MWN, D83).

A 1978 epidemiological study of Moscow embassy employees by Professor Abraham Lilienfeld of Johns Hopkins University failed to show any adverse effects, but Lilienfeld urged the U.S. State Department to continue to monitor the health of the Moscow staff over the next few years since only a short time had elapsed between the period of maximum exposure and his study.

More recently, in March 1988, the State Department acknowledged that it had again detected radiation—"primarily" in the 9-11 GHz range—at the Moscow embassy (see *MWN*, M/A88). Although the department would not speculate on the reasons for the transmissions, a number of theories have been offered over the years, including activation of bugging devices, electromagnetic interference and mind control.

Epidemiological Study of VDT Reproductive Risks Funded

On September 1, the Mount Sinai School of Medicine in New York City will launch its long-awaited epidemiological study of reproductive risks among office workers. The National Institute of Child Health and Human Development (NICHD) is sponsoring the $2 million project, which is the first prospective study ever undertaken of pregnancy risks among video display terminal (VDT) operators. The results are due in 1993.

"We will be addressing an important public health question—whether VDTs pose any risk to early pregnancy," Mount Sinai's Dr. Michele Marcus—the principal investigator for the study—told *Microwave News*. Dr. Philip Landrigan, head of Mount Sinai's Division of Environmental and Occupational Medicine, and Dr. Irving Selikoff, the previous division head, are collaborating with Marcus. Selikoff first announced plans for a VDT study in 1985 (see *MWN*, Jn85).

Over the years, the study design has evolved to encompass all aspects of office work, not just VDTs (see *MWN*, M/J87). In addition, the Mount Sinai team will address other VDT health risks such as musculoskeletal and vision ailments.

Many labor and government representatives hailed the government's decision to fund the project, but laced their praise with criticism for the long delays. Congressman Ted Weiss (D-NY), who has been an active supporter of VDT health and safety studies, called it "an important first step," but added that, "There is growing evidence that research which addresses other health risks from VDTs is also long overdue." At an NICHD-sponsored workshop last November, a Weiss aide urged the institute to sponsor a study on reproductive risks in light of the Kaiser Permanente epidemiological study, which showed that women who used VDTs more than 20 hours a week had twice the miscarriage rate of those who did other types of office work (see *MWN*, M/J88 and N/D88).

Senator Albert Gore (D-TN) commented that, "There are still many unanswered questions about the potential health effects of VDTs and of electromagnetic fields (EMFs) generally, but there is no longer any doubt that this form of radiation can cause some biochemical changes. In my view, that information alone is sufficient to warrant a renewed commitment on the part of government and private industry to study this issue and search for solutions to protect people." Gore held a hearing on VDT EMFs in 1981, when he was in the House of Representatives (see *MWN*, Jn81).

"We are incredibly thrilled," Sharon Danann of 9 to 5, the National Association of Working Women, told *Microwave News*. "We think that the study will add a great deal to this area of research," she said. The Service Employees International Union and 9 to 5, as well as a number of large corporations, are assisting Mount Sinai in identifying workplaces to participate in the study.

The Mount Sinai study will be the first to monitor office workers before they are pregnant and throughout the first few months of pregnancy. Marcus and coworkers will follow 8,000 women in New York, Boston, Cleveland and an as-yet-undetermined California city. For one year, approximately 10% of the study population will submit urine samples, which will then be tested for human chorionic gonadotropin—a sensitive indicator of pregnancy. Menstrual cycles and hormone levels will also be monitored.

AT&T Bell Labs, based in Murray Hill, NJ, will work with Mount Sinai on VDT radiation measurements.

In addition to looking at VDT use, the researchers will address the impact of stress, ergonomics and the general office environment. Potential risks due to cigarette smoking, alcohol consumption and caffeine intake will also be investigated.

A pilot study was funded by the National Institute of Environmental Health Sciences and the March of Dimes (see *MWN*, S/O87).

Canadian Study Shows No VDT-Miscarriage Link

Women who used VDTs while pregnant did not suffer an increased incidence of miscarriages, according to a new study from the University of Calgary in Alberta, Canada. Drs. Heather Bryant and Edgar Love of the university's medical school found that there was no association, regardless of the length of time spent at a terminal.

The number of operators who worked at VDTs for more than 20 hours a week was small, however. The researchers noted that their study "lacks power to comment on this single stratum of exposure." Last year a team from Kaiser reported that women who used VDTs for more than 20 hours a week had twice as many miscarriages as those unexposed (see *MWN*, M/J88).

The Calgary results appear in the *International Journal of Epidemiology, 18*, pp.132-138, 1989.

U.K.'s NRPB: Same 0-300 GHz Limits for Workers & Public

Under the U.K.'s National Radiological Protection Board's (NRPB) new guidelines, workers and the general public are subject to the same limits for exposures to non-ionizing radiation. "The board is unable to find a scientific justification for recommending lower basic restrictions for the public in comparison with workers," the NRPB advised in a May report.

The new guidelines only take into account thermal effects. While noting "some epidemiological evidence" of cancer and birth defects risks, the NRPB said that, "It would seem premature to recommend restrictions on exposures to take account of possible cancer risks."

The new recommendations have no legal force. "It's our advice," Dr. Alastair McKinlay, head of Physical Dosimetry for the NRPB, told *Microwave News*.

An editorial appearing in the May issue of the NRPB's *Radiological Protection Bulletin* pointed out that the electromagnetic fields (EMFs) from domestic appliances—e.g., heaters and kettles—are often greater than fields that arise from power lines. "A ban on the use of electricity would not be feasible, useful or welcome," it stated.

The editorial went on to comment that the "as low as reasonably achievable" (ALARA) strategy "is hardly useful when there is no way of quantifying the reduction in the possible risk against the costs, inconvenience and effectiveness of reducing existing exposures levels."

The recommendations, which cover extremely low frequencies (ELF) up to microwaves, came in response to the guidelines put forward by the International Non-Ionizing Radiation Committee (INIRC) of the International Radiation Protection Association (IRPA) (*see MWN*, M/A87 & J/F88).

Unlike the IRPA guidelines, the NRPB's "basic restrictions" are specified in terms of induced currents and specific absorption rates (SARs)—instead of electric and/or magnetic fields and power densities. The NRPB stressed that the currents and SARs are based on "reference levels" adapted from IRPA's EMF limits. But these reference levels "are not to be regarded as limits" and cannot be enforced.

In an interview with *Microwave News*, Stuart Allen of the NRPB's office in Leeds, U.K., acknowledged that there are no off-the-shelf devices now available to measure the quantities specified in restrictions 1-5 (see box at right). He added that, "If you exceed the reference levels, it does not necessarily mean that you would exceed the basic restrictions. The implication is that if you exceed the reference levels, you need to do further investigations on the characteristics of the particular exposure situation." Allen is the group leader of the NRPB's EMF Study Group.

Dr. John Male of Central Electricity Research Laboratories in Leatherhead, U.K., told *Microwave News* that the 50 Hz limits recommended by the NRPB "are not going to cause us any embarrassment—we can live with them." He said that he agrees that a distinction between workers and the general public is not necessary.

Guidance as to Restrictions on Exposures to Time Varying Electromagnetic Fields and the 1988 Recommendations of the International Non-Ionizing Radiation Committee, NRPB-GS11, is available from: Publications Officer, NRPB, Chilton, Didcot, Oxfordshire, OX11 0RQ, U.K.

NRPB: Basic Restrictions on Exposures to EMFs Below 300 GHz

1. The continuous induced current in any arm, hand, leg, ankle or foot should not exceed:

   $$\left[1 + f/1500\right] \text{ mA or } 100 \text{ mA}$$

   whichever is smaller for frequency f less than 30 MHz; f is in Hz.
2. The average specific energy absorption rate in the body over any 6 min should not exceed 0.4 W/Kg.
3. When taken in conjunction with 2 above, the maximum value of the specific energy absorption rate in any 0.1 Kg of an internal organ or tissue in the head or trunk over any 6 min should not exceed 10 W/Kg.
4. When taken in conjunction with 2 above, the maximum value of the specific energy absorption rate in any 0.1 Kg of an arm, hand, leg, ankle or foot in any 6 min should not exceed 20 W/Kg.
5. Exposures to time-integrated power densities in any pulse of duration less than 50 μs exceeding 0.4 J/m² should be neither prolonged nor frequent.
6. Radiofrequency burns from objects in the field should be avoided.
7. Any uncomfortable sensation of heat in the superficial layers of the body should be avoided at frequencies above 1 GHz.

Navy Seeks Winter Site for EMPRESS II

The U.S. Navy is planning a winter site for its electromagnetic pulse (EMP) simulator, EMPRESS II, in the Gulf of Mexico, 30-60 miles off the coasts of Mississippi and Alabama. The Navy seeks to operate the simulator approximately 60 days during the months of November through April.

The Navy is currently preparing an environmental assessment for the site and expects to complete all of its environmental reviews by October 1, 1990. It has already filed an environmental impact statement for the operation of EMPRESS II off the coast of Virginia (see *MWN*, M/J88).

EMPRESS II—an acronym for the second Electromagnetic Pulse Radiation Environment Simulator for Ships—has been at the center of a controversy over health and interference effects for the last five years (see *MWN*, O84, N84 and

J/F87). The Navy originally intended to use the simulator on Chesapeake Bay, but finally gave up in the face of intense opposition from citizens and elected officials in Maryland and Virginia. The simulator was ultimately located on the Atlantic Ocean, 15 miles off the coast of North Carolina (see *MWN*, J/A88).

In an interview with the *New Orleans Times-Picayune*, EMPRESS II Project Manager Captain W.E. Mayhew blamed the Navy's troubles at the Chesapeake Bay site on a failure to "head off initial misinformation." He added that the local politicians were "victims of our failure to get out good information." Three public meetings were held in Mississippi, Alabama and Louisiana at the end of June to brief local residents.

A recent analysis by the Congressional Office of Technology Assessment (OTA) concluded that EMPRESS II, in its Atlantic Ocean site, presented "no significant health effects" threat to humans and wildlife, but recommended further testing to determine possible electromagnetic interference (EMI) to avionics (see *MWN*, J/F89).

The proposed site is located away from airports and commercial air corridors and thus would pose no EMI threat to aircraft, the Navy told *Microwave News*.

The Navy's plans have not been well-publicized. Indeed, when asked by *Microwave News* about the southern site, a Navy spokesperson replied, "Good Lord! They're not going to drag that thing all the way around Florida?"

AMA Seeks EMP-Resistant Medical Devices

In a new policy statement, the American Medical Association (AMA) encourages the development of medical devices that are resistant to electromagnetic pulse (EMP) radiation. The AMA's House of Delegates approved a staff report on the effects of EMP at its June annual meeting (see *MWN*, S/O88).

It is not clear whether the report will be published, but the AMA's Dr. Theodore Doege, the report's author, told *Microwave News* that it "definitely represents AMA policy." The seven-page report identifies electronic equipment for monitoring life-support systems, lab instruments, computers, communications and emergency power-generating systems as among those devices most vulnerable to EMP. Diagnostic equipment, such as magnetic resonance imagers, might also be affected.

Over the years, the U.S. Army has funded research on protecting medical devices from EMP (see *MWN*, J/F86 and J/A87). In 1985, the Food and Drug Administration reported that many computerized medical devices are susceptible to electromagnetic interference (see *MWN*, N/D85).

The new report also calls for the AMA to support the recommendations of the National Security Telecommunications Advisory Committee's task force on EMP and urges that they be adapted to the medical sector (see *MWN*, S/086).

EMC Rules Around the World

The Netherlands Standardization Institute (NSI) in Delft has published a handbook, *Electromagnetic Compatibility [EMC]—Regulations and Standards Worldwide*, a highly useful compilation of EMC rules and legislation from 69 countries and territories—from Algeria to Zimbabwe. It also covers international standard-setting groups.

The guide includes rules for household electrical appliances, fluorescent lights, computers, radio and TV receivers, RF and ISM equipment and automobile ignition systems.

H.Th.C. Haus of the Nederlandse Philips Bedrijven edited the 207-page handbook.

Copies are available by special order for $55.00 each from: Sales Department, American National Standards Institute, 1430 Broadway, New York, NY 10018, (212) 354-3300. Allow extra time for shipping and handling. For further information on the NSI, contact: Mrs. P.J.A. van Heeswijk, Public Relations Dept., NNI, PO Box 5059, 2600 GB Delft, The Netherlands, (015) 690 390.

ELF NEWS

« Power Line Talk »

Philip Abelson's editorial in *Science* making the case for more EMF research funds inspires considerable irony. Three years ago in that same space, Dr. **Granger Morgan**, who heads the Carnegie Mellon team that wrote the OTA report (which in turn prompted the *Science* editorial), raised the question of when to *stop* risk-related research, using 60 Hz EMFs as an illustration (see *MWN*, M/J86). And in late 1987, *Nature*, *Science*'s principal competitor, published a commentary by Drs. **Kenneth Foster** and **William Pickard** suggesting that the time had indeed come to stop low and high frequency EMF research (see *MWN*, J/F88). Of course, all that has now changed.

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Building new transmission lines in the U.S. is getting harder every year. In a recent analysis of electric utilities industry trends, **Morgan Stanley**, an investment banking firm, reports that right now it may be more difficult to get regulatory ap-

proval to build power lines than to build generating facilities. Analyst Sanford Cohen points out that industry experts believe "a large transmission project could take 20 years from conception to completion." He also notes that over the last four or five years, U.S. transmission line construction has "dropped considerably": In 1984, transmission capacity grew at a rate of four percent, but by 1987, growth had shrunk to one percent.

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Dr. **Robert Becker**'s forthcoming book will be titled ***Cross Currents: The Promise of Electromedicine, The Peril of Electropollution.*** The publisher, Jeremy P. Tarcher, Inc., is planning to have it in bookstores by the beginning of 1990.

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Potomac Electric Power Co. (**PEPCO**), which serves the Washington, DC, area, estimates that it would cost $1.3 billion—at $100,000 per mile—to bury all of its overhead lines. In a letter to the July 8 *Washington Post*, PEPCO's H.J. Pulizzi listed the vulnerabilities of underground lines, including risks from construction and garden digging, lawn fertilizers, snow-melting chemicals, rodents, water and heat. He stated that, for "aesthetic reasons," PEPCO—along with most other U.S. utilities—has been installing underground cables in new residential areas for years, even though finding and repairing underground line problems can be "agonizingly slow."

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Dr. **Stephen Perry** has reaffirmed the link between power line EMFs and **depression**. His latest paper, published in *Public Health* (*103*, pp.177-180, 1989), provides new support for this association, which he first described in 1979 (see *MWN*, D81). He does not observe an association with heart disease, which he reported last year (see *MWN*, N/D87). This will probably be Perry's last research paper in this area. In a letter to *Microwave News* from his home in Wolverhampton, U.K., Perry said that, in order to continue his work, he would need "monitoring equipment which is too expensive." Perry hopes that someone will pick up where he has left off.

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Two more indicators that EMFs have become a key issue for utilities: The ***First Annual Transmission Symposium***, to be held in Washington, DC, September 25-26, will feature a session on health and environmental effects. Scheduled to speak are an attorney for the New York Power Authority, which is waiting for a decision in the Marcy-South trial, and an analyst from the Office of Technology Assessment, which just released its much talked about report on EMF bioeffects. And in its latest issue, *Environment Update*, a newsletter published quarterly by **EPRI**, EMFs gets more ink than either air or water pollution.

