MICRO WAVE NEWS

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INSIDE...

Microwaves Cause Persistent Eye Damage Below 4 W/Kg

U.S.–U.S.S.R. Epi Study Planned

Low-level, pulsed microwave radiation can cause persistent injury to the eye. Laboratory experiments with monkeys and clinical studies of accidentally exposed workers show that the eye's cone photoreceptors can be damaged by weak radiation, according to Henry Kues of the Johns Hopkins University (JHU) Applied Physics Laboratory (APL) in Laurel, MD, and Jack Monahan of the Food and Drug Administration's (FDA) Center for Devices and Radiological Health in Rockville, MD.

"This is the first time we have primate research data that parallel human exposure data," Kues told *Microwave News*. "It is highly unlikely that the changes in cone vision are artifacts." Kues and Monahan are now setting up an epidemiological study of selected microwave-exposed military and civilian personnel in the Soviet Union to further test their findings.

This summer, Kues and Monahan, accompanied by APL's Terry Pfenning, spent three weeks in the U.S.S.R. meeting with Soviet scientists. "The negotiations look very promising," Monahan said on his return in late September. It is likely that researchers in Kiev, Odessa and St. Petersburg will work with the JHU–FDA team.

"We arrived in Leningrad but it was St. Petersburg by the time we left," Monahan said, noting that the coup and its aftermath had not hampered their

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Congress Picks DOE To Lead Federal EMF Research

The U.S. Congress has assigned the coordination of federal electromagnetic field (EMF) health research to the Department of Energy (DOE) so that "duplication of research efforts [will] be avoided."

The DOE has scheduled a meeting for October 10-11 in Washington, DC, to draft contingency plans for a comprehensive EMF research effort covering basic science, mitigation and public education, according to Dr. Imre Gyuk, who heads DOE's EMF research program.

For fiscal year 1992 (FY92), DOE's EMF budget is $5 million (see *MWN*, J/F91). As we go to press, Washington is abuzz with rumors that the DOE will soon have a substantially larger research budget.

DOE's mandate is contained in Conference Report 102-177, which accompanied the FY92 appropriations bill for energy and water development, dated July 30. The bill was signed into law by President Bush on August 17.

« Power Line Talk »

The steering committee of the National EMF Research Program (**NERP**) postponed its September 12 meeting until October 16-17 (see *MWN*, J/A91). Three new members have joined the committee: **James DuShaw** of the International Brotherhood of Electrical Workers, Dr. **Mark Cooper** of the Consumer Federation of America and Dr. **Molly Coye**, commissioner of the California Department of Health Services. With the addition of Coye, California now has two representatives on the panel—Dr. **Charles Imbrecht**, who chairs the state's Energy Commission, is already a member....The NERP staff has identified three more groups as prospective research administrators. **Health Research, Inc.**, of Albany, NY, an independent organization that ran the New York Power Lines Project, the **Public Health Foundation** of Washington, DC, which was set up by the Association of State and Territorial Health Officers of McLean, VA, and the **Southwest Research Institute** of San Antonio, TX, are scheduled to make presentations at the October meeting.

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"The future looks promising for a major breakthrough" in our understanding of EMFs and cancer, concluded Dr. **Gilles Thériault** of McGill University in Montreal, Canada, in an address to the ***8th International Symposium on Epidemiology in Occupational Health***, held in Paris, France, on September 10-12. Thériault called the spate of recent male breast cancer studies "most intriguing" and asked, "What about breast cancer in women?" In another presentation, Dr. **Tore Tynes** of the Cancer Registry of Norway in Oslo reported a statistically significant 45% increase in leukemia among electrical workers who had been on the job at least ten years. There was essentially no excess of brain tumors among these workers, however. Tynes previously found an excess of male breast cancer among EMF-exposed workers (see *MWN*, J/F91), but, in Paris, he noted that railway and tram drivers, who had the largest increase in breast cancer—a fourfold excess—are known to be shift workers, and therefore may have abnormal melatonin cycles. This could be part of the problem, he said. Tynes told *Microwave News* that he is also working on epidemiological studies of residentially and occupationally exposed Norwegians.

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University of Maryland Professor **Robert Park**'s op-ed article, "With Alarming Frequency," which appeared in the September 1 *New York Times*—and in the September 12 *Evening Sun* of Baltimore, MD, under the title "America's Hysteria Over Health Risks"—contends that it is a "scientist's obligation to try to put the [EMF] risk in proper perspective for the public." Park then writes that people concerned about EMFs should know that "from 1930 to 1980 the per capita consumption of electric power in the U.S. increased tenfold—yet the incidence of childhood leukemia...showed no change." The article prompted *The New Yorker*'s **Paul Brodeur** to challenge Park's claims in a letter to the *Times*. Brodeur cites National Cancer Institute statistics, detailed in a June 26 *Times* article, that show nearly an 11% increase in acute lymphocytic leukemia (ALL) and more than a 30% rise in brain cancer rates from 1973 to 1988 (see *MWN*, J/F91 and J/A91). ALL and brain cancer are, respectively, the first and second most common types of childhood cancer, Brodeur notes. In an angry letter to the *Evening Sun*, Baltimore attorney **Kieron Quinn** also objects to Park's piece, charging that he and other physicists who share his view are "intellectual successors to the physicists who established to their own satisfaction that the sun revolves around the earth." Quinn is a member of EMRCET—a group of lawyers working on EMF cases (see *MWN*, M/A91). Neither response was published.

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Rhode Island's **Narragansett Electric Co.** has indefinitely postponed construction of a new 44-mile, 345 kV transmission line. The decision had nothing to do with widespread concern over potential EMF health effects from the line, or with last year's **East Greenwich** town council move to block the project by placing a three-year moratorium on new lines above 60 kV, company spokesman Bud Moran told *Microwave News*. Appealing the East Greenwich action last October, Narragansett Electric argued that the new 345 kV line "is needed to provide reliable electric service," and that without it, western Rhode Island "will be at risk of significant service interruptions" (see *MWN*, N/D90). The company now contends that the line will probably not be necessary for at least another decade. Meanwhile, the fate of two 115 kV lines still slated to run through East Greenwich rests with the state Supreme Court, which is scheduled to rule on the legality of the moratorium sometime this winter. The nearby towns of Coventry and Foster followed East Greenwich's lead by passing moratoriums of their own, and a statewide ban on high voltage power lines was proposed during the 1991 legislative session (see *MWN*, J/F91 and M/J91). Governor Bruce Sundlun subsequently appointed an EMF task force to evaluate the proposed ban (see *MWN*, J/A91).

At EPRI: Sussman Replaces Sagan, Research Budget Up

Dr. Leonard Sagan has turned over the management of the Electric Power Research Institute's (EPRI) EMF health studies program to Dr. Stan Sussman. Sagan is now a senior medical scientist in EPRI's environment division.

"I will now be free to do things I like better, such as writing and speaking—people need information on EMFs," Sagan told *Microwave News*. "This is not a sign of a change in my involvement with EMFs," he added. "I'm still heavily involved."

EPRI's EMF budget will grow by $3 million to $10 million in 1992, Sagan said. The new budget figure includes the costs of administering the program, however.

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Consumers Union (CU) has tested **electric blankets** made by Sunbeam-Home Comfort, which claims that it has now reduced their EMFs by approximately 95%. (Sunbeam also makes electric blankets for Montgomery Ward, J.C. Penney and Sears, among others.) In the October issue of *Consumer Reports*, CU confirms that the magnetic fields have indeed been reduced—no word about the electric fields, however. Nevertheless, CU still advises that "children and pregnant women avoid sleeping with electric blankets and heating pads." CU first issued this recommendation in November 1989 (see *MWN*, N/D89 and M/J90).

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Yet another **cancer cluster** has been reported (see *MWN*, S/O90 and M/J91). In the village of Dalmally, **Scotland, U.K.**, at least eight people have died of cancer in the last five years, according to reports in the British newspapers *The Observer* (July 21) and *The Guardian* (August 9). All the victims lived on two streets in the 36-home community, which is divided by a 275 kV transmission line. In addition, there reportedly have been at least two nonfatal cases of breast cancer and three deaths from motor neuron disease. Local residents are fearful. Scottish Power, which owns the line, "insists that no link between power lines and ill health has been substantiated," *The Observer* reported.

Breast Cancer and EMFs: Recent Papers

No Consistent Link with Electric Blanket Use

Postmenopausal women who used electric blankets through the night on a regular basis for ten years had a slightly increased chance of developing breast cancer, according to a new study by Dr. John Vena and colleagues at the State University of New York (SUNY), Buffalo. The 25-36% increase was not statistically significant, however, and the researchers observed neither an increased risk from general long-term electric blanket use nor a dose–response trend with years of blanket use.

"These findings do not support the hypothesis that electric blanket use is associated with an increased risk for breast cancer," the researchers concluded, but added that, "The slightly elevated estimate of risk for the most frequent electric blanket users and the potential public health significance of electromagnetic field [EMF] exposure suggest that further inquiries be undertaken."

