAPBC on the World Wide Web at: <www.napbc.org>.

PEOPLE

Dr. **Merril Eisenbud** died on August 16 of leukemia. The first director of the Atomic Energy Commission's health and safety lab in 1947, he later taught at New York University's (NYU) Institute of Environmental Medicine. Dr. **Asher Sheppard** and Eisenbud wote the first book on EMFs and health, published in 1977 by NYU Press: *Biological Effects of Electric and Magnetic Fields of Extremely Low Frequency.* In the late 1970s, Eisenbud was a member of the Electromagnetic Radiation Management Advisory Council (ERMAC), a federal committee that was first based in the White House and later transferred to the NTIA.

WIRELESS

EPRI on RF/MW Radiation... The Electric Power Research Institute has advised its members to take a close look at RF/MW sources on their properties and rights-of-way, and at possible RF/MW exposure of their employees. A report prepared by EPRI's Dr. Charles Rafferty and Ronald Skelton identifies "issues of possible concern" associated with RF/MW sources, focusing on cellular and PCS phones and base stations. The report also covers standards for exposure, as well as ongoing research on possible health hazards. Rafferty and Skelton caution that, "It is possible for workers to be exposed to fields exceeding U.S. standards if they work in close proximity" to base stations. They advise utilities to ensure that exposures do not exceed the ANSI/IEEE standard, by reviewing and modifying work practices and by training employees. Copies of the report, *Health and Safety Issues of Radiofrequency Fields from Wireless Communications Devices,* are available from: EPRI Distribution Center, 207 Coggins Dr., PO Box 23205, Pleasant Hill, CA 94523, (510) 934-4212.

VIEWS ON THE NEWS

Pulling the Plug on EMF Bioeffects Research

It is a little early to hold a funeral for EMF bioeffects research—but not by much. Never well-funded, the field is losing its major sources of support. The DOE program is slated to close, and the RAPID research effort will end soon (see *MWN,* M/J97). The industry-funded EPRI has money troubles of its own.

EMF bioeffects work is winding down, but not because there is no risk to public health. The evidence for health effects has in fact never been stronger. The opposition to EMF research has little to do with science, but its partisans have waged an aggressive campaign to pull the plug on further funding.

Most scientists doing work in bioelectromagnetics have stayed quiet. The result has been a one-sided argument, with consequences that confirm the old saying: "Silence gives consent."

For example, last July an editorial in the *New England Journal of Medicine* by Dr. Edward Campion declared that "it is time to stop wasting our research resources" on EMF studies (see *MWN,* J/A97). Campion made clear that this sweeping recommendation applies to *all* types of EMF health research. Yet the Bioelectromagnetics Society (BEMS) was too indecisive to respond. The BEMS board may not have agreed with all of Dr. Martin Blank's letter (see p.6), but surely there should have been some response.

The NAS–NRC report on EMFs led to headlines declaring that the issue was settled, but again BEMS said nothing (see *MWN,* N/D96). And the group gave only a weak, indirect answer to the American Physical Society's call for slashing EMF research (see *MWN,* M/J95).

But BEMS' timidity is not the problem—it is a symptom. The real issue is that the atmosphere in this field has been corrupted by dependence on industry and the military for funding. (The DOE and RAPID programs are only partial exceptions.) In such an environment, there is great pressure, both explicit and silent, to be a "team player." Those who never offend the patrons of research become known as responsible and objective—part of the scientific mainstream. Those who follow the data wherever it goes can be marginalized, and find it harder to get grants.

This leads to silence, even in the face of blatant attacks on scientific inquiry. When Dr. Gilles Thériault of McGill University reported a tenfold increase in lung cancer risk among utility workers with the greatest exposures to high-frequency transients, the study's sponsor, Hydro-Québec, blocked his access to the data (see *MWN,* N/D94). Imagine what would happen if Dow Chemical reacted that way to a pesticide study. Yet not a single member of the EMF community publicly condemned Hydro-Québec's outrageous behavior.

Research can be sabotaged in other, less obvious ways. For example, studies of EMF health effects are rarely followed up, even when they point to significant risks. Dr. Eugene Sobel of the University of Southern California has linked EMF exposure to three-to-fourfold increases in the risk of Alzheimer's disease in four different worker populations (see *MWN,* J/F97). Dr. Anthony Miller of the University of Toronto has found that when both electric and magnetic fields are taken into account, EMF exposures on the job are linked to a leukemia risk up to 11 times higher than expected (see *MWN,* J/A96). In both cases, interest in funding further study has been less than overwhelming.

With good reason, scientists trust a result only after it has been independently replicated. Studies that had not been repeated were ignored by the NAS–NRC EMF panel. So without funding for replication, Sobel's and Miller's work can be ignored.

Of course, lip service is paid to the need for follow-up. The president of EPRI declared that Dr. Genevieve Matanoski's results on cancer among telephone line workers "clearly warrant further study" (see *MWN,* M/J93). Yet when Matanoski, of Johns Hopkins University, sought funding for such research, EPRI's checkbook stayed closed.

Criticizing the powers-that-be is not considered a smart career move. You can find yourself labeled an ideologue, or even a purveyor of "junk science"—when, in fact, this better describes those who want to shut down EMF research.

The *New England Journal* editorial is an example of how distorted the atmosphere has become. The *Journal* hailed the National Cancer Institute's recent study of EMFs and childhood leukemia—and then lumped together concerns about EMFs, radar and cellular telephones. If anyone cited a study of cellular phone radiation and brain cancer as evidence that power lines cause leukemia, they would be ridiculed. Yet Campion makes a similar argument and gets away with it.

Bioelectromagnetics researchers believe they have little to gain by taking part in public disputes. Many honest researchers just keep their heads down and get funding wherever they can. Other talented scientists have quietly left the field.

With few alternative sources of support, it is easy to adopt the mental habit of not biting the hand that feeds you. But with calls to cut EMF research growing louder and winning more support, the habit does not do science or public health much good. These days, it looks like EMF researchers are reluctant to bite the hand that starves them.

The electromagnetism of life is a vastly understudied subject—compared, for example, to biochemistry. Lack of support for EMF research not only keeps us ignorant of possible risks, it deprives us of technology that could help fight injury and disease. FDA-approved devices to help bone repair are just a hint of what might be possible if the field got appropriate attention.

EMF bioeffects research does not have to die. But if it is to have a future, scientists who believe that bioelectromagnetics is worthy of serious study cannot remain silent. Society will never give this field the support it deserves if the scientists involved in it do not speak out—loudly—to defend its importance.

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EMF Research Must Continue

Canada May Limit RF/MW Eye Exposures from Mobile Phones

Compliance Problem for Walkie-Talkies?

A draft of a Canadian standard for radiofrequency and microwave (RF/MW) radiation would limit exposure to the eyes from cellular phones, a provision strongly opposed by industry. No other country has adopted a radiation standard for the eyes.

Canada's RF/MW rules have had limits on eye exposure since 1991, but so far these have not applied to walkie-talkies or cellular phones. The current controversy was sparked when Health Canada, the federal health agency, proposed an end to this exemption as part of a revision of the standard.

Dr. Art Thansandote of Health Canada's Radiation Protection Bureau in Ottawa declined to discuss what changes might be made to the guidelines, known as Safety Code 6, and refused to release a copy of the current draft. "The revision is still under way, and will not be completed for another six months," he said in a September interview.

"There has been quite a lot of resistance to the eye limit," Dr. Paul Cardinal, director of Aprel Laboratories in Nepean, Ontario, told *Microwave News*. But despite industry's intense opposition, said Cardinal, "Health Canada has not removed the eye requirement."

Aprel Labs is a member of the Radio Advisory Board of Canada (RABC), an industry group based in Ottawa. The government requested the RABC's comment on a new draft of Safety Code 6 in 1996, and has asked it to review later versions. The RABC has argued that the scientific basis for the eye standard is weak and that testing to prove compliance would be too expensive,

(continued on p.10)

DOE EMF Research Program Folds; Appeals To Continue Rebuffed

The long-running electromagnetic field (EMF) research program at the Department of Energy (DOE) shut down, perhaps for good, on September 30, the end of the U.S. government's 1998 fiscal year.

The DOE did not request funds from Congress to continue the program, which began in the mid-1970s, and Congress did not move to salvage the research effort.

"The DOE has said that as far as it's concerned, there is no reason for its role to continue," a congressional aide told *Microwave News*. He noted that the final report of the National Institute of Environmental Health Sciences (NIEHS) on the five-year EMF RAPID research program had not yet been delivered to Congress, and added, "Since the NIEHS is an agency of the Department of Health and Human Services (HHS), anything further would be

(continued on p.3)

NIEHS Working Group Report: Talk of Tucson and Washington

The National Institute of Environmental Health Sciences (NIEHS) has been hearing public reactions to its Working Group report that classified EMFs as possible human carcinogens (see *MWN,* J/A98). Here are some highlights of the Tucson, AZ, and Washington hearings, held September 14-15 and September 28, respectively. (Two more meetings were held, in San Francisco on October 1 and in Chicago on October 5.)

• In Tucson, Dr. Christopher Portier announced that the NIEHS had not yet decided what will be in NIEHS Director Kenneth Olden's report to Congress on the EMF RAPID program, but that it is "unlikely" to include a detailed risk analysis of EMF impacts on health. He said that it will "definitively" include the identification of EMF hazards and perhaps a dose-response analysis for childhood leukemia—but probably not for chronic lymphocytic leukemia among workers. In other words, the report will indicate whether there are health risks, but it is unlikely to quantify their relative size. Portier also pointed out that the Working Group report is only one of the inputs to Olden's report. Portier, the director of the NIEHS Lab of Computational Biology and Risk Analysis, predicted, in an October interview, that the "NIEHS' initial draft of the report will be ready in November or December." When asked when it will be sent to Congress, Portier answered, "My hope is within four weeks of the initial draft."

• Given that the Working Group voted to classify EMFs as "possible human carcinogens," what advice should be given to the public about possibly reducing EMF exposures? Dr. Indira Nair of Carnegie Mellon University in Pittsburgh was invited to explore possible options at the National EMF Advisory Committee (NEMFAC) meeting, also held in Tucson, on September 17. "Inaction is not an option," said Nair. She offered three strategies: "avoid when possible," "pursue research" and "keep people informed." She stressed that she "would err on the side of caution...because children are implicated." This is an "ethical," rather than a scientific, argument, she said. The NEMFAC members agreed to write a letter to Olden recommending that the NIEHS provide the public with information on "low- and no-cost options for minimizing personal exposure to EMFs, for those individuals who choose to exercise these options."

• Another oft-asked question in Tucson was how the Working Group would have classified EMFs if it had used the cancer guidelines developed by the Environmental Protection Agency (EPA). At the Washington meeting, *Microwave News* caught up with the EPA's Dr. Robert McGaughy, who has been evaluating EMF cancer risks for more than a decade. " If this were a chemical and we had some mechanistic data," McGaughy said, "there is no doubt that we would have classified EMFs as a B1 carcinogen—a probable human carcinogen." Of course, mechanisms are where the cancer connection is most controversial, but as far back as 1990, McGaughy and his staff judged EMFs to be probable carcinogens. They were overruled by senior managers, however. Instead, EMFs were called possible carcinogens (see *MWN,* M/J90), the same designation chosen by the NIEHS panel based on criteria developed by the International Agency for Research on Cancer. Later drafts of the EPA analysis continued to maintain that EMFs are a risk factor for cancer (see *MWN,* J/F98). A different view of how the EPA's analysis might have turned out was presented by Kathleen Shanley of United Illuminating Co. in New Haven, CT, on behalf of the Edison Electric Institute in Washington. Using a new set of guidelines, which are under review at the EPA but not yet adopted, Shanley said that animal studies showing the lack of an effect in two species would provide some assurance that there is in fact no cancer risk. "Our reading of the scientific data," she said, is that, "EMFs are not a threat to public health."

• Many people spoke at the public meetings, with varying degrees of eloquence. The most forceful presentations were those from breast cancer activists—not from the myriad groups that have sprung up over the years to oppose power lines. Indeed, the EMR Alliance, based in New York City, was not represented at the meetings, nor did it submit written testimony. Speaking on behalf of the West Islip Breast Cancer Coalition on Long Island, NY, Barbara Balaban argued for more research and more public information (see also p.3). She also urged action: "If EMFs *may* present a risk, then what is the harm in educating people about those measures they can take to avoid unnecessary exposure?" Balaban recommended the ALARA principle—that exposures should be as low as reasonably achievable.

Report Has Major Impact in Japan

The NIEHS Working Group report has stirred public concern over EMF health risks in Japan.

"Many people who oppose the utilities are using the report to fight transmission lines and substations," Dr. Tadashi Negishi of the Central Research Institute of the Electric Power Industry (CRIEPI) told *Microwave News*. "The utilities are facing a hard time," he said.

Professor Hiraku Takebe of the Atomic Energy Research Institute at Kinki University disagrees with the conclusions of the working group and criticized the NIEHS over the makeup of the panel. "There were too many epidemiologists on the committee," he said in an interview. Takebe, a geneticist who works on DNA repair mechanisms, blamed the media for reinvigorating the activists. "I am confident that the media are purposefully distorting the facts," he said.

CRIEPI's Negishi said that there has been an overreaction to the report in Japan because, in his opinion, many people are misinterpreting the "possible carcinogen" designation as an indication that EMFs "can" cause cancer. He maintained that this is especially true for newspaper and television reporters.

Even before the release of the working group's decision and report, the Japanese government had increased support for EMF health research (see *MWN,* M/J98). Negishi and Takebe were among 13 Japanese industry, academic and government officials at the DOE's EMF review and at the NIEHS public meeting, both held in Tucson, AZ, in mid-September. More people attended from Japan than from any other country outside the U.S.

more related to the HHS. I don't see the DOE coming back to it."

The congressional staffer suggested that utilities saw less need for research now that the RAPID program was coming to a close. "I think the utilities got into this because there was consumer concern, but at some point you have to come to a conclusion," he said. "That was the purpose of the five-year program."

Shirley Linde, the chair of the National EMF Advisory Committee, spearheaded a lobbying campaign directed at high-level DOE managers to try to save the program. To date, they have not committed any of the DOE's budget to continue health research. Last April, Linde presented the DOE with a petition signed by more than 1,000 breast cancer activists who wanted the program saved (see *MWN,* M/J98).

"It is reprehensible that research is stopping in the U.S. at a time when the NIEHS panel has pointed to a possible cancer risk," she told *Microwave News*. In June, a working group assembled by the NIEHS recommended that EMFs be classified as "possible human carcinogens" (see p.2 and J/A98). "How can we walk away when children are at risk?" she asked.

"This would not seem to be an opportune time for concluding EMF research," said Dr. Imre Gyuk, who has managed the DOE's program for more than ten years.

Gyuk held out some hope that the DOE might resurrect the research program. "A plan has been submitted at the request of senior management, and it is still being considered," he said in an interview in early October.

Speaking at the NIEHS public meeting in San Francisco on October 1, Nancy Evans, a Breast Cancer Fund board member who collected the signatures on the petition, urged that the DOE "core program" continue, in order to examine "the broad questions of health and disease related to the broad spectrum of nonionizing electromagnetic frequencies."

With the EMF RAPID research program at the NIEHS also coming to an end, the federal government has essentially abandoned EMF health research—except for a few grants from the National Institutes of Health. The Electric Power Research Institute (EPRI) in Palo Alto, CA, is the last major source of funds in the U.S. Its 1998 EMF budget is approximately $9 million, according to EPRI's Barbara Klein. The 1999 budget has not yet been set, she said.

At the NIEHS' September 14-15 public meetings in Tucson to hear comments on the working group's report, speaker after speaker urged that EMF research be continued, especially at the DOE. (The meetings were held during the DOE's annual EMF research review.) For instance, Marcus Barnes of Aerodyne Laboratories in Austin, TX, said that continuation of the DOE program is "crucial and imperative" in order not to "squander the last 20 years of research." And Dr. Carl Blackman of the Environmental Protection Agency (EPA) called the program a "national resource."

Because many of the speakers were researchers themselves, some might have interpreted their pleas as self-serving. But other speakers, who must give advice on EMF safety issues, made similar appeals. Gordon Miller, an industrial hygienist at the Lawrence Livermore National Lab in Livermore, CA, said that there was "clear evidence that the research needs to be continued" and pointed out that lingering uncertainty over health effects would spell trouble for the business community, especially for those in real estate who have to contend with depressed property values near power lines.

Is There a Campaign Against EMF Research?

At the Tucson DOE meeting, there were widespread rumors that the Edison Electric Institute (EEI), based in Washington, had lobbied Congress to discontinue all EMF health research. One source, who asked not to be identified, said that he had heard directly from congressional staffers that the EEI has "no interest" in continuing the DOE program. "They want this program to go away," he said.

But Richard Loughery, the EEI's director of environmental activities, unequivocally denied that the EEI is opposed to continued EMF research. "We are not up there [in Congress] lobbying against research. I can say this emphatically," he told *Microwave News* in an interview in Tucson.

Some industry groups are openly endorsing more EMF research. In a letter to the NIEHS, the American Public Power Association in Washington urged the institute to develop a health research program. And Douglas Bannerman of the National Electrical Manufacturers Association in Rosslyn, VA, told *Microwave News* that he favors continued research at the cellular level to understand mechanisms of interaction.

A number of utility representatives and consultants are arguing that, while research should continue, the effort should wait until its past achievements and future goals are evaluated. Ruth Greey, EMF issues manager at Ontario Hydro in Toronto, Canada, told the NIEHS at its Washington hearing on September 28 that she favored a "short hiatus" while public health research priorities are sorted out. Greey also noted that such a break would allow for the completion of some ongoing research projects—for instance, the Canadian and U.K. childhood cancer studies (see p.18).

Dr. Jack Sahl, a consultant based in Pasadena, CA, formerly with Southern California Edison, holds a position very similar to Greey's. He has told the NIEHS that, "Prior to deciding whether to fund new, or expand existing programs, we need to understand the goals and expected products of these programs."

Others countered that any break in funding would force researchers to move to new areas of research. This would mean that the whole field would lose years of expertise and talent, they argued. "It is a mistake to try to reassemble the program later," said Dr. Raymond Neutra, the head of the California EMF program, at the Tucson public meeting.

Last year, the *New England Journal of Medicine* called for an end to EMF studies: "It is time to stop wasting our research resources," argued Deputy Editor Dr. Edward Campion (see *MWN,* J/A97, also N/D96).

Among the institutions that have been supported by the DOE EMF research program are: government labs (Battelle PNL, Lawrence Berkeley and Oak Ridge), government agencies (EPA, National Institute for Standards and Technology and Veterans Administration), universities (Columbia, MIT, Stanford and the University of California) and an independent lab (Midwest Research Institute).

Analysis of Second Utility Worker Data Set Already Begun In Second Test of EMF–Heart Rhythm Hypothesis

Dr. David Savitz's epidemiological study linking EMFs and heart disease is still months from publication—but the first follow-up study is already under way.

"It's incredibly important to follow up and to answer the questions that have been raised," said Michael Herz of Pacific Gas & Electric (PG&E) in San Francisco. Herz told *Microwave News* that the utility is sponsoring the new study "based on PG&E's policy of educating its employees about the health issues of EMFs." The new study is a joint initiative of PG&E, Southern California Edison (SCE) and the Electric Power Research Institute (EPRI).

"We need to do this as quickly as possible," said Dr. Jack Sahl, adding that he has already started analyzing an existing data set on 40,000 SCE workers. These data were originally collected by Sahl, a former SCE employee, in a study of cancer and EMF exposure in the utility's workforce (see *MWN,* M/A93). Now a consultant based in Pasadena, CA, Sahl will investigate whether the SCE data show the same patterns of cardiac mortality found by Savitz.

In a paper that began circulating this summer, Savitz and Dr. Antonio Sastre describe an increased risk of two types of heart disease among 140,000 utility workers—an increase that Sastre had predicted, based on laboratory studies of reductions in heart-rate variability (HRV) and EMF exposure (see *MWN,* J/A98). The study will be published in the January 15, 1999, issue of the *American Journal of Epidemiology.*

HRV is a measure of the constant, natural variations in heart rhythm that result from the interplay of several reflexes controlling the heart—not the more dramatic changes that result from exercise or anxiety. HRV is increasingly used by cardiologists as a diagnostic tool, and several studies have found that it can predict the risk of certain heart conditions.

The reductions in HRV that Sastre and Dr. Charles Graham, both of the Midwest Research Institute (MRI) in Kansas City, MO, observed in their EMF studies led them to believe that EMFs might increase the risk of two kinds of heart disease associated with poor control of cardiac reflexes. This is exactly what was found when Savitz, of the University of North Carolina, Chapel Hill, tested the hypothesis against data from his earlier study of workers at five electric utilities—including PG&E (see *MWN,* J/F95).

The few studies on EMFs and cardiovascular risk have lumped together all types of heart disease, and most have not pointed to any increase. One exception, however, emerged from Sahl's own SCE worker study. In a subsequent analysis of overall mortality, published in 1997, Sahl compared cardiovascular mortality among SCE's office staff to that of field workers, such as linemen or meter readers. He found significant increases among nonmanagement field personnel, ranging from 42% to 71%—increases which their paper notes, but does not discuss.

"When I was doing the original analysis, I thought this would likely be due to lifestyle factors," Sahl explained in an interview. He pointed out that smoking, diet, alcohol consumption and other lifestyle factors can all increase the risk of heart disease. "But now," said Sahl, "in light of the Savitz results, we should take another look." In fact, he added, "I suspect that we will support the Sastre hypothesis."

Sahl also found that SCE employees had a lower rate of death from cardiovascular disease than did the population as a whole, which he cited as an example of the "healthy worker effect"—the fact that people in poor health are less likely to be employed.

Sahl expects to have results from his cardiac analysis by the end of next June. He said he will try to replicate the approach of the Savitz heart study "as much as possible." Sahl added that the SCE data set includes some additional information: measurements collected with EMDEX II personal exposure meters; data on heart disease incidence, not just mortality; and more information on potential confounders.

"It is an important project," said EPRI's Dr. Robert Kavet, a coauthor of the Savitz heart study. He commented that Sahl's study is "an opportunity to look at a cohort with quality data."

"You shouldn't look only at magnetic fields," Kavet cautioned. "You have to understand the entire worker experience." He cited shift work, stress, contact currents and possible chemical exposures as some of the other factors that must be considered. Kavet also noted that Sastre's latest lab studies of HRV and EMF exposure, supported by EPRI, are not consistent with his original findings.

In experiments conducted at the MRI in 1997 and 1998, HRV seemed unaffected by EMF exposure. "The results were so unbelievably negative," Sastre told *Microwave News.* "We didn't see a thing."

Sastre explained that he was not surprised when continuous EMFs, at both 200 mG and 900 mG, showed no effect in the latest studies: This had been true for continuous exposures in earlier experiments, carried out between 1993 and 1995. But in a 1997 study conducted for EPRI *(Effects of Magnetic Fields on Cardiac Control Mechanisms,* TR-108251, November 1997), there was also no effect from intermittent exposures of 200 mG. In contrast, Sastre stated, in previous experiments at the same exposure, "We had good statistical power and the effect was very clear-cut."

Sastre noted that the EMF–HRV association was originally observed in experiments on EMFs and melatonin in which blood was drawn from subjects every hour overnight. Although blood was taken using a catheter, subjects' sleep was somewhat disturbed by the procedure. This slight arousal might interact with the effects of EMFs, Sastre's report to EPRI suggests. He said that an experiment now under way in his lab may shed some light on this.

Sastre also noted that some people might be more sensitive to EMFs than others, and that the number of subjects in each experiment was small. Finally, he said, the more recent experiments were conducted in a different facility, in which the earth's static magnetic field is somewhat different.

"I am troubled," said Sastre. "Obviously there are things about

this we don't understand." But at present, he said, "I still think it is a real effect—but we have not defined all the [necessary] conditions to make it evident."

Research on HRV and EMFs "should definitely be pursued," Dr. Raymond Neutra, head of the California EMF program, told *Microwave News*. "We continue to support future research," said PG&E's Herz, adding that, "I would also want to look at electric fields and contact currents in future studies."

Bank Refuses Mortgage, Citing Utility Substation Next Door

A New York bank has turned down a home owner's mortgage application after concerns were raised about EMFs from an electrical substation next door. The substation is operated by the New York utility Consolidated Edison.

"The bank wanted some documentation from Con Ed that the substation is not a health hazard or grounds for concern," home owner Susan Archer of White Plains, NY, said in an interview. A conference call was held around the beginning of July, "with me, the bank and Con Ed all on the line," Archer said. "Con Ed told us that the site had been tested for PCBs and that the levels are insignificant." In a move she may now regret, Archer asked whether Con Ed had measured EMFs at the site. In response, she stated, "Con Ed said they'd have to get back to us."