"Science" Magazine Calls for More 60 Hz Health Research

Science, the leading U.S. magazine covering scientific issues, has called for increased support of research into the health effects of electromagnetic fields.

In an editorial appearing in the July 21 issue, Philip Abelson, the magazine's deputy editor, writes, "The situation calls for much more effort in research than has hitherto taken place." He recommends "more animal studies and substantial epidemiological studies, coupled with accurate measures of fields."

The editorial was prompted by the Office of Technology Assessment (OTA) report (see pp.1 and 15). Abelson cites the OTA strategy of adopting a "prudent avoidance" strategy—that is, minimizing exposures when the costs of doing so are justified.

Florida Judge Bars Students from Playing Near Power Lines

In an unusual decision which could affect future zoning policies, a Florida judge has ruled that children may not play in a Boca Raton school yard which borders on high voltage power lines. The suit was brought by three local parents who sought to close the Sandpiper Shores school because of potential electromagnetic field (EMF) health hazards (see *MWN*, S/O88, J/F89 and M/J89).

"The evidence is clear that both electric and magnetic fields affect the human body," although the "connection between EMFs and cancer is still very much up in the air," Judge Timothy Poulton of the Palm Beach County Florida Circuit Court ruled on June 8.

The judge decided that the school may remain open, but he reserved the right to review the case "upon a change of circumstances"—for example, if the upcoming National Cancer Institute study shows an association between EMFs and cancer (see *MWN*, J/F89), or if future measurements show higher EMF levels than those presented at the trial. The judge also ordered the county school board to measure nearby EMF levels every month.

Many schools around the country are near high-voltage power lines. For instance, the Sandpiper school is one of 24 in Palm Beach County located near such lines, according to local reports.

At the trial, Fred Dietrich, an engineer with Electric Research & Management in State College, PA, who testified on behalf of the school board, claimed that the average magnetic field levels in the school for a "realistic worst-case scenario"—41% of line capacity—would be approximately 1.13 mG. Dr. Andrew Marino of LSU Medical Center in Shre-

veport, LA, who testified for the parents, estimated that, using his worst-case assumptions—100% capacity—the levels would be 3.3 mG. The court leaned towards Dietrich's estimate; the judge said that his worst-case estimate was 1.55 mG.

The judge discounted some of the evidence presented by the school board's witnesses "because of [their] financial ties...to the power industry." Among the school board's other witnesses were Drs. Edwin Carstensen, Philip Cole, William Feero, Dwight Mercer and Morton Miller. Also testifying for the parents were Drs. Harris Busch, Jerry Phillips and Stephen Smith.

The judge noted that children have "no choice" about going to school and therefore EMF exposure at school is an involuntary risk: "A 1% chance that there is substantial danger is unacceptable."

Robert Rausch et al., v. School Board of Palm Beach County, FL, 15th Judicial Circuit Court in and for Palm Beach County, FL, Case No.CL-88-10772-AD, June 8, 1989.

California School Policy

On the other side of the U.S., the California State Department of Education recently adopted a policy for siting schools near power lines, noting that a "conservative approach" should be taken when evaluating sites near power line easements. The department's School Facilities Planning Division limits for schools are: 100 feet from the edge of easement for 100-110 kV lines, 150 feet for 220-230 kV lines and 250 feet for 345 kV lines (see *MWN*, M/J88).

The policy appears in *School Site Selection and Approval Guide,* p. 4, 1989; for more information, contact: Duwayne Brooks, School Facilities Planning Division, California Department of Education, PO Box 944272, Sacramento, CA 94244, (916) 322-2470.

Cancer Studies of Animals To Begin Soon in U.S. & Canada

The first major studies of the cancer risk in laboratory animals exposed to power frequency magnetic fields are about to be launched in the U.S. and Canada. In June, the Electric Power Research Institute (EPRI) issued a request for proposals (RFP) for a four-year study to begin at the end of 1989. Health and Welfare Canada, Ontario Hydro and Hydro-Québec issued their RFP in April, with applications due July 1. The results of the joint Canadian government–utility effort are expected in 1992.

The U.S. government's National Toxicology Program (NTP) is also planning its own studies of power line carcinogenicity.

For the past few years, researchers have been calling for whole animal experiments to support or refute epidemiological findings. At a May 14 workshop convened by the National Academy of Sciences-National Research Council, Dr. David Carpenter of the New York Department of Health argued that animal studies are essential in order to find out the magnitude of the leukemia and brain cancer risks associated with exposures to extremely low frequency (ELF) electromagnetic fields (EMFs) (see *MWN*, M/A89).

EPRI

The EPRI study will use strains of laboratory mice with high intrinsic incidences of leukemia and/or brain cancer to determine whether ELF fields can act as cancer initiators, promoters or as co-carcinogens. Ionizing radiation—a known carcinogen—will be used to help distinguish among these mechanisms of interaction.

The magnetic field intensities used in the experiment will be chosen to "simulate the values found in diverse residential and occupational environments." Mice will be exposed to nine combinations of magnetic fields and ionizing radiation: less than 1 mG, 100 mG and 10 G varied with 0, 0.2 and 1 Gy.

New Zealand Study Supports Electrical Work-Cancer Link

A new epidemiological study reaffirms an earlier finding showing an elevated leukemia risk among New Zealand electrical workers. The research team, which was led by Dr. Neil Pearce of the Department of Community Health at the Wellington School of Medicine in Wellington, New Zealand, also found that the increased risk was primarily for chronic—rather than acute—and lymphatic—rather than myeloid—leukemia. Radio and TV repairers, electricians, linemen and power station operators were at the greatest risk.

In general, there was no evidence of increased risk of other types of cancers, although there was some indication of a higher risk of brain tumors among electrical engineers and electricians. The researchers point out, however, that the findings for specific categories of electrical work should be regarded with caution because of the small number of cases studied.

The team concludes that the results are consistent with other occupational studies suggesting a link with electromagnetic field (EMF) exposures, but cautions that "interpretation is difficult in the current absence of quantification of 'typical' exposures to [EMFs] experienced in these types of electrical work." They note that more detailed studies with exposure assessments are under way in New Zealand.

The study appears in the *International Journal of Epidemiology, 18,* pp.55-59, 1989.

In the April 6, 1985 issue of *The Lancet,* Pearce and coworkers first reported unexpectedly high rates of leukemia among certain New Zealand electrical workers (see *MWN*, My85). Pearce issued a brief correction to the survey in the July 2, 1988 issue of the journal (see *MWN*, J/A88).

The EPRI initiative follows a recommendation for animal studies from an expert advisory group convened by EPRI in San Diego, CA, in 1987 (see *MWN*, M/A87). The specific study design was conceived at an EPRI workshop attended by cancer researchers and held in Carmel, CA, in July 1988.

"This animal study is a key element in EPRI's program to understand apparent associations between power line EMF exposure and cancer, as has been reported in humans," Dr. Charles Rafferty, a project manager in EPRI's radiation studies program told *Microwave News*. He noted that to provide the needed statistical power, the study will be large. "We want the study to be of exceptional quality," he said.

Proposals in response to RFP2965-11 on "Leukemia and Brain Cancer in Animals Exposed to 60 Hz Magnetic Fields" were due by mid-August and EPRI expects to award the contract in October.

For more information, contact: Dr. Charles Rafferty, Radiation Studies Program, EPRI, 3412 Hillview Avenue, Palo Alto, CA 94303, (415) 855-8908.

Canada

The Canadian project is very similar to the EPRI study. Either ionizing radiation or a chemical carcinogen will be used as an initiator. The study will use 1,000 mice, divided into five exposure groups—0, 20 mG, 200 mG, 2 G and 20 G. The mice will be exposed ten hours a day for 80 weeks.

"The study will cost approximately $1.3 million [Canadian]," Dr. Maria Stuchly of Health and Welfare Canada told *Microwave News*, with each of the government and utility sponsors contributing equal shares.

For more information, contact: Dr. Maria Stuchly, Bureau of Radiation and Medical Devices, Health and Welfare Canada, Room 66, HPB Building, Tunney's Pasture, Ottawa, Ontario K1A 0L2, Canada, (613) 954-0306.

NTP

At the NTP, Dr. Rajendra Chhabra is developing a protocol for a carcinogenicity study of ELF fields in rodents. When completed, the protocol will be evaluated by a committee which ranks toxicity studies according to funding priorities.

"We hope that the Department of Energy will contribute some funds for this study," Dr. Richard Griesemer, the director of the National Institute of Environmental Health Sciences' (NIEHS) division of toxicology research and testing, told *Microwave News*.

The NTP coordinates research for the U.S. Department of Health and Human Services, including the NIEHS, the Food and Drug Administration and the National Institute for Occupational Safety and Health. Dr. David Rall, the director of the NIEHS, also serves as the director of the NTP.

For more information, contact: Dr. Rajendra Chhabra, NTP, [A0-01], PO Box 12233, Research Triangle Park, NC 27709, (919) 541-3386.

Around the U.S. and Canada...

California...In a draft report, the Public Utilities Commission (PUC) agreed that further studies on EMF health effects are needed, but stopped short of recommending regulatory action: "Too little is known to be able to determine where or what rule would provide useful protection." The report, *Potential Health Effects of Electric Power Facilities*, issued in cooperation with the state Department of Health Services (DHS), was ordered last year by the state legislature (see *MWN*, M/J88, S/O88, N/D88 and M/A89). A portion of the report lists three high priority projects identified by DHS (see box on p.9). The report, which was originally due March 15, will be submitted to the legislature by September 15. The PUC and the DHS held three public meetings in the first week of August in San Francisco, Los Angeles and Sacramento. A copy of the draft report is available for $20.00 from: Documents Section, California PUC, 505 Van Ness Ave., San Francisco, CA 94102, (415) 557-1812.

Kentucky...In Mason County, a dairy farmer and his wife have settled a damages suit against Kentucky Power Co. after claiming that stray voltage from power lines 150 feet from their milking parlor was responsible for dairy production losses. David and Brenda Polley, whose home is 330 feet from the lines, also sued over potential human health effects from EMF exposures. The terms of the June settlement are confidential, Charles Kirk, the Polleys' attorney, told *Microwave News*. Kirk, who is with Royse, Zweigart, Kirk & Brammer in Maysville, said that the amount originally sought by the Polleys was $100,000.

Minnesota...A Rochester real estate broker who has been fighting a 161 kV line located within 97 feet of his home was awarded $17,500 in damages by a jury. Jim Kuehl took his case to court after unsuccessfully attempting to persuade the Rochester Public Utility to choose an alternate route for the line. The utility originally offered Kuehl $400 for an easement, and a few years later $3,760, both of which he turned down. In 1988, Kuehl—who lives with his two sons—initiated an eminent domain proceeding against the utility and received $11,500. He next appealed to the district court, seeking $80,000 in damages and claiming that the EMFs from the line posed a hazard to the health of his family and decreased the value of his property. Dr. Andrew Marino testified on Kuehl's behalf at the trial. The utility was also ordered to pay for Kuehl's expert witness and appraisal fees. Kuehl now intends to launch a power line public awareness campaign. "We have never been after money," he told *Microwave News*. "We just don't want the line so close to our home."

New Jersey...Residents and town officials in Middletown Township are engaged in a bitter struggle with Jersey Central Power & Light (JCP&L) over a new 9.8 mile 230 kV power line scheduled to go up along a commuter rail ROW. The proposed route goes through a heavily populated area and passes near two schools, according to Mary Cashen Purcell, one of the founders of the citizens' group Residents Against Giant Electric (RAGE), which was formed to fight the line. When JCP&L first introduced its proposal to the public at a March 13 town meeting, local officials raised questions about potential impacts, Committeewoman Rosemarie Peters told *Microwave News*. The utility then successfully sought to have the line classified as "contested" and transferred to the jurisdiction of the Office of Administrative Law, where a judge has scheduled a hearing for October 23. Two public hearings will also be held—in conjunction with the Army Corps of Engineers—to provide the public with an opportunity to comment. Melvin Greenberg of the Newark, NJ, law firm of Greenberg, Dauber & Epstein is representing the township—Drs. Andrew Marino, John Norgard and Lewis Walker will testify for the township at the October hearing. In an information packet distributed to the public, JCP&L, which is also fighting to build a power line in nearby Little Silver, quotes Dr. Philip Cole: "Power lines are not an important factor in public health." RAGE is launching its own public awareness campaign, Cashen Purcell said.

New Jersey...A bill that would require utilities to prepare environmental and public health reviews and to demonstrate that there are no feasible alternatives before building new power lines cleared the state Assembly Committee on Conservation, Natural Resources and Energy in July. Bill A-4783, which was sponsored by Assemblypersons Joe Kyrillos, Jr. and Joann Smith, was prompted by an ongoing dispute over a proposed power line in Middletown (see above). If adopted, the measure will only apply to contested lines of at least 138 kV. For more information, contact: Assemblyman Joe Kyrillos, Jr., One Arin Park Bldg., 1715 State Highway 35, Middletown, NJ 07748, (201) 671-3206.

New York...During half of 1988, the mean magnetic field exceeded 24.8 mG at the edge of a 345 kV ROW, according to a survey of *Magnetic Field Levels Associated with 345 kV Transmission Circuits in New York State*. It exceeded 41.2 and 52.4 mG 10% and 1% of the year, respectively. The *maximum* fields were approximately three times higher in each case. Field levels measured one foot above 345 kV underground lines were on the order of 1 mG during normal power flow. These survey results were presented at a July 26 Technical Conference in Albany, in order to assist the PSC staff in setting an interim magnetic field standard (see *MWN*, M/A88). In April 1988, the PSC concluded that such a standard should be set to ensure that magnetic fields at the edge of future ROWs be "no greater than the fields typical of the many existing 345 kV lines operating throughout the state." The commission's EMF Committee plans to draft an interim standard by the end of 1989. For more information, contact: Dan Driscoll, Office of Energy Conservation and Environmental Planning, NY PSC, Three Empire State Plaza, Albany, NY 12223, (518) 474-5368.

Proposed California Research

The California Department of Health Services (DHS) is proposing three research projects to be funded by the $2 million allocated for EMF research by the state legislature (see *MWN*, S/O88):

- An extension of an ongoing National Institutes of Health-funded study of childhood brain cancer under the direction of Dr. Susan Preston-Martin at the University of Southern California (USC) in Los Angeles. The study was originally designed to investigate the effects of nitrates. Now, questions related to EMF exposure will be added and residential measurements will be made. Approximate added cost: $700,000.
- New measurements of all the "high current configuration" homes in Denver included in the Savitz study, together with a random sample of "low current configuration" homes. Bill Kaune of Enertech, Inc. in Campbell, CA, will direct the survey of a total of 80 homes with the assistance of USC's Preston-Martin. Approximate cost: $300,000.
- An expansion of an ongoing Kaiser Permanente study of the link between spontaneous abortions and drinking (bottled and tap) water. This study, which will be co-directed by Kaiser's Dr. Robert Hiatt and DHS's Dr. Ray Neutra, will now be able to detect relative risks of 1.7 for electric blankets and 1.5 for water beds. The study will include measurements of EMF exposures of a random sample of 200 women. Indices of VDT exposure will be added. Approximate added cost: $800,000.