"Our study was prompted by Dr. Richard Stevens's theory that the high rates of female breast cancer in industrialized countries are due to light-at-night or EMFs," Vena told *Microwave News*. Stevens, of Battelle Pacific Northwest Lab in Richland, WA, was the first to suggest that breast cancer may be linked to the effects of light and EMFs on the pineal gland's production of melatonin (see *MWN*, J/F87, M/J88 and J/A90).

In an interview, Stevens said that the Vena study was not a good test of his hypothesis because the pineal gland's exposure to EMFs from electric blankets is slight. And according to Dr. Keith Florig of Resources for the Future in Washington, DC, "The field levels in the head when the current is on range from 1 to 4 mG—depending on how far the blanket is pulled up."

The exposure of different parts of the body is a "critical issue that has to be resolved," Vena acknowledged, pointing out that the pineal effect is only one of a number of potential mechanisms, including direct cancer promotion in breast tissue.

In their paper, the SUNY researchers noted that the study was limited because of its focus on postmenopausal women, who experience relatively small variations in estrogen levels. "Premenopausal women might be a better test of what is actually happening," Vena said in an interview, adding, "We plan to investigate that group." The researchers also wrote that the study had low "power" and could only detect a significant effect above a 2.1-fold risk.

The SUNY study included 382 women diagnosed with breast cancer between 1987 and 1989 and 439 controls. See John Vena et al., "Use of Electric Blankets and Risk of Postmenopausal Breast Cancer," *American Journal of Epidemiology, 134*, pp.180-185, 1991.

Demers Male Breast Cancer Study Published

Researchers at the University of Washington and at the Fred Hutchinson Cancer Research Center, both in Seattle, have published their study showing that electricians, telephone linemen and electric power workers had six times the expected rate of male breast cancer, a statistically significant finding (see *MWN*, J/A90). For radio and communications workers, the risk was almost tripled; and for workers with presumed EMF exposure, the risk increased 80%, which is of only borderline statistical significance.

"These results lend support to the theory that [EMFs] may be related to breast cancer in men. The hypothesis warrants evaluation in women," concluded Dr. Paul Demers and coworkers. Male and female breast cancer may be the same disease, they noted, but, "The implications of this study for breast cancer in women are uncertain and are dependent upon the carcinogenic mechanisms involved."

They found that the risk was highest—a statistically significant, more-than-threefold increase—among those who were first exposed before age 30 and at least 30 years prior to diagnosis. In certain occupations, the risks were twice as high. The researchers did not observe a significant trend of increasing risk with increasing length of employment.

The team studied 227 workers diagnosed between 1983 and 1987 and 300 controls. Exposures were categorized by occupation. Since Demers first reported his results in June 1990, two other research teams have published findings of an association between EMF occupational exposures and male breast cancer (see *MWN*, J/F91 and M/A91). See Paul Demers et al., "Occupational Exposure to [EMFs] and Breast Cancer in Men," *American Journal of Epidemiology, 134*, pp.340-347, 1991.

Low Breast Cancer Risk Among Blind Women

Dr. Robert Hahn of the Centers for Disease Control (CDC) in Atlanta, GA, has found that profoundly blind women had half the expected rate of breast cancer as compared to controls with at least some vision. The effect diminished substantially with increasing age.

This finding appears to support the important role of light in suppressing melatonin and increasing the risk of breast cancer. See Robert Hahn, "Profound Bilateral Blindness and the Incidence of Breast Cancer," *Epidemiology, 2*, pp.208-210, 1991.

USC EMF–Childhood Leukemia Study Due in November

The University of Southern California (USC) electromagnetic field (EMF)–childhood leukemia study, which supports the findings of the Wertheimer-Leeper and Savitz studies, will appear in the November 1, 1991 issue of the *American Journal of Epidemiology*. The EMF community has been waiting for the paper since USC's Dr. John Peters announced preliminary results last February at an Electric Power Research Institute (EPRI) workshop (see *MWN*, J/F91 and M/A91).

As originally reported, the USC team found a statistically significant 115% increased risk of childhood leukemia associated with high current wire codes, but did not observe a consistently elevated risk with 24-hour or spot magnetic field measurements. There was no cancer risk associated with measured electric fields.

The paper provides more details on the team's findings of statistically significant associations between leukemia and the use of certain household appliances: a 49% increased risk from use of black-and-white TVs (there was no link to color TVs) and a 182% increased risk associated with electric hair dryer use.

Epidemiology in Print

• A team at the University of Southern California, Los Angeles, has published a study showing that men working for more than ten years in jobs involving low frequency EMF exposures had a tenfold increased risk of developing astrocytomas, a statistically significant finding. Drs. Wendy Mack, Susan Preston-Martin and John Peters observed a significant trend of greater tumor risk with longer employment. "Our results confirm the findings of a positive association between employment in jobs involving presumed [EMF] exposure and brain tumor risk....These results indicate that [EMF] exposure may be an important factor in the etiology of astrocytoma," they conclude. Preston-Martin first reported these findings at the November 1990 Department of Energy contractors review (see *MWN*, N/D90). This study was originally part of a larger project on risk factors for brain tumors (see *MWN*, M/A90). See Wendy Mack, Susan Preston-Martin and John Peters, "Astrocytoma Risk Related to Job Exposure to [EMFs]," *Bioelectromagnetics, 12*, pp.57-66, 1991.

• Children of Scottish women who worked at electrical jobs were 50% more likely to be born prematurely and/or with a low birthweight, according to a group of French and U.K. researchers led by Dr. Silvia Sanjose of the ICRF Cancer Epidemiology Unit in Oxford. Among the electrical workers, electronics wirers had the highest risk—a 74% greater chance—of delivering premature babies and/or babies with low birthweights. The other occupational groups at risk were metal and leather workers. The group did not observe a similar risk among the children whose fathers were electrical workers. See Silvia Sanjose, Eve Roman and Valerie Beral, "Low Birthweight and Preterm Delivery, Scotland, 1981-1984: Effect of Parents' Occupation," *The Lancet, 338*, pp.428-431, August 17, 1991.

• Three recent papers by researchers at the U.K.'s National Radiological Protection Board (NRPB) survey the current EMF bioeffects literature. On epidemiological studies of general health and reproduction, Dr. J.A. Dennis and colleagues conclude that "the bulk of the evidence suggests that there are no effects at exposures below the limits advised by NRPB and [the International Radiation Protection Association]." In a second paper on cancer studies, they note that the evidence "is not sufficient to justify an excessive concern about magnetic field levels in the U.K. from domestic wiring, electrical appliances, power lines, etc., but neither, on the other hand, is there any justification for complacency." The third paper is a brief overview of studies of the bioeffects of extremely low frequency EMFs, radiofrequency and microwave radiation and static magnetic fields. Dr. R.D. Saunders and coworkers conclude that, "The possibility of a health risk cannot be ignored and should be further investigated. If there are such effects, then the evidence suggests that they are subtle and may well be masked by normal biological variation." See J.A. Dennis, C.R. Muirhead and J.R. Ennis, "Epidemiological Studies of Exposures to [EMFs]: I. General Health and Birth Outcome; II. Cancer," *Journal of Radiological Protection, 11*, pp.3-12, 13-25, 1991, and R.D. Saunders, Z.J. Sienkiewicz and C.I. Kowalczuk, "Biological Effects of [EMFs] and Radiation," *ibid*, pp.27-42, 1991.

• In a review of residential EMF studies, Dr. Sol Michaelson of the University of Rochester, NY, concludes that, "In general, the reports to date do not support a definite cause/effect relation between exposure of individuals to 60 Hz electric or magnetic fields and the relative risk of contracting leukemia or other forms of cancer." See Sol Michaelson, "Household Magnetic Fields and Childhood Leukemia: A Critical Analysis," *Pediatrics, 88*, pp.630-635, September 1991.

• In a survey of epidemiological EMF–cancer studies, Dr. Gilles Thériault of McGill University in Montreal, Canada, provides new occupational exposure data. Using an IREQ dosimeter, Thériault and coworkers found that: generating station operators had the highest mean exposures to high frequency transients (7.965 parts per million), splicers had the highest mean exposures to magnetic fields (21 mG) and linemen had the highest mean exposures to electric fields (419 V/m). Comparing EMF-exposed utility workers to non-utility workers, Thériault notes that the utility workers had 65 times greater exposure to transients, 8.1 times higher average magnetic field exposures and 7.6 times higher electric field exposures (see *MWN*, M/A89)—all were statistically significant at the $p<0.001$ level. Thériault points out that the availability of the IREQ dosimeter, developed by Hydro-Québec and marketed by Positron Industries (see *MWN*, J/F90), "opens a new field of research to test the hypothesis of a relationship between EMFs and cancer in environmental as well as in occupational settings." See Gilles Thériault, "Cancer Risks Due to Exposure to [EMFs]," *Recent Results in Cancer Research, 120*, pp.166-180, 1990.

There was a 600% increased risk from use of electric blankets, but it was not significant due to the small number of cases.

The finding of an association with wire codes but not with direct measurements "suggests two fundamentally different interpretations," according to the USC team: First, there *is* a true link between EMFs and childhood leukemia which was not observed because of measurement errors or because of the failure to measure the biologically relevant field parameters. Or second, there is *no* true association and the wire code link is spurious.