In mid-July, a Bank of New York (BONY) loan coordinator wrote to Archer, rejecting her request for an $80,000 mortgage on the grounds that the house was insufficient collateral. BONY's appraiser's report warned that the substation might cause Archer's property "to suffer from environmental conditions." According to Archer, no other environmental factors besides EMFs and PCBs were ever mentioned.

"It doesn't add up," Archer contended. She inherited the house from her parents, owns the property free and clear—and said it was appraised at $175,000. She said a BONY representative told her "that it was devalued by $50,000 because it was next to the substation."

Michelle Zachensky, a vice president at BONY in Harrison, NY, told *Microwave News* that she could not discuss a specific loan application. But, she added, "We don't have a policy that if you're near a substation or the EMFs are higher, that we wouldn't grant a loan. I don't even know how we'd know about EMFs, anyway—we don't test for that."

After BONY refused Archer's request for a mortgage, Con Ed agreed to do an EMF survey at the substation. "They said that you can submit this report to BONY to show the bank that there's no problem," Archer explained.

"We did the survey as a courtesy to Ms. Archer," Con Ed spokesperson Michael Spall said in an interview. "We realized she was in a difficult spot." The survey was performed on August 7, but Con Ed did not send Archer a copy until mid-September, after it had been reviewed by Con Ed's legal department. Asked about the delay, Spall responded, "Obviously, there are legal and financial issues here, in terms of her home having its price reduced by her lending institution."

Con Ed's caution may have been increased by the media attention that Archer's case received. The August 7 EMF survey was filmed by CNN, and according to Archer, "When Con Ed saw that CNN was there, we had to wait another two hours for its PR person to get out there." The network ran a story about Archer on September 8.

Con Ed's survey states that 60 Hz EMFs at the border with Archer's property go no higher than 1.3 mG. Measurements at the edge of the substation building, which Archer says is eight feet from the border with her property, range up to 22.8 mG.

Archer's father, who had lived in the house since the 1950s, died of leukemia in 1994. "Until now, I had never thought about the health question," she told *Microwave News*.

EPRI Weighs Initiative on Neurodegenerative Disease

The Electric Power Research Institute (EPRI) may soon sponsor research on the possible link between EMFs and neurodegenerative disease. To that end, the institute hosted a workshop in Pajaro Dunes, CA, a beach resort near Monterey, July 30-31.

"We came to learn," said Dr. Robert Kavet of EPRI in Palo Alto, CA. "While we didn't become experts overnight, it helped us understand some of what it will take to design studies in this area." Kavet called the session "a cross-pollination experience." He told *Microwave News* that the meeting had helped EPRI establish relationships with some of the leading researchers on neurodegenerative disease.

"It was a good start," said Dr. Stanley Appel, a neurologist known for his studies of amyotrophic lateral sclerosis (ALS) and Alzheimer's disease. "Obviously, the next step is to plan specific research aimed at understanding mechanisms," added Appel, who heads the neurology department at the Baylor College of Medicine in Houston.

Appel explained that this would be easiest to do in the case of electric shock, since it is already known that electric shock can cause tissue damage and inflammation of the central nervous system (CNS). With other types of EMF exposures, Appel said, "There could be some definite CNS effects, but it's harder to translate existing data into mechanisms. There's still a lot of conjecture." Still, he said, both types of exposure should be studied.

A higher rate of ALS was found in a study of Danish utility workers, published this summer, but the researchers could not say whether shocks or other EMF exposures were the more likely cause (see *MWN,* J/A98).

Dr. Eugene Sobel, an epidemiologist who has studied EMFs, Alzheimer's disease and ALS (see *MWN,* J/F97), said he expects that EPRI's initial emphasis would not be on large epidemiological studies, but rather on laboratory and animal research. "This might include studies of amyloid beta or melatonin production in people exposed to EMFs at work," stated Sobel, of the University of Southern California in Los Angeles.

Kavet said that EPRI is still evaluating its approach to research on neurodegenerative disease.

New Epidemiology on Breast Cancer, Melatonin Hypothesis

The melatonin hypothesis on breast cancer, EMFs and light-at-night is one of the few well-defined mechanisms through which EMF exposure might act to increase cancer risks. Various studies have shown that melatonin has anticancer effects, and that melatonin levels can be reduced by exposure to light-at-night or to EMFs (see, for example, *MWN,* M/A97 and N/D97). Three new epidemiological studies add to the data on the melatonin hypothesis; of these, two lend support and one does not.

EMFs at Home and at Work

Looking only at residential or occupational histories may underestimate a person's total exposure to EMFs. Last year, Dr. Maria Feychting, Ulla Forssén and Dr. Birgitta Floderus, all of the Karolinska Institute in Stockholm, Sweden, showed that risk ratios for adult leukemia are higher when both sources of exposure are included (see *MWN,* J/A97). Now these researchers, together with Karolinska's Dr. Anders Ahlbom, have applied the same approach to female breast cancer.

In an earlier study of breast cancer and residential exposure alone (see *MWN,* N/D97), Feychting and colleagues had found that exposures above 1 mG led to a sevenfold increase in risk for women under 50 whose breast cancer was estrogen-receptor-positive (ER+). But EMF exposure did not increase risk among women of all ages, and the association for women who were younger and ER+ was of borderline significance—at least partly due to the small number of cases.

The current study looked at these data together with information on occupational exposures. Once again, there was no overall increase in breast cancer risk. "However," the Swedish researchers state, "there was a tendency toward an association for women under age 50," as well as for those with ER+ tumors. Women under 50 with higher exposures to EMFs both at home and on the job had over four times the risk of others, while ER+ women showed about a doubling of risk.

Estrogen stimulates the growth of tumors that are ER+. Since a reduction in melatonin results in increased levels of estrogen, the melatonin hypothesis suggests that EMF exposure might increase risk of ER+ breast cancer.

Speaking in mid-September at the U.S. Department of Energy's annual EMF research review in Tucson, AZ, Forssén cautioned that these associations could be a result of random variation. None of the increased risks she reported is statistically significant, due at least in part to the small number of cases. EMF exposure also appeared to show a protective effect for breast cancer among women over 50, or whose disease is not ER+.

Forssén told *Microwave News* that the Karolinska team plans to continue this line of research by looking at a group of women with high occupational EMF exposures, possibly sewing machine operators, in conjunction with information on the ER status of the breast cancer cases.

Dr. Tore Tynes of the Norwegian Radiation Protection Authority in Oslo called Forssén's findings "interesting," but hard to interpret because of the small numbers involved. "We have to sort out whether this is a large problem or not," said Tynes in an interview. "We need some large studies."

Water Beds, Electric Blankets and EMFs

Dr. Marilie Gammon of the Columbia University School of Public Health in New York City and colleagues examined the use of electric blankets, heating pads and water beds, and found no association with the risk of breast cancer. The study did not distinguish between the three different devices.

"We found little or no increase in risk [associated] with having ever used these devices, with continuous use during the night or with increasing duration of use," Gammon and colleagues report in the September 15 *American Journal of Epidemiology (148,* pp.556-563, 1998). They state that their work "does not support" the hypothesis that EMFs might be especially likely to increase risk for women who develop ER+ breast cancer.

Gammon's study drew on a few questions included in a larger study of breast cancer among younger women—the Women's Interview Study of Health. Interviews were conducted with 2,199 cases and 2,009 controls in metropolitan Atlanta, central New Jersey and the Seattle area.

"It is not possible to draw sound conclusions about breast cancer and electric bed heaters from this study," commented Dr. Nancy Wertheimer of Boulder, CO, "since it does not specify the type of heater or when it was used." She pointed out that EMF exposures from water beds can vary widely, depending on placement of the heater.

Since the study's interviews did not separate the use of water beds from the use of electric blankets, Gammon told *Microwave News,* her team tried to find data on patterns of use in the geographic areas where the study was conducted. Unfortunately, she said, no such data were available. But, she added, based on anecdotal reports in all three areas, "Our general feeling is that it's mostly electric blankets." Gammon said that she looks forward to seeing results from three ongoing EMF–breast cancer studies with measured field levels, by Drs. Scott Davis, Cristina Leske and Stephanie London (see *MWN,* S/O96 and N/D97).

Cancer Rates Among the Blind

Light-at-night can reduce melatonin levels in humans—with some exceptions. In most people who are totally blind, light does not affect melatonin production, and it has been hypothesized that blind people may have lower rates of cancer as a result.

A new study by Karolinska's Dr. Maria Feychting found a cancer rate among totally blind people that was about 30% lower than that in the Swedish population as a whole. The difference is statistically significant, and Feychting concludes that this "support[s] the hypothesis of a protective effect of melatonin on cancer development." The study appears in the September issue of *Epidemiology (9,* pp.490-494, 1998).

Feychting and Dr. Anders Ahlbom identified a cohort of 1,567 people who were completely blind and 13,292 people with severe visual impairment. The incidence of cancer among the completely blind was only 69% of that for the entire Swedish population. Among those not blind but visually impaired, there was a slight 5% reduction, which was marginally significant.

It has been suggested that a reduction in melatonin may specifically "increase susceptibility to sex hormone-related cancers"

such as breast cancer. But Feychting and Ahlbom found that, "Results for prostate cancer and female breast cancer were similar to the results for all cancers combined."

In an accompanying editorial, Dr. Robert Hahn of the Centers for Disease Control in Atlanta points to this finding and argues that if melatonin does reduce the risk of breast cancer, it does not or does not only do so by affecting sex hormones. A 1991 study by Hahn pointed to a lower rate of cancer among blind women in the U.S. (see *MWN,* S/O91). Feychting and Ahlbom write that their findings "suggest a mechanism by which melatonin has an effect on cancer in general, such as...[being] an antioxidant and a free-radical scavenger."

Feychting points out that a weakness of her study is the lack of information on potential confounders, such as smoking. But results were similar for cancers that can be related to smoking versus cancers that are not related to smoking. And she points out that, "Several of the potential confounding factors would act in the opposite direction to the hypothesized effect of melatonin"—if, for example, blind women are less likely to have children, or do so at a later age.

HIGHLIGHTS

« Wireless Notes »

It is no longer too early for an epidemiological study to determine whether mobile phone use increases the risk of brain cancer. That is the conclusion reached at a meeting of scientists at the headquarters of the **International Agency for Research on Cancer** (IARC) in Lyon, France, September 1-2. Scientists from ten countries evaluated the results of preliminary surveys in Australia, Canada, France, Germany, Israel, Italy, New Zealand, Sweden and the U.K. and concluded that a sufficient number of people have used wireless phones for enough time to allow the detection of a possible effect on cancer risk—even a small one. "We had to be sure there were enough users five or more years ago," said Dr. **Elisabeth Cardis**, who heads IARC's radiation and cancer unit. An effect on cancer risk "would probably not be detectable in less than about five years from first use," she explained. The preliminary studies found that approximately 2% of adults in the nine countries were using mobile phones in 1992. Work will now begin on a detailed design for a large-scale, multi-country study, which is expected to include more than 3,000 people with brain tumors and a similar number of controls. Estimating users' past exposures to radiation emitted by their phones will be a central problem of the study, according to the IARC researchers. Participating scientists will seek funding from local, national and international sources. IARC anticipates that the study could begin as early as late 1999, with results expected in 2003 or 2004. "We presently have no evidence that mobile phone use is linked to brain tumors," said Dr. **Bruce Armstrong**, who chaired the September meeting, adding that, "If it is, the risk for an individual user is likely to be very small." Armstrong is director of the Cancer Control Information Center in Sydney, Australia.

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A recent visitor to **China** told us, *"Everyone* there is using a cell phone!" Well, maybe not everyone—but among the middle and upper classes in large Chinese cities, cellular phones are wildly popular. But some Chinese consumers are apparently concerned about possible health effects: A widely available device for "**hands-free**" use of mobile phones is being marketed with an anti-radiation pitch. The **Walkera** earphone/microphone combination promises that its use will "Protect Your Brain," "Guarantee Safer Driving" and "Prevent Radiation." Consumers are informed that, "Walkera eliminates the hazard of microwave radiation, and provides you with clear sound and supreme convenience."

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The **Australian** government is sponsoring a major study on cellular phone radiation and cancer, following up on Dr. **Michael Repacholi**'s finding of a doubling of lymphoma among GSM-exposed mice (see *MWN,* M/J97). "While the jury is still out on [mobile phones'] effects, this issue deserves money and resources, and we have committed both," said Trish Worth, a member of Parliament from Adelaide and Parliamentary Secretary for Australia's health ministry. The Aus$1 million grant (approximately US$615,000) is the largest so far in the government's Aus$4.5 million RF/MW health research program, which was launched in 1996 (see *MWN,* N/D96). Three previous awards, totaling Aus$215,000, were announced over the summer (see *MWN,* J/A98). There had been rumors that **Motorola** might fund its own replication of Repacholi's research, but spokesperson Norman Sandler told *Microwave News* that this is not the case. He said that Motorola will give the Australian team some technical assistance in the design of its exposure system, and may also donate some equipment. The research will be carried out at the **Institute of Medical and Veterinary Science** in Adelaide, where Repacholi did his original study, and will be led by the institute's director, Dr. **Barrie Vernon-Roberts**. Vernon-Roberts told Australia's *The Age* (September 10) that the study will provide a "definitive" answer to the question, "Can mobile phone-type radiation cause cancer in animal systems?" Results are expected by 2001.

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Dr. **George Carlo**'s consulting firm, Health & Environmental Sciences Group Ltd. in Washington, has announced the appointment of **Thorne Auchter** as its chief operating officer. Auchter was head of the Occupational Safety and Health Administration during President Ronald Reagan's first term (1981-1984). In addition, **Jeffrey Nesbit** has joined the firm as the director of public policy. Nesbit was an associate commissioner for public affairs at the FDA and communications director for former Vice President Dan Quayle. The Health & Environmental Sciences Group states that it "specializes in assessing, communicating and managing risks to public health."

FCC Brokers Agreement on Cell Tower Moratoriums

Wireless industry representatives have agreed with state and local officials on voluntary guidelines for moratoriums on cellular phone towers and on an informal process for mediating disputes. The guidelines recognize moratoriums as appropriate policies for towns, a shift from industry calls for the Federal Communications Commission (FCC) to preempt all such delays.

The agreement is the most significant result to date of the FCC's effort to defuse the conflict over wireless antenna siting without invoking its preemption powers. In an August 5 press release, the FCC hailed the pact as "historic."

Nevertheless, some federal lawmakers are still pressing to shift siting authority from the federal government back to states and towns. On September 24, Sen. Patrick Leahy (D-VT) and nine cosponsors introduced S.2514, an updated version of Leahy's bill to repeal the 1996 Telecommunications Act's federal preemption clause (see *MWN,* N/D97). The earlier measure stalled in committee after its introduction last fall.

"The FCC rules should not stand," Leahy demanded in the Senate, arguing that, "To deprive states of the ability to protect their land from unsightly towers is wrong."

The pressure for legislation reflects the fact that local officials still face numerous restrictions in developing siting rules. For example, the Telecom Act prohibits communities from setting stricter limits for public exposure to RF/MW radiation from wireless antennas than those issued by the FCC (see *MWN*, M/A96 and S/O97). Wireless carriers have often invoked this provision when challenging siting decisions in court.

The new guidelines state that a moratorium may be adopted "when a local government needs time" to revise its zoning ordinance. Stoppages should be of fixed length. Ordinarily, a community will not need more than 180 days to write new zoning rules, but "all parties understand" that the process may take longer.

Whether a moratorium is in effect or not, wireless companies and local officials "should work cooperatively" to facilitate antenna siting, the guidelines state. Carriers are expected to provide "appropriate, relevant and nonproprietary information" to local officials, who are also encouraged to include public input.

Kenneth Fellman, who chairs the FCC's Local and State Government Advisory Committee (LSGAC), said that dealing with moratoriums "on a case-by-case basis" rather than through "broad national preemption" was a main goal of local officials. "This agreement achieves that goal," added Fellman, an attorney and member of the Arvada, CO, city council. Fellman drafted the agreement with representatives of the Cellular Telecommunications Industry Association (CTIA) and other industry groups.

The CTIA's Thomas Wheeler described the pact as a commitment to "give peace a chance." As part of the agreement, the CTIA is withdrawing its December 1996 petition asking the FCC to preempt all local moratoriums on new tower sites (see *MWN,* S/O97). Wheeler warned, however, that if moratoriums continue to delay the expansion of wireless networks, his organization "will not hesitate to revisit the issue with the commission."

In August 1997, the FCC asked for advice on how to deal with moratoriums, especially those with no specific time limit (see *MWN,* S/O97). In an interview in the September 21 issue of the trade magazine *RCR,* FCC Chairman William Kennard argued that preemption "should be a last resort" (see *MWN,* M/A98).

The LSGAC and the wireless industry also worked out an informal process for settling disputes concerning moratoriums. Wireless companies and local officials can ask the FCC to assign volunteer mediators to review delays. After hearing both sides, the two mediators—one each from industry and local government—will offer a solution to the contending parties, who may accept or reject it. All parties retain the right to take their grievances to court.

The LSGAC will continue to discuss contentious aspects of antenna siting with the wireless industry, Fellman told *Microwave News.* Areas that Fellman would like to explore include the Telecom Act's ban on local regulation of RF/MW radiation. But he noted that there are no further proposals on the table.

Bad Vibes in High Places?

Concern about EMF health effects may have reached 10 Downing Street, the London home of Prime Minister Tony Blair and his wife, Cherie. According to British press reports, Ms. Blair has been wearing a "bioelectric shield."

Ms. Blair, an attorney, was photographed wearing a pendant at the London premiere of the musical *Dr. Dolittle*. David Chambers of Swindon, Wiltshire, told the *Daily Telegraph* (July 20) that he is "convinced" the necklace in the photo is one of the shields his company imports from the U.S. for protection from harmful electromagnetic energy. Blair's office refused to comment, according to the *Telegraph.*

Hillary Rodham Clinton is said to have recommended the shield to Ms. Blair, the *Telegraph* reported. Charles Brown of Lavina, MT, whose BioElectric Shield and Comfort Products Co. makes the shields, told *Microwave News* he could "neither confirm nor deny" that Ms. Clinton has one. "I have to respect the patient's privacy," he said.

The shields range in price from $140 in silver and brass to $1,000 in gold. The company's web site states that they utilize "a specific configuration of quartz and other crystals" which "deflects electromagnetic energy." (For further details, visit: <http://bioelectric-shield.com>.) The market for personal EMF protection products is thriving: More than 23,000 shields have been sold, according to Brown.

Some British journalists regard Blair's new accessory with skepticism bordering on derision. The *Sunday Times* (July 19), for example, snickered that Blair may be seeking protection from "harmful rays from computers, fluorescent lighting—and, perhaps, even her husband."

Taking a more psychological view, the *Birmingham Post* (July 21) suggested that Blair's choice of jewelry expressed "a sinking paranoia" brought on by "living in an electronic age," adding: "Will we discover that microwaves can turn our brains into raisins?"

And Dr. Robert Park of the American Physical Society in Washington commented that, "Neither Cherie nor Hillary has been harmed by EMFs while wearing the pendant."

FDA Cautions Physicians on EMI from Anti-Theft Systems

The Food and Drug Administration (FDA) has issued an advisory to physicians on electromagnetic interference (EMI) from anti-theft systems and metal detectors to implanted pacemakers, defibrillators and spinal cord stimulators.

"The number of reported significant patient injuries is very low," the September 28 letter emphasizes. Still, "to be on the safe side," the FDA's Center for Devices and Radiological Health (CDRH) suggests the following "simple precautions" for people with implanted medical devices:

- Do not stay near the system longer than necessary, and do not lean against it.
- Ask security personnel not to hold hand-held metal detectors near implanted devices.
- Be aware that anti-theft systems at store entrances may be hidden or not obviously visible.

"We do not think that we have a major public health problem at this time," said Dr. Elizabeth Jacobson, CDRH's deputy director for science, "but we would like it to stay that way." Jacobson pointed out that implanted devices are becoming more common, and that the use of "more and more sophisticated microcircuitry" makes them more vulnerable to interference. She spoke at a September 24 meeting of FDA's Technical Electronic Product Radiation Safety Standards Committee (TEPRSSC) in Gaithersburg, MD.

At the TEPRSSC meeting, Dr. Michael McIvor of the Heart Institute of St. Petersburg in Florida reported that acoustomagnetic anti-theft systems caused EMI among 48 of 50 volunteers with implanted pacemakers. He found that swept RF devices produced no interactions. There was no EMI to defibrillators.

The FDA considers McIvor's study to be "the single most comprehensive study on the issue," said Mitchell Shein of the CDRH. McIvor's findings appear in the October issue of *PACE (21,* pp.1,847-1,861, 1998). He first presented them at a conference last year (see *MWN,* S/O97).

McIvor's findings are "of no consequence whatsoever," Dr. Warren Harthorne of Massachusetts General Hospital in Boston told TEPRSSC. "In over 30 years of experience of treating thousands of pacemaker recipients," Harthorne said, "I am not aware of any patient who has been harmed or injured by [anti-theft] devices." In an editorial in the same issue of *PACE,* Harthorne argues that three of the four types of EMI observed by McIvor are "of no clinical relevance." The fourth, in which a pacemaker fails to fire, could cause some symptoms—but only "if the patient lingered long enough in the field."

Serious symptoms are rare, McIvor said, but not impossible. He described a 28-year-old man who passed out in an anti-theft system's gates: "When he fell down, he fell out of the magnetic field, so he woke up. He stood up. He passed out. He stood up. He passed out—until a nurse came by and dragged him out."

McIvor points to acoustomagnetic anti-theft systems as the source of most serious EMI and calls for posting warning signs. But Harthorne argues that, "If you start placing signs in stores, you're going to have a rash of hysterical patients who will then have symptoms that they never would have had otherwise."

"Whose responsibility is it to get the message out to patients?" asked TEPRSSC's Dr. Victoria Marx of the University of Michigan, Ann Arbor. Dr. Victor Parsonnet of Newark Beth Israel Medical Center in New Jersey answered that he would not bring up anti-theft systems with his patients, and, if asked, would tell them simply not to worry about it. "You don't want to alarm them," he explained. Parsonnet and Harthorne are both consultants to Sensormatic, a leading maker of security systems.

"We were never intending to send this advisory directly to patients—it would only scare them," FDA's Jacobson told *Microwave News.* She stressed that it was addressed to physicians "to make sure that the appropriate information is out there."

Jim Putzke of the Health Industry Manufacturers Association said that the most common neurostimulators today are spinal-cord stimulators that control pain. But, he added, devices are now being used to treat Parkinson's disease, tremors, urinary incontinence and more. "Almost everything that you can possibly imagine" is being experimented with, he said.

CDRH's Jon Casamento said that the FDA had received several reports of EMI from security systems to spinal-cord stimulators: "Most of these interactions were very painful, and patients even reported being jolted or thrown to the floor." Jacobson said that the FDA does not know of any ongoing studies of EMI with spinal-cord stimulators.

The FDA's advisory can be found on the Internet at: <www.fda.gov/cdrh/safety/easnote.html>.

Magnetic Field Therapy Not the Greatest, Ali Decides

Boxing legend Muhammad Ali tried magnetic field therapy this summer, but soon quit in disgust.

Ali, who has Parkinson's disease, was treated at Dr. Jerry Jacobson's clinic in Boca Raton, FL. Jacobson's "resonance" therapy uses very weak magnetic fields—in the nanogauss range—at frequencies ranging from below 1 Hz to 100 Hz.

In an interview, Jacobson, formerly a dentist, conceded that the fields are well below background levels, but said he has identified frequencies that can trigger a desired response.

Ali tried the therapy at Jacobson's invitation, according to Ali's spokesperson, Jill Siegel. She told *Microwave News* that Ali was annoyed when Jacobson told the press that the former champion was at the clinic. Ali now has "zero interest" in pursuing the therapy, Siegel said.

In an August 6 press release, Jacobson said he was "disappointed" that Ali did not stay "long enough for the treatment effects to hold." But Siegel said that Ali and his wife, Lonnie, "saw no signs of improvement" from the therapy.

Investors have been eager to support Jacobson. Last March, a private placement of restricted shares in his company, Pioneer Services International, was increased to $670,700 after the initial offering of $450,000 was oversubscribed, a company press release announced. (In July, the company was renamed Jacobson Resonance Enterprises.)

Jacobson is also using EMFs to treat chronic pain from osteoarthritis, as well as epilepsy and migraines.

according to Cardinal and others.