Alberta, Canada...On May 12, the Energy Resources Conservation Board ruled in favor of routing a 240 kV power line along an existing ROW—the first choice of both TransAlta Utilities Corp. and those citizens concerned about health hazards. In its decision, however, the board disregarded the health effects issue, concluding that "biomedical research and epidemiological studies do not demonstrate harmful biological effects caused by [60 Hz EMFs] associated with high-voltage transmission lines" and that "the question of health effects should not influence its decision on the placement of the line." At hearings held last November, Drs. William Bailey and Jack Mandel testified on behalf of TransAlta.

British Columbia, Canada...Following a July 11-14 public inquiry, the BC Utilities Commission allowed BC Hydro to complete the disputed 230 kV Dunsmuir-Gold River power

line, but ordered it to extend its offer to buy the homes along the ROW until September 15 (see *MWN*, M/J89). According to the commission's July 26 *Report and Recommendations*, which accompanied the commission order, 66 of the 144 property owners who received a buy-out letter accepted the utility's offer, but the utility also received approximately 140 responses from other homeowners. The commission denied a request to move the line, but noted that, "BC Hydro may find it advantageous to consider rerouting its transmission lines at a future date." "Our plan is to proceed with the line. We've nothing more to say beyond that," BC Hydro's Peter McMullan told *Microwave News*. The inquiry was prompted by numerous complaints from local residents concerned about potentially higher levels of EMFs from the new line. Dr. Andrew Marino, testifying on behalf of a citizens group, questioned the credibility of utility-funded studies and said that he considers a "safe level" of electric and magnetic fields to be 50 V/m and 1-2 mG, respectively. Drs. Antonio Sastre and Linda Erdreich, both of ERI, Inc., were among BC Hydro's expert witnesses. In its report, the commission said that, "It is clear that some results emerging from the studies conducted to date give reason for concern," but it concluded that there is "insufficient evidence to support a presumption of an actual health risk" and countered Marino's statements, calling them "strident sweeping allegations." Commenting that the utility acted "imprudently" in offering a buy-out, the commission ordered the utility to "exclude the net cost of the buy-out program from their cost of service" to ensure that "no precedent is established." It also recommended that BC Hydro collaborate with the BC Ministry of Health to devise and fund research programs already under way on EMF effects.

UPDATES

COMPATIBILITY & INTERFERENCE

EMI Did Not Cause Accidental Bomb Drop... The USAF is "99% sure" that a worn-out, malfunctioning bomb rack was to blame for the May 4 accidental bomb drop by an F-16 jet over western Georgia (see *MWN*, M/J89). There had been speculation that EMI might have triggered an electro-explosive device aboard the F-16, releasing the 500-pound bomb. But a spokesman at Moody AFB told *Microwave News* that, although the USAF cannot absolutely rule out other causes, it is almost certain that EMI was not a factor in the accident.

FCC News... The FCC has denied three petitions challenging its newly revised Part 15 rules, which govern the use of such non-licensed RF appliances as remote control units, garage door openers and cordless telephones (see *MWN*, M/J89). In its June 19 order, the FCC ruled that Sensormatic Electronics Corp., Linear Corp. and the American Radio Relay League "failed to meet the criteria necessary to obtain a stay of an administrative action."...CBEMA calls *TP-5*—the FCC's proposed procedure for measuring emissions from digital devices—a "substantial organizational improvement over its predecessor, *MP-4*"—even though it requires "certain modifications" (see *MWN*, M/A89 and M/J89). CBEMA favors the proposal because it "distinguishes measurement procedures on the basis of size and physical characteristics, rather than the intended environment of use or the applicable emanation limits."...And on July 31, the FCC announced that it had initiated a proceeding to update its rules governing the importation of RF devices capable of causing interference. For more information, contact Richard Engelman at the FCC's Field Operations Bureau, (202) 632-6345.

EMP

Army To Move Woodbridge Simulators... The U.S. Army has announced that it will no longer operate EMP simulators at its Woodbridge Research Facility in Virginia, which is operated by the Harry Diamond Labs. The Woodbridge EMP simulators have been shut down since May 1988 as part of a legal settlement which required environmental assessments for most DOD EMP facilities (see *MWN*, M/J88 and J/F89). The Army is considering moving the EMP simulators, although a new location has not yet been announced. In July, the Army released the results of an environmental assessment of the Woodbridge facility, whose mission is to "solve a broad spectrum of nuclear weapons effects and Army systems survivability problems." The assessment does not address the EMP simulators since they will be relocated. No significant environmental impacts were identified. The facility, which is approximately 25 miles southwest of Washington, DC, lies adjacent to nine military family housing units which are scheduled to close by 1995. An elementary school is located about one-half mile away. The commander of the Harry Diamond Labs acknowledged to the *Washington Post* (July 13) that the densely populated neighborhood around the Woodbridge installation is not the place for high-power EMP testing. For more information, contact: U.S. Army Lab Command, ATTN: AMSLC-PA, 2800 Powder Mill Rd., Adelphi, MD 20783, (202) 394-3590.

MEASUREMENT

Electric Field Probe on the Market...A broadband electric field probe developed by engineers at NIST is now being marketed by Electro-Mechanics Co. of Austin, TX, as part of a total measurement system. The probe can measure fields between 1 and 1000 V/m, from 1 MHz to 10 GHz, and is only 8.41 cm long and 1.75 cm in diameter. The system—which consists of a probe, a metering unit and a data processing/interface unit—costs $7,585. Foreign orders are $8,345. NIST's Drs. Motohisa Kanda and Lanny Driver, who designed the probe, described it in detail in "An Isotropic Elec-

tric-Field Probe with Tapered Resistive Dipoles for Broad-Band Use, 100 kHz to 18 GHz," which appeared in the February 1987 issue of *IEEE Transactions on Microwave Theory and Techniques* (see *MWN*, J/F87). For more information on the Model 7100 Broadband Isotropic Probe System, contact: Electro-Mechanics Co., PO Box 1546, Austin, TX 78767, (512) 835-4684, or (800) 253-3761 (outside of TX). For a copy of the NIST paper, contact: Dr. Motohisa Kanda, NIST, Division 723.03, 325 Broadway, Boulder, CO 80303, (303) 497-5320.

Military Standards...NIST researchers J.E. Cruz and E.B. Larsen recommend that, when doing testing for military standards, "shielded rooms should be used only when it is not feasible to use other facilities, such as an open area field site or a fully loaded screenroom." They outline possible ways for improving measurement methods in a new report, *Alternative Techniques for Some Typical MIL-STD-461/462 Type of Measurements*, NIST Technical Note 1320. Copies are available for $2.50 each from the Government Printing Office, Washington, DC 20402. Order No.003-003-02946-7....Ed Aslan of the Narda Microwave Corp. in Hauppauge, NY, describes a system for the calibration of electromagnetic radiation monitors in accordance with the requirements of MIL STD 45662 in a paper appearing in the latest issue of *The Journal of Microwave Power & Electromagnetic Energy, 24*, pp.102-107, 1989.

MEDICAL APPLICATIONS

Preventing Osteoporosis with PEMFs...A team of researchers led by Dr. Clinton Rubin of the Musculo-Skeletal Research Lab at the State University of New York in Stony Brook, NY, has found that short, daily periods of exposure to PEMFs may reverse the trend of osteoporosis caused by a lack of mechanical stimulation. The team studied a population of mature male turkeys whose wing bones were incapacitated through surgery. The turkeys were divided into seven exposure populations: five groups exposed to PEMFs (3 msec bursts at a repetition rate of 1.5 Hz, each burst containing 120 repetitions of an asymmetrical pulse) at one of five different intensities, one group with inactive coils and one with no coils. In all the groups, the turkeys' second wing served as the control. The birds were exposed for one hour a day, five days a week over an eight-week period. The cross sections of the bones revealed that there was "an effective window of [PEMFs] in which bone mass can be controlled in the absence of function"—bone mass was increased 12.3% in one of the exposure groups. The team believes that PEMFs influence the behavior of the cell populations responsible for bone regeneration "because of the physiological characteristics of the signal." In contrast, the study group exposed to inactive coils showed a bone mass *reduction* of 10.8%, as compared to the controls. This figure was not significantly different from the 13% bone loss observed in the control group. The researchers conclude that their data suggest a "potential role for the use of PEMFs in the prevention of loss of bone" in immobilized patients and in the elderly. "Prevention of Osteoporosis by Pulsed Electromagnetic Fields" appeared in the *Journal of Bone and Joint Surgery, 71*, pp.411-417, March 1989.

MRI Safety... Dr. G. Jerome Beers of the Boston University Medical Center in Boston, MA, has published a major review article on the bioeffects of weak EMFs, with special emphasis on magnetic resonance imaging (MRI) and magnetic resonance studies (MRS). He concludes that, "Research specifically on MRI and MRS devices has so far failed to demonstrate significant harmful effects at 1.5 T or less. It may, therefore, be rather conservative for a recent NIH panel to have recommended caution in using MRI on pregnant patients. Whether such conservatism should extend to pregnant MR personnel is not clear....Nevertheless, careful attention to further developments in relevant research would seem reasonable, along with possibly an increase in scientific dialogue within the MR community concerning the subject." Beers also suggests that "MRI and MRS researchers might want to consider the subject as an area to which they could contribute." The review appears in *Magnetic Resonance Imaging, 7*, pp.309-331, 1989....And in the June 16, 1989 issue of the *Journal of the American Medical Association*, Drs. Frank Shellock and Howard Bierman comment on the recent relaxation of the FDA's rules for exposures to MRI EMFs. (See also *MWN*, M/J86, M/J87 and J/A88.)

Microwaves for the Prostate... English doctors, picking up on research developed in Israel, are using microwave radiation to treat prostate problems, including cancer. The *New Scientist* reports in its May 27 issue that while some European researchers see great promise in this type of hyperthermia treatment as an alternative to major surgery, others are more skeptical. According to the article, as many as 30% of all U.S. males over 60 have a prostatectomy, in which most of the gland is removed.

Resources... The July 1989 issue of the *IEEE Transactions on Biomedical Engineering* is devoted to functional electrical stimulation—used to enhance or restore neurological function. Drs. Gideon Kantor of the FDA and Charles Robinson of the VA Hospital in Hines, IL, were the guest editors....Drs. Richard Magin and Andrew Peterson, both of the University of Illinois in Urbana, present an invited review of "Noninvasive Microwave Phased Arrays for Local Hyperthermia" in the July/August 1989 issue of the *International Journal of Hyperthermia, 5*, pp.429-450.

MEETINGS

EPRI Utility Seminars...EPRI will host a workshop on *Power-Frequency Electric and Magnetic Field Laboratory Research*, September 27-29, in Delavan, WI. Among the issues to be addressed are cancer research, neurobiology and behavior, developmental toxicology, whole animal and cell physiology, mechanisms of interaction and engineering factors.

Also scheduled is a panel discussion on EMF-related developments of the past year. Registration fees start at $175. For more information, contact: Robert S. Banks Associates, PO Box 14574, Minneapolis, MN 55414, (612) 623-4646.... EPRI is also sponsoring a course on *Measurement of Power System Magnetic Fields*, September 14-15, in Lenox, MA. The meeting is open to EPRI members only at a cost of $1,600. For more information, contact: Hazel Mazza, GE Co., High-Voltage Transmission Research Center, East New Lenox Rd., PO Box 796, Lenox, MA 01240, (413) 494-4359.

Ionospheric Effects...A call for papers has been issued for the *6th International Ionospheric Effects Symposium*, to be held in Washington, DC, May 1-3, 1990. The deadline for abstracts has been extended to September 15. The meeting is being sponsored by the Naval Research Lab, the Air Force Geophysics Lab, the Army Center for Command, Control and Communication Systems and the Office of Naval Research, among other branches of the DOD, and by the NTIA. The symposium will be unclassified. For more information, contact: Ionospheric Effects Symposium Coordinator, Code 4180, Naval Research Laboratory, Washington, DC 20375.

MILITARY SYSTEMS

HPM R&D... The Naval Air Development Center in Warminster, PA, has issued a request for proposals (RFP) for a study to identify the potential vulnerabilities of manned aircraft digital fly-by-wire control systems to high power microwaves (HPMs). The primary objectives of the study are: to develop a credible HPM threat profile—e.g., flux levels, frequencies and pulse durations; to identify probable HPM entry points, coupling paths, induced voltage/power/energy levels and consequent HPM effects; and to define hardening measures. The study does not call for any HPM testing; it will be limited to a review and an analysis of existing research. For more information on Solicitation N62269-89-R-0231, contact: John Stabilito, Purchase Service Branch, Code 84573, Naval Air Development Center, Warminster, PA 18974, (215) 441-2683....The Naval Research Laboratory (NRL) has issued a call for research on the effects of microwaves on electronics systems. For more information on Solicitation N00014-89-R-ET12, contact: Evelyn Taylor, Code 3240.ET, NRL, 4555 Overlook Ave., SW, Washington, DC 20375, (202) 767-6457....The U.S. Army Missile Command at the Redstone Arsenal in Alabama has awarded two contracts to Sparta, Inc., of Laguna Hill, CA, for work on a directed RF energy effects data base. The contracts are for a total of $195,000.

PEOPLE

Dr. **Lee Rosen** has left W/L Associates to join the NIH Division of Research Grants. After working with Dr. **Bill Wisecup** for nine-and-a-half years on power line issues, Rosen is now down the hall from Dr. **Elliot Postow**, who joined NIH from the Navy Medical R&D Command. Postow is the former editor of *Bioelectromagnetics*. Rosen told *Microwave News* that he hopes to be able to keep up with ELF health issues....Dr. **Richard Phillips**, another former editor of *Bioelectromagnetics*, will retire from EPA in September and plans to move back to the West Coast....After almost 33 years with AT&T Bell Labs' Radiation Protection Department, Dr. **Max Weiss** has retired. He will continue to serve on a number of state advisory groups, including the New Jersey Commission on Radiation Protection....The FDA has awarded Dr. **Przemyslaw Czerski** its Commendable Service Award for his "outstanding accomplishments in research" on the biological effects of EMFs and for his leadership in standard-setting activities. And Dr. **Zory Glaser** has been awarded the Public Health Service Commendation Medal for his work on radiological health and medical devices.

STANDARDS

NAB Opposes Seattle 100 μW Limit... The National Association of Broadcasters (NAB) is urging the city of Seattle, WA, not to adopt a proposed RF radiation standard that is ten times stricter than the ANSI standard—100 μW/cm² in the 30-300 MHz frequency band (see *MWN*, J/A88). The NAB argues that the proposed standard is "not supported by scientific data, is inordinately restrictive and would not benefit the public," and that "sound public policy should be based on established evidence, not superstition or fear of the unknown." The NAB was responding to a Draft Environmental Impact Statement (EIS) issued in May—a public hearing was held on May 30 in Seattle. The EIS, which covers a telecommunications policy and land use as well as the disputed RF ordinance, was prepared by the Seattle Office for Long-Range Planning. Under the proposed rules, the Department of Health would issue permits to broadcasters. According to the EIS, the department could grant a "special exception" under certain conditions, but levels could never exceed 200 μW/cm². The NAB again made its case for a national RF/MW exposure standard instead of the evolving "patchwork quilt" of local rules (see *MWN*, S/O85, M/A86, M/J86 and J/A88). For more information, contact: Cliff Marks, Office for Long-Range Planning, 200 Municipal Bldg., Seattle, WA 98104, (206) 684-8056.