With regard to the possibility of an unknown confounder being responsible for the wire code association, the USC team noted that the missing variable would have to be "strongly associated with risk or extremely tightly correlated with wiring configuration classification to have produced the odds ratios" in this and other studies.

The team investigated 232 cases of leukemia among children age 10 and under between the years 1980 and 1987 and matched them with an equal number of controls. Further analysis of the data is under way. The researchers plan future papers.

USC's Dr. Stephanie London is the lead author of the study, "Exposure to Residential Electric and Magnetic Fields and Risk of Childhood Leukemia." It was funded by EPRI.

Congress Awards NAS-NRC $600,000 for ELF Health Review

The U.S. Congress has appropriated $600,000 for a National Academy of Sciences (NAS)-National Research Council (NRC) review of the possible health effects from exposure to extremely low frequency (ELF) electromagnetic fields (EMFs). The project is scheduled to begin in early 1992 and is expected to take more than two years to complete.

An NRC panel will initially conduct a short feasibility study to determine whether there is in fact a need for a full-scale effort, Dennis Mahlum, the project officer for NAS-NRC's Board on Radiation Effects Research, told *Microwave News*. In a telephone interview from his office in Washington, DC, Mahlum said that the project will focus on the carcinogenic, reproductive and behavioral effects of ELF EMFs, but will also include research at other frequencies, where appropriate. No panel members have yet been appointed.

The final study plan is still in preparation; when completed, it will be submitted to the Department of Energy (DOE), which will serve as the conduit for the $600,000. The final product is likely to be an ELF EMF research agenda, Mahlum said. In July, the Environmental Protection Agency (EPA) released its own research strategy document (see *MWN*, J/A91).

Congress set aside the funding for the NAS-NRC review in the appropriations bill for energy and water development for fiscal year 1992, Public Law 102-104, which President Bush signed on August 17. In addition, the joint House–Senate conference report accompanying the law designates the DOE as the lead federal agency for EMF research (see p.1).

Rep. Joseph McDade (R-PA), the top-ranking Republican on the House of Representatives' Appropriations Committee, added the NRC project to the bill. His district includes Scranton, PA, where residents fear that a transmission line may be responsible for a cluster of cancer cases (see *MWN*, J/F91 and M/J91).

In a February 21 letter to NAS President Dr. Frank Press, McDade asked the NAS-NRC to undertake "an independent evaluation" of EMFs and health. On March 8, Press responded that the NAS-NRC staff was "enthusiastic" about doing the study. "As now envisioned," Press wrote, "a committee of approximately 15 experts, representing a broad range of expertise, would perform the study." He estimated that the study would take 24-30 months at a cost of approximately $600,000.

Earlier this year, the NRC circulated a proposal among federal agencies for a study of EMFs from video display terminals (VDTs) but was unable to attract support (see *MWN*, M/A91). The NAS-NRC has an ongoing review of the potential health effects of very low frequency (VLF) radiation from the U.S. Air Force's Ground Wave Emergency Network (GWEN) (see *MWN*, M/J90 and N/D90).

There now are four federally supported reviews of EMF health effects in progress. In addition to the two NAS-NRC projects, EPA is continuing its assessment of EMF cancer risks (see p.12) and the Committee on Interagency Radiation Research and Policy Coordination (CIRRPC) is doing its own review in association with the Oak Ridge Associated Universities (see p.12). The Health Effects Institute is conducting a feasibility study, partly with EPA funding, for a possible EMF research program (see *MWN*, M/A91, M/J91, J/A91 and p.8).

On September 11, Rep. Joe Kolter (D-PA) introduced H.R. 3293, which would authorize the NAS to undertake an EMF research review. The bill was moot upon introduction.

Other Congressional Action

• Michigan Senators Donald Riegle and Carl Levin, both Democrats, have jointly introduced a bill which would allot $2 million to study stray voltage from electrical power transmission systems. The Electrical Transmission Research Act of 1991, S.1685, would require the DOE to direct the NAS to conduct an additional two-year investigation into "the sources of, the damages caused by and the possible means of preventing" stray voltage. The bill would start research on stray voltage exposure mitigation "before the biological scientific studies are completed," according to Riegle, who added that, "If we do not begin to solve these problems soon, it will be 15 years before those who live

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near power lines can sleep peacefully knowing they are not suffering any ill health effects from the lines above their heads." The legislation has been assigned to the Senate Committee on Energy and Natural Resources.

- A plan by Senator Frank Lautenberg (D-NJ) to introduce a bill that would provide $45 million over four years for power frequency EMF research, first floated in June, has been put on hold. In August, Lautenberg spokesman Steven Schlein told *Microwave News* that attempts to draft the legislation failed and that there may never be a bill. EMF legislation is not a priority item for the senator, he conceded.
- Rep. Frank Pallone's (D-NJ) legislation to provide $34 million over five years to the DOE for EMF research will not make it out of the House of Representatives' Committee on Science, Space and Technology this year. In May, the committee authorized $2.2 million for EMF research by EPA for fiscal year 1992—$1.5 million of which was to be used to support a joint public–private research initiative (see *MWN*, M/J91). As we go to press, Congress has not yet completed work on the EPA appropriations bill.

Michigan Hearing Spurs Congressman To Oppose Line

Michigan Rep. Howard Wolpe (D) has asked Consumers Power Co. (CPC) of Jackson, MI, to suspend construction of a controversial 115-mile, 345 kV transmission line, citing concerns about electromagnetic field (EMF) exposures. In an August 13 letter, Wolpe urged the utility to "announce a moratorium on this project."

Wolpe is the chairman of the House Committee on Science, Space and Technology's Subcommittee on Investigations and Oversight, which held a hearing on August 6 in Battle Creek, MI, on the power line and EMFs.

"It is clear that exposure to [EMFs] poses a potential risk of adverse health effects," Wolpe wrote to CPC Chairman William McCormick, adding that, "It is incumbent upon [CPC]...to demonstrate that it has taken all prudent actions to avoid unnecessary public exposure" to EMFs. He also wrote that the testimony presented at the hearing "raised serious questions" about the need for the line and he criticized the utility for not considering "cost-effective alternatives."

CPC's McCormick responded in a September 6 letter that the utility has taken numerous steps to ensure that EMFs from the line are not hazardous. "Despite the lack of any definitive evidence of health problems caused by [EMFs], we incorporated a design that would produce an EMF level at the boundary of the transmission line right-of-way that is *ten times* lower than the most rigorous current safety standard adopted by any state in the U.S.," he wrote, though he did not identify specific levels. He added that, should the state of Michigan or the federal government set stricter standards, CPC will comply with them. McCormick also said that continuing growth in electricity demand makes the line necessary.

In his letter to CPC, Wolpe also paraphrased Dr. Leonard Sagan of the Electric Power Research Institute (EPRI), a witness at the hearing, as "begrudgingly" agreeing that "it would be prudent to avoid potential health risks" associated with new lines if electricity demand could otherwise be met at a lower cost. Sagan responded angrily in an interview with *The Energy Daily* (August 22), a Washington, DC, newsletter, stating that, "My scientific reputation is being used to further someone's political aim." He said that he does not know the specifics of the proposed line and that Wolpe had misrepresented his comments. He told the panel that "the evidence [on EMFs and health] is inconclusive, but deserves further research."

In addition to Sagan, others testifying at the hearing included: Dr. William Farland of the Environmental Protection Agency (EPA); Dr. Abraham Liboff of Oakland University, Rochester, MI; Michael Morris of CPC; State Reps. Michael Nye and Glenn Oxender, both Republicans; and Cathy Smith of Michigan Residents Against Giant Electric (Michigan RAGE).

Liboff summarized his research on EMF effects and told the subcommittee that he believes that extremely low frequency (ELF) EMFs pose "a hazard to humans." He urged that universities be given a more substantial role in EMF research. "The future of the research on ELF effects on health will be most efficiently accomplished using traditional competitive university science settings—laboratories, graduate students and freedom from political interference," Liboff said in his prepared statement.

CPC's Michael Morris said that the utility routed the 345 kV line using "an ultraconservative approach that is head and shoulders better than all existing [EMF] standards, so that any impact will be minimal."

Cathy Smith testified that there is no need for the line. She and Alan Barak, a Lansing attorney representing Michigan RAGE, argued that CPC falsely contends that the demand for electricity will outgrow current transmission and distribution capacity. The Michigan Municipal Cooperative Group Utilities, made up of municipally owned and cooperative electric utilities, backed RAGE's argument that the line is not needed.

The 345 kV CPC line is slated to run from Battle Creek, MI, to Akron, IN (see *MWN*, M/J91).

California Legislature Approves $7 Million EMF Fund

A bill to establish an electromagnetic field (EMF) research and education fund of up to $7 million has passed both houses of the California legislature and is awaiting Governor Pete Wilson's signature.

The legislation, SB920, was sponsored by Senator Herschel Rosenthal, chairman of the Senate Energy and Public Utilities Committee. On September 12, in a 54-24 vote, the General Assembly sent the bill to the Senate floor, where it was approved 31-0 the next day.