David Bell of the manufacturers' group Electro-Federation Canada in Toronto said, "I think Health Canada is now somewhat uncomfortable with this eye standard—not because there's no scientific data whatsoever that support it, but because the department was not aware of the extreme economic impact it would have." In an interview, Bell said that Health Canada would now have to decide "whether they'll dig in their heels, or back off and say they were wrong." He warned that overly strict regulations "could shut off the flow of technology to Canada, technology which is perfectly acceptable to Europe and the U.S."

The question of ocular effects from RF/MW radiation has been little-studied. While several labs have worked on the problem, the scientific work most often cited in support of an eye exposure limit is a series of studies conducted by Henry Kues of Johns Hopkins University in Laurel, MD (see box below).

The wireless industry contends that Kues's work cannot serve as the basis for a standard for eye exposure. Bell called Kues's results "interesting," but argued that they "do not represent a scientific consensus."

Health Canada's Thansandote said his agency is undertaking its own research on RF/MW effects on the eyes, in association with the Eye Institute of the University of Ottawa. But, he said, results will not be available before March. That is also when the revision of Safety Code 6 and a Royal Society of Canada report on RF/MW safety are to be released. The latter is being prepared at Health Canada's request (see p.11).

Even if Health Canada applies the eye limit to cellular phones, it will probably not require that they be tested to show compliance. The mandatory regulations for cellular phone manufacturers are drawn up by another government agency, Industry Canada, which will likely require proof of compliance with the eye limit

Kues's RF/MW Eye Experiments at Center of Canadian Controversy

Canada's proposed limit for eye exposure is largely due to a series of experiments by Henry Kues of Johns Hopkins University's Applied Physics Lab in Laurel, MD.

Kues's work has been conducted over a period of 15 years—but the wireless industry is unimpressed. "The eye limit is based on a study that has never been reproduced, even though there have been attempts to do so," asserted Dr. Paul Cardinal of Aprel Labs, expressing a common industry view. But Kues says that a real replication of his experiments has never been attempted.

Kues has repeatedly observed damage to the corneas of monkeys after exposure to RF/MW radiation (see *MWN,* J/A83, S/O86, J/A87, J/A88 and S/O91). He found that pulsed signals showed the strongest effects, causing changes in the eyes at exposure levels as low as 2.6 W/Kg. When pulsed radiation was used in conjunction with anti-glaucoma drugs, the effect was magnified, with changes observed at specific absorption rates (SARs) down to 0.26 W/Kg. Kues also observed some effects from continuous wave (CW) signals, but only at higher SARs—a minimum of 5.3 W/Kg.

Only one published study has been cited as an attempted replication of Kues's work. In a paper in *IEICE Transactions on Communications (E77-B,* pp.762-765, 1994), Dr. Yoshitsugu Kamimura of Utsunomiya University in Japan reported no changes in the eyes of five RF/MW-exposed monkeys. But each monkey in Kamimura's study was exposed only once, while Kues used repeated exposures. Moreover, Kamimura used only CW radiation. Kamimura himself noted these differences and wrote that studies with pulsed radiation and repeated exposures are essential to an evaluation of Kues's work.

Also cited as a failed replication of Kues's experiments is a study by Dr. Shin-tsu Lu and colleagues at the Armstrong Lab at Brooks Air Force Base in San Antonio, which was presented in June at the *20th Annual Meeting of the Bioelectromagnetics Society* in St. Pete Beach, FL.

Lu found no structural damage to the retinas of monkeys due to exposure to high peak power microwaves at average retinal SARs of 4-20 W/Kg. While he observed some functional changes that may be an early indicator of mild injury, Lu stated that the Armstrong Lab data suggest that these are probably reversible.

"In all fairness," said Kues, "I don't think it's a true replication." He noted differences in the two groups' diagnostic protocols: "I don't think they've done electron microscopy, which is where we saw most of the changes."

More important, Kues said, the pulse waveform used in his experiments was "totally different" from that which Lu's group employed. He explained that Lu used a "soft-pulse radar," as opposed to the "very sharp, almost square, waveform" with which Kues observed robust effects.

"It depends on your definition of replication," responded Lu. "We simply followed normal protocols—but yes, the pulse Kues used and what we used are different." As for the question of electron microscopy, Lu argued that this was not the only technique used by Kues, and that in his early experiments Kues had described changes that could be observed with an ordinary microscope.

Kues called interactions with anti-glaucoma drugs "one of the most important aspects of the whole issue." But despite the fact that this was where Kues found the strongest effects, there has never been any attempt to replicate this work. According to the U.S. Food and Drug Administration (FDA), over two million Americans use anti-glaucoma medication.

Kues said his work does not prove any hazard from cellular phones, noting that most use CW signals. Even digital systems do not use "the traditional pulsed signal with a 1,000-fold difference between average and peak power," he said. "It's hard to compare our experiments to cellular phone technology," he concluded.

The FDA has declared that it is important to study possible ocular effects of cellular phone radiation, and has urged the industry-sponsored group Wireless Technology Research (WTR) to do so (see *MWN,* M/A97). Yet neither WTR nor the FDA has funded any research along these lines. Neither have individual wireless companies, though Hewlett-Packard did fund a study by Kues on the effects of CW millimeter waves on the eyes (see *MWN,* M/A96 and M/J97).

Unfortunately, Kues said, there has been little interest "in funding basic research into RF/MW ocular effects." Kues will soon be closing his bioeffects lab due to lack of funding.

only for higher-power "push-to-talk" radios like walkie-talkies.

"Tests and computations were carried out by several manufacturers, including Ericsson, Motorola and Nokia, for several cellular and PCS models in normal operating mode," said Dr. Veena Rawat of Industry Canada's Spectrum Engineering Branch. "These showed that phones that met the general 1.6 W/Kg exposure limit were below the 0.2 W/Kg eye limit as well." Therefore, Rawat told *Microwave News,* Industry Canada will not require separate eye exposure tests for hand-held cellular phones.

"All three manufacturers reported that their eye-specific SAR tests came out at or below 0.1 W/Kg," confirmed Norman Sandler of Motorola, in Schaumburg, IL. He said that Motorola's tests used the phone in the normal position, next to the ear.

Walkie-talkies operate at a higher power than cellular phones and are often held directly in front of the face, with the antenna close to one eye. Industry Canada does plan to require that they be tested to prove compliance with the eye limit. Motorola, Ericsson and other companies oppose this, and Rawat said that discussions on this point are continuing.

"I would expect that some walkie-talkies will have trouble meeting the Canadian 0.2 W/Kg standard," commented Dr. Niels Kuster of the Laboratory for EMF and Microwave Electronics at the ETH in Zurich, Switzerland, an opinion shared by Aprel Labs' Cardinal.

Electro-Federation Canada's Bell warned that companies selling on an international basis "can't afford to develop two versions of everything." He asserted that if walkie-talkies must prove compliance with the eye limit, "it would get rid of half of the push-to-talk radio in Canada."

Rawat took a different view, suggesting that Canadian rules could influence the marketplace in the United States: "In the U.S., there is no eye limit—but the folks building the radios are building them for the North American market. So they will have to find ways to show that they can meet the eye requirement."

The final revision of Industry Canada's regulations should be published in November, according to Rawat. If so, they would be completed before Health Canada's Safety Code 6, which is supposed to be the basis of the regulations. But Rawat does not see this as a problem, since Industry Canada has based its work on the most recent draft of the revised Safety Code 6. "We are working closely with Health Canada," she explained. "If there were any major changes being considered, we would know about it."

Bell said that the standard-setting discussions have been difficult. On the one hand, he said, Health Canada does not see economic issues as its responsibility; on the other, manufacturers are not medical experts. But he is optimistic about the final result. "Industry Canada has worked hard to build a bridge between us, and has been trying to come up with requirements that are reasonable," said Bell. "There are no bad guys here."

When Canada first adopted a limit for eye exposure, as part of Safety Code 6 in 1991, transmitters operating at less than 7 W were exempt from all exposure standards (see *MWN,* S/O87 and J/A91). The eye requirement therefore did not apply to walkie-talkies and cellular phones.

In the U.S., a similar 7 W exclusion was abandoned in 1996, when the Federal Communications Commission adopted its current RF/MW regulations (see *MWN,* J/A96).

Royal Society of Canada To Review RF/MW Health Risks

The Royal Society of Canada (RSC) in Toronto has established an expert panel to assess potential health risks from human exposure to RF/MW radiation. The panel's report, due in March, will focus on cellular phones and towers.

"We were convened at the request of Health Canada to look at the adequacy of Canada's RF/MW safety standard," said the panel's chair, Dr. Daniel Krewski of the University of Ottawa. Among the questions to be considered is whether the standard, known as Safety Code 6, should address "non-thermal effects," according to an August 4 RSC statement.

"When this report is issued, it will be the most comprehensive and credible overview of the scientific literature anywhere," Dr. William Leiss, chair of the RSC Committee on Expert Panels, told *Microwave News*.

"There's a lot of public concern about the new wireless technologies," Leiss noted. He pointed to controversies over cellular tower construction and commented, "People go to their government and ask, 'What can you tell me about this?'—and the answer is, virtually nothing."

Revision of Safety Code 6 began in 1993, according to Health Canada spokesperson Lynn Lesage. Asked why the RSC's evaluation was requested so late in the process, Lesage responded, "Given the concerns that have been raised in public lately, the department decided it would be beneficial to ask an independent group of experts to look at the issues."

"The only reason the government asked for this panel is that citizen activists lit enough matches between their toes," said Milt Bowling of Public Against Cellular Tower Emissions (PACT) in Vancouver, BC. Bowling said that PACT and other groups had pressed hard for an independent evaluation of RF/MW safety issues, and that no decisions should be made before the RSC report is completed.

David Bell of Electro-Federation Canada suggested that Health Canada had asked for the RSC report because "they have a hot potato on their hands." Bell told *Microwave News,* "They didn't realize at first that it was hot, and now they would like to hand it off to someone else."

Lesage said that the RSC panel's work and Health Canada's revision of Safety Code 6 will proceed in tandem—both will be released at about the same time. But, she added, "We're not going to hold back the release of the revised Safety Code 6 if the panel report is not ready." If the RSC report is delayed, Lesage said, it would be taken into account at a later time.

"We *will* make the March deadline," the RSC's Leiss declared. He stressed the panel's independence, noting that the government had not been consulted on its membership, and would not receive an advance copy of the report.

The panel members are: Dr. Craig Byus, University of California, Riverside; Dr. Barry Glickman, University of Victoria, BC; Dr. Daniel Krewski, University of Ottawa; Dr. Gregory Lotz, U.S. National Institute for Occupational Safety and Health, Cincinnati; Dr. Rosemonde Mandeville, Biophage Inc., Montreal; Mary McBride, British Columbia Cancer Agency, Vancouver; Dr. Frank Prato, University of Western Ontario, London; and Dr. Donald Weaver, Queen's University, Kingston, Ontario.

Hot New Papers

Michael Bracken et al., "Correlates of Residential Wiring Code Used in Studies of Health Effects of Residential Magnetic Fields," ***American Journal of Epidemiology, 148,*** **pp.467-474, September 1, 1998.**

"In a study carried out in southern Connecticut in 1988-1991...[w]omen who lived in very-high-current configuration wiring coded homes were more likely to be in manual jobs and their homes were older (built before 1949, odds ratio (OR)=73.24, 95% confidence interval (CI) 29.53-181.65) and had lower assessed value and higher traffic densities (highest density quartile, OR=3.99, 95% CI 1.17-13.62). Because some of these variables have themselves been associated with health outcomes, the possibility of confounding of the wiring code associations must be rigorously evaluated in future EMF research."

W.T. Kaune, M. Feychting, A. Ahlbom, R.M. Uhlrich and D.A. Savitz, "Temporal Characteristics of Transmission Line Loadings in the Swedish Childhood Cancer Study," ***Bioelectromagnetics, 19,*** **pp.354-365, 1998.**

"Swedish transmission line load currents were not stable over long periods, so that contemporaneous load current (or a contemporary magnetic field measurement) was not a good surrogate for historical load current (or historical magnetic fields). The results provide a potential explanation for the failure of the Swedish study to find an association between leukemia and contemporaneous magnetic field levels measured many years *after* the etiologic period, and suggest that the inclusion of load-current data could significantly improve the quality of historical field calculations."

A.W. Preece, K.A. Wesnes and G.R. Iwi, "The Effect of a 50 Hz Magnetic Field on Cognitive Function in Humans," ***International Journal of Radiation Biology, 74,*** **pp.463-470, 1998.**

"This study has presented evidence for power frequency magnetic fields at less than recommended intervention levels [6 G vs. 16 G] as having some effect on cognitive function in humans. In particular, elements of short-term memory are adversely affected although there is no evidence or otherwise of a continuing effect. In contrast, there is no evidence of such effects from a static magnetic field of the same magnitude....It would be particularly interesting to repeat this study with different fields to look for evidence of a dose-response, perhaps concentrating on those functions that appeared to be affected."

Two Packs a Day vs. Three Packs a Day

S. Milham, "Carcinogenicity of Electromagnetic Fields," ***European Journal of Oncology, 3,*** **pp.93-100, 1998.**

"[T]he best explanation for the low risk ratios found in the EMF [epidemiological] studies is that the controls are exposed. In Table 14, I present the basic data of the Doll and Hill (1956)* British physicians smoking-lung cancer study. Notice that a high relative risk is achieved only when heavy smokers are compared to nonsmokers. Comparing heavy smokers to light or moderate smokers gives risks a lot like what we see in EMF studies. I submit that the EMF equivalent of nonsmokers does not exist in the industrialized world."

Adapted from Table 14—Relative Risk of Dying from Lung Cancer for British Male Physicians, by Smoking Category

Heavy Smokers vs.…	Relative Risk
Nonsmokers	23.7
Light Smokers	3.5
Moderate Smokers	1.9

*R. Doll and A.B. Hill, "Lung Cancer and Other Causes of Death in Relation to Smoking: A Second Report on the Mortality of British Doctors," *British Medical Journal, 2,* pp.1,071-1,081, 1956.

Robert Malyapa et al.,"DNA Damage in Rat Brain Cells After *In Vivo* Exposure to 2450 MHz Electromagnetic Radiation and Various Methods of Euthanasia," ***Radiation Research, 149,*** **pp.637-645, June 1998.**

"[T]he guillotine method of euthanasia is the most appropriate in studies relating to DNA damage. Furthermore, we did not confirm the observation that damage is produced in cells of the rat cerebral cortex or hippocampus after a 2-hour exposure to 2450 MHz CW microwaves or at 4 hours after the exposure."

FROM THE FIELD

Future Research Needs—EMF Epidemiology

At the close of the NIEHS' EMF Working Group meeting in Minneapolis in June, each of the four small groups was asked to draft an agenda for future research. These were to be considered for inclusion as an appendix to the Working Group's report. As it turned out, only the epidemiology small group (adult and childhood combined) completed this assignment, according to NIEHS' Dr. Christopher Portier, who coordinated the meeting and coedited the Working Group's report. The research agenda for EMF epidemiology, which is reprinted below, was written by Dr. Maria Feychting of the Karolinska Institute in Stockholm, Sweden, with the assistance of the other members of the epidemiology group. (For a list of members of this and the other small groups, see MWN, *J/A98; see also p.2.)*

Childhood Cancer

In considering future research, it is useful to assess the likely impact of additional studies on the assessment of the possible association between exposure to magnetic fields and the occurrence of childhood cancer. Results of the meta-analyses of magnetic field exposure and childhood cancer suggest that additional studies of designs similar to those already conducted will do little to affect the average result (meta-analysis) of the studies unless there are several thousand subjects in the study. A study of this size is unlikely if not impossible. Therefore, innovative designs will be needed to provide useful information.

There are three areas in which this innovation might be particularly useful: (1) increasing the exposure gradient among subjects; (2) conducting more sophisticated analyses of existing data; and (3) improving the exposure assessment measurements.

Increasing the Exposure Gradient

One major limitation of the previous studies of magnetic field exposure and childhood cancer is the low prevalence of high exposure subjects. More information is needed about the risk associated with very high exposure levels, e.g., exposures at or above 0.4 or 0.5 $\propto$T (4-5 mG). There are currently at least three ongoing large studies of childhood leukemia and ELF EMFs (two in Canada and one in the U.K.). A new study is being planned in Italy and there are plans to expand the existing German study.[1] All of these use (or plan to use) long-term measurements of the magnetic fields in the children's homes. It is still unclear if the studies are large enough to include a sufficient number of highly exposed children to improve upon the scarcity of highly exposed subjects.

Until we see the results from at least the ongoing studies, a worthwhile design for a new study of childhood cancer and residential ELF EMF exposure would be a replication of the Nordic studies with mag-

netic fields calculated from historical data on transmission line loads and configurations.

Innovative designs in countries with larger populations, modeled after the Nordic studies, could also be developed to include more highly exposed subjects. Such designs could sample populations living in close proximity to high voltage transmission lines, where homes can have exposures as high as 3 or 4 ∝T (30-40 mG). At least one such pilot study is under way in the U.S., using a geographic information system (GIS) to identify the relevant cohort.

Conducting More Sophisticated Analyses of Existing Data

Analyses using dose-response models (both linear and nonlinear) for the analysis of measured exposure data may provide additional insights. They also may allow for comparisons across different exposure metrics by looking at comparable regression slope estimates.

Pooling existing data into a single analysis will increase the number of highly exposed subjects and may allow for consideration of complex dose-response models. There is one ongoing EU project that will pool data from all Nordic countries, the U.K., Germany, the NCI–CCG study and one of the Canadian studies.

Improving Exposure Assessment Methods

Childhood leukemia studies could also be improved by using area monitors which measure exposures based on biological interaction mechanisms. Such monitors would need to measure frequency ranges adjacent to ELF (VLF and static magnetic fields), high frequency transients and the detailed characteristics that can be computed by waveform capture.[2] In addition, exposure assessment methods to accurately characterize electric field exposure need to be developed. With such techniques, dose metrics based on biomechanism research can be measured with precision, enabling epidemiologic studies to test mechanistic hypotheses directly.

Few studies have evaluated the effect of exposure from sources other than power lines. With adequate estimates of ELF EMF exposures from appliances, such studies could provide valuable information. The ideal childhood study would combine EMF exposures from transmission lines, distribution lines, ground currents, and appliances, but that ideal would require several breakthroughs in exposure assessment methodology.

Adult Cancer

The exposure assessment methods have become more sophisticated over time, but work-shift measurements have primarily been made for electric utility workers, and only a few studies have made measurements of occupational exposures in the general population. The majority of measurements have been made for male workers, and there is a substantial need for better characterization of the exposures for female workers.

New studies of leukemia or brain tumors must improve the exposure assessment methods considerably to provide useful information, and should be designed as population-based studies with considerable efforts to keep nonparticipation rates low. One way to improve exposure assessment would be to use personal monitors with the capabilities (discussed above) to measure biologically relevant exposure metrics. Job exposure matrices can also be improved by incorporating location and source information along with job titles.[3] In addition, residential and occupational exposures should both be assessed when possible.[4] To study residential exposures alone does not seem worthwhile for adult cancers.

To date, few high-quality studies have examined cancers other than leukemia and nervous system tumors. With other cancers, priority should be given studies designed to test specific mechanistic hypotheses (e.g., a risk confined to estrogen-receptor-positive breast cancer, an increased risk for hormone dependent tumors, etc.). There are at least three ongoing large case-control studies of ELF EMF exposure and female breast cancer. It is not clear yet if these studies will have a large enough number of young women and complete information about estrogen receptor status.

The improvement of the exposure assessment methods mentioned above is also important in new studies of other cancer end points, as well as using a population-based design with proper selection of controls. Considering the shortcomings in the exposure assessment methods used previously for female occupations, a few studies focusing on occupations known to entail high exposure levels (e.g., seamstresses) may be worthwhile.

Other Outcomes

Although evidence for many of the outcomes evaluated at the Working Group meeting was judged to be inadequate, some outcomes are of higher priority for future research due to the evidence to date.

Further research is warranted to replicate the recent observation by Savitz et al.[5] of exposure-dependent excess risk in utility workers for sudden death due to arrhythmias and acute myocardial infarctions. The potential health implications of these findings need to be further examined using relevant ICD codes in other existing cohort studies with appropriate magnetic field exposure assessment (e.g., the Southern California Edison cohort[6] and the Hydro-Québec component of the Canada-France study[7]). Hypothesis-driven occupational studies relating magnetic field variations to measures of heart rate variability, diastolic blood pressure (another predicted morbidity end point) and individual lifestyle characteristics in stratified samples of workers are also of interest.

Further research is needed on the possible association between occupational ELF EMF exposure and Alzheimer's disease. Useful information can be provided by studies that are population-based and use improved exposure assessment techniques, collect information about occupational histories and have valid confirmation of diagnoses and proper control selection techniques. There is no need for further exploratory studies.

Another outcome where additional research is needed is amyotrophic lateral sclerosis (ALS). Again, useful information can best be provided by studies that are population-based and use improved exposure assessment techniques, collect information about occupational histories and have valid confirmation of diagnoses and proper control selection techniques. As for Alzheimer's disease, there is no need for further exploratory studies. Evaluation of confounding from electric shock is essential in studies of ALS.

1. J. Michaelis et al., "Combined Risk Estimates for Two German Population-Based Case-Control Studies on Residential Magnetic Fields and Childhood Acute Leukemia," *Epidemiology, 9,* pp.92-94, 1998.

2. M. Methner and J. Bowman, *Hazard Surveillance for Workplace Magnetic Fields: I. Walk Around Sampling Method for Measuring Ambient Field Magnitude; II. Field Characteristics from Waveform Measurements,* Cincinnati: National Institute for Occupational Safety and Health, 108pp., March 1998.

3. A. Miller et al., "Leukemia Following Occupational Exposure to 60 Hz Electric and Magnetic Fields Among Ontario Electric Workers," *American Journal of Epidemiology, 144,* pp.150-160, 1996.

4. M. Feychting, U. Forssén and B. Floderus, "Residential and Occupational Magnetic Field Exposure and Leukemia and Central Nervous System Tumors in Adults," *Epidemiology, 8,* pp.384-389, 1997.

5. D. Savitz et al., "Magnetic Field Exposure and Cardiovascular Disease Mortality Among Electric Utility Workers," *American Journal of Epidemiology,* to be published January 15, 1999.

6. J. Sahl, M. Kelsh and S. Greenland, "Cohort and Nested Case-Control Studies of Hematopoietic Cancers and Brain Cancer Among Electric Utility Workers," *Epidemiology, 4,* pp.104-114, 1993.

7. G. Thériault et al., "Cancer Risks Associated with Occupational Exposure to Magnetic Fields Among Electric Utility Workers in Ontario and Québec, Canada, and France: 1970-1989," *American Journal of Epidemiology, 139,* pp.550-572, 1994.

U.K. Meeting on Mechanisms and Consequences of 50/60 Hz EMFs

On September 24-25, the U.K.'s University of Bristol hosted a symposium on Mechanisms and Consequences of Power Frequency Electromagnetic Field Exposures. *The meeting was sponsored by the Institute of Physics and Engineering in Medicine and the Institution of Electrical Engineers, with support from the university. The symposium program and abstracts of the speakers' papers are posted on the university's Web site:* <www.bris.ac.uk/Depts/Medphys/meeting. html>. *Drs. Alan Preece and Joe Eavis of the university's Department of Medical Physics and Bioengineering filed the following report. Preece can be contacted at* <a.w.preece@bristol.ac.uk>.

Possible mechanisms of interaction between EMFs and living systems were examined through reviews of behavioral effects and epidemiological studies, with special emphasis on breast cancer, childhood cancer and neurodegenerative diseases. Societal issues including risk perception and legal action were also discussed, as were the potential economic and legal consequences to the electric utilities and the insurance industry.

Speakers were asked to consider whether there are health consequences from exposure to power frequency EMFs—and if so, what are they and what are their implications? These questions were considered in the following context:

- The energy associated with these fields is too low to act as a conventional carcinogen.
- Some epidemiological evidence points to an association.
- Few reproducible biological effects have been demonstrated.

Dr. Ted Litovitz of the Catholic University of America in Washington cited many examples from labs around the world indicating that EMFs can cause cellular changes that can be either beneficial or detrimental. He explained that different cell lines could respond to applied stimuli in different ways, thereby confounding attempts at replication. Litovitz also noted that cells can adapt to an applied stimulus so that their response may change with time.

Also addressing the question of reproducibility, Dr. Ross Adey of the University of California, Riverside, argued that the convergence of experimental data, and not necessarily exact duplication, should be the key objective. Turning to work from his lab, Adey said that EMFs interact by disrupting communication between adjacent healthy cells. (Tumor cells show a similar lack of intercellular communication.) His favored mechanism centers on the ability of EMFs to influence the lifetime of free radicals. This could explain the suspected EMF association with ALS and Alzheimer's—and possibly the proliferation of cancer cells—by disrupting apoptosis (programmed cell death).