EIA on TV/VCR Immunity...ANSI has published ANSI/EIA 544-1988, *Immunity of TV and VCR Tuners to Internally Generated Harmonic Interference from Signals in the Band 535 kHz to 30 MHz*. A copy is available for $13.00, prepaid, from: Sales Department, ANSI, 1430 Broadway, New York, NY 10018.

TECHNOLOGY

Zapping Hazardous Wastes... An efficient, cost-effective method for decontaminating soil full of toxic wastes using RF radiation has been developed by scientists at the IIT Research Institute (IITRI) in Chicago, IL. IITRI claims that the procedure, "RF *in situ* decontamination," has been demonstrated to be 99% effective in removing hazardous wastes and that it is

two-to-four times cheaper than traditional methods. The process, in which electrodes beam 2-45 MHz radiation into the contaminated soil, is "similar to the heating accomplished within a microwave oven, although the area heated is much larger and the frequencies are much lower," according to IIT-RI's Jack Bridges, one of the developers. "During the heating process, water and hazardous components in the soil are rapidly evaporated; the vapors are collected and condensed for subsequent removal from the site," he said. The remaining gases and liquids are reportedly one-thousandth of those produced by excavating and incinerating wastes. In a recent field test, approximately 30 tons of soil laced with jet fuel and chlorinated hydrocarbons were almost completely decontaminated, IITRI reports. The *in situ* method is an extension of an earlier IITRI technology—developed by Bridges and IITRI's Harsh Dev—using RF heat energy to extract fuels from oil shale and tar sand deposits. IITRI recently sold the commercial rights to its RF *in situ* process to Roy I. Weston, Inc., a West Chester, PA, company. A report describing the *in situ* process is available from: Dr. Glenn Paulson, Director, Center for Hazardous Waste Management, IITRI, 10 W. 35th St., Chicago, IL 60616, (312) 567-4250....On a related front, the April 10 *Wall Street Journal* reported on a procedure developed by the West German company Vetco Sanitec which uses microwaves to disinfect medical waste.

VDTs

Electric Allergies... In a recent study of 32 people "with alleged hypersensitivity to electricity," experts at the Department of Neuromedicine at the National Institute of Occupational Health (NIOH) in Stockholm, Sweden, found that most of the group attributed their problems to work at VDTs. But it is far from clear whether VDTs are responsible for all the cases. "We don't know what is causing the problem," NIOH's Dr. Kjell Hansson Mild told *Microwave News*. Using low-radiation VDTs did not improve the subjects' conditions—nor did eliminating "unnecessary" electrical appliances. "In some cases, there is a psychological component—and among those working with VDTs, stress and lack of ventilation may also be problems," Mild said. Nevertheless, he emphasized that electrical sensitivity is a real issue. Indeed, others in the U.S. and the U.K. have shown that weak EMFs can cause allergic reactions that are frequency specific (see *MWN*, M/A87 and J/A88). According to NIOH's Dr. Bengt Knave, the combination of VDT flicker and magnetic fields may explain why VDT workers report hypersensitivities more than other exposed groups, such as railway workers or welders. Mild said that since 1984, approximately 1,400 workers with dermatological problems have been referred to NIOH and about 10% of them have electrical sensitivities. But, he added, "That is just the tip of the iceberg." Mild said that a society has been formed in Sweden for those who suffer from these ailments.

ETC...

RF To Fight Terrorism?...A Washington state doctor suggests that there is a "simple solution" to guard against terrorist bombs aboard aircraft. In a letter to the June 7 *Wall Street Journal*, Dr. Jeffrey Reynolds advocates beaming RF energy at all baggage prior to takeoff to detonate any blasting caps that might trigger hidden explosives.

But Seriously, Folks... Standup Comic Billy Crystal to a packed Moscow audience in early August: "I wanted to perform in the U.S. embassy because it has the best microphones."

OTA Report on ELF Hazards *(continued from p.1)*

issue as a problem of field exposure rather than as a problem of high-voltage transmission lines."

The 103-page report, which was prepared for the OTA by Drs. Indira Nair, Granger Morgan and Keith Florig, all of Carnegie Mellon University's Department of Engineering and Public Policy in Pittsburgh, PA, provides detailed coverage of most of the major laboratory and epidemiological studies conducted over the past decade, as well as a section on risk assessment and policy alternatives.

Among the report's proposals is a strategy of "prudent avoidance": attempting to route new transmission lines so that they avoid people; widening transmission line rights-of-way; developing designs for distribution systems—including new grounding procedures—which would reduce the associated fields; and redesigning appliances to minimize or eliminate fields.

The report downplays the value of establishing regulatory standards with the rationale that, since the research appears to point to frequency window effects, setting a "safe" limit at this time cannot be scientifically supported and might potentially do "more harm than good."

In addition to calling for a balanced mixture of cell, whole animal and epidemiological studies, the report cautions against becoming too fixed on cancer as the "single health effect of concern."

The report has received widespread news coverage. For instance, the Associated Press story ran under the headline "Data on Electromagnetic Fields, Potential Risks Needed, Study Says" (*Arizona Daily Star*), while *USA Today* featured the report under the headline "Killer Toasters?"

Biological Effects of Power Frequency Electric and Magnetic Fields is available for $4.75 from: U.S. Government Printing Office, Superintendent of Documents, Washington, DC 20402, (202) 783-3238; specify stock number 052-003-01152-2. It serves as a background paper for another OTA report, *Electric Power Wheeling and Dealing: Technological Considerations for Increasing Competition.*

Cells exposed to microwaves alone did not respond. "You need a promoter like TPA to see the effect," Balcer-Kubiczek said in an interview in Tucson. "We are observing a synergistic effect of microwaves and TPA." She added that, "It is not clear whether the effect is caused by the microwave carrier frequency or by the ELF modulation. This is something we would like to follow up."

Last year, Dr. Abe Parola reported that 100 Hz sine waves could malignantly transform cells (see *MWN*, M/A88). Parola is at the Ben-Gurion University of the Negev in Beer-Sheva, Israel.

In a paper published earlier this year in *Radiation Research* (see references below), Balcer-Kubiczek and Harrison reported that microwaves can transform cells. They wrote, "In the experiments reported here, microwaves appear to act as an initiator in a two-stage transformation assay." They went on to note a "striking" similarity between their microwave findings and those of previous studies using ultraviolet radiation.

One point is clear, however: the cell transformation is not caused by heating. "It is important to note that any positive result from our *in vitro* microwave protocols cannot be explained by microwave hyperthermia because heat alone is known to be non-carcinogenic," the researchers point out. Also, they report that the measured temperature elevation in the microwave-exposed cell flasks did not exceed 0.3°C, and that the tumor promoter was added after microwave treatment.

The cell assay used by the Maryland researchers is very well characterized and widely used. It was originally developed for studying chemical carcinogens. "It predicts carcinogenic potential for chemicals with an accuracy of approximately 80%," Balcer-Kubiczek said.

The researchers have run the same experiment using various combinations of ionizing and non-ionizing electromagnetic radiation, as well as with ultrasound—with and without chemical promoters. In Tucson, they reported that continuous wave ultrasound does not cause cell transformation. They began their microwave experiments five years ago; they were originally supported by the Office of Naval Research and are now funded by the National Cancer Institute.

As early as 1981, Dr. Stanislaw Szmigielski of the Center for Radiobiology and Radioprotection in Warsaw, Poland, reported that non-thermal levels of microwaves could accelerate the development of tumors (see *MWN*, My81). Balcer-Kubiczek said that, "Our new results are not inconsistent with those of Szmigielski."

A major epidemiological study released by Szmigielski in 1985 showed that radiofrequency and microwave radiation had caused abnormally high rates of cancer among exposed servicemen; the preliminary results of an ongoing prospective epidemiological study support this finding (see box at left).

In a long-term exposure study carried out at the University of Washington in Seattle, rats exposed to relatively low levels of microwaves had a statistically significant increase in cancer, primarily of the endocrine system (see *MWN*, J/A84 and Mr85).

1. Note that the published papers cite an 83 μsec pulse width.

Papers by E.K. Balcer-Kubiczek and G.H. Harrison

"Search for Neoplastic Transformation *In Vitro* Following Pulsed 2.45 GHz Microwaves" and "Search for Neoplastic Transformation *In Vitro* Following Pulsed Ultrasound," presented at the *11th Annual Meeting of the Bioelectromagnetics Society*, Tucson, AZ, June 1989. The ultrasound results have just been published in the *Journal of Ultrasound in Medicine and Biology, 15*, pp.335-340, 1989.

"Induction of Neoplastic Transformation in C3H/10T½ Cells by 2.45 GHz Microwaves and Phorbol Ester," *Radiation Research, 117*, pp.531-537, 1989.

"Survival and Oncogenic Transformation of C3H/10T½ Cells After Extended X Irradiation," *Radiation Research, 104*, pp.214-223, 1985.

"Evidence for Microwave Carcinogenesis *In Vitro*," *Carcinogenesis, 6*, pp.859-864, 1985.

"Far-Field 2.45 GHz Irradiation System for Cellular Monolayers *In Vitro*," *Journal of Microwave Power, 20*, pp.145-151, 1985.

"Oncogenic Transformation of C3H/10T½ Cells by X-Rays, Fast-Fission Neutrons, and Cyclotron-Produced Neutrons," *International Journal of Radiation and Biology, 44*, pp.377-386, 1983.

Polish Epi Study Continues To Show RF/MW Cancer Link

An ongoing prospective epidemiological study of the Polish military continues to indicate that personnel exposed to radiofrequency and microwave (RF/MW) radiation have a higher than expected incidence of cancer.

In 1985, Dr. Stanislaw Szmigielski of the Center for Radiobiology and Radioprotection in Warsaw, Poland, announced that a major epidemiological study of military personnel showed a statistically significantly higher rate of cancer among servicemen exposed during 1971-1980, as compared to those unexposed (see *MWN*, Mr85). For blood-forming organs and lymphatic tissue, the rates were nearly seven times those expected.

Subsequently, a five-year (1986-1990) prospective epidemiological study was initiated to test the cancer hypothesis. In a recent letter to *Microwave News*, Szmigielski said that an analysis of the data collected after three years—at the end of 1988—"supports our earlier results from retrospective studies, although the differences between the exposed and non-exposed groups are somewhat smaller (although still highly statistically significant) than those found for the decade of 1971-1980." He wrote that the preliminary results indicate a doubling of the incidence of all forms of cancer among those exposed to RF/MW radiation (see also *MWN*, J/F87).

COMMENTARY

America Tunes In, But For How Long?

In June, the electromagnetic field (EMF) health debate went public with the almost simultaneous publication of Paul Brodeur's *New Yorker* series on the "Hazards of Electromagnetic Fields" and the Office of Technology Assessment's (OTA) report on power line EMFs (see p.1). The media, which, in the past, had been only fitfully interested in the EMF issue, suddenly could not get enough of it.

A clear consensus has emerged: We need to know much more about the effects of EMFs. Now the question is whether money will be available for the necessary studies.

Newsweek (July 10) warned, "We're not quite sure what we're up against, and we need urgently to find out." And *Time* (July 17) recommended limiting exposures from electric blankets, electric clocks and TV sets and advised, "Until the verdict is in, the watchword is prudence, not panic." (*U.S. News & World Report*—the third major weekly—ran a similar piece over two years ago—March 30, 1987.)

Television news soon followed. *Good Morning America* aired a segment on August 11 which included an exchange between Drs. David Carpenter, of the New York State Department of Health, and Gilbert Omenn, the chairman of the Electric Power Research Institute's (EPRI) EMF advisory committee. Dick Cavett devoted two of his cable talk shows to interviews with Brodeur.

And there is more to come. Articles are in the works at *USA Today, Family Circle, Discover* and *BusinessWeek*, among many others. The *Sunday Today Show* will air a piece on August 20; other news shows, including the much-hyped *Prime Time Live*, are planning their own EMF segments.

Public awareness certainly has grown. On the negative side, too much attention has been devoted to household appliances. *USA Today*'s short blurb on the OTA report was headlined "Killer Toasters?" (June 19) and the *New York Times* (July 11) ran illustrations of no fewer than eight different appliances—but, nonetheless, managed to omit the two which present the greatest potential risk, electric blankets and video display terminals (VDTs). The *Times* also managed to overstate EPRI's 1989 EMF bioeffects research budget—$5.5 *billion*, instead of $5.5 million.

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By far the most important word came from *Science* magazine. In a July 21 editorial, Deputy Editor Philip Abelson called for "much more" money for EMF health research (see p.6). Abelson based his appeal on the OTA report.

All this media attention has prompted replies from industry. In a letter to utility chief executive officers, EPRI called the OTA report a "balanced review" and sought to correct some of Brodeur's criticisms. EPRI stressed that it is working hard to find answers to power line health questions.

Over at ERI, Dr. Robert Kavet—whose earlier career at EPRI is featured in the *New Yorker* articles—prepared a review of Brodeur's analysis of VDT EMFs for the Center for Office Technology, whose members include IBM and AT&T. After disputing a number of Brodeur's points, Kavet nevertheless agreed that more needs to be done: "Further research and careful critical analysis should continue to address and resolve the questions raised by the science, as well as to address the public health concerns about health effects."

Dr. H.B. Graves and attorney Tom Watson, both at Crowell & Moring, the Washington, DC, law firm which represents utilities across the country, have released a "Fact Sheet" to try to put their own spin on the *New Yorker* series. They devote a number of pages to the Marcy-South lawsuit and to the team of experts which they assembled for the New York Power Authority and other utility clients. But they are silent about the serious charges that some of these experts violated National Institutes of Health rules on outside income in testifying as paid witnesses in these cases. Power companies are distributing the fact sheet far and wide.

The IEEE's Committee on Man and Radiation, known as COMAR, is preparing its own response.

What has been missing so far is the government's response. Informed sources have told *Microwave News* that high-level reviews of the state of research and current funding levels are under way at a number of federal agencies. Yet no one has come forward to make funding available for more research.

Members of Congress have been equally silent. Representative George Miller (D-CA) held a one-day hearing on power line health risks two years ago (see *MWN*, S/O87). But not a word has been heard since then from Miller or from anyone else on Capitol Hill. All legislative and regulatory activity remains at state and local levels.

The public is clamoring for answers and there is a national consensus for more health research. What more will it take for the federal health establishment to take its head out of the sand and start making EMFs a national priority?

CONFERENCES

New Listings

September 14-15: **Measurement of Power System Magnetic Fields,** Lenox, MA. Contact: Hazel Mazza, General Electric Co., High-Voltage Transmission Research Center, East New Lenox Rd., PO Box 796, Lenox, MA 01240, (413) 494-4359 (see p.12).

September 25-26: **1st Annual Transmission Symposium,** Washington, DC. Contact: The Management Exchange, 123 East 54th St., New York, NY 10022, (212) 371-8320 (see p.6).