If it becomes law, the measure will require California electric utilities to finance the EMF study fund through a onetime fee; an "urgency" provision will immediately send $4,390,000

to the state Public Utilities Commission (PUC) and the Department of Health Services (DHS) for a two-year EMF initiative; and the rest of the fund will be allocated by the legislature for follow-up research.

The California effort is intended to complement the joint public–private National EMF Research Program (see *MWN*, J/A91 and p.2), and has widespread support among utilities as well as among labor and environmental groups, Michael Shapiro, a Rosenthal aide, told *Microwave News*. "None of the major players among California utilities has voiced opposition to the bill," Jack Sahl of Southern California Edison said in a telephone interview, adding that state utilities do not want "to wait around for other entities" to implement EMF research.

At least 80% of the initial allotment is earmarked for DHS research, which would include cellular and epidemiological studies, investigations of EMF health risks among children attending schools near power lines and the development of possible mitigation techniques. A research status report would have to be submitted to the legislature by December 1, 1993.

The rest of the money would be appropriated to the PUC, which would be required to outline an interim prudent avoidance policy by June 30, 1992. The PUC would also oversee the work of a recently formed, 17-member "consensus" group made up of scientists, government officials, consumers and utility representatives. The group—which will help to identify and develop regulatory measures—will hold its first meeting October 10-11.

The bill also directs state utilities to develop employee education programs, provide EMF measurements to customers upon request and distribute written EMF health risk information at least once a year.

The legislation was prompted by "current EMF uncertainty and controversy," and allows for "the longer-term possibility that we may be faced with a serious EMF health problem," Rosenthal remarked at an American Law Firm Association EMF seminar, *Developing a Corporate Strategy*, on September 26 in Los Angeles, CA. The new effort is a follow-up to a $2 million EMF initiative, also sponsored by Rosenthal, passed in 1988 (see *MWN*, S/O88 and N/D88).

BPA Now Reports No Melatonin Effect in Sheep

Sheep living directly under a high voltage transmission line did not show depressed levels of melatonin, according to researchers from the Bonneville Power Administration (BPA), based in Portland, OR, and from Oregon State University (OSU) in Corvallis.

OSU's Dr. Fred Stormshak reported preliminary results showing a 20-25% reduction in serum melatonin at last November's annual Department of Energy (DOE) EMF meeting (see *MWN*, N/D90). Stormshak will present the updated results at this year's DOE review, to be held November 3-7 in Milwaukee, WI.

The researchers compared a group of ten sheep penned under a 500 kV BPA transmission line with a control group of ten sheep penned away from the line. The sheep under the line were exposed to magnetic fields ranging from 15-60 mG and electric fields of 4.5-7.5 kV/m, while the control group was exposed only to background EMF levels.

Over 6,000 blood samples were taken from the sheep over a ten-month period. Initially, sheep under the line had lowered melatonin levels, but later results showed a great deal of "random variation," with no statistically significant difference between the two groups, Jack Lee, a BPA environmental health specialist, told *Microwave News*.

The study is now being repeated using groups of 15 sheep. The replication, in which larger pens will be used to insure that the sheep do not shield each other from the electric field, as they might have in the first study, will also investigate immunological effects. Some of the sheep have EMDEX meters strapped to their bodies to gauge actual EMF exposures, Lee said in a telephone interview.

Melatonin is a hormone secreted by the pineal gland which regulates biological cycles and inhibits cancer. Other studies have shown lowered melatonin levels in animals exposed to EMFs (see *MWN*, M/J88 and J/A90).

Litigation Update

• On July 15, a jury in the Superior Court of Fulton County, GA, ordered Georgia Power Co. to pay Jimmy and Marilyn Barrett $22,000 for one-third of an acre of property condemned for a transmission line right-of-way (ROW). The Barretts, of Buford, GA, had challenged Georgia Power's initial $4,800 property valuation in a condemnation proceeding, arguing that the utility should compensate them for land beyond the ROW where increased EMF levels are detectable. They also asked for compensation for the loss of use of the property and for loss of privacy. The Barretts sought $207,000. A court-appointed Special Master awarded them $13,821—which included $5,013 for EMF-related "consequential damages"—but the Barretts appealed that ruling, leading to the jury trial. According to the Barretts' attorney, John Blandford of Blandford & Werbin in Chamblee, GA, the Barretts feared EMFs from the line might cause them to develop cancer and claimed that the EMFs "contaminated an area as much as 200 feet" from the line. The attorney for Georgia Power, Donald Janney of Troutman, Sanders, Lockerman & Ashmore in Atlanta, GA, said that the utility had offered to settle with the Barretts for $23,000 one week before the case went to trial.

• In a case filed on July 24 against Georgia Power Co. and Oglethorpe Power Co., Larry and Nancy Jordan and their children of Douglasville, GA, charge that Nancy's non-Hodgkin's lymphoma was due to exposure to EMFs from a power line that crosses their property. They are seeking $5 million for negligence, fraud and punitive damages, among other claims. The suit, filed in the Superior Court for Douglas County, GA, alleges that the utilities failed to disclose the potential health risks of power frequency EMFs. The Jordans are being represented by Eugene Brooks of Middleton & Anderson in Savannah, GA, Bruce DeBoskey of Silver & DeBoskey in Denver, CO, and Paul Carroll of Hine, Carroll & Niedrach in Rome, GA. DeBoskey is a founding member of the Electromagnetic Radiation Case Evaluation Team (EMR-CET), a group of plaintiffs' lawyers involved in EMF litigation (see *MWN*, M/A91).

NCI Weighs an EMF Initiative

The National Cancer Institute (NCI) is considering sponsoring a well-defined project on electromagnetic field (EMF)–cancer research. A two-day NCI workshop, *Molecular Mechanisms of Potential EMF-Induced Transformation*, was held September 12-13 in Bethesda, MD, to assess the need, and justification, for such an initiative.

The EMF workshop was only the first step in a "highly competitive" decision-making process, Dr. Richard Pelroy of NCI's Radiation Effects Branch told *Microwave News*. He stressed that the process was still in its early stages; if approved by internal and external reviewers, a formal decision would be announced in about a year, he said.

"There is enormous political pressure for the NCI to become involved" in the EMF issue, according to a knowledgeable source who has been following developments at the NCI. Last May, three branches of the National Institutes of Health (NIH), led by the National Institute of Environmental Health Sciences (NIEHS), published a joint request for EMF proposals (see *MWN*, M/J91).

The NCI and NIH efforts are "complementary," NIEHS's Dr. Michael Galvin, a participant at the NCI workshop, said in a telephone interview. NIEHS is undertaking a multifaceted approach to EMF research, while NCI is interested in addressing specific questions, Galvin explained. He said that the May call for proposals had prompted a "good response."

Other participants at the workshop included: Drs. James Felton (Chair), Larry Anderson, Roswell Boutwell, Kelly Clifton, Marvin Frazier, Reba Goodman, Robert Liburdy, Martha Linet, Richard Luben, J.R. McLean, Martin Misakian and Thomas Tenforde.

HEI Scales Down Plans for EMF Research Program

The Health Effects Institute (HEI) is scaling down its plans for a public–private electromagnetic field (EMF) research program. At the second meeting of the HEI feasibility study committee on August 26-27 in Cambridge, MA, HEI President Dr. Andrew Sivak asked the committee to consider a smaller research program with a $2.5 million budget, as well as the original $20-30 million effort (see *MWN*, M/A91, M/J91 and J/A91).

HEI's funding sources are uncertain—and have become more so by the recent designation of the Department of Energy (DOE) as the lead agency for EMF research (see p.1).

HEI had requested a three-year funding commitment from the Environmental Protection Agency (EPA), but, according to Sivak, EPA will now have to consult with the DOE before it can commit any money to EMF research from its 1992 budget. "If the money isn't forthcoming, I'm not sure the institute is excited about going ahead with the project," he said.

At the August meeting, the committee members focused on the reduced research effort. Most favored a few simple in vitro experiments that could yield definitive, repeatable results. Sivak told *Microwave News* that HEI could fund about five to ten projects in a few areas of research—for example, effects on calcium ion transport, melatonin production and cell division.

Dr. Richard Setlow of Brookhaven National Lab, the chairman of the feasibility committee, indicated that it is unlikely that HEI will sponsor human studies.

Although some committee members want HEI to address public education, EPA's Dr. Doreen Hill, an invited observer, said that she was not sure that risk information is "appropriate" for HEI. Dr. David Savitz of the University of North Carolina, Chapel Hill, agreed: "I see HEI as having a unique niche: It should take advantage of [its] well-established tradition in elegant, biologically-driven lab research."

The committee heard presentations from Dr. Joseph Bowman of the National Institute for Occupational Safety and Health (NIOSH) in Cincinnati, OH, on the University of Southern California EMF–childhood leukemia study (see p.4) and from Dr. Walter Rogers of the Southwest Research Institute in San Antonio, TX, on melatonin studies of baboons exposed to fields of 30 kV/m and 1.0 G (see *MWN*, N/D90).