Dr. Richard Luben, also of the University of California, Riverside, agreed that there is little question that EMFs can cause cellular changes. He pointed out that EMF effects on human breast cancer cells have now been reproduced in four different labs, including his own. He stressed, however, that biological effects cannot, at this stage, be linked with carcinogenesis and that they are a long way from explaining the epidemiological findings.

This view was seconded by Dr. Gary Boorman of the U.S. NIEHS, who pointed to the mixed results from the EMF RAPID research program. He noted that the bioeffects issue is still open, with mechanistic studies neither proving nor disproving epidemiological associations.

On the other hand, Prof. Denis Henshaw of the University of Bristol presented experimental results supporting his hypothesis that seeks to explain the epidemiological results. He proposed four mechanisms whereby power lines can interact with pollutant-laden airborne particles, leading to increased human doses, particularly for the skin and lungs.

Dr. Zenon Sienkiewicz of the U.K.'s National Radiological Protection Board reported that EMFs can cause specific and consistent changes in the learning behavior of mice, rats and humans. These effects are reproducible but not permanent. While there is no doubt that intense EMFs can cause these effects, the key question is whether there are low-level effects and, if so, whether they are small, transient and reversible.

Prof. Ray Cartwright of the U.K.'s University of Leeds reviewed the EMF–childhood cancer epidemiological literature, as well as the ongoing U.K. childhood cancer study, which is the largest to date. He commented that the greatest statistical power would come from pooling data from different studies. Next, Prof. Paul Elliott of the Oxford (U.K.) Small Areas Statistics Unit reviewed residential studies of adult cancers and power lines. He suggested that there is some evidence of an increased risk of adult leukemia and non-Hodgkin's lymphoma but no statistically significant risk for brain cancer or for breast cancer. He outlined a U.K. pilot study which found some evidence of an increased risk of leukemia and brain tumors near high voltage overhead power lines but that had a very low statistical power. Elliott is extending the study to look at all lines above 132 kV.

Dr. Eugene Sobel of the University of Southern California in Los Angeles discussed the epidemiological studies of breast cancer and neurodegenerative diseases. Studies of Alzheimer's and ALS consistently show elevated associations for EMF exposures, although they are often not statistically significant. Sobel has put forward the hypothesis that EMFs can contribute to increased production of amyloid beta, which in turn leads to the development of Alzheimer's.

Dr. Brian Stollery, a psychologist at the University of Bristol, showed how people's attitudes have changed since World War II: Today, new developments are viewed with suspicion. Atomic bombs, Chernobyl, BSE (commonly known as mad cow disease) and genetically modified food have fueled public anxiety, in large part because the risks are uncertain and hard to explain and quantify. It may be that conceding a risk and quantifying it may be the best way to quell anxiety. For example, the public does not see radon as much of a health hazard.

The problems facing the insurance industry were outlined by Christian Brauner of the Swiss Reinsurance Co. in Zurich and Alastair Speare-Cole of the Aon Group Ltd. in London. Brauner argued that EMFs are a phantom risk, though one that can cause anxiety and provoke a successful legal action. Speare-Cole considers possible EMF claims to be a small risk, compared, for example, to the millennium bug. But Brauner warned that they could cause large consequences for the industry as a whole.

The legal issues were addressed by Alan Fisher of Dibb Lupton Alsop and Martyn Day of Leigh, Day & Co., both in London. Fisher believes that the legal system can handle technological problems such as power lines and mobile phones using "the precautionary principle" without changing the existing framework of the law. Day, on the other hand, is concerned that individuals have to bear the costs of a product found to be harmful after it has gone to market, and argues that industry should be liable because it made the profit.

At the close of the meeting, the U.K.'s Dr. John Swanson of the National Grid Co. and the Electricity Association emphasized that industry must balance what he called the phantom risk of EMFs with the real risk of shock. The utilities are trying to keep power lines away from existing homes but believe that local planning authorities should not object on safety grounds if developers want to build new homes under old lines—given the lack of a proven health risk. Recent surveys have shown only a low level of public concern. The only groups to benefit from legal challenges, Swanson argued, are lawyers.

Overall, the presentations supported the probable association between EMFs and childhood leukemia, but the mechanisms of interaction are still far from clear. Biological changes have been established, but there is no evidence that these are deleterious.

Clippings from All Over

[S]iting new transmission and distribution lines is far from [a] simple process...In fact, it's nearly impossible. Just ask the utilities that have been seeking permission for years to build new transmission wires—nobody wants them nearby.

—William Brier, vice president for marketing and communication, Edison Electric Institute, Washington, letter to the editor, "Nobody Wants Those Ugly Electricity Wires," *Wall Street Journal,* p.A23, September 10, 1998

"Whether it is disguised as a plastic tree or not, it is going to be very tall, an invasion on the visual environment. If I want to see a plastic tree, I'll take myself off to Legoland."

—Ian Leiper, Beaconsfield, Buckinghamshire, U.K., on the plan of telecommunications firm Orange to erect an 80-foot cellular tower designed to resemble a Scots pine in his town, quoted in "Plastic Pine Drives Residents up the Pole," *BBC Online* (Internet), August 7, 1998

"It's radiating us 24 hours a day. I cannot protect myself against this radiation."

—Linda Evans, former star of television series *Dynasty,* on RF/MW emissions from wireless telephone antennas near her home in Rainier, WA, quoted by Joel Coffidis in "Linda Evans Leads Fight Against Cellular Phone Tower," the *Olympian* (WA), p.1, August 27, 1998

"If you're trying to beat the government, don't bother."

—Robert Curtis, Occupational Safety and Health Administration (OSHA), Salt Lake City, explaining that, due to understaffing, OSHA is enforcing its rules on RF/MW radiation only in response to complaints, quoted by Brad Smith in "Time Running Out for RF Compliance," *Wireless Week,* p.96, September 28, 1998

The melatonin hypothesis merits continued systematic investigation.

—Dr. Robert Hahn, Centers for Disease Control and Prevention, Atlanta, editorial, "Does Blindness Protect Against Cancers?" *Epidemiology, 9,* p.483, September 1998 (see pp.6-7)

One project, somewhat ominously dubbed "Soul Catcher," seeks to develop a computer that can be implanted in the brain to complement human memory and computational skills. In addition, it would enable the gathering of extrasensory information—in this case, data transmitted by wireless networking.

—Rob Fixmer on research by British Telecommunications PLC, in "The Melding of Mind and Machine May Be the Next Phase of Evolution," *New York Times,* p.F6, August 11, 1998

If an astrophysicist can study the origin of the universe without apology, should an epidemiologist have to apologize for work that is so practical?

—Drs. Kenneth Rothman, Boston University School of Medicine, Boston, Hans-Olov Adami, Karolinska Institute, Stockholm, Sweden, and Dimitrios Trichopoulos, Harvard School of Public Health, Boston, in "Should the Mission of Epidemiology Include the Eradication of Poverty?" *Lancet,* p.810, September 5, 1998

"We've demonstrated that you can transmit the biological effect by E-mail between Chicago and Paris. With this approach, you could transfer the activity of a drug by means of standard telecommunications technology."

—Dr. Jacques Benveniste, Digital Biology Laboratory, Clamart, France, explaining the research for which the *Annals of Improbable Research* gave him one of its 1998 "Ig Nobel" prizes, quoted by Steve Nadis in "French Scientist Shrugs Off Winning His Second Ig Nobel Prize," *Nature,* p.535, October 8, 1998

"One is for mummy, two for daddy, three for grandma. That's all the kid has to know."

—Joao Mendes Dias, director of product marketing, Telecel Communicacoes Pessoais SA, Portugal (Airtouch Communications is its majority owner), on Vitamina K, a wireless phone marketed to 8- to 15-year-old children, quoted by Gautam Naik in "Prepaid Plans Open Up Cellular Phone Market," *Wall Street Journal,* p.B1, September 16, 1998

"MICROWAVE NEWS" FLASHBACK

Years 15 Ago

• Studies at Chicago's IIT Research Institute show that voltages induced by nearby power lines can cause railway signaling systems to malfunction, mistakenly displaying a green light in place of red.

• The U.S. is "quietly stepping up research on microwave beam weapons," writes AP reporter Barton Reppert. Such technology would be used to disrupt electronic systems in enemy weapons and defenses.

• In its new contract with Boston University, a clerical workers' union becomes the first in the U.S. to have the right for pregnant VDT operators to be assigned alternative work.

Years 10 Ago

• In pretrial discovery for a lawsuit filed by a former employee, Robert Strom, Boeing releases an internal memo stating that "the whole chemical balance within the body is disturbed" by electromagnetic pulse radiation.

• Sweden's Dr. Hakon Frölen confirms his 1987 finding that pulsed magnetic fields can cause increases in fetal deaths in mice.

• In response to the EPA's decision to close down its non-ionizing radiation program, the agency's Science Advisory Board tells EPA Administrator Lee Thomas that "the agency must not totally abandon its work in the area."

Years 5 Ago

• NIOSH plans to study a cluster of seven brain tumors among employees working in the newsroom of the *St. Louis Post-Dispatch,* where magnetic fields as strong as 80 mG have been measured.

• Officials from several federal agencies decline to attend a CTIA-sponsored symposium held to plan a wireless phone safety research program after the FDA's Dr. Elizabeth Jacobson questions whether the CTIA program would be "objective or credible."

• Personnel at two U.S. Air Force bases, the Armstrong Lab in Texas and the Phillips Lab in New Mexico, disagree on the health risks of RF/MW radiation. Phillips' Dr. Cletus Kanavy says that "something is drastically wrong" with Armstrong's denial of nonthermal biological effects.

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UPDATES

BRAIN TUMORS

Better Diagnosis Means More Case Reports... Between 1973 and 1994, there was a 35% rise in the reported incidence of childhood brain cancer in the U.S. But a team of NCI researchers in Bethesda, MD, contends that this probably reflects improved detection of tumors rather than an actual increase in the disease. Writing in the September 2 issue of the *Journal of the National Cancer Institute (JNCI, 90,* pp.1,269-1,276, 1998), Dr. Malcolm Smith and coauthors report that a statistical analysis of NCI data on malignant childhood brain cancer reveals that the rate of incidence fits a "jump model" of change more closely than a "linear model." That is, the rate was relatively constant before rising quickly in the mid-1980s, and then became steady again at a higher value. The fact that the data are more consistent with the jump model, the authors conclude, "supports the hypothesis that the observed increase in incidence somehow resulted from changes in detection and/or reporting." An actual increase in brain cancer would have been more evenly spread over the 22 years, they contend. The team expected to find the increase confined mostly to 1984 and 1985 because magnetic resonance imaging (MRI) came into wide use as a diagnostic tool at that time. MRI allows the detection of brain tumors that go unnoticed by computerized tomography (CT), which previously had been the most sensitive diagnostic technique for brain cancers. Their hypothesis also gains support, the authors write, from data showing that less virulent gliomas in the brain stem and cerebrum account for most of the overall rise in malignant brain cancer in children. These tumors are those "for which MRI is most contributory, since MRI is more sensitive" than CT in detecting them. In an accompanying editorial in the *JNCI,* Dr. William Black, a radiologist at Dartmouth Medical School in Hanover, NH, writes that, "Although a concomitant environmental cause of increased incidence cannot be completely excluded, it is unlikely." (See also *MWN,* J/F91 and J/A91.)

Cluster Prompts Lawsuit Against Amoco... In August, four former employees and surviving relatives of three others sued Amoco Corp. in Cook County Circuit Court in Chicago. A cluster of seven brain tumors at the company's Naperville, IL, research center led the plaintiffs to conclude that on-the-job exposures caused the cancers. The seven employees had been involved in similar chemical research projects and spent time in the same three-building complex. Each developed the same type of tumor—a glioma. The suit contends that their work at the center exposed them to "defective, unsafe and/or unreasonably dangerous chemicals," according to the August 28 *New York Times.* At Amoco's request, the *Times* reported, researchers at the University of Alabama, Birmingham, and at Johns Hopkins University in Baltimore reviewed the medical records of the center's 8,000 past and present employees, and found 19 cases of brain cancer. The seven glioma cases among personnel working in a limited area within the center represent a sevenfold excess over the expected rate, Amoco's chief epidemiologist told the *Times.* Five of the seven men had worked in the same building, and three of them were assigned to the same lab—now closed. In 1993, a survey by a team at Johns Hopkins found that petroleum refinery workers were exposed to magnetic fields as high as 2 G, averaged over a shift (see *MWN,* J/F94).

CONFERENCE PROCEEDINGS

EMFs and Molecular Oncology... The July 1998 issue of *Electro- and Magnetobiology* (Vol.17, No.2) includes a selection of papers from the *International Life Sciences Conference '97* and the *2nd Slovenian-Croatian Meeting on Molecular Oncology Today,* held jointly in Slovenia last October. The annual life sciences conference emphasizes an interdisciplinary approach, according to Dr. Gregor Sersa of the Institute of Oncology in Ljubljana, Slovenia, who headed the organizing committee. The theme for 1997 was the biophysics and biology of tumors and, in an introduction, Sersa writes that EMF bioeffects were a major topic. For instance, one paper addresses the use of electric fields to make tumor cell membranes more permeable to certain molecules; another describes how application of low-level direct current can increase the effectiveness of anticancer treatments. For ordering information, contact: Marcel Dekker Inc., (212) 696-9000; Fax: (212) 685-4540.

MEETINGS

RF/MW Dosimetry...A NATO Advanced Research Workshop on *Radiofrequency Radiation Dosimetry: Its Relationship to the Biological Effects of Electromagnetic Fields* was held in Gozd Martuljek, Slovenia, October 12-16. One of the objectives of the meeting was to help revise the *RF Radiation Dosimetry Handbook.* For more information, contact: Jon Klauenberg at Brooks AFB, TX, at Fax: (210) 536-3977, or E-mail: <b.jon.klauenberg@aloer.brooks.af.mil> or Damijan Miklavcic at the University of Ljubljana by Fax: (386+61) 1264658, or E-mail: <damijan@svarun.fe.uni-lj.si>.

MELATONIN

Breast Cancer Among Flight Attendants... Since 1995, three studies have pointed to an elevated breast cancer rate among female flight attendants in Canada, Finland and the U.S. Scientists have pointed to several factors as possible causes: ionizing radiation, pesticides—and now a drop in the hormone melatonin. In 1995, Finnish researchers reported in the *British Medical Journal (BMJ, 311,* pp.649-652, 1995) that flight attendants had a risk of breast cancer almost twice as high as that in the general population. The following year, the *BMJ* published a Danish study that showed a similar increase *(312,* p.253, 1996). An elevated rate of breast cancer has also been found among American flight attendants, Dr. Daniel Wartenberg of the Environmental and Occupational Health Sciences Institute in Piscataway, NJ, reported in a letter to the *BMJ* this June 20 *(316,* p.1902, 1998). Wartenberg stated that this increased risk shows some association with exposure to the pesticide DDT, which was routinely used in airline cabins until the 1970s. Now Dr. Anthony Mawson of Carolinas Health Care System in Charlotte, NC, has advanced another reason as to why flight attendants may be at greater risk: lower melatonin levels caused by chronic jet lag. "Jet lag disrupts the function of the pineal gland, which secretes melatonin in response to darkness," Mawson wrote in a research letter in the August 22 issue of the *Lancet (352,* p.626), adding that it takes several days in a new time zone to recover fully. "Breast cancer is associated with decreased melatonin production," he noted, and the hormone has been shown to inhibit the growth of human breast can-

POSTDOCTORAL/CAREER DEVELOPMENT FELLOWSHIP ON HEALTH EFFECTS OF NIR

The National Institute for Occupational Safety and Health (NIOSH) is seeking a postdoctoral fellow to conduct research on new methods for measuring worker exposures to biologically important characteristics of electric and magnetic fields at radio frequencies and extremely low frequencies. The fellowship is designed for a recent PhD with a strong physics or engineering background who wants to start a career in occupational health research. The 2-3 year fellowship includes a stipend of at least $38,000, dependent on qualifications. This position includes an option to take university courses in health physics and industrial hygiene, as a start for a career in occupational health. Qualifications include a PhD in physics, engineering, or industrial hygiene, the ability to work well with a multidisciplinary research team, and a strong background in EMF theory, computer programming, and electronics. Deadline for applications is January 15, 1999.

For more information on applications, interested candidates should contact: Dr. Joseph Bowman, NIOSH, Mail Stop C-27, 4676 Columbia Parkway, Cincinnati, OH 45226. Phone: (513) 533-8143, E-mail: <jdb0@cdc.gov>.

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cer cells. Mawson concluded with three predictions that follow from this hypothesis and that can be readily tested: Female flight attendants should have lower melatonin levels than controls, breast cancer risks should go up with length of employment and melatonin levels should go down. Dr. John Toy of Britain's Cancer Research Campaign expressed interest in this hypothesis in an interview with *The Independent* (August 21), a U.K. newspaper, but warned that women should not respond by running out to buy melatonin. "Melatonin is not harmless and can have serious side effects," Toy emphasized, "including low blood pressure, nightmares and sleep disorders" (see also *MWN,* M/A96, M/J96 and J/F98).

PEOPLE

Dr. **Indira Nair** has been appointed vice provost for education at Carnegie Mellon University in Pittsburgh....Dr. **Mary Elizabeth Jacobs** is now "on detail" as the deputy director of the Office of Blood Research and Review at the FDA's Center for Biologics Evaluation and Research. She was formerly the director of the Division of Life Sciences at the FDA's Center for Devices and Radiological Health....EPRI has given Dr. **Paul Zweiacker** of the Dallas electric utility TU Services its Technology Transfer Award for 15 years of "encouragement and support" of EPRI EMF research. The institute calls him an "EMF Research Champion." Zweiacker is also a member of the National EMF Advisory Committee....Dr. **Jerome Beers** has begun a research fellowship in functional MRI at the Massachusetts General Hospital NMR Center in Boston....President Clinton has named Dr. **David Michaels** of the City University of New York Medical School to serve as the assistant secretary of energy for environment, safety and health.

Keeping Current: Follow-Up on the News

◆ A major epidemiological study of EMFs and childhood leukemias, led by Mary McBride of the British Columbia Cancer Agency in Vancouver, has been submitted for publication. No word yet on when it will appear in print.

◆ Dr. Murray Finkelstein of the Ontario Ministry of Labor in Toronto reports that the U.S. National Institutes of Health have turned down his request for a grant to investigate melanoma and testicular cancer among highway patrolmen (see *MWN,* J/A98).

◆ In his weekly Internet column (October 2), Dr. Robert Park of the American Physical Society (APS) in Washington writes that the APS Executive Board has voted to stand by its 1995 conclusion that an EMF–cancer link is not "scientifically substantiated" (see *MWN,* M/J95). Subsequent research has "uncovered no evidence" of EMF health effects, the board contends.

◆ In the October issue of *Health Physics,* ICNIRP's Rüdiger Matthes answers questions about the commission's new EMF and RF/MW exposure limits (see *MWN,* J/A98). The issue also includes two comments on the limits from the Netherlands.

◆ Following postponements by both sides, the citizens and labor groups challenging the FCC's limits for RF/MW exposures will probably meet the FCC in the federal appeals court in New York City the week of December 14 (see p.8 and *MWN,* N/D97 and J/A98).

◆ The Iridium satellite phone system's "agreement in principle" with European radio astronomers (see *MWN,* J/A98) has run into problems. There is still no deal on time-sharing after 1999. The concessions made by U.S. astronomers "are unacceptable to us," a Dutch astronomer told *Science* (October 2). "We are not willing to give up daytime observations," he added.

◆ Those who want to keep up with U.S. and international standards are advised that the American National Standards Institute in New York City now has an online version of its biweekly update, *ANSI Standards Action.* It can be found at: <www.ansi.org>.

As We Go to Press

◆ ◆ ◆ On October 14, Melissa Bullock withdrew her lawsuit against Northeast Utilities, which had been filed in December 1991 in the Connecticut Superior Court in New Haven (see *MWN,* J/F 92). Bullock had developed a brain tumor, which she claimed was caused by EMFs from power lines and a nearby substation in Guilford, CT. The trial was scheduled to begin in January. More on this in our next issue. ◆ ◆ ◆

Unfinished Business: EMF Research Must Continue

Does EMF exposure increase your risk of cancer? Most epidemiological studies say yes—but the increase is not large, compared to smoking cigarettes.

But some epidemiologists say that EMF studies are like comparing two-pack-a-day smokers to those with a three-pack-a-day habit. The problem is that EMFs are so ubiquitous in industrialized societies that unexposed controls are impossible to find.

Dr. Samuel Milham decided to look into this analogy, and went back to the data in Sir Richard Doll's classic paper on tobacco. What he found is startling (see p.12). Compared to nonsmokers, heavy smokers were 24 times more likely to get lung cancer. But compared to light smokers, their risk was only three-and-a-half times higher. Compared to moderate smokers, heavy smokers' odds were only twice as bad.

Of course, the fact that this is true for tobacco doesn't prove a thing about EMFs. It's only an analogy. To see if it holds up, we have to look a little deeper.

First, it is striking that we still know so little about who is exposed to what. Milham did the first EMF occupational study over 15 years ago (see *MWN,* J/A82). Yet only recently did we recognize that sewing machine operators have higher EMF exposures than do electric utility workers (see *MWN,* S/O95).

Sources of EMFs turn up in surprising places. For example, Swedish researchers reported last year that steel-belted radial tires can expose automobile passengers to EMFs as high as 50 mG. Thus, an office worker with a long commute might have more exposure than a utility worker. A suburban kid who gets shuttled around in his parents' car might have more exposure than a child living within sight of a power line. Who is the exposed individual, and who is the control?

And the problem is not just the many sources of EMF exposures, but also whether they will be accurately measured. One reason the EMFs from tires went unnoticed for so long is that they tend to be at frequencies below 40 Hz, and are filtered out by most 50/60 Hz meters. This has been demonstrated by Milham, a consultant in Olympia, WA (see *MWN,* M/A98).

Incomplete measurement of EMFs can blur estimates of risk in many ways. At the beginning of the EMF health debate, the focus was on exposure to electric fields. Magnetic fields soon moved into the limelight, pushing electric fields into the background. But two years ago, Dr. Anthony Miller of Canada's University of Toronto found that the highest risk for leukemia came when *both* electric and magnetic fields were taken into account (see *MWN,* J/A96).

Looking at either exposure separately tells less than half the story, Miller found. Utility workers with high magnetic field exposure had a leukemia risk one-and-a-half times greater than expected. But those with high exposure to magnetic *and* electric fields had an 11-fold increase in risk.

An even larger risk was observed by Dr. Gilles Thériault of McGill University in Montreal in his study of workers at Hydro-Québec (HQ) (see *MWN,* N/D94). Lung cancer risk was 17 times higher than expected for workers most exposed to high frequency transients.

These results from Miller and Thériault have two things in common. One is that people with the highest exposures to specific types of EMFs can have much higher cancer risks. If most EMF studies are like comparing light smokers to heavy smokers, the work by Miller and Thériault may be like studying people who chain-smoke Camels. Investigating highly exposed workers should be a top priority.

Second, both findings have been more or less ignored. Despite double-digit risks, they are rarely mentioned in the EMF debate. It is astonishing that they have prompted little or no follow-up—in fact, HQ cut off Thériault's access to the study's data (see *MWN,* N/D94).

Too many people have uncritically accepted the idea that if there is a risk from EMFs, it must be small. This unproven assumption is used as an argument to slash research funding. And as we report on p.1, this has now become official U.S. policy. The DOE's EMF research program has folded, and there is no more government funding for EMF health research.

But there are both moral and pragmatic reasons why EMF research must continue.

To point out that it is impossible to be unexposed to EMFs in modern society is not a complaint against electricity. We are not Luddites, calling for a return to the past. Electric power has become so widespread precisely because of its tremendous social benefits. But the result is that EMF exposure is no longer a matter of individual choice. Whether or not you use an electric hair dryer, you will be exposed to EMFs—possibly from sources of which you are completely unaware. A society that has made electric power such an intimate part of daily life has a responsibility to see that it is used safely.

The practical reasons for research on EMFs are even stronger. Many possible health risks are relatively unexplored. This is true for heart disease, Alzheimer's and breast cancer—all diseases that are extremely common. If any one of these proves to be a genuine hazard, even a small risk would carry a tremendous social cost. EMFs are too ubiquitous to ignore.

We are just beginning to understand how EMFs can affect our health, but too many people are in a hurry to come to a conclusion. It is shortsighted, to say the least, for a country with a $6 trillion economy to think it cannot spare even a few million dollars to investigate the safety of something so pervasive—and essential—as electric power.