October 27-29: **Electromagnetic Fields and Neurobiology: A Current Perspective,** Hilton of Santa Fe, Santa Fe, NM. Contact: D. Hjeresen, M-899, Los Alamos National Lab, Los Alamos, NM 87545, (505) 667-3839.

November 2-5: **Meeting of the Society of Telecommunications Consultants (STC),** ***Telecommunications Consulting in the 1990s,*** Sheraton Hotel and Towers, Seattle, WA. Contact: Effie Cooper, STC, 1841 Broadway, Suite 1203, New York, NY 10023, (212) 582-3909.

December 11-14: **5th International Conference on Mobile Radio and Personal Communications,** University of Warwick, U.K. Contact: Institute of Electrical Engineers, Savoy Place, London WC2R 0BL, U.K., (01) 240-1871, ext. 222.

1990

March 25-28: **1st International Congress on Therapeutic Electromedicine and Lasers,** Hyatt Regency, Jerusalem, Israel. Contact: Dr. Zion Singer, Secretary, Scientific Committee, Open University of Israel, PO Box 39328, Tel Aviv, 61392 Israel.

March 30-April 3: **44th Annual Broadcast Engineering Conference and 68th Annual Convention of the National Association of Broadcasters (NAB),** Georgia World Congress Center, Atlanta, GA. Contact: Engineering Conference Committee, Science and Technology Department, NAB, 1771 N St., NW, Washington, DC 20036, (202) 429-5346.

April 4-5: **26th Annual Meeting of the National Council on Radiation Protection and Measurements (NCRP),** Mayflower Hotel, Washington, DC. Contact: NCRP, 7910 Woodmont Ave., #800, Bethesda, MD 20814, (301) 657-2652.

April 17-20: **International Magnetics Conference (INTERMAG '90),** Metropole Hotel, Brighton, U.K. Contact: Davina Houseago, INTERMAG '90, c/o ITEL, Brighton Polytechnic, Brighton BN2 4GJ, U.K., (273) 670400.

May 1-3: **6th International Ionospheric Effects Symposium,** Washington, DC. Contact: Ionospheric Effects Symposium Coordinator, Code 4180, Naval Research Laboratory, Washington, DC 20375 (see p.12).

May 6-11: **12th World Congress on Occupational Safety and Health,** Congress Centrum Hamburg, Hamburg, F.R.G. Contact: World Congress on Occupational Safety and Health, Hamburg Messe und Congress GmbH, Postfach 30 24 80, D-2000 Hamburg 36, F.R.G., (040) 35 69 22 42.

May 7-11: **IEEE AP-S International Symposium & URSI Radio Science Meeting,** Dallas Convention Center, Dallas, TX. Contact: Dr. Oren Kesler, IEEE AP-S/URSI Symposium, PO Box 860130, Plano, TX 75086, (214) 952-3772.

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MICRO WAVE NEWS

Vol. X No. 4 A Report on Non-Ionizing Radiation July/August 1990

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Male Breast Cancer Again Tied to Occupational EMF Exposures

Support for the Johns Hopkins Study

Epidemiologists at the Fred Hutchinson Cancer Research Center in Seattle, WA, have uncovered new evidence for an association between occupational exposures to electromagnetic fields (EMFs) and the development of male breast cancer. The study supports the preliminary findings of a Johns Hopkins University (JHU) study, reported late last year, showing an increased risk of male breast cancer among young New York telephone workers (see *MWN*, N/D89).

Paul Demers, working with Dr. David Thomas's research group at the Hutchinson center, has found that telephone linemen, electricians and electric power workers have six times the expected rate of male breast cancer—a statistically significant increase. For radio and communications workers, the risk was almost tripled. Overall, there was almost a doubling of the cancer risk for all EMF-exposed workers.

Special Report on EMFs and Breast Cancer: Are Women at Risk? Is the Pineal Gland Responsible? pp.9-10

"Our results support the theory that EMFs are related to male breast cancer and raise the possibility of a tie to breast cancer among women," Demers told *Microwave News*. Indeed, Demers's findings are leading experts to take the possible link to female breast cancer more seriously (see story on p.9).

"It's a very important study that seriously raises the suspicion that

(continued on p.8)

Prospects for Federal EMF Research Funding Improve

The outlook for an expanded federal research program on the biological effects of electromagnetic fields (EMFs) has greatly improved. At a congressional hearing on July 25, industry and government representatives endorsed a research budget of $34 million over the next five years. The bill, H.R.4801, which was introduced by Rep. Frank Pallone (D-NJ), is now likely to advance in the House of Representatives.

Rep. James Scheuer (D-NY), chairman of the House Committee on Science, Space and Technology's Subcommittee on Natural Resources, Agriculture Research and Environment, convened the hearing to consider H.R.4801, saying, "Much more must be done before we can be complacent

(continued on p.12)

ELF NEWS

« Power Line Talk »

Three years after beginning its study and two years after its last meeting, a working group on ELF fields set up in 1987 by **Health and Welfare Canada** has issued its report, *Electric and Magnetic Fields and Your Health*. Members of the working group were recruited from governmental agencies, academia, labor unions and utilities (see *MWN*, M/J87). One member, **Gary Cwitco** of the Communications and Electrical Workers of Canada, is unhappy not only for the delay in publication, but because the working group's real report—including its recommendations and conclusions—is buried in an appendix at the back of the published pamphlet. In an April 19 letter to Canada's Minister of National Health and Welfare, Perrin Beatty, Cwitco charged that the report had taken so long to be published that it is considerably weaker than if it had been written today. In addition, he expressed his surprise and frustration that the minister had not yet acted on one of the two recommendations made by the working group—to set up a committee to advise on future bioeffects research. Cwitco said that he had been "misled" by Health and Welfare Canada and that his concerns were "so great" that he would "seriously consider abstaining from any further work" with the department. At last word, Cwitco had not heard back from Beatty.

«« »»

A "very concerned grandmother" has gone directly to the White House to express her concern over cancer risks from **electric blankets**. In a May 27 letter, she asked **Barbara Bush** to "do everything in your power to increase public awareness of this grave, potential danger." Her suspicions were aroused two years ago, when her 2½-year-old granddaughter was diagnosed with a neuroblastoma. After seeing a TV report on EMFs and electric blankets, the woman questioned her daughter, who contacted five other mothers of children with neuroblastomas and discovered that the six of them had all used electric blankets during their pregnancies. "It is a heartbreak to think that possibly a lot of these cancers might never have happened had the public been warned," she wrote. The grandmother, who lives near New York City, asked that her name not be published.

"Microwave News" in "Time"

The recent explosion in media coverage of nonionizing radiation health risks reached new heights with the July 30 issue of *Time* magazine, in which *Microwave News* was profiled in a three-column article by Philip Elmer-DeWitt titled "Hidden Hazards of the Airwaves: An Obscure Newsletter Uncovers the Perils of the Information Age."

«« »»

"Open, frank and honest communication..." is essential if the electric power industry is to head off a stampede toward restrictive public policy on power line construction, the Electric Power Research Institute's (**EPRI**) Director of Corporate Communications **Richard Claeys** told the American Public Power Association (APPA). In a June 11 speech at the APPA's annual meeting in Denver, CO, Claeys described a rising tide of public concern over EMF hazards. An EPRI poll of 100 utility CEOs last December found that customer inquiries and press calls about EMFs have tripled and that employee concerns are up 50 percent. "I exhort you, as industry leaders and communications professionals, to plan now...prepare yourselves for the possibility of positive research evidence or—and maybe worse—conflicting or inconclusive findings in an atmosphere of rising public anxiety," Claeys said. He advised his audience not to dismiss fears out of hand, but rather to acknowledge their legitimacy and support further scientific research: "You have to help in giving this issue the attention and the sincere concern that it deserves."

«« »»

IBM in Boulder, CO, has agreed to pay $680,000 to bury a planned 230 kV line that nearby residents feared would create higher EMF levels and reduce the value of their homes. IBM's contribution represents the difference in cost between building a double-circuit overhead line (reportedly $2.3 million) and a single-circuit underground line ($3 million). The line, which will be approximately two miles long, is intended to serve IBM's needs exclusively. An IBM spokesman told us that following an agreement with the local utility, Public Service Co., the company now has "happy neighbors." Construction is expected to begin in the spring of 1991.

«« »»

After hearing testimony on the potential health hazards of power line EMFs, the **Great Yarmouth Borough Council** in the **U.K.** has rejected a new 132 kV overhead transmission line proposed by Eastern Electricity, according to the July 22 issue of *The Observer*, a U.K. weekly newspaper. The council is asking Eastern to bury the line, a move which would add £4 million ($7 million) to the £120 million ($216 million) project. This is the first time a power line project has been derailed on health grounds in the U.K., *The Observer* noted. Power line EMFs have been the subject of sharp debate in England since *Electronics World+Wireless World*, a monthly trade magazine, ran a cover story on the "Killing Fields" in its February 1990 issue (see *MWN*, M/A90).

Mother of Leukemia Victim Sues Washington State Utility

In June, the mother of a teenage girl who died of leukemia in 1987 filed a "wrongful death" suit against the Public Utilities District (PUD) of Clark County, WA. The suit alleges that exposure to electromagnetic fields (EMFs) from power lines at home and at school and from a substation near her home caused the cancer.

Between 1979 and 1983, Ariana Hightower attended Crestline Elementary School, which has a 12.5 kV distribution line and a 115 kV transmission line running adjacent to school property. There were seven cases of cancer reported among Crestline students between 1982 and 1989.

In the suit, Ariana's mother, Sheila Hightower Anderson, contends that the utility "has a common law duty to prevent harm to the public" and was negligent in that it failed to warn citizens in Clark County of potential EMF hazards, according to the July 6 issue of *Clearing Up*, a Pacific Northwest energy industry weekly. Anderson's complaint was filed shortly before the statute of limitations deadline.

"We don't feel the utility is to blame," said Clark PUD spokesman Bruce Bosch. In response to community concerns, the utility measured EMF levels at Crestline and other schools in the Vancouver, WA, area earlier this year and found "very low levels of both electric and magnetic fields that were caused by the fluorescent lighting...."

Michael Hicks, the Vancouver attorney who is representing Mrs. Anderson, would not comment on whether suits from other Crestline parents would be forthcoming.

The apparent cancer cluster has prompted the Southwest Washington Health District to initiate an investigation into possible causes, including EMFs. Dr. Karen Steingart, the chief investigator on the case, told *Microwave News* that, compared with other schools in the area, Crestline does not have significantly elevated EMF levels. She also noted that there were four different types of cancer among the seven children, and four of the seven had lived in the area for less than one year prior to diagnosis. A final report has not yet been issued.

In December 1987, a Texas family sued Houston Lighting & Power, alleging that EMFs from a 345 kV power line caused Michael Scott to develop an astrocytic brain tumor at age 26 (see *MWN*, J/F88). John McDowell of Bankston & McDowell in Houston, TX, the attorney representing the Scott family, told *Microwave News* in late July that the suit is still pending and that he expects a trial date in early 1991.

Correction

In the M/J90 issue, the stated increase in brain tumors observed by Dr. David Savitz among children whose mothers used electric blankets during the first trimester of pregnancy was incorrect. It should have read 300%. See *American Journal of Epidemiology, 131*, pp.763-773, 1990.

Prudent Avoidance —Swedish Style

The Swedish National Energy Administration (NEA) has advised that new schools, day-care centers and playgrounds not be located near power lines, "pending further research."

In a February 1 letter that has been widely distributed among utility officials and health researchers, Jaak Nõu, the head of NEA's department of electrical safety, recommended that magnetic fields in those areas not exceed 2-3 mG—the threshold for increased childhood cancer risks indicated by the Wertheimer-Leeper and Savitz studies. The letter was addressed to a homeowner living next to a power line which the State Power Board is planning to upgrade from 220 kV to 400 kV.

Nõu also urged a "strategy of caution" for residential construction over the next two years, recommending that areas furthest away from power lines be developed first, with additional work contingent on the results of ongoing studies.

Several epidemiological studies on the link between power line magnetic fields and cancer are now under way in Sweden (see *MWN*, M/J87 and N/D89).

New Jersey Drafts 200 mG Power Line ROW Limits

The New Jersey Commission on Radiation Protection is considering the adoption of standards to limit power line electromagnetic fields (EMFs) and to prohibit the siting of new playgrounds in their right-of-ways (ROWs).

"My goal is to get the power companies to take health concerns seriously when they put up new power lines," Dr. Fred Sterzer told *Microwave News*. Sterzer, of MMTC, Inc. in Princeton, NJ, is the chairman of the commission's Non-Ionizing Radiation Advisory Committee, which is drafting the standards. He advocates making power line EMFs "as low as is reasonably achievable," a strategy better known by its acronym, ALARA. Sterzer does research on biomedical applications of non-ionizing radiation.

Dr. Max Weiss, the chairman of the commission and a former staffer at AT&T Bell Labs, told *Microwave News* that the commission is "not far away from adopting some rules." Action could come at the commission's next meeting on September 19, or, more likely, at its October 17 session. The commission can accept or reject the advisory committee's recommendations.

If adopted, the standards would require that EMFs at the edge of a new power line's ROW not exceed 200 mG. The magnetic field strength of existing power lines would be

Public Exposure Limits for ELF Magnetic Fields

Regulatory Body	Magnetic Field Limit (mG)	MWN References
International Radiation Protection Association (1989)	1,000	M/J89
New York (1990) Public Service Commission	200*	M/A90
New Jersey (1990) Commission on Radiation Protection	200* (draft)	See story below
Florida (1989) Department of Environmental Regulation	150-250*	M/A89

* Along power line right-of-ways

(The Wertheimer-Leeper and Savitz studies indicated an increased cancer risk in children at 2-3 mG.)

limited to "the maximum current rating." The draft standards are similar to those in Florida and to one proposed in New York state (see table above).

Electric field strength would be limited to 3 kV/m along the ROWs of all power lines.

John Karcher of Jersey Central Power & Light (JCP&L) in Morristown, a member of the committee, said that he is in basic agreement with the 200 mG limit.

The proposed standards have already drawn fire from citizens who point to epidemiological studies which have found an increased risk of cancer at levels one hundred times weaker than the proposed limit. "The power companies couldn't ask for anything more," said Melvin Greenberg, a lawyer for Middletown Township, which is opposing a new JCP&L 230 kV power line through the town (see *MWN*, J/A89).

Mary Cashen Purcell, one of the founders of Residents Against Giant Electric (RAGE), a group opposing the new line, criticized the composition of the drafting committee. "The foxes are guarding the chickens," she said. She characterized the controversy as a struggle of "industry against citizens, profits over common sense."

One of the options being considered for the new rules would prohibit the construction of new playgrounds in ROWs. Weiss said that there is "general agreement" on this provision.

How the state will treat those playgrounds already in ROWs is not clear. Sterzer said that there are playgrounds under power lines all over the state and that he favors their removal, but he acknowledged that this is probably not politically feasible.

Sterzer stressed that in keeping with the ALARA policy, power companies would have to show that they have taken "reasonable measures to minimize the fields" from new power lines. The proposed standards would require that new or upgraded power lines be built so that they would generate lower EMFs:

> The new line must be constructed using the following methods: (1) underground burial in pipe-type cable; (2) transmission of power via direct current; (3) high phase order; (4) if the line is a double circuit, use compact configuration, reverse phasing and raise the conductors ten feet higher than standard construction; or (5) if the line is a single circuit, vertically configure the conductors and raise the conductors 10 feet higher than standard construction.