Sivak, Setlow and Dr. Peter Valberg of Gradient Corp.—which is coordinating the feasibility study for HEI—have drafted a research plan incorporating the committee's suggestions. Sivak said, "We're going to present several areas of research that are not completely constrained by money." The committee will meet again on October 11 to review the plan before Sivak presents it to the HEI board on October 24. If the board gives its approval, Sivak hopes to issue a request for proposals by early 1992 and to sign contracts by May or June.

HEI's Asbestos Record

At the August meeeting, Dr. Asher Sheppard of the VA Hospital in Loma Linda, CA, asked Dr. Andrew Sivak how he would answer the charges that HEI's credibility had been undermined by its work on asbestos. Sheppard, a member of the EMF feasibility committee, cited a resolution by the National Association of Attorneys General (NAAG) which expressed a "deep concern" about HEI-AR's—HEI's project on asbestos research—ability to produce unbiased results (see *MWN*, M/J91 and J/A91).

Sivak responded that HEI had earned a great deal of credibility during 11 years of administering research and that there is nothing that HEI can do to satisfy certain factions of the EMF community.

In an interview with *Microwave News*, Sheppard said that Sivak's response was "unsatisfactory—he totally skimmed over the issue. I'd be surprised if HEI got any more money until Sivak can assure a credible EMF program."

The HEI-AR final report on asbestos was released on September 25 and is available at no cost from: HEI-AR, 141 Portland St., Suite 7100, Cambridge, MA 02139, (617) 225-0866.

NEMA Review Cautious on EMF–Cancer Link

Current scientific data are "insufficient" to confirm an electromagnetic field (EMF)–cancer link, and regulating EMF exposures would be "premature," according to an analysis sponsored by the National Electrical Manufacturers Association (NEMA), a trade group based in Washington, DC.

The 125-page literature review, *Extremely Low Frequency Electromagnetic Fields and Cancer: Focus on Tumor Initiation, Promotion and Cancer*, was written by biochemist Dr. Earl F. Walborg Jr., who, together with well-known cancer researcher Dr. Thomas Slaga of the University of Texas, founded Dermigen, Inc., a Smithville, TX-based consulting firm, in 1988.

Though epidemiological studies "have produced evidence suggesting an association between residential [EMF] exposure" and childhood cancer, Walborg argues that the data do not confirm a causal link and stresses the need to determine critical parameters of exposure. Most animal studies have not demonstrated an EMF–cancer relationship, he writes, acknowledging that "an appropriate animal model may not have been utilized." In vitro research has "shown that power frequency [EMFs] can modulate several biological processes" that may be involved in tumor development, including DNA synthesis, RNA transcription, cell proliferation, immune response, enzymatic reactions and pineal gland function, Walborg states.

On November 12, NEMA will sponsor a workshop titled *EMF: Science, Regulation and Law* as part of its annual meeting. NEMA also has published a short brochure, *Biological Effects of Electric and Magnetic Fields*, which presents nontechnical answers to EMF health effects questions. Earlier this year NEMA endorsed the National Electromagnetic Research Program (NERP), a joint public–private research project (see *MWN*, J/A91). The report and the brochure are available at no cost from: NEMA Public Affairs, 2101 L St., NW, Washington, DC 20037, (202) 457-8455.

FROM THE FIELD

Seattle's Concerns Over ANSI 1991 RF/MW Safety Standard

Excerpted below is a letter from Sue Donaldson, a member of the Seattle, WA, City Council to Dr. Tom Budinger of the Lawrence Berkeley Lab in Berkeley, CA, the chairman of the IEEE's Standards Coordinating Committee (SCC) 28, which is responsible for revising the 1982 American National Standards Institute's (ANSI) safety limits for occupational and public exposures to radiofrequency and microwave (RF/MW) radiation. For many years, the city of Seattle has been developing an RF/MW exposure standard (see MWN, *J/A88, J/A89 and S/O89). *In addition, King County, WA, which includes Seattle, is considering adopting its own RF/MW standard.*

In mid-September, Dr. Don Justesen, a member of SCC-28, sent a "provisional response" to Donaldson on behalf of Budinger. In a telephone interview, Budinger told Microwave News *that he and the cochairs of the subcommittee that revised the standard—Drs. Eleanor Adair of the John Pierce Foundation in New Haven, CT, and Om Gandhi of the University of Utah, Salt Lake City—will prepare a written response prior to SCC-28's next meeting on November 2.*

August 12, 1991

Dear Dr. Budinger:

The city of Seattle has been following the progress of SCC-28 in developing guidance for protecting humans from non-ionizing radiation hazards. Revision of the American National Standards Institute (ANSI) C95.1 guidance pertaining to safety levels for human exposure to radiofrequency [RF] electromagnetic fields of 3 kHz to 300 GHz is extremely important to local agencies that have responsibility for issuance of land use permits for telecommunications facilities. This is especially true in light of the absence of federally promulgated standards.

With the inclusion of safety guidance for "uncontrolled environments" as presented in the final draft of ANSI C95.1-1991, the standard is directly applicable to public exposure to non-ionizing electromagnetic radiation (NIER). For this reason, and in consideration of concerns about RF fields expressed by citizens residing in the city of Seattle, we look to you for further explanation of the content of C95.1-1991 and the rationale by which SCC-28 accepted particular guidance levels, safety factors, measures and exclusions. This is very important to us in determining what, if any, local actions are appropriate to enforce the ANSI guidance, and/or further address health concerns in Seattle.

I chair the Seattle City Council Land Use Committee and also an advisory committee concerned with telecommunications facilities in Seattle. On behalf of the Seattle Telecommunications Facilities Advisory Committee, I ask for your response to a number of questions that have come up in reviewing the ANSI C95.1-1991 final draft and the biological literature....

We have five general areas of concern:

- Selection of 4 W/Kg as the level for adverse effects on the basis of data on altered animal behavior, and use of 4 W/Kg as the platform upon which all subsequent components of the standards are set;
- Inadequate explanations of the rationales for a two-tiered standard (other than for induced currents considerations), and the particular safety factors selected;
- Dismissal of non-thermal effects as stated in the conclusion that, "Research on the effects of chronic exposure and speculations on the biological significance of non-thermal interactions have not yet resulted in *any meaningful basis* for alteration of the standard" (emphasis added);
- Lack of the justification for exclusion of portable devices operating at 7 watts and below; and
- Broad assurances provided in the recommended guidelines about avoidance of risk convey the impression that all health issues have been thoroughly and completely addressed, yet there is no acknowledgment of legitimate concerns about cancer which still need thorough investigation.

Questions pertaining to these areas of concern follow:

A. *4 W/Kg Threshold and Biological Endpoint:* What justification is there for disregarding the evidence indicating the existence of health effects below 4 W/Kg, when within the body of scientific studies available to SCC-28, there is evidence supporting the existence of deleterious effects occurring below 4 W/Kg?

The Environmental Protection Agency's (EPA) 1984 review of the literature reached the conclusion that: "...biological effects occur

at an SAR of about 1 W/Kg; some of them may be significant under certain environmental conditions." EPA's publication in the *Federal Register* (July 30, 1986) regarding federal radiation protection guidance states: ..."The evidence indicates that exposure of human beings at frequencies in the resonant region at an SAR of approximately 1 W/Kg produces significant changes in body temperature under some environmental conditions." I understand this conclusion is based in part upon the results of modeling analyses showing whole-body average SARs of 1-4 W/Kg for relatively short durations (1 hour) produce significant increases of about 1°C in human body temperature at ambient temperatures of 25-30°C (77-86°F). The EPA *Federal Register* notice advises that a 1°C rise in the core temperature of humans exposed to RF radiation should be considered hazardous to relatively healthy individuals. In addition, it seems reasonable to conclude that increases in body temperature are likely to occur at SARs lower than 1-4 W/Kg if exposures occur under more thermally stressful conditions, e.g., higher ambient temperature and/or higher relative humidity.

Why did the committee reject the scientific evidence indicating death will occur in some laboratory animals at a dose rate of 4 W/Kg? Why is behavioral disruption identified as the critical biological endpoint in the final draft guideline when it has been demonstrated that prolonged exposures at 4 W/Kg may cause death?...

The final draft of the revised C95.1 guideline indicates (pp.6-1–6-2): "The literature review was followed by extensive deliberations of a Working Group on Risk Assessment that was charged to reach agreement on an SAR at which potentially deleterious health effects *are likely* to occur in human beings" (emphasis added). What precisely does the committee mean by "are likely"? What probability factor and dose–response function are being conveyed here, i.e., are we to assume a 1% probability; or, say 50% or 90%? Is there evidence for the shape of a curve representing the probability of deleterious effects as a function of SAR and thereby evidence for the setting of such probabilities? Is there a quantitative basis for the slope of such a curve in the range near 4 W/Kg?

Use of 4 W/Kg as a threshold suggests it is entirely unlikely that any deleterious effects will occur under 4 W/Kg and conversely, at 4 W/Kg and above, chronic exposure may constitute a health hazard. Is such a sharp distinction, i.e., threshold, realistic on the basis of data for deleterious effects as a function of SAR?