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Trying To Make Sense of It All

U.K. Parliamentary Panel Seeks Stricter RF Limits, More Research

The Select Committee on Science and Technology of the U.K. Parliament has recommended adoption of much stricter radiation limits. The committee concluded that there is no evidence of a health hazard from mobile phones or from towers but called for increased research on possible health effects.

In a report released by the House of Commons on September 22, the committee asked the National Radiological Protection Board (NRPB) to follow the exposure guidelines set by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). To do so would entail an 80% reduction in current U.K. limits for the specific absorption rates (SARs) associated with mobile phones.

The U.K. SAR limit, 10 W/Kg, is the most lenient in the world. Even if brought into line with ICNIRP's 2 W/Kg standard, it would still be looser than the U.S. limit of 1.6 W/Kg. The U.K. radiofrequency and microwave (RF/MW) exposure standards are, in general, among the least stringent — and most complex — anywhere (see *MWN*, J/A89 and J/F94).

The NRPB maintains that its RF/MW exposure standards are already strict enough to protect human health, and that no change is needed. Dr. Michael Clark, an NRPB spokesperson, said that Parliament's call for tighter limits was based on "broadly political rather than scientific considerations."

The science and technology committee described the proposed adoption of the ICNIRP limits as "a precautionary measure," and stated that the scientific

(continued on p.10)

EMF Epidemiology Studies: Moving Towards a Clearer Picture

Studies of electromagnetic fields (EMFs) and cancer may seem to be a mess of conflicting evidence. Some residential studies link cancer to measured magnetic fields, some to wire codes, others to neither one. Some occupational studies report an increase in one type of cancer, some in another.

But two new analyses point to a more consistent picture.

Data from ten studies of EMFs and childhood leukemia indicate that the association with measured magnetic fields is "remarkably consistent across studies," according to Dr. Sander Greenland of the University of California, Los Angeles (see p.3).

And an EPRI analysis has found that, when examined together, several large occupational studies "suggest a small increase in risk of both brain cancer and leukemia." The analysis concluded that, "What previously seemed to be important differences in results across studies...may well have resulted from chance fluctuation" (see p.3).

« Power Line Talk »

In a recent keynote address on the biological effects of power line EMFs, Dr. **Russel Reiter** spoke eloquently about the state of the science, but, when pressed to offer policy judgments, he fell silent. Overall, the evidence for health impacts is "not compelling," he said. "There are clearly no definitive answers." Speaking at the General Assembly of the International Union of Radio Science (**URSI**) in Toronto in mid-August, Reiter pointed to the "inability to reproduce effects" as the central stumbling block. He cited an example from his own lab at the University of Texas Health Science Center in San Antonio: "We got more dramatic effects when we used 'dirty fields,' but when I got a new computer-controlled exposure system from EPRI, it was harder to see effects." The problem may lie in the uncertainty over the most appropriate exposure metric, Reiter allowed. "The bottom line is that sometimes we don't know what we are doing." At the end of the talk, he was asked a series of questions often posed by a concerned public — for example, "Would you use an electric blanket?" Reiter declined to give his opinion. Dr. **Ross Adey** of the University of California, Riverside, followed by asking him to comment on the overlay of politics on the science, specifically as to the NIEHS Working Group's designation of EMFs as possible human carcinogens (see *MWN,* J/A98). Again, no response. Then, Dr. **Yahya Rahmat-Samii** of the University of California, Los Angeles, posed a question that he said he is asked all the time: "Would you buy a house next to a power line?" Reiter responded that there are two distinct issues: possible health impacts and economic losses depending on public perceptions of the health risks. "In fact," Reiter continued, "I got a call on this exact question just a few days ago." What did Reiter tell his caller? "I don't remember," he said in a voice that could barely be heard.

«« »»

It's payback time. That's what the National Institutes of Health (**NIH**) told the **Lawrence Berkeley Laboratory** (LBL) in the wake of the government's misconduct finding against Dr. **Robert Liburdy**, formerly with LBL (see *MWN,* J/A99). In an August 3 letter to the lab, the NIH's **National Cancer Institute** (NCI) demanded repayment of an $804,321 grant to Liburdy. Just five days earlier, NIH Director Dr. **Harold Varmus** had received a letter from Rep. **Tom Bliley** (R-VA), chair of a House committee that oversees the NIH, demanding to know whether the agency was "making any efforts to recover the taxpayers' money for the NIH grants that supported the falsified studies." Though Liburdy was not required to retract most of the data or any of the conclusions in the two published papers at issue, the NCI is seeking repayment of the entire research grant. The August 3 letter states that the government "considers the research...to be tainted, voiding any possible utility, as the fabricated and falsified data were central to the research." Rep. Bliley's letter cited press reports that Liburdy had received $3.3 million in federal grants, but NIH's Varmus wrote back that most of these grants funded research that was unrelated to the misconduct charge. LBL spokesperson Ron Kolb told *Microwave News* that the lab is appealing the repayment demand. Kolb said that LBL has already returned the $361,566 portion of the grant that had not been used. He argued that to require repayment of money already spent would unfairly penalize LBL. But even paying back the entire grant may not be enough to make Bliley happy: His letter suggests he may want to see Liburdy put in jail. "Did the **Office of Research Integrity** [ORI] make any attempt to refer this matter for criminal prosecution?" the congressman asked. Varmus answered that ORI has been advised by the **Office of Inspector General** (OIG) that "it is considering initiating an investigation into this matter," after which the OIG could make "a referral to the Department of Justice for possible criminal or civil action."

«« »»

A Colorado appeals court has reinstated a lawsuit that seeks damages for "trespass" on private property by power line EMFs. The three-judge panel held that a jury must consider **Mark** and **Erica Van Wyk**'s claim that "the noise and electromagnetic radiation emanating from the power line unreasonably interfere with their quiet use and enjoyment of their property." Last year a New York court dismissed a trespass claim in an EMF case on the grounds that the fields "are incapable of being perceived by the senses and, thus, are not...a 'physical' invasion" (see *MWN,* J/F98). In the Van Wyk lawsuit against **Public Service Co. of Colorado**, the utility asserted that neither EMFs nor noise from the upgraded line constitute "the type of physical invasion that is required to sustain a claim for trespass." But that argument was rejected by the Colorado Court of Appeals in Denver in its June 24 decision. The Van Wyks' suit targets a power line that was upgraded from 115 kV to 230 kV in 1997. The appeals court ordered a trial on their claims that the upgraded line produces loud noises and that "the EMF created by the power line encroaches upon the property owners' land."

"EMF Health & Safety Digest" To Close Down

In yet another sign of the electric utility industry's decreasing concern over the EMF issue, Robert Banks has announced that he will close down his consulting company and stop publishing the *EMF Health & Safety Digest* at the end of the year.

The newsletter is part of the EMF Information Project run by Robert S. Banks Associates Inc. in Minneapolis, with support from EPRI, the Edison Electric Institute (EEI) and the American Public Power Association, among others. Banks also organized EMF science seminars for EPRI, at first annually and then every other year. The seminar scheduled for last March was canceled on short notice (see *MWN,* M/A99).

The *Digest* is the last of the electric utilities' newsletters on EMFs, which once included EEI's *EMF News* and Central Maine Power's *EMF Keeptrack* and *Between the Lines* (see *MWN,* S/O97).

Utility Worker Studies Do Not Conflict, States EPRI Analysis

A joint analysis of three large studies of utility workers and EMFs has found that their results are much more consistent than originally thought. Dr. Leeka Kheifets of EPRI in Palo Alto, CA, found that, "Overall, the studies suggest a small increase in risk of both brain cancer and leukemia."

Kheifets and colleagues examined data from the largest and most reliable studies of electric utility workers, which some had seen as being at odds. For example, one reported an increase in the risk of leukemia, but not brain cancer, while another found the reverse. But Kheifets concluded that, "Apparent inconsistencies in the findings of these studies can be explained by statistical variation."

Dr. David Savitz of the University of North Carolina, Chapel Hill told *Microwave News* that the balance of evidence on occupational EMF exposure "points more neatly, now, to a small increase in both cancers associated with increasing estimated magnetic field exposure." Savitz led one of the three utility worker studies in the combined analysis (see *MWN,* J/F95).

The other two were Dr. Jack Sahl's study of workers at Southern California Edison (see *MWN,* M/A93 and J/A93) and the Canadian-French study of workers at Hydro Québec, Ontario Hydro and Electricité de France, led by Dr. Gilles Thériault (see *MWN,* M/A94). Sahl, Savitz and Thériault are all coauthors of the Kheifets paper, published in the August issue of *Occupational and Environmental Medicine (56,* pp.567-574).

"What previously seemed to be important differences in results across studies...may well have resulted from chance fluctuation," the researchers wrote. They concluded that, "All studies are compatible with a weak association between magnetic fields and both brain cancer and leukemia," and that this joint analysis "at least slightly strengthened the case for an association."

This is consistent with two meta-analyses of occupational studies led by Kheifets, one on brain cancer and one on leukemia (see *MWN,* J/F96 and N/D97). These studies, which were not confined to utility workers, found statistically significant increases in both diseases.

The pooled data from the utility worker studies point to a 12% increase in brain cancer risk, and a 9% increase in leukemia, per 10 μT-years. (A μT-year is a measure of cumulative exposure. A worker exposed to a 2 μT field for a five-year period, or one exposed to a 0.5 μT field for a twenty-year period, would each have 10 μT-years — or 100 mG-years — of exposure.)

"I was struck by the overall consistency in the results," said Sahl, a consultant in Upland, CA. "When you sit down and take a more thoughtful look at them, we find that the studies are really quite similar." But Sahl was reluctant to draw any general conclusions about occupational EMF exposure, noting that, "Other work environments — smelting plants, for instance — are much more complex, in terms of types of EMF exposure and potential confounders."

Thériault emphasized that, "It's always quite difficult to compare different studies." But, he added, "I find it quite fascinating that when you look at the things that you *can* compare, they are in fact quite compatible."

Kheifets did not respond to requests for comment. EPRI had called for some sort of joint analysis of the utility worker studies soon after the Savitz study was published (see *MWN,* J/F95).

"Consistent" Picture on EMFs and Childhood Leukemia

An analysis of research on EMFs and childhood leukemia has found that the link to measured magnetic fields is "remarkably consistent across studies," according to Dr. Sander Greenland of the University of California, Los Angeles.

Greenland told the annual meeting of the Society for Epidemiological Research (SER) this June in Baltimore that pooled data from ten studies showed no elevated risk of leukemia for children exposed to less than 2 mG — but above that amount, the risk ratio "rose steadily."

In a surprise to many, including himself, Greenland found much wider variation in the results of studies based on wire codes. "This was just the opposite of what I'd been led to expect," Greenland said in an interview. (Wire codes categorize power lines as low- or high-current, based on appearance and proximity.)

The pooled analysis found a higher risk of leukemia for children with higher exposures. Children exposed to 6 mG or more had an 80% greater risk, a statistically significant increase (95% confidence interval=1.1-2.9). But Greenland cautioned against taking one significant finding as definitive: "In all these studies, there's a relative handful of subjects with exposures of 5 mG and above." He stressed that, "This study doesn't establish an effect."

"I view the Greenland analysis as quite persuasive in documenting the inconsistency of wire code studies and the consistency of evidence pointing to magnetic fields," Dr. David Savitz, president-elect of the SER, told *Microwave News*. "There is tremendous imprecision in the interesting part of the dose-response curve, where exposures are highest," noted Savitz, who is at the University of North Carolina, Chapel Hill. "Nonetheless, I think this presents the most strongly positive integrated evidence on magnetic fields and cancer that I've seen."

Greenland's analysis used data from 13 studies, ten of which measured magnetic field levels while six of the 13 used wire codes. "The results from studies using wire codes weren't really very consistent with each other," Greenland said. "They range from somewhere around nothing to something pretty positive."

The pooled analysis has been submitted for publication, said Greenland, who collaborated on the study with Drs. Asher Sheppard, Michael Kelsh and William Kaune.

Sheppard told *Microwave News,* "Our analysis turns topsy-turvy the idea that there is a 'wire code paradox'." Though not conclusive, Sheppard noted, measured-field results showed "a consistent pattern" of higher odds ratios for subjects with the highest exposures. A consultant based in Redlands, CA, Sheppard presented results of the analysis at the June meeting of the Bioelectromagnetics Society in Long Beach, CA.

Dr. Daniel Wartenberg said that these findings are similar to those of his 1998 meta-analysis of 15 childhood leukemia studies (see *MWN,* J/F99). "Results for the studies with calculated

and measured magnetic fields are more consistent than for those with wire codes," said Wartenberg, of the Environmental and Occupational Health Sciences Institute in Piscataway, NJ. "Wire codes might not be equally applicable in different regions."

Another meta-analysis of childhood leukemia studies, funded by the European Community, is being conducted by Drs. Anders Ahlbom and Maria Feychting of the Karolinska Institute in Stockholm. Results are expected next year (see *MWN,* M/J99).

A recent childhood leukemia study by Dr. Lois Green of the University of Toronto in Canada pointed in the same direction as Greenland's combined analysis, finding a link to measured EMFs but not to wire codes (see *MWN,* J/A99). Another Canadian study, by Dr. Mary McBride of the British Columbia Cancer Agency in Vancouver, did not find a link to either one (see *MWN,* M/J99). Greenland said that his analysis did not include the McBride or Green studies, but that their published data did not suggest that either would have had a dramatic effect on his results. Data from Dr. Martha Linet's study for the National Cancer Institute was included, and Greenland said that this "fit right in with all the rest" (see *MWN,* J/A97).

Greenland said that progress towards more conclusive answers will require studies that include more people with high exposures. He expressed hope that a study now under way in Japan might "break the logjam" (see *MWN,* M/J99). He noted that in some of the more densely populated Asian cities, "you have a lot more dwellings near high-tension lines."

"It's a rather frustrating situation, to have had about 12,000 subjects in all these studies and still not have gotten an unambiguous answer," said Greenland. Still, he added, "Considering all the ambiguities and uncertainties that always come up in the course of an epidemiological study, it's really rather remarkable how consistent the magnetic field studies are with one another."

Löscher Again Finds EMFs Can Promote Breast Cancer

Germany's Dr. Wolfgang Löscher continues to find experimental evidence that EMFs can promote breast cancer.

Löscher's latest results were published in the August 1 issue of *Cancer Research (59,* pp.3,627-3,633), arguably the most prestigious cancer journal in the world. "The referees were very enthusiastic," Löscher told *Microwave News*. He is at the School of Veterinary Medicine in Hannover. (See also *MWN,* J/A93, S/O94, J/F95 and J/A95.)

Paradoxically, the new results appeared at about the same time that the failed attempts to repeat his work were published by an American team in another high-quality journal, *Carcinogenesis* (*20,* pp.899-904, May, and *20,* pp.1,615-1,620, August). (See also *MWN,* M/A98 and M/J98.)

Löscher's new findings "are the strongest yet," Dr. Larry Anderson told *Microwave News*. Anderson was in charge of three EMF–breast cancer studies at the Battelle Pacific Northwest Labs in Richland, WA, which did not find a promotional effect.

Löscher and Dr. Susanne Thun-Battersby, together with Löscher's longtime collaborator, Dr. Meike Mevissen, now at the University of Bern in Switzerland, exposed 99 female rats to a 1 G, 50 Hz magnetic field for one week, before giving each rat a 10 mg dose of the chemical carcinogen DMBA. The magnetic field exposure then continued for 26 weeks, after which the animals were killed and examined for tumors. A second set of 99 DMBA-initiated rats served as controls. The German team did not know which animals were exposed to the EMFs.

The 50 Hz magnetic field enhanced the growth and development of the breast tumors. The largest difference came 13 weeks after DMBA administration, when the exposed rats had close to twice as many tumors as the controls. By the end of the experiment, the controls had closed some of the gap. Nevertheless, there were still more rats with breast tumors among those exposed to the magnetic fields — 64.7% vs. 50.5%, a statistically significant difference. The tumors were histologically confirmed at the end of the experiment, which fact, Anderson noted, "speaks to criticisms of earlier experiments."

When asked by *Microwave News* about the divergence between his and the American results, Löscher replied, "Both studies are correct; the explanation must be in the genetic variations." Indeed, Anderson does not claim that his experiments should carry greater weight than Löscher's. "We believe our results and we have no reason to disbelieve Löscher's results," he said.

While Anderson would like to repeat his experiment, Löscher does not want to. "It makes no sense to do it again," Löscher said.

In the *Cancer Research* paper, Löscher's team explains the differences between its experiments and Battelle's:

> [A]lthough the studies were conducted in an attempt to replicate our previous MF [magnetic field] studies in the DMBA model, there were various differences from our experiments, including another diet, shorter exposure per day (e.g., 500 hours less exposure in 13 weeks), the use of different rooms for sham and MF exposure, differences in the exposure systems and the use of a subline of [Sprague-Dawley] rats with markedly higher susceptibility to DMBA than our rats. Because of this higher sensitivity to DMBA, two of the three DMBA protocols used in the United States study resulted in almost 100% tumor incidence in sham controls, which prevented obtaining any additional effect by MF exposure. Thus, because of these various differences, these experiments cannot be considered as replicate studies of our experiments.

Löscher reports a new and "interesting" finding in his new experiment: EMFs did not promote tumors equally across the six mammary complexes.

Scientists at the National Institute of Environmental Health Sciences (NIEHS), which sponsored the Battelle studies under the EMF RAPID program, have been dismissive of the work of Löscher's team. Relations between them have become strained (see *MWN,* N/D98).

In its June report to Congress on the EMF RAPID program, the institute concluded that, based on the Battelle studies, there is "strong evidence" that EMFs do not promote breast cancer.

Neither NIEHS' Dr. Gary Boorman nor Dr. Christopher Portier would comment on the new Löscher results. Boorman helped design the Battelle study, and Portier was the principal author of the NIEHS RAPID report to Congress.

Replication Attempt Finds No Support for Lai-Singh Work; Debate Continues Over DNA Damage from Microwaves

In a study that is almost complete, researchers in Dr. Joseph Roti Roti's lab at Washington University in St. Louis have found no evidence of DNA damage from microwave exposure. They are attempting an exact replication of work by Drs. Henry Lai and N.P. Singh that observed single- and double-strand DNA breaks in the brains of rats.

Dr. Isabelle Lagroye presented preliminary findings from the ongoing study at the annual meeting of the Bioelectromagnetics Society (BEMS) in Long Beach, CA, in June. In the study, live rats were exposed to pulsed 2450 MHz microwaves for two hours, and examined for DNA damage four hours later. With most of the work complete, no DNA damage has yet been detected.

Roti Roti's team had conducted several previous follow-up studies on the Lai-Singh work, none of which found any microwave effect (see *MWN,* J/F98, M/J98 and S/O98). These were criticized, however, for not being exact replications. Some observers, especially those in the wireless industry, believe that Roti Roti's current effort will be the final proof needed to put this highly contested matter to rest. But enough disagreements persist that a quick resolution seems unlikely.

Arguments over the contradictory findings have focused on how the two labs measured DNA damage. While both Roti Roti and Lai-Singh used a method known as the "comet assay" (named for the comet-like pattern made by DNA fragments), each lab chose a different version of the technique. Rather than using the procedure developed by Singh and used in the Lai-Singh experiments, Roti Roti decided to use a version developed by Dr. Peggy Olive of the British Columbia Cancer Research Centre in Vancouver.

Roti Roti's choice made things more complicated. The debate over microwave effects was soon entangled in a dispute as to whether Roti Roti was using Olive's technique correctly, after he reported an unprecedented level of sensitivity. Lai and Singh, as well as other researchers, were skeptical that such sensitivity was possible using Olive's procedure, which led them to question the validity of Roti Roti's results with microwaves at cellular phone frequencies.

"Damage from ionizing radiation cannot be detected below about 3-5 rads [3-5 cGy]," insisted Singh in an interview this September. "And that is with healthy lymphocytes." Cancer cells and other cells grown in culture will show higher background levels of DNA damage, Singh explained. "With fibroblasts, for example, you can only detect damage down to 15-25 rads."

In a 1997 paper in *Radiation Research,* Dr. Robert Malyapa and Roti Roti reported detection of significant DNA damage from as little as 0.6 rads, with both mouse fibroblasts and human brain cancer cells.

In the past, Olive has expressed doubt that it is possible to get sensitivity much below exposures of about 5 rads, even under the best conditions. She is said to have expressed skepticism to other researchers about the sensitivity claimed in the Malyapa-Roti Roti study. Olive did not respond to repeated requests for comment from *Microwave News*.

Malyapa also declined to comment, referring all questions to Roti Roti.

In an extensive interview, Roti Roti told *Microwave News* that results in his lab were not qualitatively different from those in Olive's. "She's gotten down to around 2.5 rads," he said, in work which she has not published. "So our sensitivity is not that much higher." But Roti Roti conceded that these numbers understate the difference, since the sensitivity reported in his lab was in work with fibroblasts and cancer cells.

Lagroye, of Dr. Bernard Veyret's group at the University of Bordeaux in France, has been working in Roti Roti's lab on the current Lai-Singh replication study. Using the Olive assay, she has observed DNA damage in mouse fibroblasts down to a 1 rad exposure. "Because of time constraints, I did not attempt to go below 1 [rad]," she told *Microwave News*.

Asked what is being done differently in Roti Roti's lab to produce a better sensitivity than Olive has achieved herself, Roti Roti and Lagroye pointed to a number of possible improvements: the computerized image analysis system used to measure the spread of the comet tail, the mathematical method for calculating DNA fragments, slight differences in the way the DNA is treated and the larger amount of data collected. "If each of these gave a 1.5- to 2-fold increase in sensitivity, we could expect a [net] 7.5- to 32-fold increase," said Lagroye.

Lai, however, is unconvinced. "You have to be very lucky to get such an improvement in every one of those steps," he said in an interview. "I cannot say that they cannot do it, but a lot of people are skeptical."

In fact, Singh's method is considered by most researchers to be more sensitive, and is more widely used. For example, a 1999 review article on the comet assay states that while the two versions are "similar in practice, the Singh method appears to be at least one or two orders of magnitude more sensitive."

Roti Roti questions this assessment. "That's the conventional wisdom," he said. "But the data we're getting so far suggest that they may be comparable."

Dr. Kim O'Neill of Brigham Young University (BYU) in Provo, UT, said that the Singh version of the assay is somewhat more sensitive. But, he added, it is "almost too sensitive — if you play the wrong music in the lab, you can have problems." O'Neill himself uses the Olive method.

Dr. James McNamee of the Canadian government's Radiation Protection Bureau (RPB) in Ottawa uses the Singh version. He agreed that with Singh's assay, it is more difficult to get reproducible results. "It's easy to run the assay with the Singh method, but it's tough to do it well," he said. "The problem is getting conditions standard enough from one experiment to another."

Roti Roti has explained his initial decision to use the Olive method in just these terms. "In terms of day-to-day response, the Olive method seems more robust, in that it's more reproducible," he said in September. "We thought we'd get results more quickly with the Olive method." But in retrospect, Roti Roti said, "I'm kind of agreeing with everybody's criticism that we should

have used the Singh assay to begin with." The replication study now under way employs both the Singh and Olive methods.

The use of the Singh method by Lagroye and Roti Roti has not convinced Lai and Singh. "I doubt very much whether they're doing the Singh method right," said Lai, "because of some discrepancies in the figures presented at BEMS."

Lai points to Roti Roti and Lagroye's data on the use of the enzyme proteinase K (PK), which is part of Singh's procedure but not Olive's. PK dissolves protein–DNA cross-links that can prevent the detection of DNA damage. At the BEMS meeting, Lagroye reported that when the Singh method was used without PK, DNA damage could not be detected after an exposure to 100 rads (1 Gy) of ionizing radiation. (With PK, she did observe DNA damage after a 100 rad exposure.)

"Something looks wrong with that graph," said Lai. "One hundred rads is not powerful enough to cause cross-linking, so there should be no difference with or without PK." Lai still thinks microwaves can increase DNA damage. "In our lab," he said, "we are still getting the same results."

What could account for the two labs' conflicting findings? Canada's McNamee and other researchers doubt that the choice of the Olive or the Singh technique is at the root of the matter. "I consider the differences between the assays themselves to be relatively minor," he said. "Both should be able to detect damage, if it's there." O'Neill, of BYU, agreed, saying, "They are both good methods. For microwave analysis, either one should give you a conclusive result."

"Roti Roti, Lai and Singh are all good investigators," McNamee told *Microwave News*. "If people are getting different results, it could be due to many factors."

"This issue has become very highly charged," commented McNamee. "What we need is for several different labs to get involved and do their own work, and over time it'll iron itself out."