Before they could be adopted, the standards would be reviewed by lawyers from the state Department of Environmental Protection and a public hearing would be held. According to Weiss, the process could take from six months to a year.

EPA To Test Gaussmeters

The Environmental Protection Agency (EPA) will evaluate ELF gaussmeters. Edwin Mantiply of EPA's Office of Radiation Programs (ORP) in Las Vegas, NV, who is leading the project, is limiting the tests to relatively inexpensive, non-recording meters.

In June, Mantiply asked more than 20 manufacturers to loan EPA their meters. The tests will include measurements of accuracy, sensitivity, frequency response and susceptibility to radiofrequency interference. The results, which are due by the end of the year, will be made available to the public.

Until now, no government agency has tested the growing number of ELF gaussmeters on the market. For a list of available meters, see *MWN*, J/F90 and M/J90.

For more information, contact: Edwin Mantiply, EPA, ORP, PO Box 98517, Las Vegas, NV 89193, (702) 798-2476.

Alexandria, Virginia, Moves To Reduce Power Line EMFs

The city council of Alexandria, VA, has voted to endorse a plan to reduce power line electromagnetic field (EMF) levels on several blocks in the densely populated Old Town section of the city. The plan, proposed by a task force made up of representatives from the city council, citizens groups and Virginia Power, would require that the lines be either buried, relocated or upgraded from 4 kV to 34.5 kV.

Distribution lines crisscross Old Town, running very close to buildings on the narrow streets. Magnetic fields of up to 45 mG have been measured inside some of the houses.

Though the council's endorsement is not a formal approval of the plan, Thomas O'Kane, Alexandria's director of transportation and environmental services, told *Microwave News* that the city is presently looking into underground routes for the lines. Estimates of the cost of burial run as high as $3 million.

Negotiations with Virginia Power over funding for the project are still under way. Coincidentally, Virginia Power's 30-year franchise agreement with the city runs out this year, and the utility is in the process of negotiating to maintain its exclusive rights to supply Alexandria with electricity. Though the city previously paid for burying lines in Old Town, John Oyenart, Virginia Power's customer service manager, told *Microwave News* that Alexandria's mayor, Jim Moran, has proposed that the utility pay for the project as a condition of the franchise agreement.

Although Oyenart refused to endorse or to reject the task force's proposal, he was skeptical about the merits of the plan. "The jury is still out as far as any possible EMF health risks," he said, adding that he "is pretty sure that undergrounding won't get rid of the fields."

Since the utility does not acknowledge any EMF health risks, the project may be billed as "historic undergrounding," intended to preserve the aesthetic beauty of Old Town, O'Kane said.

PSE&G Makes a Promise

"You have a right to know the facts and we pledge our best efforts in getting them to you," Public Service Electric and Gas (PSE&G), New Jersey's largest electric utility, promises in an ad running in 15 daily New Jersey newspapers. The ad is part of a $70,000 publicity campaign on EMFs which began in June and which will conclude in August.

The ads—titled "What you should know about EMF"; "What is being done about EMF"; and "A promise about EMF"—stress PSE&G's commitment to the Electric Power Research Institute's (EPRI) research program on bioeffects and to keeping customers informed.

The ads do not acknowledge EMF health hazards: "It is PSE&G's belief, based on the latest...evidence, that EMF does not represent a threat to the health and safety of its customers and employees." EMF health effects are termed "rare, difficult to detect and quite subtle, if they exist at all," though the utility admits that there are "valid concerns."

According to Neil Brown, a company spokesman, PSE&G had received 100 requests for more information by mid-July.

HIGHLIGHTS

Abnormal Immune Systems Among Aluminum Workers

Aluminum workers who were routinely exposed to very high magnetic fields and toxic chemicals had abnormal immune systems, according to a new study by Drs. Robert Davis and Samuel Milham Jr. of the Washington state Department of Health in Olympia.

In their pilot study, Davis and Milham selected 23 apparently healthy volunteers, aged 35-54, from a group of 350 workers and found that 15 of the 20 who worked in the "potrooms" had elevated levels of T8 suppressor lymphocytes (white blood cells) compared to the three who worked in other parts of the plant. The large number of T8 cells lowered the ratio of T4 to T8 lymphocytes—an indicator of abnormal immune function. Two of the three non-potroom workers also had low T4/T8 ratios, though these were due to low T4 counts.

"These workers definitely had abnormal immune profiles," Milham told *Microwave News* in a telephone interview. "Now we must find out whether their immune functions are impaired." Potroom workers were employed on an average of 18 years at the plant—13 years in the potrooms.

Those suffering from AIDS also have low T4/T8 ratios, making them very susceptible to pathogens which the immune system could otherwise fight off. In AIDS patients, however, the ratio is low because of an abnormally low number of T4 helper lymphocytes.

Potroom workers are exposed to very high magnetic fields, intense heat and a host of toxic chemicals, including benzene and polycyclic aromatic hydrocarbons. Aluminum ions are reduced into the metal in large steel pots.

Although Davis and Milham did not measure the electromagnetic fields (EMFs) in the potrooms, they cited a study by Dr. Tom Tenforde—now at the Battelle Pacific Northwest

Lab in Richland, WA—indicating that magnetic fields greater than 100 G can be generated in the electrolytic reduction of aluminum. Whether the magnetic fields were static or time-varying was not specified.

The new study was prompted by Milham's observation of a cluster of five cases of B-cell lymphoma among aluminum plant workers between 1978 and 1985. Previous studies of occupational mortality among Washington state aluminum workers had also shown higher-than-expected rates of lymphoma. Although Davis and Milham point out that the observed immune system changes may have no bearing on the increased lymphoma rate, they note that immunodeficiency is a "known risk factor" for B-cell lymphoma.

The researchers were also careful to point out that, "The cause of these findings is unknown." Nevertheless, they cited experiments by Dr. Dan Lyle, working with Dr. Ross Adey at the VA Hospital in Loma Linda, CA, showing that EMFs can alter the immune response of exposed cells (see *MWN*, My83).

In addition, Dr. Jerry Phillips, who recently joined Adey's lab, has reported that human cancer cells exposed to EMFs are less susceptible to attack by lymphocytes (see *MWN*, J/A86).

Milham is the author of a number of landmark studies on the link between EMFs and cancer (see *MWN*, J/A82, My85, J/A85, M/A86, N/D87 and J/F89).

Davis and Milham's paper, "Altered Immune Status in Aluminum Reduction Plant Workers," appears in the *American Journal of Industrial Medicine, 18*, pp.79-85, July 1990.

Swiss Advisory Group Endorses IRPA's RF/MW Limits

An advisory committee to the Swiss Federal Office for Environment, Forests and Landscape (known by its German acronym, BUWAL) has endorsed the International Radiation Protection Association's (IRPA) standards for human exposure to radiofrequency and microwave radiation in the 100 kHz–300 GHz frequency band.

The IRPA standards, adopted in 1984 and revised in 1988, are based on a specific absorption rate (SAR) of 0.08 W/Kg for the general public—equivalent to 200 $\mu W/cm^2$ at 10-400 MHz (see *MWN*, Mr84 and J/F88).

The BUWAL will use the committee's recommendations to set federal safety standards.

In its June 1990 report, the advisory group, chaired by Dr. H. Krueger, a professor at the Swiss Federal Institute of Technology (ETH) in Zurich, concludes that the threshold for ill effects, based on animal studies, is in the range of 2-4 W/Kg and recommends the application of a safety factor of 50. It also notes that, at frequencies below 50 MHz, shock and burn hazards occur at SARs "well below 2 W/Kg."

Though Krueger's committee indicates that modulated fields and specific frequencies may be responsible for non-thermal effects, it decided that, without knowing the responsible mechanisms of interaction, it was impossible to set standards for non-thermal effects.

A future report will address health risks from exposures to frequencies below 100 kHz.

For a copy of *Biological Effects of Non-Ionizing Electromagnetic Radiation on Human Beings and the Environment—Part 1: Frequency Band 100 kHz to 300 GHz*, Environmental Protection Document No. 121, contact: Dokumentationsdienst, Bundesamt für Umwelt, Wald und Landschaft (BUWAL), Hallwylstrasse 4, 3003 Bern, Switzerland, (031) 61-69-64.

The title of the document in German is: *Biologische Auswirkungen Nichtionisierender Elektromagnetischer Strahlung auf den Menschen und seine Umwelt—1. Teil: Frequenzbereich 100 kHz bis 300 GHz*, Schriftenreihe Umweltschutz Nr.121.

RF Link to New York Cancer Cluster Under Study

An investigation is under way of a cluster of non-Hodgkin's lymphomas (NHL)—a rare cancer of the lymph system—among workers at the University of Rochester, NY. Since 1980, there have been at least ten—some say eleven—cases reported among those who now work, or used to work, at the school's Lattimore Hall, according to the Rochester *Times-Union*. No cause for the cluster has been identified, though some have pointed to the campus's 1,000-watt FM radio (WRUR) antenna, located 100 feet from Lattimore Hall.

"It's a striking cluster," Dr. James Melius, director of the division of occupational health and environmental epidemiology at the state Department of Health (DOH), told *Microwave News*. Melius, who is following the university's investigation for the DOH, added that radiofrequency (RF) radiation is a "legitimate concern."

There are, however, opposing views on whether RF radiation may be a factor in the cluster. In an interview, Dr. Clifford Reifler of the University of Rochester's Medical Center said that RF radiation has been dismissed as a possible cause, along with asbestos, radon, ionizing radiation, water contamination and building materials. "It doesn't appear to be a problem with the environment," he added. Reifler is coordinating the university's investigation with the DOH.

A June 9 RF radiation survey of Lattimore Hall and nearby buildings by Galson Technical Services, Inc., a Rochester-based consulting firm, found no detectable levels. The report, commissioned by the university, concluded that the RF levels are not hazardous because they are far lower than the guidelines specified by the American National Standards Institute (ANSI) and by the American Conference of Governmental Industrial Hygienists (ACGIH).

Galson's failure to detect RF radiation may be due to the meter used: the HI-3002 manufactured by Holaday Industries in Eden Prairie, MN. Holaday's Dave Baron told *Microwave News* that, "The low end of the sensitivity range of the HI-

3002 is 250 μW/cm². To detect levels in the microwatt range one should use one of our more sensitive meters."

Dr. Robert Becker, a consultant based in Lowville, NY, who has been following the cluster investigation, doubts that the ANSI and ACGIH standards are appropriate for assessing cancer risks: "These 'safe' levels have little justification in reality, they are rather arbitrary and have been questioned for some time," he said. "The RF survey in no way proves that there is no relation between the cancer cluster and the radio signals."

The university was first alerted to the Lattimore Hall cluster in 1986 when three women in their 30s developed cancer: two were diagnosed with NHL, one with breast cancer. Since then, nine more cases of NHL have been identified. One of these cases is not officially considered part of the cluster, since it involves a student who was at the university for only 18 months before the cancer was diagnosed.

"Our plan is to follow up and see if there are any more cases [of NHL]," Melius told *Microwave News*. The DOH is now going over health records of current and former university employees to see if some cases have been overlooked. Mary Ellin Arch, who is covering the cluster for the *Times-Union*, said that she has been inundated with calls from people who say that they are part of the cluster but haven't been counted.

There have been additional cases of breast cancer since the first report, though the investigators are not considering these, because there is "no suggestion that breast cancer has ever been caused by environmental factors," Reifler said.

Lattimore Hall housed chemistry labs until it was renovated in 1974, prompting some to question whether some leftover toxic substance might be responsible for the cluster. Reifler dismisses this, however: "Anything that was in the building before 1974 is gone," he said.

Makeup of IEEE Committee on NIER Under Fire

The membership of the Institute of Electrical and Electronic Engineers' (IEEE) committee developing standards on non-ionizing electromagnetic radiation (NIER) is being criticized because of its lack of biological and medical expertise and because the majority of its members represent the U.S. military.

The dispute threatens to delay the revision of the 1982 American National Standards Institute (ANSI) safety guidelines for radiofrequency and microwave (RF/MW) radiation and to hinder the committee from developing exposure standards for extremely low frequency (ELF) electromagnetic fields (EMFs). IEEE Standards Coordinating Committee 28 (SCC28), the new incarnation of ANSI Committee C95, has been working on revising the RF/MW standard since 1983 (see *MWN*, J/A83).

Fletcher Buckley, a member of the IEEE Standards Board, who works for General Electric (GE) in Moorestown, NJ, raised the issue of the IEEE's lack of expertise in bioelectromagnetics in a May 16 memorandum to Marco Migliaro of Impell Corp. in Melville, NY, the chairman of the IEEE Standards Board. "It is not clear that the IEEE by itself can come to an authoritative conclusion on the long-term dangers of cancer from long-term exposure to low-level [EMFs]," Buckley wrote.

"Where is the competence to determine low-level effects? We at the IEEE are not in the field nor do we publish epidemiological studies or other literature on cancer," he told *Microwave News* in a telephone interview. Buckley explained that he is concerned about the IEEE's expertise in both ELF EMFs and RF/MW biological effects. He also made clear that he was not speaking on behalf of GE.

Buckley's memo touched off a letter-writing campaign in support of the committee's work by a number of its members, including: Dr. Jay Brandinger of SRI International on behalf of the Electromagnetic Energy Policy Alliance, a trade group based in Washington, DC; Dr. Bill Guy of the University of Washington in Seattle; Dr. Don Justesen of the VA Medical Center in Kansas City, MO; John Mitchell of the Air Force School of Aerospace Medicine in San Antonio, TX; Dr. Elliot Postow of the National Institutes of Health (NIH) in Bethesda, MD; and Dr. Sol Michaelson of the University of Rochester in Rochester, NY.

Indeed, in his letter to Migliaro, Justesen raised "the question of the appropriateness of [Buckley's] membership on the

ELF-Shielded VDTs Expected in 1991

Sigma Designs, Inc. will market high-resolution video display terminals (VDTs) that are shielded to reduce ELF fields in the first quarter of 1991—the first U.S. company to make such a commitment for cathode ray tube monitors.

Only monochrome and gray-scale VDTs with reduced ELF emissions will be available, according to Sigma's Charlie Waters. In a telephone interview, he told *Microwave News* that all color monitors sold in the U.S. are manufactured overseas. "We are dependent on the Japanese for a color solution," he said. Sigma's color terminals are made by Sony Corp.

Following the lead of IBM (see *MWN*, N/D89), Sigma announced in late July that it would immediately start selling VDTs shielded to meet Swedish guidelines for very low frequency (VLF) fields. Sigma has been selling low VLF computer terminals in Sweden since 1988.

Sigma, which is based in Fremont, CA, did not specify the emission levels of its ELF-shielded VDTs, saying only that it would meet the Swedish ELF guidelines expected later this year.

Sigma is a major supplier of VDTs and other hardware for IBM, Macintosh and compatible systems. Last year, its sales were over $75 million. The company sells tens of thousands of VDTs each year, according to Waters.

Standards Board." Migliaro could not be reached for comment.