B. *Rationale for the Two-Tiered Standard and Specific Safety Factors:* In the interest of reaching an understanding of the degree of conservatism present in C95.1-1991, we need more specific information related to the rationale for the two-tiered standard and the specific safety factors applied to each tier....

What exactly does the committee mean by "safety factor"? What model is being employed—a probabilistic model where the standards are based on an extrapolation process to determine a level of exposure at which there is a low probability of effect, or a threshold model for which significant effects occur only above a specific threshold value? What is the basis for the specific numerical values (10 and 50) selected by SCC-28 as safety factors?

C. *Relevancy of Non-Thermal Interactions to Modification of the Standard:* The final draft ANSI C95.1-1991 document states on p.6-4: "Research on the effects of chronic exposure and speculation on the biological significance of non-thermal interactions have not yet resulted *in any meaningful* basis for alteration of the standard" (emphasis added) and on p.6-11: "Studies such as those indicating effects, in vitro, on cell function were considered transient and reversible with no detrimental health effects."

Since 1986, a number of research articles have been published concerning thermal or low-level exposures and effects on tissues on the eye (Kues et al., 1987, 1989), effects on cholinergic activity of rat brains (Lai et al., 1987), effects suggesting microwave action on endogenous brain opiods (Lai et al., 1986a, 1986b), effects of short pulses on integrity of the blood–brain barrier (Neubauer et al., 1990), effects on fetal development (Tofani et al., 1986) and effects on the incidence of tumors in chronically exposed rats (Kunz et al., 1985). In addition, a number of in vitro areas have been investigated, including cancer-promoting changes in cultured cells (Balcer-Kubiczek and Harrison, 1986, 1989, 1991). Of the topics on animal exposures, only experimental data on the blood–brain barrier were considered by SCC-28 as a result of the time window set for the literature reviewed.

These recent research results emphasize the existence of biological effects at exposures below 4 W/Kg that may result in deleterious health effects. The recent findings together with older work demonstrating nonbehavioral effects at thermal levels of exposure further weaken the arguments that establish the standard on a behaviorally determined threshold of 4 W/Kg, and the premise that the standard is based upon a conservative view of the existing data.

In light of the work cited above, is there not a biological basis for reexamination of the basic premise that established the standard on a behaviorally determined threshold of 4 W/Kg?

Even if it were more firmly established that in vitro effects referred to in the statement from p.6-11 are indeed "transient and reversible," how can it be assumed that no future health impact may result? Given modern concepts of cell biology and the latency for onset of some diseases, this seems questionable.

D. *Exclusion Clause for Portable Devices:* The exclusion for low-power devices runs contrary to the whole philosophy of the rest of the standard. What is the detailed basis for the exclusion? Are there biological data that support the inherent assumption that if the input power of the radiating device is 7 watts or less, or 1.4 watts or less, the energy deposited in the body is harmless regardless of proximity to the body or duration of exposure? What consideration has been given to hot spots and different kinds of antennas? The recently revised language of C95.1-1991 that indicates the exclusion "...does not apply to devices with the radiating structures maintained within 2.5 cm of the body" needs clarification. What is meant by "maintained"? Also, §4.4, p.4-14 indicates the relaxation of power density limits is allowed for exposure of all parts of the body except for the eyes and testes, yet §4.2.3 and §6 make no mention of the exclusion being disallowed when applied to these parts of the body. How are we to interpret the recommended guidance when hand-held radios may be used with the antenna in close proximity to the eyes?...

E. *Possible Cancer Effects and Definitive Statements of Risk:* A number of statements in the C95.1-1991 final draft suggest an absence of health risks from NIER associated with allowable exposures, yet there has been very little experimentation related to possible elevated risks of cancer.

Would you agree that the issue of cancer and RF exposures has been given far too little attention experimentally for definitive statements about risk of either a positive or negative nature?

I want to thank the SCC-28 committee members for the long hours and intensive efforts undertaken to address this important area. Undoubtedly, the job has been a difficult one. I am not an advocate of the creation of a patchwork of local NIER standards.

I am hopeful that a better understanding of SCC-28's perspective on the above will satisfy the concerns I have presented. Your response is very important to Seattle's decision on whether to embrace the recommended guidance of ANSI C95.1-1991, and as such will be greatly appreciated.

Sincerely,
Sue Donaldson
Councilmember, Seattle City Council

CIRRPC Sharply Critical of EPA EMF–Cancer Report

The Committee on Interagency Radiation Research and Policy Coordination (CIRRPC), which is managed by the White House Office of Science and Technology Policy (OSTP), has urged the Environmental Protection Agency (EPA) to overhaul its draft report on electromagnetic fields (EMFs) and cancer.

In an August 5 letter to EPA Assistant Administrator Erich Bretthauer, CIRRPC Chairman Dr. Alvin Young wrote that the committee believes the report should be "substantially revised, if not rewritten." That conclusion echoes the recommendation of EPA's Scientific Advisory Board's (SAB) Non-Ionizing EMF Subcommittee that the document has "serious deficiencies and should be rewritten" (see *MWN*, J/A91).

Young cautioned that "the evidence presented...does not provide a scientifically sound basis for linking cancer to exposures to electric and magnetic fields." He called the document's executive summary "unnecessarily alarming" and emphasized the importance of rewriting it. "The interpretation of the data is biased towards accentuating a positive correlation," he argued.

Young's letter was accompanied by comments from seven federal departments and agencies that had been asked to review the EPA draft report (see box below). Of the seven, the National Cancer Institute (NCI) and the Department of Defense (DOD) criticized the document as sharply as CIRRPC, emphasizing many of the same points.

NCI's Dr. John Boice stated that "the conclusions presented remain scientifically unsound and unnecessarily alarming." Robert Barker, assistant secretary of defense, urged that, "This report should not be published. Alternatively, the scope of the report could be expanded to incorporate the volumes of research which document a lack of EMF effects, and its conclusions modified accordingly." Late last year, a U.S. Air Force review was similarly critical (see *MWN*, N/D90).

Dr. Imre Gyuk of the Department of Energy found the report improved over an earlier draft but said that the executive summary "suffers from a severe case of overgeneralizations, speculations and unjustifiable conclusions." Reviewers from the Center for Devices and Radiological Health and from the National Institute of Standards and Technology were generally positive in their comments.

Comments Submitted to CIRRPC on EPA EMF–Cancer Report

Seven federal departments and agencies submitted comments to CIRRPC on EPA's draft review document on EMFs and cancer. Compiled below are excerpts from some of the comments.

• **Department of Defense** (Robert Barker, assistant secretary): "...[T]he document does not support a scientific assessment that [EMFs] are possible carcinogens. The document is inconsistent and seriously deficient in not presenting a balanced and comprehensive review of the literature. In addition, it appears to gloss over or ignore studies showing negative results....The overall weight of the epidemiologic evidence is so slight as to be almost nonexistent—certainly not sufficient to justify the alarmist nature of this document....This report should not be published."

• **Department of Energy** (Dr. Imre Gyuk, program manager for electromagnetic research): "[C]larity and understanding of the important issues are still hampered due to treatment of disparate frequency ranges [ELF and RF] in the same chapters....The document would be less subject to attack if it were simply stated that studies of carcinogenesis in animals exposed to ELF have not been done....[The] Executive Summary suffers from a severe case of overgeneralizations, speculations and unjustifiable conclusions."

• **Department of Energy** (Harry Pettengill, deputy assistant secretary for health): "[The] conclusions regarding the risk of cancer in children and adults seem appropriate. While the risks are low, there does seem to be a consistent trend for certain type-specific cancers. There certainly is the need for continued health research in this area and the development of better indicators of exposure."

• **Department of Transportation** (Dr. Aviva Brecher, project manager, maglev EMF health effects): "The EPA draft report is a useful compendium, and a fairly balanced critique of research results to date. I concur with Dr. Imre Gyuk of DOE that lumping ELF fields effects with those of RF and higher (MW) frequencies [of] electromagnetic radiation is technically incorrect and unwarranted....The incomplete, uncertain and internally inconsistent current state of knowledge on EMF and cancer must be more forcefully stated...."

• **Food and Drug Administration's Center for Devices and Radiological Health** (Walter Gundaker, acting director): "This is a well-researched document which presents a reasonable and balanced examination of the evidence available to date. It prudently refrains from rejecting the large body of evidence out-of-hand because of perceived weaknesses of individual studies, yet acknowledges that the aggregate picture has many questions yet to be answered...."

• **National Cancer Institute** (Dr. John Boice, head of the radiation epidemiology branch): "All [NCI] reviewers agreed that the human epidemiologic data to date did not support the sweeping conclusions made in the EPA document. In our judgment the conclusions presented remain scientifically unsound and unnecessarily alarming....There appeared to be a tendency throughout the report to dismiss negative or inconclusive findings rather than weighing these inconsistencies in the overall interpretation....Missing throughout is a clear statement that we cannot conclude at this time whether [EMFs] pose a cancer hazard."

• **National Institute of Standards and Technology** (Paul Todd, biostatistician): "I see no serious problem with issuing the book as it stands. Experimenters who have been quoted may not feel the same way, but the report treats all of the research fairly, and, if anything, is too noncritical."