McNamee's lab is starting its own *in vitro* study on the Lai-Singh findings. He hopes to start exposures in the next few months, and to have some results by mid-2000. "We'll be able to process a much larger number of samples at once than has been the norm," he said. His lab has written its own image-processing program because of questions about how commercial software may handle some parameters. "We want to be sure we aren't getting a computer-generated result," McNamee explained.

Dr. Luc Verschaeve of VITO in Mol, Belgium, is also planning further studies on effects of microwaves on DNA. Last year, at a workshop in Vienna (see *MWN,* N/D98), he presented an overview of data from his studies to date, with results that he described as "contradictory." For example, human lymphocytes exposed to the signal from a 954 MHz base station antenna showed an increase in genetic damage, as measured both by classical chromosome tests and by the comet assay (see also *MWN,* N/D96 and S/O97). No effect was seen, however, in studies with microwave exposure in the lab in TEM cells.

Roti Roti said it might be possible for his lab to work directly with Lai and Singh to find the reasons for their different results, but he emphasized that his own group is "looking at the twilight of our DNA damage funding" from Motorola. Lagroye's study had additional support from France Telecom.

Industry representatives are not calling for more research to resolve the conflict between the Lai-Singh and Roti Roti labs. Rather, they have cited Roti Roti's results as reasons why the Lai-Singh work need not be cause for concern.

This June, for example, Motorola's Dr. Quirino Balzano told the British Parliament that the Lai-Singh experiments are "a very good example of an experimental procedure which has not been validated, and has not been able to be replicated."

Isabelle Lagroye et al., "Measurement of DNA Damage After Acute Exposure to 2450 MHz Microwaves in Rat Brain Cells by Two Alkaline Comet Methods," Abstract 1-1, *21st Annual Meeting of the Bioelectromagnetics Society,* Long Beach, CA, June 20-24, 1999.

Henry Lai and N.P. Singh, "Single- and Double-Strand DNA Breaks in Rat Brain Cells After Acute Exposure to Radiofrequency Electromagnetic Radiation," *International Journal of Radiation Biology, 69,* pp.513-521, 1996; and "Melatonin and a Spin-Trap Compound Block Radiofrequency Electromagnetic Radiation-Induced DNA Strand Breaks in Rat Brain Cells," *Bioelectromagnetics, 18,* pp.446-454, 1997.

Robert Malyapa et al., "Measurement of DNA Damage After Exposure to 2450 MHz Electromagnetic Radiation," *Radiation Research, 148,* pp.608-617, 1997; "Measurement of DNA Damage After Exposure to Electromagnetic Radiation in the Cellular Phone Communication Frequency Band (835.62 and 847.74 MHz)," *ibid., 148,* pp.618-627, 1997; "Detection of DNA Damage by the Alkaline Comet Assay After Exposure to Low-Dose Gamma Radiation," *ibid., 149,* pp.396-400, 1998; and "DNA Damage in Rat Brain Cells After *In Vivo* Exposure to 2450 MHz Electromagnetic Radiation and Various Methods of Euthanasia," *ibid., 149,* pp.637-645, 1998.

E. Rojas, M.C. Lopez and M. Valverde, "Single Cell Gel Electrophoresis Assay: Methodology and Applications," *Journal of Chromatography B, 722,* pp.225-254, 1999.

Luc Verschaeve and Annemarie Maes, "Mobile Phone Cytogenetics," *Proceedings of International Workshop on Possible Biological and Health Effects of RF Electromagnetic Fields* (Michael Kundi et al., eds.), pp.221-230, Vienna, Austria, July 1999.

Australia Moves Towards New RF/MW Health Standard

The Australian government is moving to develop a new standard for public exposures to RF/MW radiation.

The new set of limits will be developed by an expert group under the aegis of the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA). The members of the group have yet to be chosen, according to Dr. Colin Roy, who heads ARPANSA's non-ionizing radiation division in Yallambie. The Australian Radiation Lab was combined with the Nuclear Safety Bureau in February to form ARPANSA.

The frequency-independent, or "flat," 200 $\mu W/cm^2$ standard that had been in place since 1985 lapsed earlier this year. At that time, Standards Australia, a private group, could not reach agreement on new, ICNIRP-based guidelines favored by many of its members.

The Australian Communications Authority (ACA) will continue to enforce the flat limit until the new government standard is ready, probably in late 2000 (see *MWN,* M/J99).

Meanwhile, the Australian Communications Industry Forum has agreed to develop a code of practice for mobile telephone base stations.

The government has come under fire for lack of public participation in the new initiative. Lyn McLean of the Electromagnetic Radiation Alliance of Australia in Sutherland told *Microwave News* that her group had expressed "strong misgivings" about the standard-setting process. The ACA stated that there had been "extensive consultation" with interested parties and that all had accepted the government's plan.

New Zealand Favors ICNIRP Limits, Curbs on Local Control

New Zealand is moving to adopt the RF/MW radiation guidelines of the International Commission on Non-Ionizing Radiation Protection (ICNIRP) as a national standard and may discourage local authorities from setting stricter limits. New Zealand is one of the few countries where local governments can set their own limits.

In July, the Ministry of Health and the Ministry for the Environment released for public comment a draft "guidance" to local governments, which aims to "encourage a consistent approach" to regulating sources of RF/MW radiation. The document recommends the "strict application" of the ICNIRP limits.

In April, Standards New Zealand, a private group, adopted ICNIRP-based guidelines for RF/MW exposures to replace its frequency-independent 200 $\mu W/cm^2$ standard (see *MWN,* J/F90 and M/J99). The latest government proposal would advise local authorities to adopt the Standards New Zealand guidelines and forsake more restrictive rules, such as the city of Auckland's current 50 $\mu W/cm^2$ limit (see *MWN,* N/D96).

"The concept of local control seems to have been lost," said Dr. Ivan Beale of the University of Auckland, who was a public representative in the Standards New Zealand deliberations. Beale told *Microwave News* that the change in policy was driven by pressure from the telecommunications industry and by a recent ruling of the country's Environment Court. The ruling held that a wireless carrier could not be required to reduce RF/MW emissions from a cellular antenna, since it already complied with ICNIRP limits and no RF/MW health hazards have been established at levels below those limits.

On the other hand, Roger Matthews, an Auckland planning official, does not believe that the proposed guidance would put an end to the city's RF/MW standard. "There is and will continue to be discretion," he told *Microwave News*. "To remove discretion, the government would have to legislate, and they are not about to do that."

In drafting its new guidelines, Standards New Zealand grappled with how to address prudent avoidance measures to reduce public exposures. While endorsing "low- or no-cost interventions," the proposed guidance recommends that any such measures be voluntary.

In the draft guidance, the health ministry argues that there is, at most, "residual scientific uncertainty" as to the safety of low-level RF/MW radiation. "Even if future research does eventually show that health effects exist, the risk from exposures to radiofrequency fields is likely to be very small or negligible."

This conclusion departs from that of a 1996 independent literature review, which was commissioned by the health ministry (see *MWN,* N/D96). That analysis, by New Zealand researchers, found that, "[T]here is a high level of scientific uncertainty" about potential hazards of low-level radiofrequency radiation. They wrote that the evidence "may be construed as either 'incomplete evidence of cause' *or* 'incomplete evidence of safety'."

The proposed guidance does not address the Ministry of Education's 1996 ban on new wireless antennas at public schools (see *MWN,* S/O96).

The 109-page document, *Towards National Guidelines for Managing the Effect of Radiofrequency Transmitters,* is available on the Internet at: <www.mfe.govt.nz/about/publications/rma/draft_rf_guidelines.pdf>.

New Cordless Phones: Higher Power, More Exposure

Cordless phones, long thought to be a negligible source of microwave radiation exposure, are now approaching the peak power levels used in cellular phones. The Federal Communications Commission (FCC) has started requiring manufacturers of the new higher-power cordless models to show that they comply with federal exposure limits.

These new cordless models use a technology known as Digital Spread Spectrum, or DSS, and the peak power of some is as high as 400 mW. This compares with a peak power of about 500 mW to 1 W for 1800 MHz PCS mobile phones.

"We have requested specific absorption rate (SAR) data to demonstrate RF exposure compliance" for several cordless phones introduced in the last year and a half, said Kwok Chan of the FCC Office of Engineering and Technology laboratory in Columbia, MD. "We generally ask for data on SARs when phones operate at 100 mW or above — sometimes even less, depending on other performance data."

Since DSS phones send a pulsed signal, their average power is lower. Still, Chan said, the more powerful DSS cordless phones have SARs "comparable to the low end of the range for PCS [cellular] phones."

A cellular phone must communicate with antennas that can be miles away. In contrast, traditional cordless phones are designed for use within a few hundred feet of the base station in the owner's home, and therefore need far less power. The peak power of traditional cordless models stays below 5 to 25 mW, and for many it is less than 1 mW. At such low power levels it would be impossible to exceed federal exposure limits.

The cordless picture changed last year, when DSS phones first appeared on the U.S. market. They operated with a peak power of 100-200 mW, Chan told *Microwave News*. "More recently," Chan said, "mostly in the last five to six months, we've seen a few at even higher power levels — around 300-400 mW." The peak power of cordless phones is not allowed to exceed 1 W.

DSS phones are "likely to be the standard type of digital cordless phone in a year or two," according to the September *Consumer Reports*. Their extended range is a prominent theme in marketing campaigns, with some companies claiming that theirs can be used three-quarters of a mile away from home.

Chan noted that higher power is not the only source of DSS phones' increased range. He explained that DSS phones use "digital coding techniques that can pull the signal out of a higher level of noise," enabling the user to travel farther from the base station before the signal breaks up.

Similarly, Chan said, "Higher power does not necessarily mean that the SAR has to be higher," noting that SARs are influenced

by many aspects of a phone's design.

So far, less than a dozen cordless models have been required to submit SAR data to the FCC, said Chan. Consumers will see more different models in stores, since the same type of DSS phone may be sold under various brand names.

Though most DSS phones are labeled as "900 MHz," they actually broadcast in a range between 902 and 928 MHz. This is part of the ISM band, which was first established for industrial, scientific and medical uses. DSS phones shift frequencies in the course of a call, using a "spread spectrum" technique similar to that used in CDMA cellular phones.

The technology originally used in cordless phones operates at 49 MHz and has a maximum range of about 400 feet. Also known as a "25-channel" phone, these analog models are still being made and operate at the lowest power. "Some of these have an output power in microwatts, not milliwatts," said Chan.

900 MHz cordless phones were introduced later, both analog and fixed-frequency digital models, with an effective range as high as 1,400 feet. These often use more peak power, but are still under 25 mW. For any of these models, said the FCC's Chan, "the power is so low that I hardly pay attention."

Higher-power cordless phones are also being marketed in Britain, where questions about their safety have become a focus of media attention and public concern.

Most often cited are cordless phones made to the Digital European Cordless Telephone (DECT) standard, which operate at 1900 MHz with a peak power of 250 mW. Unlike DSS cordless models or many cellular phones, DECT phones do not reduce their power to the lowest level needed to maintain a call, said the U.K.'s Alasdair Philips, a consultant on RF/MW safety issues based in Ely, Cambridge.

After several stories on possible health effects of DECT phones appeared in the U.K. media this summer, including coverage in the *Sunday Times* (July 4) and on BBC 4 radio (July 12), Britain's National Radiological Protection Board (NRPB) in Chilton issued a statement in response. "Exposure to radio signals from cordless phones is many times below the guidelines and therefore their use is not considered hazardous to health," the NRPB concluded.

Nokia Applies for Patent for Low-Exposure Phone Antenna

Nokia, the world's leading mobile phone manufacturer, has developed an antenna that directs "most of the radiation away from the caller," according to Britain's *New Scientist* (September 4).

The company, with headquarters in Finland, has applied for a U.K. patent for its new antenna. Nokia's Peter Harrison, based in Camberley, Surrey, told *Microwave News* that the patent has yet to be formally granted. He noted that a phone with this antenna will have a larger bandwidth than others.

Details are available on the U.K. Patent Office's Web site, <www.patent.gov.uk>, under publication number GB2330951. Japan's Mitsubishi and Hitachi have patented designs for reducing wireless phone RF/MW exposure (see *MWN,* N/D96).

Desperately Seeking SARs

All over Europe — as well as in the U.S. — there is a growing interest in which mobile phones cause the lowest radiation exposures.

British and Swedish legislators want consumers to have SAR data so that they can make up their own minds about possible radiation risks. On September 22, a U.K. parliamentary committee advised industry and government officials to find ways to assist "consumer choice" (see p.1).

About ten days earlier, Eva Flyborg, a member of the Swedish parliament, introduced a motion calling for manufacturers of mobile phones to make SAR numbers public. "If they refuse, we should seriously consider a legislative approach," Flyborg told *Microwave News*.

Flyborg explained that she favors disclosure of radiation levels because, "We simply know too little today about the health risks" and because "children and teenagers are using phones more and more." There is an "immediate need" to clarify whether safety standards protect the public, she said.

In Switzerland, the consumer magazine *K-Tip* published the SARs for 25 different phones in its September 22 issue. Five were tested both with the antenna up and with it down. SARs ranged from 0.10 W/Kg for the Motorola StarTac 130 (0.38 W/Kg with the antenna retracted) to 1.59 W/Kg for the Bosch GSM 908. (These SARs are averaged over 1 g of tissue, as required in the U.S. — in Europe, they are averaged over 10 g.) The 900 MHz Philips Genie had the highest measured SAR: 2.67 W/Kg with the antenna down (1.26 W/Kg with the antenna up).

In an accompanying editorial, Hans Räz wrote that the SAR safety standard is "worthless" because, "It was established without knowledge of the long-term risks of radiation, and set so that any manufacturer can meet it without difficulty."

News of the *K-Tip* survey was released in the U.K. by the *Independent on Sunday* on October 3. Sweden's Clas Tegenfeld, an EMF researcher in Linghem, has put the *K-Tip* list, together with other published SAR data, on his "Better Electromagnetic Environment" Web site; see <www. bemi.se>.

Meanwhile, *20/20,* an ABC television news magazine, will present its own measurement results to the American public in mid-October. Sources told *Microwave News* that *20/20* will disclose that some cellular phones did not meet the FCC's 1.6 W/Kg limit in certain testing positions.

ABC News hired the Institute for Mobile and Satellite Radio Technology in Kamp-Lintfort, near Düsseldorf, Germany — the same firm used by *K-Tip* — to do the SAR measurements. A *20/20* producer explained that none of the four American testing labs contacted by ABC was willing to measure SARs if the names of the manufacturers of the phones were to be revealed.

The first set of SAR measurements was disclosed by the Swiss media — the television show *Kassensturz* did so in 1997 (see *MWN,* N/D97).

Chinese RF/MW Exposure Standard Is the Strictest

In China, the Health Ministry's limit for public exposures to 30-300 MHz radiation is the most stringent in the world. Public concern about RF/MW radiation is strong, according to Motorola's Dr. C.K. Chou, who visited China in May (see box at right).

"The whole country is concerned about RF health effects," Chou told *Microwave News*. He said that according to an internal government document, 16% of China's cellular telephone base stations cannot be operated due to public objections.

But Dr. Huai Chiang of Zhejiang University Medical College in Hangzhou, a leading authority, said in an interview that she knew of no such report.

Nevertheless, there appears to be no doubt that there is widespread interest in possible health effects. Chinese scientists "are eager for information," said Ron Petersen of Lucent Technologies, who also went to Beijing in May.

Petersen told *Microwave News* that China is "far behind" the Western countries in the field of dosimetry. "In terms of measurements, they are about where we were 15 years ago," he said. Petersen pointed out that when measurements are taken too close to a cell phone antenna, there will be areas where the standard is exceeded — and this may be what is generating public concern.

Chiang described Chinese RF/MW standards during a recent visit to the U.S. She attended the Bioelectromagnetics Society annual meeting in Long Beach, CA, in June, where she presented a paper and briefed SCC-28, the IEEE standards committee. She later discussed the standards with *Microwave News*.

China's Health Ministry and Environmental Protection Agen-

Repacholi Mission to China

Dr. Michael Repacholi is expanding his International EMF Project to involve China. In May, Repacholi visited Beijing for talks that touched on the proposed worldwide harmonization of exposure standards for EMFs and for RF/MW radiation. Among those accompanying him were representatives of both wireless technology manufacturers and the U.S. Air Force.

The Chinese "have agreed to participate fully," Repacholi told *Microwave News* from his office at the World Health Organization in Geneva. He said that in November, Chinese scientists will travel to Erice, Italy, where Repacholi will be hosting a workshop on biological and health effects of pulsed RF/MW radiation, as well as meetings on coordination of international research and on standards harmonization (see *MWN*, M/J99).

Along with the world's largest population and a booming wireless telephone market, China has RF/MW exposure limits that are among the most stringent in the world (see story at left and table below).

Joining Repacholi in Beijing were Germany's Dr. Jürgen Bernhardt, chair of the International Commission on Non-Ionizing Radiation Protection, Dr. C.K. Chou of Motorola in Plantation, FL, Dr. Michael Murphy of Brooks Air Force Base in San Antonio, Ron Petersen of Lucent Technologies in Murray Hill, NJ, and Prof. Veli Santomaa of the Nokia Research Center in Helsinki, Finland.

This list was assembled by *Microwave News*; Repacholi did not respond to a request for a list of those accompanying him.

China's Two Sets of RF/MW Exposure Limits

	Health Ministry			EPA	
Frequency	Public 1st Class*	Public 2nd Class†	Occupational	Public§	Occupational§
100 kHz-3 MHz	10 V/m	25 V/m	50 V/m (5 A/m)	40 V/m 0.1 A/m	87 V/m 0.25 A/m
>3-30 MHz	10 V/m	25 V/m	25 V/m	67/√f V/m 0.17/√f A/m	150/√f V/m 0.40/√f A/m
>30-300 MHz	5 V/m	12 V/m	50 μW/cm²‡	40 μW/cm²	200 μW/cm²
>300 MHz-3 GHz	10 μW/cm²	40 μW/cm²	50 μW/cm²¶	40 μW/cm²	200 μW/cm²
>3-15 GHz	10 μW/cm²	40 μW/cm²	50 μW/cm²¶	f/75 μW/cm²	f/15 μW/cm²
>15-30 GHz	10 μW/cm²	40 μW/cm²	50 μW/cm²¶	200 μW/cm²	1,000 μW/cm²
>30-300 GHz	10 μW/cm²	40 μW/cm²	50 μW/cm²¶	—§§	—§§

* For permanent exposure and for all people.
† For temporary exposure only — not allowed in homes, hospitals or schools.
‡ For exposures of 8 hours/day; the limit is doubled for 4 hours/day or less.
For pulsed waves, the limits are 25 μW/cm² for 8 hours/day and 50 μW/cm² for 4 hours/day.
¶ For continuous wave/rotating pulsed wave radiation; must not exceed 400 μWhr/cm² for a working day.
Must not exceed 25 μW/cm² or 200 μWhr/cm² for a working day for stationary pulsed wave radiation.
§ f=frequency in MHz.
§§ No limit has been set.

cy (EPA) each has its own public and occupational exposure guidelines (see table on p.9). Chiang said that she expects the two standards to be "harmonized in a few years."

The Health Ministry limits exposures to 5 V/m — the equivalent of 6.6 μW/cm^2 — between 30 and 300 MHz for long-term exposures of the general public, especially groups thought to be sensitive, such as children and hospital patients.

The 6.6 μW/cm^2 limit is even stricter than Russia's 10 μW/cm^2 standard, although a recent revision of the Russian standard dictates a special lower limit for pregnant women and children under 18.

From 300 MHz to 300 GHz, the Chinese Health Ministry specifies 10 μW/cm^2 and 40 μW/cm^2 for continuous and temporary exposures, respectively. For workers, the standard is also frequency-independent, from 30 MHz up to 300 GHz, with a limit of 50 μW/cm^2.

The Health Ministry limits are based on effects observed in medical examinations and epidemiological studies and are stricter than those of the EPA. Tighter standards are specified for pulsed radiation, because, according to Chiang, pulsed radiation is "more effective in producing a biological effect" for the same power density.

The EPA limits are derived from specific absorption rates (SARs). They are based on maximum whole-body SARs of 0.02 W/Kg and 0.1 W/Kg for the general public and workers, respectively. The ICNIRP and ANSI/IEEE limits are also based on SARs, but at levels that are four times higher: 0.08 W/Kg and 0.4 W/Kg, respectively.

According to Chiang, the EPA uses its limits in licensing and monitoring TV and radio transmitters and other RF/MW sources.

There are currently no EPA standards for millimeter-wave radiation (30-300 GHz), because such sources are absent in the general environment. Chiang also pointed out that there are no epidemiological studies for exposures at these frequencies.

U.K. Parliament to NRPB: Lower Limits and More Research *(continued from p.1)*

justification for the NRPB's current rules has gone "largely unchallenged."

Nonetheless, Alasdair Philips, a consultant based in Ely, Cambridge, called the Parliament's recommendation to adopt the ICNIRP standard "a slap on the wrist" for the NRPB. He pointed out that earlier this year the NRPB had reaffirmed its commitment to its own standards and declined to bring them into line with those of ICNIRP (see *Documents of the NRPB, 10,* No.2, p.2, 1999).

At present, the U.K. government has only a small RF/MW health effects research program. At a parliamentary hearing on June 9, Tessa Jowell, the minister for public health, revealed that her total budget for mobile phone health research is about £60,000 (approximately $100,000) a year.

"We recommend that a higher priority [be] given to a research program into the health impacts of mobile phones" in view of the current state of scientific uncertainty, stated the committee (see p.11 for a complete summary of the committee's findings).

The chair of the parliamentary committee, who is also named Dr. Michael Clark, was widely quoted in the British press as saying that £60,000 could only pay for "one man and a dog." He called for enough money to fund a team of some 50 researchers.

The committee specifically pointed to a "need to confirm or deny" that microwaves can cause DNA breaks (see p.5).

In addition, the committee advised that the public be told the SAR of each mobile phone model "to assist consumer choice" (see p.8 and p.11). In his submission to Parliament, Dr. Alan Preece of the University of Bristol had specifically recommended that SAR figures "should be in the public domain so that concerned individuals can make a choice."

By early October, the NRPB had not yet responded to Parliament. The NRPB's Clark told *Microwave News* that a formal answer was still under consideration. But he added that any change in exposure limits is unlikely before a report is issued by an expert panel that the government has charged with investigating mobile phone health risks.

The expert panel has gotten off to a slow start. Jowell requested advice in early April after the release of a study by Preece which showed that cell phone radiation can speed up brain function (see *MWN,* M/A99). In addition, wireless health risks have been a hot topic in the British press over the last year (see *MWN,* J/A98 and N/D98).

While Sir William Stewart, a former science adviser to the prime minister, was named the chair of the ten-member expert group in June (see *MWN,* J/A99), the other members of the panel were announced by the NRPB only on August 24. The group is composed primarily of academic researchers (see p.11). Two exceptions are John Fellows, a student at Edinburgh University, and Dr. Michael Repacholi of the World Health Organization's (WHO) EMF Project in Geneva, the only non-British member. The NRPB's Clark told *Microwave News* that the members were selected by Stewart.

The composition of the panel was the subject of an extended exchange at the June 9 hearing before the Committee on Science and Technology. "I intend [the expert group] to have a strong representation of the consumer and public interest," Jowell said, adding that she did not want anyone from industry on the panel.

In his testimony, Dr. Roger Clarke, the director of the NRPB, countered that neither consumer nor industry representatives would be on the panel, but that they would be "invited to submit evidence and perhaps appear in front of the group."

The new report from Parliament recommends that there be "at least two lay members" on the expert group and that the "rationale for their appointment must be made clear." A number of observers have wondered why Fellows was selected, given that he has no prior knowledge of RF/MW issues. The committee also noted that it had no objection to industry representatives with "useful, relevant expertise" being on the panel.

When asked who would decide which issues would be investigated by the expert group, NRPB Director Clarke told the committee that he would do so himself, in conjunction with Sir Richard Doll, the chair of the NRPB Advisory Group on Non-

Ionizing Radiations.

The NRPB has announced that Minister Jowell approved the following scope of the inquiry for the panel: "To consider present concerns about possible health effects from the use of mobile phones, base stations and transmitters, to conduct a rigorous assessment of existing research and to give advice based on the present state of knowledge. To make recommendations on further work that should be carried out to improve the basis for sound advice."

In September, the expert panel published a "Call for Evidence" in a number of national newspapers, including the *Times* and the *Daily Mail*, as well as in the *New Scientist,* seeking written evidence on mobile phone health risks. The deadline for submissions is October 15.