At the last meeting of SCC28, held in San Antonio, TX, on June 9, NIH's Postow expressed concern over the predominance of military interests on the committee, pointing out that 17 of the 31 members are associated with the Department of Defense (DOD), as are 8 of 13 liaison members. The DOD's role in the redrafting of the standard was also raised at last year's SCC28 meeting in Tucson, AZ (see *MWN*, S/O89).

"I am not happy with the process," Postow said in an interview. Similarly, Dr. Om Gandhi of the University of Utah in Salt Lake City, the cochairman of the subcommittee that is revising the 1982 ANSI standard, told *Microwave News* that the SCC28 committee "is not going to sit well with the public." Gandhi said that the committee needs new members, adding that, "I think it should be a balanced committee."

SRI's Brandinger, the chairman of SCC28's membership subcommittee, has been asked to investigate how to achieve balance. In an interview, he predicted that two of the military members would step down from the committee.

At the June meeting, the members of SCC28 voted to set up a new subcommittee to study the possibility of issuing a standard for exposures to ELF EMFs. The only dissenting votes came from Dr. Dave Erwin of the Air Force School of Aerospace Medicine and Lt. Col. H.F. Kerschner of the U.S. Naval Medical Command in Washington, DC. SCC28 Chairman Dr. Tom Budinger of the Lawrence Berkeley Lab in Berkeley, CA, deferred selecting the members of the new subcommittee.

"The IEEE will probably investigate ELF frequencies," John Woods, the institute's staff liaison with SCC28, told *Microwave News*, but he pointed out that a number of other IEEE groups have an interest in the subject.

Interestingly, both issues—the committee's membership and the desirability of setting ELF standards—have been raised before. In 1984, Dr. Nicholas Steneck, a professor of history at the University of Michigan in Ann Arbor, charged that the committee did not represent the public interest (see *MWN*, O84), and in 1986, a subcommittee issued a report on the question of ELF standards—but the idea was never pursued (see *MWN*, J/F86).

It is not clear how long the resolution of these issues will delay the approval of the revised RF/MW standard and whether the IEEE will allow SCC28 to address ELF EMFs. While a clear majority of the members of the subcommittee that revised the 1982 standard favor the proposed draft, the questions of membership expertise and balance will have to be resolved before the standard can be adopted.

Male Breast Cancer Again Tied to EMFs *(continued from p.1)*

exposure to EMFs increases the risk of breast cancer in men, and perhaps, in women," Dr. Richard Stevens of the Battelle Pacific Northwest Lab in Richland, WA, said in a telephone interview. Three years ago, Stevens published a paper suggesting that the higher incidence of breast cancer among women in industrialized countries is related to increased EMF exposures and/or increased "light-at-night" (see *MWN*, J/F87).

Demers's case-control study was based on 227 cases of male breast cancer occurring over a three-year period and 300 controls. Exposures were characterized by occupational history.

Demers pointed out that his results are "consistent" with the few available details on the JHU study. Last November, Drs. Genevieve Matanoski, Patrick Breysse and Elizabeth Elliott reported that they had found at least two cases of breast cancer among male central office technicians where none were expected. Furthermore, there were three or four more cases which did not fit the study's case definition, according to Breysse (see *MWN*, N/D89).

Matanoski told *Microwave News* that after analyzing her data, she contacted the Hutchinson researchers—who were already investigating male breast cancer risk factors—and suggested they take a look at the potential EMF connection.

The JHU team has suspended work on the New York study pending the completion of their nationwide case-control study of telephone workers (see *MWN*, N/D88 and M/A90).

Like the JHU researchers, who focused on active—hence, younger—workers, Demers observed a higher risk among men who were first exposed before they turned 30. Workers who were first exposed 30 or more years prior to diagnosis made up a second high risk group, Demers said: "If we had limited our study to ten-year exposures, we may not have seen anything." He noted that there was a great deal of overlap between the two groups. Duration of exposure, for the most part, was not related to risk, however.

Demers announced his findings at the *23rd Annual Meeting of the Society for Epidemiologic Research*, held June 12-15 at the Snowbird Resort near Salt Lake City, UT. He expects to submit a paper for publication in the near future. Demers's study is part of the larger investigation of male breast cancer by Thomas and coworkers being conducted at the Hutchinson center.

A second study of male breast cancer, which was also presented at the Utah meeting, concluded that there was no association with on-the-job EMF exposures. Paula Rosenbaum, who works with Dr. John Vena at the State University of New

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York in Buffalo, declined to discuss her findings with *Microwave News*. Vena was unavailable for comment.

The male breast cancer cases in the JHU study were among "central office technicians" who were exposed to complex EMFs with transient pulses generated by the on-off switching of equipment, JHU's Breysse told *Microwave News* last November. At that time, he suggested that the on-off pattern may be more significant for biological activity than constant 60 Hz field exposures. Those with the highest risk in the Demers study—electricians, telephone linemen and electric power workers—may also have been exposed to complex EMF waveforms.

Are EMFs Risk Factors for Breast Cancer in Women?

As the link between electromagnetic fields (EMFs) and male breast cancer grows stronger, researchers are asking whether EMFs may also play a role in the development of breast cancer among women.

Dr. Richard Stevens of the Battelle Pacific Northwest Lab has long maintained that the link between EMFs and female breast cancer requires a full-scale investigation (see p.1).

Actually, while there have been no studies of EMFs and female breast cancer, many experts say that male and female breast cancers are essentially the same disease.

"There are many more similarities than there are differences among male and female breast cancer," Dr. David Blask of the University of Arizona College of Medicine in Tucson told *Microwave News*.

Similarly, Dr. David Thomas of the Fred Hutchinson Cancer Research Center in Seattle, WA, said that male and female breast cancers "look the same histologically under the microscope."

When asked about the EMF-female breast cancer connection, Blask replied, "I don't know if there is enough to sound the alarm, but it's something worthy of study." Thomas

Is the Pineal the Key to the Mechanism of Interaction?

Dr. Russel Reiter of the University of Texas Health Science Center in San Antonio, a pioneer researcher on the effects of light and ELF fields on the pineal gland, may have an explanation for how magnetic fields might lead to cancer.

It has long been known that the pineal's production of the hormone melatonin—which inhibits the growth of certain cancers—can be suppressed by EMFs, as well as by light (see *MWN*, M/J88). Now Reiter suggests that fast magnetic field pulses are responsible for this EMF effect.

By examining the nocturnal pineal rhythms of rats exposed to a 400 mG static magnetic field which was periodically inverted, Reiter and coworkers have narrowed down the cause of the effect to abrupt changes in the field. They propose that the electric currents induced by these changes create magnetophosphenes in the retina, which are interpreted as light by the brain. This in turn causes melatonin levels, which are elevated at night, to drop.

The ability of ELF fields to trigger magnetophosphenes has long been known, but the effect has generally been considered benign.

Reiter emphasizes that relatively steady magnetic fields do not affect pineal rhythms. "A short, quick pulse is what clearly induces the change by inducing the electrical currents necessary to create visual impressions of light," Reiter told *Microwave News*. Shifting position while sleeping, for example, wouldn't interrupt the pineal-melatonin cycle, but turning on a hair dryer might, he said.

In a recent paper published in *Biochemical and Biophysical Research Communications*, Reiter and colleagues conclude that the observed pineal effects are most likely explained by "induced currents in the nervous system caused by the on- and off-transients of the...magnetic field...."

What is not clear is whether magnetic field exposures during the day—when melatonin levels are normally low—affect nighttime levels. Reiter's team is currently working on this question.

"Clearly, there may be some adverse effect of electric and magnetic field exposure," Reiter said, but added, "We don't know if these exposures change melatonin levels enough to cause cancer."

Dr. David Blask of the University of Arizona College of Medicine in Tucson and Dr. Steven Hill of the Abilene Christian University in Abilene, TX, reported in 1988 that melatonin concentrations similar to levels present in the bloodstream caused a 60-78% inhibition of *in vitro* human breast cancer cell proliferation, but that lower and higher levels had no effect. More recently, Blask has been working with researchers at the Battelle Pacific Northwest Lab in Richland, WA, who have done trailblazing work on ELF field effects on pineal rhythms and cancer.

Much more work is needed to fill in all the pieces of the puzzle. Indeed, the Environmental Protection Agency's current draft report on EMFs and cancer (see *MWN*, M/J90 and p.11) calls for more research on the EMF-pineal-breast cancer link: "The suppressive effects of ELF on pineal melatonin production and the general oncostatic properties of melatonin in several endocrine-stimulated tumors provide indirect evidence for the hypothesis that ELF exposure may be a risk factor in the growth of these tumors. Studies which incorporate all three parameters, ELF exposure, melatonin production and breast cancer induction, are needed for further evaluation of this hypothesis."

said that until more results on EMF effects were in, he would not be willing to "make the jump" from male to female breast cancer.

The results of his ongoing study of risk factors for male breast cancer may provide leads for further study of breast cancer in women, Thomas concluded in a paper presented at the *Annual Meeting of the American Epidemiological Society*, March 22-23, 1990, in Baltimore, MD.

Due to the prevalence of the disease, the impact of an EMF-female breast cancer link, if it exists, would be considerable. The American Cancer Society estimates that in 1990 breast cancer will account for 29% of all cancers—and 18% of all cancer deaths—among women.

Men account for about 1 of every 150 cases of breast cancer per year in the U.S., according to the National Cancer Institute (NCI). In 1988, there were only about 900 cases among men, compared with 143,000 among women. Between 1982 and 1986, there was a 15% increase in the incidence of female breast cancer; during this period, male breast cancer decreased 10%; similarly, breast cancer deaths increased among women and decreased among men.

From 1960 to 1985, breast cancer incidence among women in Portland, OR, rose 45%, according to a new analysis in the *Journal of the National Cancer Institute*. Kaiser Permanente's Dr. Andrew Glass and NCI's Dr. Robert Hoover note that the incidence of the disease "has been rising steadily in the United States for at least 50 years."

Some of the risk factors for men observed by Thomas include a history of breast cancer among close family relations (male or female), exposure to ionizing radiation and testicular pathology and dysfunction. The first two are also risk factors for women. Other risk factors for women include early menarche, advanced age at birth of the first child and late menopause.

Approximately 60% of female breast tumors and 80% of male breast tumors are estrogen receptor-positive, according to Blask, who added that melatonin can block the stimulatory effect of estrogen on these tumors. And Glass and Hoover recently reported that between the mid-1970s and -1980s, the incidence of estrogen receptor-positive tumors among women increased an average of 131%—compared to a 22-27% increase for estrogen-receptor negative tumors—"perhaps implicating hormonal factors in the rising incidence of breast cancer." Blask pointed out that, "No one is really certain about hormonal changes in men with breast cancer. It hasn't been studied very much at all."

Breast Cancer and EMFs: References

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FROM THE FIELD

Sitting on Transformers

To the Editor:

Based on observations and a few measurements, I would like to add a piece to the 60 Hz magnetic field exposure puzzle. At least in the Las Vegas area, ground-mounted transformers are used in residential areas as part of the underground power distribution system. These transformers are housed in hinged steel boxes on concrete pads adjacent to sidewalks. The boxes have horizontal dimensions of about 0.9 by 0.9 meter and are about 0.6 meter high.

The magnetic field (or more properly flux density) near these boxes decreases rapidly with distance; the field is typically less than 0.1 μT or 1 mG at horizontal distances of more than 1 meter from the transformer. However, the apparent common use of the transformers for seating by the public requires us to consider field strengths near and at the surface of the steel container of the transformer.

During periods of high power consumption (which occur here in the summer), I have measured maximum 60 Hz magnetic fields at the surface of the transformer boxes of approximately 40 μT or 400 mG. This measurement was made at the side of a box. Surface field values vary at different locations on the surface and change in time as the power load changes. The maximum field on the upper horizontal (seating) surface of the transformer box is usually found near the center of the box or along the hinge. These values varied from about 10 to 30 μT or 100 to 300 mG.

Measurements during the fall when power consumption is low indicated the fields were decreased by about a factor of three. Some data were acquired on the field strength variation with height above a transformer box. For example, at the surface the field was 7.3 μT, at 10 cm above the box the field decreased to 3.1 μT and at 20 cm the field was 1.1 μT.

The use of ground-mounted transformers as seating would seem to be an easily avoidable source of exposure.

Sincerely,
Edwin D. Mantiply,
Office of Radiation Programs
U.S. Environmental Protection Agency
Las Vegas, NV

EPA on Guy Chronic MW Exposure Study

In its new report on the potential carcinogenicity of electromagnetic fields[1] (EMFs), the Environmental Protection Agency (EPA) analyzes the results of Dr. Bill Guy's long-term exposure study[2] at the University of Washington in Seattle, in which rats were exposed to modulated 2450 MHz microwave (MW) radiation over their lifetimes. Reprinted below is an excerpt from EPA's assessment of the Guy study, which appears on pp.4-40–4-42 of the report. Note that EPA refers to 2450 MHz as radiofrequency (RF) radiation.

The University of Washington study, done at a power level carefully calibrated to simulate human exposure at the maximum continuous level allowed by the [American National Standards Institute] standard, showed the induction of benign adrenal pheochromocytomas in the exposed group and no statistically significant elevation at any other site. There is a slight elevation of carcinomas in each of several other glandular organs (pituitary, thyroid, adrenal cortex, pancreas, testes and liver), which is statistically significant if they are all considered as a single group. This apparent induction of malignant tumors occurs without an increase in benign tumors of those sites. There is also statistically significant elevation in the incidence of carcinomas, but not sarcomas, at all sites.

Combining tumors across these glandular organs is justifiable on the generalized hypothesis that [EMFs] affect all tissues in the body and that these glands, being specialized to respond to small amounts of specific circulating hormones, have cell membrane-bound receptors whose function could be affected by ion currents induced by the external fields. Although this concept is consistent with recent research on the mechanism of tissue interaction with low frequency fields, there are at least two reasons why the combining of glandular organ tumors of all sites may not be appropriate. These are:

a. The proposed mechanism is based on low frequency field phenomena, whereas RF radiation accounts for most of the energy in the applied field.

b. This proposed mechanism, though plausible, has not been empirically established.

The combining of carcinomas of all sites is a different issue than the combining of carcinomas of the glandular organs alone. The former can be justified on the basis that all organs are more or less equally exposed to the same fields and induced currents without specifying the nature of the biological response to the fields, whereas the latter requires an additional specific hypothesis of how biological tissue responds to these fields. Combining of carcinomas at all sites is considered to be more valid than combining of glandular organ carcinomas alone because the additional incompletely tested hypothesis is not necessary.

The clear positive findings of Szmigielski et al.[3] show that RF fields without low frequency components stimulate the growth of tumors and indicate that they may act as a tumor promoter, or a modifying factor in the development of tumors. The role of tissue heating as a mechanism for this effect is not clear.

In summary, the University of Washington long-term animal study provides evidence that pulsed [EMFs], in the absence of an appreciable tissue heating effect, induce carcinomas generally across all tissues of the body without being localized to any single site. The same generalized carcinoma response also appears in the glandular organs as a group. The exposure also induces benign adrenal medulla tumors without any evidence of adrenal hormone imbalance. This lesion is typically of a low degree of malignancy.