• **Occupational Safety and Health Administration** (Sheldon Weiner, director, office of standards analysis and promulgation): "[O]ur reviewer of the epidemiological sections of the report feels that EPA has implied an unsupportable degree of confidence in the positive studies relative to carcinogenesis both in children and adults. On the other hand, our reviewer of the animal and in vitro studies feels that EPA has understated the strength of the evidence supporting a carcinogenic link."

CIRRPC Begins Its Own Health Review

An independent review panel on EMF health effects under the direction of CIRRPC met for the first time on September 5-6 in Washington, DC. CIRRPC initiated the review late last year after the White House Office of Science and Technology Policy opposed release of EPA's draft review of EMFs and cancer.

The panel plans to meet monthly and to complete its work within six months. The review was scheduled to start early this year but was delayed for undisclosed reasons (see *MWN*, N/D90, J/F91 and J/A91).

Oak Ridge Associated Universities (ORAU) of Oak Ridge, TN, and Washington, DC, is coordinating the review under contract to CIRRPC. According to a statement issued by ORAU, the review panel will evaluate reported carcinogenic, reproductive and neurophysiological effects. It will consider both power frequencies (15-180 Hz) and very low frequencies (VLF) (10-30 kHz) from video display terminals (VDTs), though they will be addressed separately.

Dr. Glenn Davis, chairman of ORAU's Medical Sciences Division, is chairman of the review panel. The other ten members are: Drs. William Bennett, Yale University, New Haven, CT; Joseph Brady, Johns Hopkins University School of Medicine, Baltimore, MD; Robert Brent, Jefferson Medical College, Philadelphia, PA; Leon Gordis, Johns Hopkins University School of Medicine; William Gordon, Rice University, Houston, TX; Samuel Greenhouse, George Washington University, Washington, DC; Russel Reiter, University of Texas, San Antonio; Gary Stein, University of Massachusetts Medical Center, Worcester; Charles Susskind, University of California, Berkeley; and Dimitrios Trichopoulos, Harvard University School of Public Health, Boston, MA. (Susskind was originally named to head the panel.)

RAC Approves SAB Report on EPA Cancer Assessment

At a September 20 meeting, the Science Advisory Board's (SAB) Radiation Advisory Committee (RAC) unanimously approved the Non-Ionizing EMF Subcommittee's report on the Environmental Protection Agency (EPA) draft EMF–cancer assessment. Four of the seven RAC members were present at the Washington, DC, meeting.

The subcommittee report asks EPA to rewrite its EMF–cancer assessment, citing "serious deficiencies," and cautions that there are insufficient data to classify EMFs as carcinogenic (see *MWN*, J/F91, M/J91 and J/A91).

The SAB's Executive Committee will now review the subcommittee's report at an October 29-30 meeting. Kathleen Conway, an SAB staff member, told *Microwave News* that she expects the executive committee will also approve it. If so, the report will then be sent to EPA Administrator William Reilly.

Five More Cancer–Police Radar Claims Filed

The number of legal claims alleging that police officers developed cancer as a result of operating speed radar units has increased by five, bringing the total to eight. Three Connecticut officers with cancer have filed workers' compensation claims. And the widow of a Wisconsin state trooper who died of cancer and a California police officer who has cancer have filed lawsuits against radar manufacturers. All five of the officers used radar units manufactured by Kustom Signals, Inc., of Overland Park, KS.

In Connecticut, Thomas Malcolm, 42, of the Windsor Locks Police Department (WLPD), charges that he developed testicular cancer from operating a Kustom radar since 1977. Ricardo Rachele, 33, also of the WLPD, used a Kustom unit since 1979 and has cancer in his shoulder and collarbone. A third officer, Vincent Casertano, 56, of the Shelton Police Department, has thyroid cancer—he began operating a Kustom radar in 1971. All three are represented by attorney Stuart Rothenberg of Rothenberg, Rothenberg & Rothenberg in Manchester, CT.

William Gifford, Windsor Locks' police chief, told the Manchester, CT, *Journal Inquirer* that he will continue using the Kustom radar units but that he plans to investigate whether they can cause cancer. Gifford did not respond to a request for comment from *Microwave News*.

In Wisconsin, Naomi Sudbrink of Augusta is suing Kustom, which manufactured the radar units her late husband Arnold had used for more than three years as a Wisconsin state trooper, and five insurance companies. Arnold Sudbrink died last September from cancer that first developed in his eye. The suit was filed on September 13 in Wisconsin Circuit Court for Eau Claire County, where Arnold Sudbrink lived.

Officer Steven Cottini of the Concord (CA) Police Department and his wife, Christine, are seeking $12.5 million from Kustom and MPD, Inc., of Owensboro, KY, for Steven's testicular cancer. From 1977 to 1979, while working for the San Bruno (CA) Police Department, Cottini used the MPD units. From 1979 to 1987, he used the Kustom radar devices while at the Concord Police Department. The suit was filed September 10 in U.S. District Court for Northern California in San Francisco.

John Sweeney of Agoura Hills, CA, is the attorney for both Sudbrink and the Cottinis. Earlier this year, Sweeney sued Kustom on behalf of three plaintiffs (see *MWN*, M/A91 and J/A91).

William Ruppert, a partner in Kustom, told *Microwave News* in a telephone interview that he had no comment on the claims made against the company.

FDA Police Radar Hot Line

The Food and Drug Administration's (FDA) "Problem Reporting Hot Line" is now responding to inquiries about police radar health effects. Data collected from callers may be used to develop an epidemiological survey, according to agency officials.

The hot line, which is regularly used for problems with medical devices, is referring calls to the television, acoustics and microwaves products branch of the Office of Compliance at the agency's Center for Devices and Radiological Health. The hot line number is: (800) 638-6725.

NIOSH VDT Epi Study Revisited

Two letters published in the September 12 *New England Journal of Medicine* question the conclusions of the National Institute for Occupational Safety and Health (NIOSH) study of VDT workers and spontaneous abortions (see *MWN*, M/A91).

In one letter, Dr. Robert Newcombe and Edward Coles of the University of Wales College of Medicine, U.K., cite "considerable" differences between the study population and the controls in the mean number of pregnancies per woman, cautioning that, "The results presented could conceal a potentially serious hazard associated with the use of VDTs, if the difference in the rates of pregnancy resulted from excess early, undetected fetal loss in the exposed group."

The second letter, written by editors of *Microwave News* and *VDT News*, argues that NIOSH's conclusion—that exposure to VDT electromagnetic fields (EMFs) was not associated with an increased risk of spontaneous abortion—was not justified since both the case and the control groups were equally exposed to extremely low frequency EMFs.

In their response, NIOSH's Dr. Teresa Schnorr and colleagues said that the apparent differences in pregnancies went away when adjustments were made for the women who had worked as both directory assistance operators (the case group) and general operators (the control group) during the study period. With respect to EMFs, they pointed out that the crucial difference between cases and controls was that the VDT operators were exposed to higher very low frequency (VLF) EMFs.

Microwave Eye Damage *(continued from p.1)*

mission.

In a presentation at the June meeting of the Bioelectromagnetics Society (BEMS), Kues described how the eyes of monkeys exposed to 3.5-4 W/Kg of 1.25 GHz radiation (0.5 μsec pulses at 16 Hz) for four hours a day, three times a week for three weeks lost most of their cone function and half of their rod function. One week after exposure, the rod photoreceptors returned to approximately 80% of their pre-exposure level, but the cones remained damaged. Cone damage is manifested by a loss of color discrimination and some decrease in visual acuity, Kues explained. Impaired rods result in reduction in night vision.

Four monkeys were exposed and all suffered similar damage, leading Kues and Monahan to conclude that the threshold for the effect is below 3.5 W/Kg. Examination of the eye tissue confirmed the degeneration of cones and suggested that a specific population of cones is more vulnerable than others—different types of cones are responsible for detecting different colors.

Kues and colleagues at JHU medical school's Wilmer Institute—Kues divides his time between the APL and Wilmer—examined two workers who were accidentally exposed to 6 GHz microwaves while operating an illegal satellite uplink. The 30-watt transmitter exposed their retinas to an estimated 5 mW/cm^2 of continuous wave radiation for two 15-minute periods. Both men suffered a 50% loss in cone response as measured by changes in electroretinograms (ERGs). Seven months later, there was no improvement.

Based on these results, Kues and Monahan recommend diagnostic tests for those occupationally or accidentally exposed to microwaves, including: specular microscopy, retinal and iris fluorescein angiography and ERGs. If referred by an ophthalmologist, the Wilmer Institute will examine anyone who has been accidentally exposed to microwave levels in excess of existing safety guidelines as part of its research program, Kues said.

Researchers at JHU-APL have been investigating the effects of microwave radiation on the eye since the early 1980s. In a series of studies, a team led by Kues and Monahan has shown that low-level, pulsed radiation can injure the endothelial layer of the cornea and cause leakage in the blood–aqueous barrier. The effect occurs at a specific absorption rate (SAR) of 2.6 W/Kg or less (see *MWN*, J/A83, S/O86 and J/A87). In addition, the team found that eyes treated with glaucoma drugs are much more sensitive to microwaves—at levels as low as 0.26 W/Kg (see *MWN*, J/A88).