In addition to Stewart, the members of the expert panel are: Dr. Colin Blakemore, University of Oxford; Dr. Laurie Challis, University of Nottingham; Dr. David Coggon, MRC Environmental Epidemiology Group, Southampton; Sir David Cox, University of Oxford; John Fellows, past president, Edinburgh University Students' Association; Dr. Michael Repacholi, WHO International EMF Project, Geneva, Switzerland; Dr. Michael Rugg, Institute of Cognitive Neuroscience, London; Dr. Anthony Swerdlow, University of London; and Thelekat Varma, Walton Center for Neurology and Neurosurgery, Liverpool. Dr. Alan Baddeley of the University of Bristol, Dr. Hilary Walker of the U.K. Department of Health and Graham Worsely of the U.K. Department of Trade and Industry are panel observers. The NRPB's Drs. John Stather and Nigel Cridland are serving as the panel's secretary and assistant secretary, respectively.

Summary of U.K. Parliament Select Committee on Science and Technology's Recommendations and Conclusions

General Conclusion

Validated scientific evidence supports the conclusion that neither mobile phones nor their associated base stations, if they comply with current maximum exposure guidelines, as they appear to do, present a health hazard. Uncertainties, however, remain. Some scientific results, albeit unreplicated, and anecdotal evidence underline the need for further research (¶41*).

Specific Conclusions

(a) We recommend that the Government adopt the ICNIRP recommended guideline limits for microwave exposure as a precautionary measure. We further recommend that these guidelines be introduced quickly but with a grace period to allow network operators to achieve full compliance (¶22).

(b) We reject the main criticisms of the NRPB. Whilst the NRPB's guidelines for maximum microwave exposures are significantly higher than those found in some other countries, their scientific justification is largely unchallenged. Other bodies, including ICNIRP, a European Expert Group and the WHO, agree with the NRPB's assessment that there is no scientific basis for exposure limits to avoid potential harm from athermal effects of microwaves (¶28).

(c) We recommend that the NRPB regularly review the scientific evidence for athermal effects (¶29).

(d) The establishment of the Expert Group on Mobile Phones is a highly appropriate response from Government but we view it as a temporary measure. In the long term, Government and the NRPB must ensure that the Advisory Group on Non-Ionizing Radiations has sufficient resources to discharge its duties effectively and in a timely manner. We regard this as a responsible recognition by Government that constant vigilance is required in a rapidly changing field (¶31).

(e) We recommend that, while they should not be in the majority on the proposed Expert Group, if industrial representatives have useful, relevant expertise, they should be included (¶32).

(f) We recommend that there should be at least two lay members of the Expert Group, as recommended in our previous report (¶33).

(g) Greater clarity in the role of lay members on advisory bodies and working groups is required. We recommend that their role be clearly set out, in advance of appointment, in terms of bringing alternative perspectives to bear and holding up scientific assumptions to proper scrutiny. To perform effectively lay members may need some specialist knowledge. The rationale for their appointment must be made clear (¶34).

(h) We agree that there is a "need to confirm or deny the work on microwave-induced DNA fragmentation." We note with approval that industry is cooperating with the WHO and the EU's fifth framework program to determine priorities for a collaborative research program to examine athermal effects of non-ionizing radiation and endorse the need for this (¶35).

(i) We agree with the Royal Society of Canada that the evidence for neurological problems reportedly caused by mobile phones, including symptoms such as headache, nausea, tiredness, sleep problems and memory loss, is unclear, but there is sufficient anecdotal evidence and uncertainty to justify further research (¶36).

(j) We believe that the level of publicly funded research into the effects of microwave emissions falls short of an adequate program into an area where public health implications should be regularly reviewed. We recommend that the Government ensure that a higher priority is given to a research program into the health impacts of mobile phones. The public health aspects of new technologies should be incorporated into the Foresight Program (¶37).

(k) It is essential that there is an independent and appropriately funded research program which is seen to be objective and which is seen not to be directed by commercial interests, even if industry makes a contribution to the funding (¶39).

(l) We recommend that the industry and the NRPB explore ways in which the design of mobile phones might limit personal exposure to radiation as a means of assisting consumer choice (¶40).

*Refers to paragraphs in the Select Committee's report, *Mobile Phones and Health* (House of Commons No.489), available from the Parliamentary Bookshop, 12 Bridge St., London SW1A 2JX, U.K., (44 +171) 219-3890. The full text of the report is available on the Web at: <www.parliament.the-stationery-office.co.uk/pa/cm199899/cmselect/cmsctech/489>.

Motorola Memos: Small Changes in Manufacturing or Test Procedures Can Mean Big Changes in SARs

Below are excerpts from three memos from Motorola, recently obtained by Microwave News. *They open a window onto how a mobile phone maker tests its new models for compliance with exposure limits.*

The two phones described in the memos were at first found to exceed the 1.6 W/Kg specific absorption rate (SAR) limit of the ANSI/IEEE safety standard. (SARs in the original memos are given in mW/g; we have changed these to W/Kg.)

As detailed below, different manufacturing conditions and settings can have dramatic effects on the phones' SAR values. One memo notes a "wide variation" in SARs for three different phones of the exact same model. And something as seemingly minor as the paint used to coat the phone can change the SAR.

Changes in testing configurations could also cause the SAR to change. Whether the antenna is up or down, whether the test is done with or without a simulated hand—according to one memo, these factors could alter the result by up to a factor of four.

In the U.S., the FCC did not require compliance with the 1.6 W/Kg limit until August 1996 (see MWN, *J/A96). But it began to consider what limits should be imposed on mobile phones in March 1993, when the commission proposed adopting the 1992 ANSI/IEEE standards (see* MWN, *M/A93).*

These memos show how Motorola—along with other companies—was preparing for the new rules. It is not clear, however, when Motorola began to require that its phones comply with the FCC SAR standard.

The Microtac Lite has been one of Motorola's most popular phones. According to the Motorola Cellular Information Center, it was first put on the market "around the first quarter of 1994." The following two excerpts, from memos written in November 1993 and February 1994, detail the difficulties that faced Motorola in trying to get the phone to comply with the 1.6 W/Kg limit. Motorola's Libertyville Cellular Electromagnetics Laboratory is in Illinois.

Date: November 10, 1993
Subject: SAR Measurements of Microtac Lites

Summary

The Libertyville Cellular Electromagnetics Laboratory has performed a set of detailed measurements of the maximum potential exposure of the user of a U.S. Microtac Lite cellular phone. The measurements show that the peak SAR in the phantom user of the Microtac Lite cellular phone is above the 1.6 W/Kg limit of the ANSI C95.1-1991 [*sic*] Safety Standard for exposure of humans to Radio Frequency Electromagnetic Energy (EME) in the uncontrolled environment. The Microtac Lite maximum SAR level is in the range of 1.6 W/Kg to 2.2 W/Kg depending on the unit measured and the phones' actual transmitter power output. The maximum SAR level has been measured in the temporal area of the phantom user with the phone's antenna in the retracted position....The presence of a human hand is not simulated in the test setup....

Measured Results

The intent is to measure the actual SAR generated by the Microtac Lite phones as the user would have received the product from the factory. Thus, all measurements were made on the phones "as is," namely no changes to the phones either mechanically or in terms of transmitter power output were made....Variation from unit to unit in actual transmitter output power is partially responsible for the wide variation in measured SAR. In order to give an indication of what the SAR would have been had the phones all had the same transmitter output power, the measured SAR numbers are normalized to a transmitter power of 600 mW. The results are indicated below.

Phone serial number	*measured SAR*	*600 mW normalized SAR*
no s/n, call it PM-1	2.21 W/Kg	2.10 W/Kg
D89DC2EE	2.00 W/Kg	1.83 W/Kg
no s/n, call it PM-2	1.89 W/Kg	1.81 W/Kg

As late as February of 1994, the Microtac Lite still exceeded the 1.6 W/Kg limit.

Date: February 10, 1994
Subject: Microtac Lite housing paint

...Here are the results of standard SAR tests that I have done on a Microtac Lite:

unmodified radio: SAR=2.23 W/Kg
same radio with front housing replaced by housing with no conductive paint: SAR=2.69 W/Kg

I have done other tests that involve using copper tape instead of conductive paint as well as numerous others involving extra conductive paint, conductive paint in different locations on the front housing, and even completely covering the housing with conductive paint or copper tape. All of these tests have only increased SAR by amounts ranging from a couple of percent to over 50%.

The following memo shows the large difference in SAR that can result from testing with or without a simulated hand, or with the antenna up or down. NMT stands for the Nordic Mobile Telephone system, which is used in the Scandinavian countries. Most European regulations allow an SAR of up to 2 W/Kg.

Draft

Date: January 18, 1994
Subject: SAR Measurements of NMT Eagle

The Libertyville Cellular Electromagnetic Laboratory has performed a set of detailed measurements of the maximum potential exposure to the user of an NMT Eagle cellular phone....

Measured Results

The intent is to measure the actual SAR generated by the NMT Eagle phone as the user would have received the product from the factory. Thus all measurements were made on the phone "as is," namely no changes to the phones either mechanically or in terms of transmitter power output were made....

Antenna position	*without simulated hand*	*with simulated hand*
retracted	2.02 W/Kg	1.25 W/Kg
extended	0.66 W/Kg	0.47 W/Kg

In order to give an indication of what the SAR would have been had the phone had a transmitter power of 1 W (NMT spec), the measured SAR number is modified in dB by the difference between actual measured power and 1 W. This results in an SAR of 2.79 W/Kg with the antenna in the retracted position and 0.91 W/Kg with the antenna in the extended position, both without the simulated hand....

Conclusion

The U.S. NMT Eagle phone has a measured SAR of as much as 2.02 W/Kg in the highest cubic cm. This is 1.0 dB [about 20%] higher than the 1.6 W/Kg limit....

Hot New Papers

Eugene Johnson, Sylvester Chima and David Muirhead, "A Cerebral Primitive Neuroectodermal Tumor in a Squirrel Monkey," ***Journal of Medical Primatology, 28,*** **pp.91-96, April 1999.**

"A male squirrel monkey (>20 years) was euthanized after a 5-day history of intermittent ataxia and general depression. No hematological or clinical biochemical abnormalities were found. The monkey had been used in a physiological study that involved exposing the animal weekly for 90 minutes to 2450 MHz radiofrequency radiation over a 3-year period....[T]he squirrel monkey in this case was the only one of a group of monkeys to develop a brain tumor [a malignant tumor of the right cerebral cortex] after long-term microwave radiation....It is...not unlikely that the long-term exposure of this animal to microwaves may have been associated with the presented pathology....[T]he cerebral primitive neuroectodermal tumor presented in this case is only the second described in a nonhuman primate....The aggressive and malignant nature of the tumor was clearly shown...."

Ronold King, "Shielding by a House from the Electric Field of a Power Line," ***Radio Science, 34,*** **pp.773-779, July-August 1999.**

"The claim that 'a typical house shields about 90% of electric fields from outside' is examined when the house is located near a high-voltage, 50 to 60 Hz transmission line. Calculated electric fields near such a line are used. In order to provide an accurate analysis, the usual house shape is approximated first by a hemisphere, then by a cylinder and finally by a box-like shape on the conducting earth....It is concluded that the superposition of incident and scattered fields from pipes and wires in the walls yields widely varying fields at different points, but that the average exposure of persons living inside the house is not greatly reduced below exposure to the unmodified field of the power line."

Michael Burkhardt and Niels Kuster, "Review of Exposure Assessment for Handheld Mobile Communications Devices and Antenna Studies for Optimized Performance," W. Ross Stone ed., ***The Review of Radio Science 1996-1999,*** **pp.873-918 (New York: Oxford University Press, 1999).**

"Antennas for mobile communications equipment must not only be inexpensive to produce, small and light; they must also provide high radiation efficiency, in order to conserve battery energy and to ensure communications under bad radiation conditions. In addition, the antennas must withstand the mechanical and environmental demands of daily usage (bending, dropping, etc.). Classical simple whip and helical antennas mounted on the top of handsets are therefore still the dominant antenna types for current cellular phones. However, their omnidirectional free-space pattern with cylindrical symmetry is degraded when operated in close proximity to the user's body, due to absorption and reflections at the head. In general, the smaller the antenna and the closer to the head it is operated, the more directional its radiation pattern becomes, and the greater the amount of energy lost through absorption by the user. Since the resulting far-field pattern is similar to that of directional radiators, more sophisticated antennas with minimum energy loss in the user's head could substantially increase radiation performance. An additional motivation for improved antennas is that the user's exposure could become a factor for a consumer's choice."

Margaret Wrensch, Michael Yost et al., "Adult Glioma in Relation to Residential Power Frequency Electromagnetic Field Exposures in the San Francisco Bay Area," ***Epidemiology, 10,*** **pp.523-527, September 1999.**

" In a population-based study, we examined residential power frequency electromagnetic field exposures for 492 adults newly diagnosed with histologically confirmed glioma between August 1, 1991, and April 30, 1994....Residential exposure assessment consisted of spot measures with EMDEX meters and wire codes based on characterization and loca-

Digital Cell Phone Signals: Protection Against Brain Tumors

Ross Adey et al., "Spontaneous and Nitrosourea-Induced Primary Tumors of the Central Nervous System in Fischer 344 Rats Chronically Exposed to 836 MHz Modulated Microwaves," ***Radiation Research, 152,*** **pp.293-302, September 1999.**

"We have tested an 836.55 MHz field with North American Digital Cellular (NADC) modulation in a two-year animal bioassay that included fetal exposure. In offspring of pregnant Fischer 344 rats, we tested both spontaneous tumorigenicity and the incidence of induced central nervous system (CNS) tumors after a single dose of the carcinogen ethylnitrosourea (ENU) *in utero,* followed by intermittent [2 hours/day] digital phone field exposure for 24 months....SAR levels simulated localized peak brain exposures of a cell phone user. Of the original 236 rats, 182 (77%) survived to the termination of the whole experiment and were sacrificed at age 709-712 days. The 54 rats (23%) that died during the study ('preterm rats') formed a separate group for some statistical analyses. There was no evidence of tumorigenic effects in the CNS from exposure to the TDMA field. However, some evidence of tumor-inhibiting effects of TDMA exposure was apparent. Overall, the TDMA field-exposed animals exhibited trends toward a reduced incidence of spontaneous CNS tumors ($p<0.16$, two-tailed) and ENU-induced CNS tumors ($p<0.16$, two-tailed). In preterm rats, where primary neural tumors were determined to be the cause of death, fields decreased the incidence of ENU-induced tumors ($p<0.03$, two-tailed)....

TDMA field exposure appeared to decrease the incidence of spontaneous primary CNS tumors and those induced by the transplacental administration of the carcinogen ENU, but at incidence levels that were not statistically significant for the full experimental group. This inhibitory effect was more evident (statistically significant) in the preterm animals....

While our animal tumor protocol aimed to determine whether TDMA field exposure resulted in an increase in a number of indices of tumorigenicity, the potential inhibitory effect of TDMA field exposure should not be dismissed out of hand because of marginal statistical significance in a study with few tumors overall. We suggest that additional experiments be performed to establish with certainty whether or not the TDMA-mediated inhibitory effect bears a causal relationship to the field exposure....[T]here is considerable evidence in the literature to support the suggestion that low frequency modulated radiofrequency fields are capable of interacting with biological systems when applied at athermal levels, involving interactions with key messenger and growth-regulating enzyme systems. These reported athermal sensitivities would be consistent with an action of TDMA fields in tumorigenesis in conditions of low tumor incidence, and they suggest important options for further research with athermal exposures...."

(See *MWN,* M/J96 and J/A96.)

tion of nearby power lines....Using the Kaune-Savitz wire code classification, the relative risk for longest-held residences coded as "high" compared with "low" was 0.9 (95% confidence interval (CI)=0.7-1.3), while relative risk and 95% CIs for front door spot measures of 1.01-2.0 mG, 2.01-3.0 mG and higher than 3.0 mG compared with ≤ 1.0 mG were 1.0 (0.7-1.4), 0.6 (0.3-1.1) and 1.7 (0.8-3.6)....Because of potential exposure misclassification and the unknown pertinent exposure period, these data cannot provide strong support against, but clearly do not support, an association between adult glioma and residential power frequency electromagnetic field exposures."

Qishan Yu, Om Gandhi, Magnus Aronsson and Ding Wu, "An Automated SAR Measurement System for Compliance Testing of Personal Wireless Devices," *IEEE Transactions on Electromagnetic Compatibility, 41,* pp.234-245, August 1999.

"An automated specific absorption rate (SAR) measurement system has been developed for compliance testing of personal wireless devices. Unlike other systems, this system uses a model with a lossy ear-shaped protrusion, and the accuracy of this experimental setup has been checked by comparing the peak 1 g SARs for ten cellular telephones, five each at 835 and 1900 MHz, with the results obtained using a 15-tissue anatomically based model with the finite-difference time-domain (FDTD) numerical electromagnetic technique....The head and neck part of the model with an ear-shaped protrusion of 3 mm thickness is made of a lossy outer shell of 5-7 mm thickness of epoxy laced with KCl solution. The phantom is filled with appropriate frequency-specific fluids with measured electrical properties (dielectric constant and conductivity) that are close to the average for gray and white matters of the brain at the center frequencies of interest (835 and 1900 MHz)....Peak 1 g SARs for ten telephones using different antennas are within ±1 dB of those obtained using the FDTD numerical method....The measured and calculated SARs for the ten telephones, which have quite different operational modes [TDMA or CDMA] and antenna structures (helical, monopole or helix-monopole), vary from 0.13 to 5.41 W/Kg. Even though widely different peak 1 g SARs are obtained because of the variety of antennas and handsets, agreement between the calculated and the measured data is good and generally within ±20% (±1 dB)...."

Dalsu Baris, Martha Linet et al., "Residential Exposure to Magnetic Fields: An Empirical Examination of Alternative Measurement Strategies," *Occupational and Environmental Medicine, 56,* pp.562-566, August 1999.

"Our results suggest the need for caution when imputing missing magnetic field data to reconstruct historical exposures....Our results argue against attempting to estimate lifetime exposure to magnetic fields with imputed values derived from current residences to fill in gaps caused by unmeasured residences lived in previously."

New Books: Short Reviews

Mark Powell, *Science at EPA: Information in the Regulatory Process*. 433 pp., $49.95, Washington: Resources for the Future (RFF), 1999.

Powell presents eight detailed case studies that explore the role of science in regulatory decision-making — unfortunately, for our readers, neither EMFs nor RF/MW radiation have made the cut. Of special interest, nevertheless, is the discussion of the roles played by uncertainty and consensus-building in the formulation of public policy. Much of what Powell has written will not sit well with readers at the Environmental Protection Agency (EPA). Indeed, the agency's senior research and development official called this analysis "flawed" and "naive" (see *Science,* August 27, p.1,351). Powell calls for a doubling of EPA's research budget. RFF is an economics-oriented think tank based in Washington.

Alwyn Scott with Mads Peter Sørensen and Peter Leth Christiansen, *Nonlinear Science: Emergence and Dynamics of Coherent Structures*. 474 pp., $39.95, New York: Oxford University Press, 1999.

This is not a book for the mathematically squeamish. But there are still items for those of us who cannot make our way through pages of differential equations, n-by-n matrices and multiple integrals. The two chapters that bracket the technical stuff are more relevant to a general audience. The opening overview, "The Birth of a Paradigm" runs from John Scott Russell's first description of a solitary wave in 1834 to the coining of the term "soliton" in the 1960s and on to the most recent applications of nonlinear science. In his final chapter,"Looking Ahead," Scott presents the reader with this sage advice: "Perhaps the most important message to carry away from the experiences of nonlinear science over the past three decades is this. *Don't be overly impressed by theorists*. Always think things through for yourself. Be wary of procrustean tendencies to stretch or truncate the facts of nature until they fit within the confines of some narrow doctrine. As the theorists lovingly unfold their formulations, maintain a jaundiced eye."

Tim Rifat, *Remote Viewing: The History and Science of Psychic Warfare and Spying*. 442 pp., £17.99, London: Century, 1999.

Rifat recounts government efforts to develop psychological warfare and spying techniques during the Cold War, first in the Soviet Union and later in the U.S. While primarily interested in the development of paranormal psychological skills such as remote viewing, Rifat also looks at attempts in both countries, beginning in the 1960s, to use modulated microwaves for mind control. His command of facts is, to be kind, shaky. For instance, Dr. Robert Becker is not a "Los Angeles physicist," and to say that Dr. Ross Adey "repeated [Dr. Carl] Blackman's experiments" gets things exactly backwards. And then there is his reliance on "experts" such as Eldon Byrd and Andrija Puharich. The bulk of the book is a bunch of appendices, one of which is devoted to a reproduction of a 1976 U.S. Defense Intelligence Agency report on RF/MW bioeffects research in "Eurasian Communist Countries." Rifat argues that the document "shows that the dangers [of mobile phones] were known over 20 years ago." This document was declassified in 1976, at the request of Barton Reppert, then of the Associated Press. There is nothing new here. Paul Brodeur discussed the report in 1979, in *The Zapping of America* (Norton). *Remote Viewing* is currently available only in the U.K.

Across the Spectrum

"We do not believe cell phones can pose any health risks to humans."

— Dr. Russell Owen, FDA's Center for Devices and Radiological Health, Rockville, MD, quoted by Patricia Wen, "Mixed Signals" *Boston Globe,* p.C4, October 4, 1999 (see p.19)

"The ear can take a lot of abuse."

— Kwok Chan, FCC laboratory, Columbia, MD, quoted by Jeffrey Silva in "Scientific Community Debates Validity of RF Absorption Tests," *RCR,* p.2, September 20, 1999

"[N]ot one single study of RF and cancer could be said to be strongly persuasive as to causality. There is no basis at this time that RF can cause cancer. My position is -40 on the spectrum chart of -40 to +40."

— Dr. Philip Cole, professor of epidemiology, University of Alabama, Birmingham, speaking in support of a DTV tower proposed for the Lookout Mountain antenna farm near Denver, quoted in "Summary of 12 Hours of 'Super Tower' Hearings," *City and Mountain Views* (Golden, CO), p.17, August-September 1999 (see *MWN,* J/A98, M/A99 and J/A99)

"Adults have no idea this subculture is springing up."

— Industry "insider," quoted by John Harlow in "Mobiles Trap Children in Spiral of Debt," on the U.K. "tele-tot" mobile phone market, four million and growing, *Sunday Times* (U.K.), p.13, September 19, 1999

"The airlines are misleading the traveling public. There is no real connection between cell phone frequencies and the frequencies of the navigation."

— John Sheehan, chair of the 1996 RTCA Inc. inquiry on EMI to avionics, quoted by Jon Auerbach in "Connecting Flights: Cell Phone Use Aloft May Not Be the Danger that Airlines Claim," *Wall Street Journal,* p.A1, October 5, 1999 (see p.19 and *MWN,* S/O96)

"There are still some who believe there is a correlation between ELF EMFs and adverse health effects and are continuing to push for more research. We should also be concerned about the epidemiological bias of the World Health Organization study, as well as recommendations in the EMF RAPID report to Congress urging the National Institute for Occupational Safety and Health and the Occupational Safety and Health Administration to review exposure guidelines and ensure they provide adequate worker protection."

— Doug Bannerman, consultant to the National Electrical Manufacturers Association (NEMA), Rosslyn, VA, quoted in "EMF Research Shifting Focus to Higher Frequencies," *Electroindustry* (published by NEMA), p.8, August 15, 1999

"Somebody ought to pay attention to the siting of these things, so we don't have a bad feeling about this 15 years from now."

— Dr. Tom McGill, Fletcher Jones professor of applied physics, California Institute of Technology, Pasadena, CA, on Pacific Bell Wireless's plan to install antennas at a school, quoted by Kevin Uhrich in "Sorry, Wrong Number," *Los Angeles Times,* September 16, 1999

"Are we next going to have advertisements on the wall of the church or a sign saying, 'This crypt sponsored by McDonald's'?"

— Peter Burt, Daventry District Council, Northamptonshire (U.K.), quoted by Helen Johnstone in "Vicar Under Fire for Phone Mast in Church Spire," *Times* (U.K.), August 23, 1999 (see also *MWN,* M/J99)

"The more towers, the more dead birds."

— Dr. Bill Evans, Cornell Laboratory of Ornithology, Ithaca, NY, in "Communications Towers Killing Birds," a press release on *Avian Mortality at Communications Towers,* held in Ithaca on August 15, Cornell University News Service, September 22, 1999

"To our knowledge, after extensive research, there has never been an incident where a use of a wireless phone created a spark that caused a fire or explosion."

— Jeffrey Nelson, spokesperson, Cellular Telecommunications Industry Association (CTIA), Washington, quoted by Bernadette Tansey and Michael Cabanatuan in "Cell Phone Fire Hoax Spurs Warnings from Fuel Industry," *San Francisco Chronicle,* p.A17, August 28, 1999 (see p.18 and *MWN,* J/A99)

"Microwave News" Flashback

Years 15 Ago

• Dr. Carl Blackman reports that the frequency windows within which ELF magnetic fields alter calcium efflux in brain tissue shift with the strength of the Earth's magnetic field.

• Maryland officials are concerned that a U.S. Navy electromagnetic pulse (EMP) simulator proposed for Chesapeake Bay might cause interference at the nearby Calvert Cliffs nuclear power plant.

• For the first time, work in occupations with high EMF exposures is linked to increased brain cancer risk, by Dr. Ruey Lin.

Years 10 Ago

• Lawsuits alleging cancer due to RF radiation exposures — from an AM radio antenna in Washington state and from an FM transmitter in Kentucky — are settled out of court. The terms are not revealed.

• Motorola's Dr. Q. Balzano says that the IEEE standards committee will "look like yo-yos" if the exposure limit for frequencies above 3 GHz is doubled from 5 mW/cm^2 back up to 10 mW/cm^2.

• In a victory for the New York Power Authority, a judge rejects the claim of 58 landowners along the 345 kV Marcy-South power line that "cancerphobia" caused their properties to lose value.

Years 5 Ago

• "Basic information in all areas" is needed to determine whether wireless phone radiation is safe, says the CTIA's scientific adviser, Dr. George Carlo, contradicting CTIA President Thomas Wheeler's earlier claim that the phones had been proved safe.

• The NIEHS issues the first round of grants under the EMF RAPID program. The 21 awards, which run for up to four years and total $15.5 million, are for cellular and animal research.

• Dr. Om Gandhi advises the FCC that his 1993 estimates of SARs from wireless phones are too low, by factors of as much as two and a half. After correcting errors in both calculated and measured estimates, Gandhi says, the two methods are again in agreement.

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UPDATES

AVIONICS EMI

Cute But Dangerous?... They might not look like much of a threat. But Furbys — wide-eyed, furry dolls that respond to speech and seem to gradually "learn" human language—have been banned from the National Security Agency in Fort Meade, MD, due to concern that they might also "learn" government secrets. The *Wall Street Journal* (September 24) reports that the high-tech toys now may not be used on most U.S. airlines. "Airlines, concerned about interference with navigational equipment, have started insisting [that] the toy can only be carried on board if the batteries are removed," the *Journal* states. Some foreign carriers have adopted a similar rule: Furbys are so common on airline flights in Japan that it is common for the captain to make "a special Furby announcement" before a plane takes off. Japanese airlines say that the rule will be enforced strictly. "We're sympathetic to children who may be without their Furby's company for a long trip," said a Japan Airlines representative, "but this is a safety issue." The manufacturer, the Tiger Electronics division of Hasbro Inc., insists that the computerized dolls do not pose a risk. "There is no conclusive evidence that Furbys interfere with electronic equipment," a company spokesperson said.

CONGRESS & RF SITING AND RESEARCH

Leahy Seeks More Local Control, Research... The U.S. Congress is again considering weakening the 1996 Telecommunications Act's federal preemption of local control over tower siting. And this time, it is also pushing for federally funded research on the safety of RF/MW radiation. In August, Sen. Patrick Leahy (D-VT) introduced S.1538, which, if enacted, would authorize local officials to demand written evidence of compliance with the FCC's RF/MW exposure limits and allow them to require the use of "alternative telecommunication or broadcast technologies" if a proposed installation is "inconsistent" with local rules. For those disputes that end up in court, the bill requires wireless carriers to show that they are in compliance with the telecom act. S.1538 allocates $10 million in fiscal year 2000 for research into RF/MW health effects, to be directed by the Department of Health and Human Services (HHS), and requires the HHS to report to Congress on the present state of RF/MW safety research by January 2001. On August 5, Leahy told the Senate that the lack of a federal research effort "should no longer be overlooked" and that the EMF RAPID program "could serve as an excellent model" for such an effort. S.1538 follows two similar initiatives by Leahy, both thwarted by Sen. John McCain (R-AZ), who, as chair of the Senate Commerce Committee, wields much power over telecom laws (see *MWN*, N/D97 and S/O98). "McCain is usually not sympathetic to the direction we're moving in," an aide to Leahy told *Microwave News*. S.1538's backers have a strategy to avoid this obstacle: They will try to attach their bill as a "rider" to a popular piece of legislation, according to Leahy's aide. The new measure's sponsors also include Sens. Russ Feingold (D-WI), Kay Bailey Hutchison (R-TX), James Jeffords (R-VT) and Daniel Moynihan (D-NY). In the House, Rep. Bernie Sanders (Ind-VT) introduced H.R.2834 and H.R.2835 in September. The two bills are effectively the same as the Senate proposal, with research funding addressed in the latter measure.

EXPOSURE METRICS

Workshop Proceedings... In September 1998, the U.K.'s National Radiological Protection Board (NRPB) hosted a workshop on *Exposure Metrics and Dosimetry for EMF Epidemiology*. Attendance was by invitation only, and was limited to 49 participants from academia, government and industry. The meeting was closed to the press, but the proceedings are now available. On power frequencies, particularly noteworthy papers include: the U.K.'s Dr. Philip Chadwick on an assessment of industrial environments; Sweden's Dr. Birgitta Floderus on combining residential and occupational exposures and the resulting relative risks (see *MWN*, J/A97); and the U.S.'s Dr. Michael Yost on magnetic field exposure metrics beyond time-weighted averages, using trolley workers as a case study. The RF/MW section is essentially limited to papers on cellular phones and towers, with very little on studies of broadcast or radar radiation. Of interest here are: the U.S.'s Dr. Q. Balzano on the critical variables for estimating the radiation exposure of cell phone users; Drs. Elisabeth Cardis and M. Kilkenny of the International Agency for Research on Cancer (IARC) in France on the multicenter cell phone-cancer study (see *MWN*, J/F98 and S/O98); and Drs. G.F. Pedersen and J.B. Andersen of Denmark on the differences between the ELF and RF signals from CDMA and TDMA handsets. The workshop, which was organized by the NRPB together with ICNIRP and the WHO, was sponsored by the GSM Association, the Mobile Manufacturers Forum and the U.K.'s National Grid Co. Representatives from the funding organizations, together with three staffers from the U.S.'s EPRI, made up close to a quarter of those invited to attend. The proceedings are available for £53.00 in the U.K. and US$100.70 elsewhere from: Nuclear Technology Publishing, PO Box 7, Ashford, Kent TN23 1YW, U.K., (44+1233) 641683, Fax: (44+1233) 610021, E-mail: <sales@ntp.org.uk>, Web: <www.ntp.org.uk>. They were published as Vol.83, Nos.1-2, 1999 of *Radiation Protection Dosimetry*, which was provided to all subscribers of this journal.

PEOPLE

France's Dr. **Bernard Veyret** has been elected vice-chair of URSI Commission K on electromagnetics in biology and medicine. He will take over as chair from Japan's Professor **Shoogo Ueno** in 2002 at the next URSI General Assembly, to be held in Maastricht, the Netherlands. At this August's assembly in Toronto, Ueno took over from Dr. **James Lin** of the U.S. Meanwhile, Motorola's Dr. **Q. Balzano** has been elected vice-chair of URSI Commission A on electromagnetic metrology....Dr. **Edward Elson**, who long worked on microwave health effects at the Walter Reed Institute of Research in Washington, retired on August 31....**Shaheera Bieber** has succeeded **Ruth Greey** as EMF issue manager at Ontario Hydro Services Co. in Toronto, which runs the transmission and distribution division that was part of Ontario Hydro. Greey is currently on a two-year assignment with the Canadian Electrical Association in Ottawa....Dr. **David Rall**, the former director of the NIEHS, died on September 28 from injuries sustained in a car accident. He was 73. In a 1988 speech, Rall said: "The big challenge for environmental health sciences in the 21st century is likely to be exploring the effects of microwaves and other EMFs on living things."

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—Fortune *magazine, July 5, 1999*

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Conferences & Courses

November 6-7: **COST 244bis Workshop on Emerging Technologies,** University of Southampton, U.K. Contact: Dr. Terry Kenny, Multiple Access Communications, Chilworth Research Center, Southampton SO16 7NS, U.K. (44+23) 8076-7808, Fax: (44+ 23) 8076-0602, E-mail: <cost244@macltd.com>, Web: <www.radio.fer.hr/cost244>.

November 8-9: **1999 Tower Summit and Show,** Paris Hotel and Casino Resort, Las Vegas, NV. Contact: Shorecliff Communications Inc., 27127 Calle Arroyo, Suite 1909, San Juan Capistrano, CA 92675, (800) 608-9641 or (949) 443-3735, Fax: (949) 443-9206, Web: <www.scievents.com>.

November 9-10: **Mobile Phones — Is There a Health Risk?** London, U.K. Contact: Simon Moss, IBC, (44+171) 453-5495, Fax: (44+171) 636-1976, E-mail: <cust.serv@ibcuk.co.uk>, Web: <www.ibctelecoms.com/health99>.

November 11-12: **Electromagnetic Compatibility Compliance for Medical Devices,** Park Hyatt Hotel, Philadelphia, PA. Contact: Barnett International Conference Group, 1400 N. Providence Rd., Suite 2000, Media, PA 19063, (800) 856-2556 or (610) 565-2622, Fax: (610) 565-4842, E-mail: <customer.service@parexel.com>, Web: <www.barnettinternational.com>.

December 12-13: **COST 244bis Workshop on Quality Assurance in EMF Epidemiology,** National Institute for Working Life, Solna, Sweden. Contact: Dr. Birgitta Floderus, Karolinska Institute, PO Box 210, S-17177 Stockholm, Sweden, (46+8) 728-7286, Fax: (46+8) 31 39 61, E-mail: <birgitta.floderus@imm.ki.se>, Web: <www.radio.fer.hr/cost244>.

January 10-13, 2000: **RF Safety: Science, Compliance and Communications,** Marriott Riverwalk Hotel, San Antonio, TX. Contact: Michelle Gutberlet, Electromagnetic Energy Association, 1255 23rd St., NW, Suite 200, Washington, DC 20037, (202) 452-1070, Fax: (202) 833-3636, E-mail: <eea@elecenergy.com>, Web: <www.elecenergy.com>.

In our last issue, we mistakenly listed the November 19-21 4th European Bioelectromagnetics Association Congress *in Zagreb, Croatia. In fact, it was held in 1998. We apologize for the error.*

Keeping Current: Follow-Up on the News

◆ On July 12, the Council of Ministers of the European Union formally adopted its recommendation on public exposures to nonionizing radiation (see *MWN,* J/A99). The text was published in the July 30 *Official Journal of the European Communities,* which is available on the Web at: <europa.eu.int/eur-lex>.

◆ In a September 21 letter, Thomas Wheeler, president of the CTIA, urged the IEEE subcommittee on mobile phone compliance testing to complete its work on revised guidelines with "all deliberate speed" (see *MWN,* J/F99).

◆ NIOSH's *Manual for Measuring Occupational Electric and Magnetic Field Exposures,* which was released earlier this year, is now available in "pdf" format on NIOSH's Web site: <www.cdc.gov/niosh/98-154pd.html> (see *MWN,* N/D98).

◆ A special issue of *IEEE Transactions on Microwave Theory and Techniques,* on medical applications and biological effects of RF/MW radiation, is slated for November 2000. Submissions should be sent by November 15, 1999, to: Dr. Arye Rosen, Sarnoff Corp., 201 Washington Rd., Princeton, NJ 08543.

◆ Just when we thought that the mobile phone–gas station ignition hazard had been put to rest (see p.15 and *MWN,* J/A99), the EPA issued a "cellular phone alert." On August 13, EPA's Howard Wilson told his managers that it would be "prudent" not to use cell phones "near areas where flammable and/or combustible liquids and chemicals are stored." And the *Calgary Sun* reported on September 28 that the Technical Standards and Safety Authority of Ontario, Canada, has issued its own warning about using cell phones when pumping gas.

◆ Magnetic Shield Corp. in Bensenville, IL, has introduced a gaussmeter rental program. The devices can be used for 30 days for $79, with a $100 deposit. For more information, see the company's Web site: <www.magnetic-shield.com>.

As We Go to Press

A meeting organized by the CTIA, FDA and WHO to define future research needs on mobile phone safety was cancelled at the last minute. Originally scheduled for October 12-13 in Rockville, MD, the meeting had not been rescheduled at press time.

All costs were to be paid by the CTIA. Government sources suggested that FDA officials were concerned that the agency might be seen as too close to industry.

VIEWS ON THE NEWS

Trying To Make Sense of the News

Six years ago, the wireless industry declared that mobile phones were safe, while the FDA warned that no one really knew.

Now they seem to have traded places. This month, the head of the industry research group Wireless Technology Research (WTR) warned that the consumer is not being protected, while the FDA said that the phones pose no risk at all.

"We do not believe cell phones can pose any health risks to humans," stated the FDA's Dr. Russell Owen (see p.15). Owen claims to have been misquoted: In a widely circulated e-mail, Owen wrote that, "Neither the content nor the context accurately reflects what I said." But reporter Patricia Wen told *Microwave News,* "That is a verbatim quote." Owen stated this opinion several times in different ways, she said.

WTR head Dr. George Carlo disagrees with Owen. "My recommendation is that it's much better for children to use a pager than a cell phone," Carlo told the *Boston Globe*. "The science is in a gray area," he explained. Carlo modeled a "hands-free" headset for a *Globe* photographer and urged adults to keep mobile phone antennas at least two inches from the skull.

Carlo's recommendations make sense — but not because of anything we have learned from WTR's shell game of a research program. The prudent avoidance measures cited by Carlo make sense precisely because of how much we do *not* know about cellular phone safety, at a time when there are over 250 million cellular customers worldwide.

If the FDA, WTR or anyone else had mounted a serious health research effort over the last six years, we would have a wealth of data to digest. Instead, we are left chewing on sound bites.

* * *

Epidemiological evidence on EMFs and leukemia now paints a clearer, more consistent picture than ever before. Data from ten studies taken together show a significant risk for children exposed to 6 mG or more (see p.3). And officials of EPRI, the electric utility industry group, have concluded that the main studies of workers in the industry suggest an increase in the risk of both leukemia and brain cancer (see p.3).

You might think that the EMF issue would now be taken more seriously. Instead, we get an end to the government's research program, cutbacks at EPRI and newspaper editorials that declare, "People sincerely concerned about possible health dangers from EMFs...should be relieved to learn that [the threat] was a fake" (*Providence Journal,* August 13).

* * *

"It's not a problem" to use cellular phones on a commercial airplane in midflight, aviation consultant John Sheehan told the *Wall Street Journal* (see p.15). The *Journal* suggested that the airlines' real motive for restricting their use is to force passengers to use the high-priced "air-phones" built into the seat backs.

But here's what Sheehan told *Microwave News* three years ago: "Although interference from personal electronic devices is extremely rare, the very fact that it can *possibly* occur should give the FAA and airlines pause about their unrestrained use." Sheehan chaired a committee of the aviation standards group RTCA that prepared a report on this issue (see *MWN,* S/O96).

The *Journal* dismissed evidence of interference from wireless phones as "anecdotal," arguing that attempts to recreate such interference have failed. But Sheehan's committee pointed out that, "The likelihood [of reproducing interference] is low since it has been impossible to duplicate the original conditions with the same device, aircraft, location, RF environment and the airborne system's settings." The *Journal* quoted from the report, but somehow left this part out.

If a mobile phone, laptop or video game did play a role in a plane crash, would we know it? When we asked Sheehan, he answered, "To tell you the truth...it would be very difficult to tell." He added, "I guess it's public knowledge that after Secretary [of Commerce Ron] Brown's crash, a special team of investigators was dispatched to look at that very thing — especially to see if somebody might have been using a cellular telephone."

An airline pilot posted this response to the *Journal* on the junkscience.com Web site: "When executing an instrument approach to 50 feet with 600 feet of visibility while traveling at 145 knots, precision is vital. Do not expect me as your pilot to be sympathetic with your impatience to call your broker via cell phone or to play Nintendo."

* * *

Last year, Britain's NRPB hosted a meeting on dosimetry (see p.17 and *MWN,* M/J98). We wanted to attend — but the NRPB told us the invitation-only meeting was "limited to leading experts in the fields of epidemiology, EMF exposure metrics and dosimetry...and mobile telephony."

One who did get an invitation was CTIA Vice President for External and Industry Relations Jo-Anne Basile. Until three years ago, Basile was a CTIA lobbyist on Capitol Hill; before that she was a congressional staffer. Whenever we have spoken with Basile, she has always been well-informed, friendly and intelligent. But she is no more of a "leading expert" than we are.

Clearly, *Microwave News* and others were kept out because the press and the public were not welcome at this industry-funded meeting. The NRPB seems to view public scrutiny as an annoyance. This habit of working behind closed doors is part of the reason that Britain has a mobile phone exposure standard at least five times higher than that of any other country in the world.

But, as we report on page 1, the U.K.'s exposure standard may be about to change. The NRPB complains that this is based on what it calls "political considerations." We have another name for it: public accountability.

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Bioelectromagnetics Society Meeting: A Report

The annual meeting of the Bioelectromagnetics Society (BEMS) is the event of the year for the biological wing of the microwave community. Experimental results are presented at BEMS long before they appear in print, giving researchers a chance to keep up and offering government and corporate officials a look at what might be driving tomorrow's regulations. There was something for everyone at this year's meeting in Washington, DC, but for many the big surprise was a paper about thermal mechanisms.

In the past, the so-called non-thermal effects have attracted the most attention. The proposition that low levels of non-ionizing radiation can alter biological systems, once considered a heresy, is now much more widely accepted. Of course, the possible mechanisms are still a matter of uncertainty and debate. While this year's papers at BEMS would generate few headlines, they confirmed the importance of power and frequency windows to explain bioeffects and added confusion to the drug-microwave synergy picture. The blood brain barrier seemed all but forgotten.

Environmental Protection Agency (EPA) researchers reported that miniscule internal electric fields can release calcium ions in the brain when excited by unmodulated ELF fields. Here again, power density windows were observed. Equally exciting was a report of a new frequency window: one which peaks at a modulation of 60 Hz and which is related to the immune system. Attempts to replicate the synergy between microwaves and tranquilizers have generally failed and many of those working on it have given up.

URSI Meeting

The BEMS meeting was scheduled to coincide with the 20th assembly of the

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Information and Litigation Center Set Up in Washington, DC

A new center has been established to help people alleging injuries from exposure to microwave radiation. The Microwave Radiation Information and Action Center, operating out of Washington, DC, will actively seek and disseminate government documents and will provide legal advice to those who have been exposed.

The center was set up by Stuart Lemle, the head of the Washington law firm Lemle and Associates, and Barton Reppert, a Washington based journalist. Lemle will serve as executive director.

The center has four main objectives: (1) to serve as a clearinghouse for information on the irradiation of the US embassy in Moscow and other cases involving human exposure to microwave radiation; (2) to promote the release of information on microwaves now in government files through requests under the Freedom of Information Act (FOIA), and when necessary through litigation; (3) to offer legal advice to persons who believe they have suffered health problems as a result of exposure to microwave radiation; and (4) to promote

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International Union of Radio Science (URSI), and the attendance of each profited. On August 13, immediately after BEMS, many of the participants moved over to the URSI meeting to hear a series of lectures on the *Interactions of Electromagnetic Waves with Biological Systems.* These general reviews of bioeffects, medical applications and standards will be collected, together with a critical analysis, into a special edition of *Radio Science,* but will probably not be published until the summer of 1983. (In preparation for the meeting, URSI published *Review of Radio Science, 1978-1980,* edited by S.A. Bowhill of the University of Illinois, Urbana-Champaign. The compendium has chapters on bioeffects, measurements and interference, among other subjects. A copy is available for $20 from URSI, Avenue Albert Lancaster 32, B-1180 Brussels, Belgium.)

New Thermal Data

Certainly any vote on the most provocative paper of the meeting would have been won by Dr. Gregory Lotz of the Naval Aerospace Research Lab in Pensacola, FL. Lotz and two co-workers exposed male rhesus monkeys to 225 MHz RF fields at power densities ranging between 1 and 10 mW/cm² (SAR = 0.3-4.0 W/Kg). The frequency is near the monkey's theoretical whole-body resonance, but even so, Lotz found that at 5 mW/cm² (SAR = 1.5 W/Kg), the exposures caused "much greater heating than that which would be predicted based on dosimetric considerations and on comparisons to other frequencies." Lotz concluded by saying that there was "something unexplained" going on.

Whatever the explanation may turn out to be, the implications of his results were immediately apparent. The ANSI standard, now in the final stages of review, is based on the assumption that there are no demonstrable hazards associated with whole-body average SAR's of less than 4 W/Kg. Lotz's showing "dramatic" heating at an average SAR of 1.5 W/Kg could, as one agency official was quick to point out, have a profound impact on future standards. For the moment, everyone will have a chance to mull the paper over until the next gathering at October's *Microwaves and Thermoregulation* symposium at the Yale medical school.

Windows: Old and New

A new twist in calcium efflux research was reported by EPA's Dr. Carl Blackman: he exposed brain tissue to 16 Hz fields in the *absence* of a carrier frequency at ambient voltages of 1 to 70 V/m. In that range he identified two power windows, which caused statistically significant enhancement of calcium mobility. The internal electric fields were substantially lower than a thousandth of a V/m, making this, according to Blackman, "a solid case of a response that cannot be explained by a general heating mechanism."

Runs at 1 Hz and 30 Hz showed no effect, confirming the previously known activity of the 16 Hz field. The one quirk was that Drs. Ross Adey and Suzanne Bawin had done a similar experiment five years ago, and while they too had found power and frequency windows, the ELF fields had *reduced* calcium flow—not increased it (*Proceedings NAS, 73,* 1999, 1976). Blackman believes the different conditions in the two labs could explain this apparent inconsistency.

Dr. Rochelle Medici of Fairview State Hospital in Costa Mesa, CA, showed that the 16 Hz window has direct behavioral implications. Although earlier behavioral tests carried out in 16 Hz amplitude modulated fields with neonatal chicks had proved negative, Medici tried again with ducklings on the grounds that water, used as a reinforcer in the experiment, is ineffective for chicks. Using a carrier frequency of 450 MHz and a power density of 1 mW/cm², Medici did find a significant difference in activity for the ducks in the 16 Hz field as compared to controls. Modulation at 3 Hz had no effect.

A completely new type of microwave window was reported by David Lyle, a graduate student working with Adey at the University of California, Riverside. Lyle was able to inhibit cell-mediated immune response with modulated 450 MHz radiation. He observed the greatest inhibition when the 1.5 mW/cm² field was modulated at 60 Hz. Lyle speculated that this mechanism of action may be related to the calcium efflux from brain tissue, given that cytolytic immune response is calcium dependent.

Drug Disorder

The sorting out of tranquilizer-microwave synergy seems as far off as ever. (See *MWN,* February 1981.) Both Dr. Rufus Sessions of Walter Reed Army Institute of Research, Washington, DC, and Dr. Richard Lovely of Battelle Northwest in Richland, WA, have been unable to produce the synergy reported by Dr. John Thomas. The exposure system was different in each experiment, leading to speculation that the possible discrepancy may turn on near and far field dosimetry. (Thomas used a near field exposure system, Lovely, the far field and Sessions circular waveguides.) Whatever the source, Thomas will have to find it himself, because neither Sessions nor Lovely intends to pursue the drug work.

Thomas may get some help, however, since Sessions will soon become the director of the Division of Behavioral Sciences at the Armed Forces Research Institute of the Defense Nuclear Agency. The move will put him near Thomas's lab at the Naval Medical Research Institute, and no doubt accessible for consultation.

The news from Guy lab in Seattle was equally contradictory. Robert Johnson was able to replicate the study reported at last year's meeting showing synergy between valium and 1 mW/cm² radiation with a different strain of rats and a different crew running the experiment. But in his new work, he failed to see any valium synergy in a shuttlebox behavioral test. Johnson will continue to work with valium and librium.

Blood Barriers

At last year's BEMS meeting in San Antonio, three research groups presented papers on their studies of microwave-induced permeability of the blood brain barrier (BBB). Surprisingly, no new work was reported this year.

Allan Frey did announce the results of a related study carried out by Elaine Coren and himself at their Randomline lab: the effect of microwaves on the blood-vitreous humor barrier in the eye, which they claim has a similar derivation and function as the BBB. In two experiments, they exposed rats to pulsed (7.5 pps, 10 usec), 1.2 GHz radiation with an average power of 75 uW/cm² for 25 minutes. In both cases, they detected significant leakage of the tracer dye through the barrier. Frey concluded that microwaves were definitely affecting the blood barrier in the eye, but he "didn't have enough information to say what was happening and why."