Both the old and the new results challenge the specifics of the current (1991) revision of the 1982 American National Standards Institute (ANSI) guidelines for human exposure to radiofrequency and microwave radiation. The SCC-28 committee rewriting the standard concluded that "whole-body SARs below 4 W/Kg were not associated with effects that demonstrably constitute a hazard for humans." The SCC-28 committee has been criticized for ignoring the previous Kues-Monahan findings (see p.9).

At the BEMS meeting, Kues was asked why the epidemiological study would be done in the U.S.S.R. instead of in the U.S. He replied that U.S. military officials had been "very reluctant" to provide any data. In an interview, Kues said that the Department of Defense is concerned about privacy issues.

A paper describing both the monkey and human results has been submitted for publication to *Archives of Ophthalmology*.

UPDATES

COMPATIBILITY & INTERFERENCE

Black Hawk Helicopter Accidents...EMI has never caused a Black Hawk helicopter accident, according to Secretary of the Army Michael Stone. In an unpublished, August 6 letter to the *New York Times*, obtained by *Microwave News* through the Freedom of Information Act, Stone contends that reports of seri-

ous EMI problems "wrongly discredit an Army helicopter that has proven itself to be a safe, highly effective piece of equipment." One such report, a November 1987 piece from Knight–Ridder Newspapers, blamed EMI for the crashes of five Black Hawk helicopters and the deaths of 22 servicemen since 1982 (see *MWN*, N/D87). A June 1988 investigation by the DOD concluded that the Black Hawk is indeed susceptible to EMI, and in a September 1988 memo to the DOD Inspector General, Stone, then under secretary of the Army, acknowledged that "EMI does raise safety of flight concerns with respect to the Black Hawk" (see *MWN*, S/O88 and N/D88). In his letter to the *Times*, Stone calls the Black Hawk "one of the safest helicopters in the Army's inventory," and points out that, "Since 1987, the accident rate has fallen by 47%." Stone does not mention that in 1987 the Army issued warnings to Black Hawk pilots to stay away from high-power radio transmitters and instituted a program to shield the helicopter from EMI.

INTERNATIONAL

Trip to China... Study Mission International (SMI), a division of W/L Associates, and the Bioelectromagnetics Society are organizing a 19-day, five-city tour of China for September 1993. Participants will meet with Chinese researchers working on the biological effects of 50 Hz EMFs, RF/MW radiation and millimeter waves, as well as their medical and agricultural applications. Dr. C.K. Chou of the City of Hope National Medical Center in Duarte, CA, who will lead the delegation, told *Microwave News* that the trip will be a "mixture of business and pleasure—we intend to explore bioelectromagnetic research and see the sights." Space is limited to 35 scientists and their spouses at a cost of less than $3,000 per person. For more information, contact: Dr. William Wisecup, W/L Associates, 120 W. Church St., Frederick, MD 21701, (301) 663-1915.

MEDICAL APPLICATIONS

RF for a Racing Heart...RF radiation can be used as an effective treatment for paroxysmal supraventricular tachycardia (PSVT)—a rapid heartbeat condition which afflicts roughly one in every 200 people in the U.S.—according to several recent studies. In the past, drug therapy or surgery was required to prevent natural electrical impulses in the heart from triggering up to 300 beats per minute. Now researchers are using RF radiation to insure that these impulses, typically occurring 60 times per minute, stimulate only one beat each. The June 6 *New England Journal of Medicine* includes two papers on this new treatment: Dr. Warren Jackman and coworkers at the University of Oklahoma Health Sciences Center in Oklahoma City report that the treatment is "highly effective," and a team headed by Dr. Hugh Calkins of the University of Michigan Medical Center in Ann Arbor asserts that the new method is "feasible and practical" and has "a favorable risk–benefit ratio." In an accompanying editorial, Dr. Jeremy Ruskin of the Massachusetts General Hospital in Boston predicts that, if the early data are confirmed, the technique will become the "treatment of choice" for PSVT patients. In a paper published in the June 29 issue of *The Lancet*, German researchers led by Dr. Karl-Heinz Kuck of the University Hospital Eppendorf in Hamburg state that the RF treatment "has none of the disadvantages of direct-current shock therapy," and that initial reports on its use are "promising." Despite these optimistic conclusions, the researchers do note some adverse reactions to the treatment. For a popular account of the new research, see the July 20 issue of *Science News*.

MRI Safety... The safety of magnetic resonance imagers (MRIs) is again being questioned. Participants at a May conference on MRI safety held in Bethesda, MD, heard several reports that the intense static magnetic fields, RF EMFs and gradient EMFs from new high-speed MRIs have occasionally produced biological responses ranging from vertigo to a metallic taste in patients' mouths at strengths as low as 1.5 T, according to the July/August issue of *The Institute*, a publication of the Institute of Electrical and Electronics Engineers. Dr. Jeffrey Weinreb of the New York University Medical Center's MRI Department stated in a presentation at the conference that, "We've been saying [that MRIs are safe] for so long, we almost believe it. We now know there are many potential safety hazards with MRI." *Science* also reported on the meeting, which was sponsored by the New York Academy of Sciences. "For the moment...the main task seems to be to find out what effect these high-tech medical wonders actually have on living tissue," it reported in its May 31 issue.

MEETINGS

T&D on EMFs... Excerpts from presentations at a conference held in February are the heart of a 16-page article, "EMF: How Dangerous?" in the June issue of *Transmission & Distribution* magazine, which sponsored the meeting (see *MWN*, M/A91). Among the speakers were: Paul Brodeur of *The New Yorker;* Arthur Bryant of Trial Lawyers for Public Justice, Washington, DC; Dr. Granger Morgan of Carnegie Mellon University, Pittsburgh, PA; U.S. Rep. Frank Pallone (D-NJ); James Sanford of PSE&G of New Jersey; and Thomas Watson of Crowell & Moring, Washington, DC. A copy of the June issue can be obtained for $5.00 from: Intertech Publications, PO Box 12901, Overland Park, KS 66212, (913) 541-6628.

PEOPLE

Dr. **Alicia Dustira** is the EMF contact in the White House Office of Science and Technology Policy (OSTP), reporting to Dr. **Allan Bromley**, the President's science advisor, who has criticized EPA's draft EMF–cancer assessment (see *MWN*, N/D90 and M/J91)....The IEEE has recognized Dr. **Eleanor Adair** of the John Pierce Foundation in New Haven, CT, and **Richard Harris** of National Public Radio for their "literary contributions furthering public understanding of the engineering profession." At a September 1 awards ceremony, the IEEE's U.S. Activities unit praised Adair for "her scholarly and balanced paper titled *Currents of Death Rectified*," a response to Paul Brodeur's book on EMFs which first appeared as a series of articles in *The New Yorker*. Harris was honored for "his balanced five-part series" on EMFs, which ran April 15-19, 1991. Harris

is continuing to follow the EMF debate; he aired an update on the EPA cancer report on September 17....Dr. **Jan Walleczek** has joined Dr. **Ross Adey**'s laboratory at the VA Hospital in Loma Linda, CA. His work is being supported by a grant from the John Fetzer Institute in Kalamazoo, MI....Dr. **Maria Stuchly**, who will soon leave Health and Welfare Canada for the University of Victoria in British Columbia, has been named chair of the International Union of Radio Science's (URSI) newly formed Commission K on Electromagnetics in Biology and Medicine. Dr. **Paola Bernardi** of the University of Rome is the vice-chair. Commission K was set up at URSI's August 1990 meeting in Prague, Czechoslovakia. Stuchly plans to have the first meeting of the more than 20 members of her committee at the *1st World Congress for Electricity and Magnetism in Biology and Medicine* in Orlando, FL, in June 1992 (see *MWN*, M/A91).

STANDARDS

NRPB Updates MRI Standards... The U.K.'s NRPB's revised standards for exposures to MRI systems, outlined by Dr. R.D. Saunders in the July 1991 *Radiological Protection Bulletin*, are generally two-tiered, with a lower limit which may be exceeded under controlled conditions and an upper limit which should not be exceeded. For *static magnetic fields*, the lower limit is 2.5 T and the maximum is 4 T. For *gradient magnetic fields*, the board specifies a maximum induced current density of 400 mA/m² (or 20 T/s) when the magnetic fields are changing for longer than 120 μsec. This limit can be relaxed for shorter exposures. For RF radiation, the board recommends lower and upper limits for whole body SARs of 1 W/Kg and 2 W/Kg, respectively, for exposures of more than 30 minutes. Progressively higher SARs can be applied for shorter exposures up to maximum limits of 2 W/Kg and 4 W/Kg, respectively, averaged over a 15-minute period. Separate limits are specified for the head, trunk and limbs. The board also advises that women should not have an MRI exam during the first three months of pregnancy. A copy of the "Board Statement on Clinical Magnetic Resonance Diagnostic Procedures," *Documents of the NRPB*, 2, No.1, is available for £5.00 from: Her Majesty's Stationery Office Publications Center, PO Box 276, London SW8 5DT, U.K., (44+071) 873-9090.

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