Under the plausible but unproven hypothesis that either all tissues or the endocrine glands in particular interact with the fields by way of a common carcinoma-induction mechanism, the University of Washington study can be said to demonstrate that pulsed RF fields are carcinogenic. It is not known whether the RF or the low frequency components or both acting together are responsible for the effects. The finding in the Szmigielski et al. study that unmodulated 2450 MHz RF radiation accelerates the development of both spontaneous and chemically-induced tumors indicates that the RF component has carcinogenic activity, but the possibility of whole-body heating as a contributory factor in their study cannot be ruled out.

If, in fact, only the RF component produces the effect, then the rationale for considering the glandular organs as a target disappears, since it is based on the idea of an EMF-activated plasma membrane phenomenon in the glandular tissue. However, in this case, all rat tissues are still exposed more or less equally to the radiation, so there

is still a valid reason for combining carcinomas at all sites.

Therefore, regardless of which range of frequency components is biologically effective, there is a valid rationale for combining the tumor sites as we have done, and the University of Washington study can be said to have demonstrated the carcinogenic action of this type of pulsed RF radiation.

1. EPA, *Evaluation of the Potential Carcinogenicity of Electromagnetic Fields*, Workshop Review Draft, No. EPA/600/6-90/005A, June 1990. Contact: Dr. Robert McGaughy, Office of Health and Environmental Assessment (RD-689), EPA, 401 M St., SW, Washington, DC 20460, (202) 382-5898. See *MWN*, M/J90.

2. A.W. Guy et al., *Effects of Long-Term Low-Level Radiofrequency Radiation Exposure on Rats*, Nine Volumes: Report Nos. USAFSAM-TR-83-17, 83-18, 83-19, 83-42, 83-50, 84-2, 84-31, 85-11 and 85-64; issued between September 1983 and August 1985. See, especially Volume 8 (TR-85-11): "Evaluation of Longevity, Cause of Death and Histopathological Findings," April 1985. For more information, contact: Dr. David Erwin, [RZP], USAF School of Aerospace Medicine, Aerospace Medical Division (AFSC), Brooks Air Force Base, TX 78235, (512) 536-2576; Dr. Bill Guy, Bioelectromagnetics Research Lab, RJ-30, University of Washington, Seattle, WA 98195, (206) 543-1071. See *MWN*, J/A84, Mr85 and N/D86.

3. S. Szmigielski et al., "Accelerated Development of Spontaneous and Benzopyrene-Induced Skin Cancer in Mice Exposed to 2450 MHz Microwave Radiation," *Bioelectromagnetics*, 3, pp.179-191, 1982. See also *MWN*, My81.

Congressional Support for EMF Research Funding (continued from p.1)

about our uninterrupted level of exposure to EMFs." Scheuer and ranking minority subcommittee member Rep. Claudine Schneider (R-RI) endorsed the Pallone measure, almost assuring its passage out of committee.

The subcommittee may act on the bill in the remaining few weeks of the current congressional session or may hold further hearings to prepare for action in 1991, according to a top subcommittee aide. She noted that it is still possible that Scheuer will offer a funding amendment on the floor of the House in the current session if a Senate cosponsor can be found.

In contrast to past congressional hearings on EMFs, which have been poorly attended by congressmen (see *MWN*, N/D87 & M/A90), Scheuer's hearing drew nine members of congress. A standing-room-only audience packed the committee room.

The changed perception of the EMF issue was further evidenced by the virtually unanimous backing for the Pallone legislation. Both Democrats and Republicans on the subcommittee expressed support for the bill, as did the Edison Electric Institute (EEI), the Electric Power Research Institute (EPRI) and the American Public Power Association (APPA).

Indeed, some witnesses asked for more than the $3 million Pallone recommended for fiscal 1991. Dr. Robert San Martin, deputy assistant secretary for utility technologies at the Department of Energy (DOE), said that $6 million would be preferable—$5 million for research and $1 million for public information. APPA recommended an annual funding level of $12 million.

James Cunningham, representing the New York Power Authority (NYPA) and the Large Public Power Council (LPPC), restated the LPPC's proposal for an industry-funded, government-coordinated $15 million research effort. He first announced the proposal at a congressional hearing in March (see *MWN*, M/A90).

The most reluctant endorsement of Pallone's funding proposal came from Dr. William Farland, director of the Environmental Protection Agency's (EPA) Office of Health and Environmental Assessment. As Farland read from his prepared text, Scheuer interrupted abruptly, charging that Farland was not "addressing the question" of whether the EPA supports Pallone's bill. Farland attempted to explain EPA's past work on EMFs, but Scheuer interrupted again. Under Scheuer's prodding, Farland conceded the agency's support. "We support the draft as it was presented to us. We think there are ways to improve it," he said.

Dr. David Nagel, vice president of Apple Computer's Ad-

Scheuer To Pursue Case of NCI Scientists

Rep. James Scheuer plans to investigate the National Cancer Institute's (NCI) response to alleged misconduct by three NCI scientists who testified on behalf of electric utilities concerning EMF health risks.

His subcommittee will seek an explanation as to why NCI officials allowed the scientists to serve as expert witnesses dismissing EMF risks when the institute was embarking on a multimillion-dollar cancer study, a senior Scheuer aide told *Microwave News*. Altogether, the three received nearly $125,000 for appearing for the New York Power Authority at the Marcy-South transmission line trial (see *MWN*, N/D88 and J/F89).

At the July 25 congressional hearing, Scheuer interrupted Dr. Ross Adey as he was reading excerpts from his prepared testimony. "Wait a minute," Scheuer said. "There is a very important part of your testimony that you didn't read. Do you want to read it or should I?"

Adey then read the following:

> It is a matter for public outrage that scientists employed by the [NCI]... received large personal fees for court appearances in behalf of electric power companies by declaring in an issue far beyond their individual or collective competence that there are no mechanisms by which [EMFs] could play a role in cancer. And this they did in the very month that NCI put forth a national request for proposals to study the epidemiology of childhood leukemia in relation to [EMF] exposures. What should the public's expectation be for the credibility of such a study?

Scheuer responded that, "It looks to me like a clear dereliction of duty on behalf of NCI leadership and scientists" in not preventing such a conflict of interest from occurring.

vanced Technology Group, also said that $3 million is insufficient. Apple recently joined the public debate on EMF health risks after *MacWorld* ran a cover story in July titled "Could Your Computer Be Killing You?" The magazine reported that its laboratory tests showed that an Apple color display monitor had produced extremely low frequency (ELF) EMFs as high as 15 mG 12 inches from its right side.

Earlier this year, the committee approved an amendment allocating $1 million for fiscal 1991 to EPA for EMF research. Under the amendment, which was sponsored by subcommittee member Rep. George Brown (D-CA), the funding would increase to $2 million annually for fiscal years 1992 and 1993 (see *MWN*, M/J90).

If Pallone's legislation is enacted, the DOE will maintain its leading role in EMF research, with EPA and the National Institute of Environmental Health Sciences (NIEHS) playing roles in setting EMF research priorities (see *MWN*, M/J90).

At the hearing, several witnesses emphasized the need for uninterrupted funding. Dr. Ross Adey of the VA Hospital in Loma Linda, CA, told the subcommittee that, "The pace of our acquisition of needed knowledge has been far from optimal."

Adey countered longstanding concerns that researchers are unable to explain how EMFs might cause ill effects: "Studies at the cell and molecular level have built, and continue to build, a series of critically important bridges between laboratory science and human epidemiology; so that it is no longer possible to say that mechanisms mediating interactions of electromagnetic fields with biomolecular systems remain unknown with respect to potential health problems."

The DOE's endorsement of H.R.4801 was an about-face from its stand at the March congressional hearing, when San Martin defended the agency's research program as "rational and reasonably satisfactory at this time" and rejected suggestions that the DOE might do more.

This reversal is consistent with a widespread shift in attitudes about EMF research, which observers attribute to the June release of EPA's cancer review (see *MWN*, M/J90), Paul Brodeur's widely publicized article on cancer clusters near power lines and electrical substations in the July 9 *New Yorker* and Brodeur's article on video display terminal EMFs in the July *MacWorld*.

Mitigation Controls?

Scheuer and ranking minority member Schneider both emphasized the need for study of how to mitigate EMF exposures. They both criticized the DOE for opposing the provision in Pallone's bill which would authorize such work.

"Since no health effects arising from EMF exposure have been established," San Martin said, "we believe that extensive concurrent work on mitigation is not appropriate."

Schneider suggested that a possible step for controlling exposures would be to set federal limits on field levels at the edge of transmission line right-of-ways (ROWs). James Cunningham of the NYPA noted that several states are attempting to do so but cautioned against federal rules. "What is needed now is not regulation, but research," he said.

EPA's Farland also told the subcommittee that, "At this time, the agency is not making any recommendations to the general public in the report or as a direct consequence of the report. There are many uncertainties which remain about the degree or extent of any hazard posed by exposure to EMFs."

Most of the witnesses supported a federal information program as called for in H.R.4801. Testifying on behalf of EPRI's Dr. Leonard Sagan, Dr. Stanley Sussman said that, "There is an important need for a federal EMF information center, as well as for an EMF mitigation research effort."

UPDATES

COMMUNICATIONS

AM Broadcast X-Rays... Certain types of AM broadcast transmitters may produce X-radiation at much higher levels than previously believed, according to Bruce Hunter of the Voice of America. Hunter found that transmitters using efficient pulse-width modulators require 20-30 kilovolts, "which greatly enhances the production of ionizing radiation in the form of x-rays." He recommends greater worker awareness of ionizing radiation risks and closer monitoring of x-radiation levels in his paper, "X-Ray Emission from Broadcast Transmitters," which appeared in *IEEE Transactions on Broadcasting, 36*, pp.14-23, March 1990.

COMPATIBILITY & INTERFERENCE

Protecting Avionics... The FAA's specifications for protecting electronic flight systems against high-power RF/MW radiation are "excessive" and do not "represent the actual threat levels," according to the General Aviation Manufacturers Association (GAMA), a group based in Washington, DC. In an April 30 position paper, GAMA asked the FAA to reduce its current shielding specifications for critical functions from 100 V/m to 20 V/m. Previously, the FAA's shielding requirement had been pegged to 200 V/m in the 10 kHz-18 GHz band (see *MWN*, N/D89). The FAA is most concerned about 1-400 MHz signals, GAMA noted. "There is no documented evidence of incidents or accidents involving civil airplanes caused by exposure" to high-energy RF/MW radiation, GAMA maintained. GAMA is running its own tests and plans to issue a report. For its part, the FAA expects to issue proposed rules to protect against the RF/MW threat this October. The agency is also identifying "unique high-power transmitters on flight charts so that aircraft operating in the vicinity of these transmitters can avoid the specified locations," according to a May 7 RF/MW program plan.

Satellite Signals Muscle Out Astronomy... The growing

number of military radionavigational satellites is taking a toll on radioastronomy research. In a letter to *Nature* (June 7, 1990), John Galt of the Herzberg Institute of Astrophysics in British Columbia, Canada, states that the U.S. Navstar global positioning system and the parallel Soviet system, GLONASS, emit "sidebands" at 1660-1670 MHz that interfere with signals from hydroxy (OH) radicals. Galt judges that this satellite "pollution" has already "seriously curtailed radio studies of important classes of stars." He urges that, in the future, satellites be designed to be compatible with radioastronomy and that existing systems that cause interference be phased out.

EMP LITIGATION

Expert Witnesses in Strom Suit... Depositions are being taken prior to the *Robert Strom and Barbara Strom v. The Boeing Co.; Boeing Medical Services Co.; The Lovelace Biomedical and Environmental Research Institute; and EG&G, Inc.* trial (see *MWN*, J/A88). Robert Strom, a former Boeing electronics technician, alleges that his leukemia is a result of extensive exposure to electromagnetic pulse (EMP) radiation during his work at Boeing, and that the company was aware that EMP radiation was a potential hazard but continued to expose him while monitoring his health. Lists of expert witnesses have been filed with the court by both sides. On behalf of the ***Stroms***, the experts are: Dr. Frank Barnes, University of Colorado, Boulder; Dr. Robert Becker, Becker Biomagnetics, Lowville, NY; Dr. Ralph Coates, Emory University, Decatur, GA; Dr. John Huff, The Mason Clinic, Seattle, WA; Dr. Robert Levine, Yale University School of Medicine, New Haven, CT; Dr. Abraham Liboff, Oakland University, Rochester, MI; Dr. Samuel Milham, Department of Health, State of Washington, Olympia; Dr. Richard Parks, Seattle, WA; Dr. Peter Wright, Polyclinic, Seattle, WA. On behalf of ***Boeing***, the experts are: Dr. Robert Adair, Yale University, New Haven, CT; Dr. Philip Cole, University of Alabama, Birmingham; Frank Cranny (affiliation unknown); Col. John Cutting, Department of Defense, Washington, DC; Dr. Bruce Dickerson, Environmental Research Information, Inc., New York, NY; Roy Ellis (affiliation unknown); Dr. David Erwin, School of Aerospace Medicine, Brooks AFB, TX; Dr. William Godden, Blanco, TX; Dr. Arthur Guy, University of Washington, Seattle; Dr. Mark Israel, University of California, San Francisco; B.K. Kwon, National BioSystems, Inc., Rockville, MD; Gordon McHenry (affiliation unknown); John Mitchell, School of Aerospace Medicine, Brooks AFB, TX; Dr. Gilbert Omenn, University of Washington, Seattle; Dr. John Pickering, Albuquerque, NM; Dr. David Savitz, University of North Carolina, Chapel Hill. On June 11, Boeing's attorneys advised the court that Omenn and Savitz "may not be available to testify at the trial." The expert witnesses for ***Lovelace*** are: Dr. Albert Jonsen, University of Washington, Seattle; Dr. Don Justesen, VA Medical Center, Kansas City, MO; Barbara Mishkin (tentative), Hogan & Hartson, Washington, DC; Dr. Paul Mossman, Albuquerque, NM. The attorneys representing the Stroms are Michael Withey, J. Murray Kleist and Leonard Schroeter, of Schroeter, Goldmark & Bender in Seattle, WA; Arthur Bryant of Trial Lawyers for Public Justice in Washington, DC; and Herbert Newberg of Philadelphia, PA. Representing Boeing are John Dillow and V.L. Woolston, of Perkins Coie in Seattle, WA. Representing Lovelace are William Squires III and Stuart Dunwoody, of Davis Wright Tremaine in Seattle, WA.

MEDICAL APPLICATIONS

Placebo as Good as TENS... Transcutaneous electrical nerve stimulation (TENS) is ineffective in treating lower back pain, according to a study in the June 7, 1990 issue of the *New England Journal of Medicine* (*322*, pp.1627-1634). Dr. Richard Deyo of the Seattle, WA, Veterans Affairs Medical Center and colleagues found no statistical difference between the reported improvements in back pain from one group of 36 patients using EMPI Corp.'s EPIX 982 TENS unit and from another group of 36 patients using a sham unit. In contrast, one month of exercise led to a statistically significant improvement. The research team notes that the use of TENS to treat lower back pain is based on the theories that high frequency TENS counterstimulates the nervous system to modify the perception of pain and that low frequency, high-amplitude TENS raises endorphin levels in the spinal fluid. In an interview with the *Wall Street Journal* (June 7), Michael Connoy, the president of EMPI Corp. of St. Paul, MN, criticized the one-month treatment period used by the researchers as too short and the intensity of the pulses as too weak. According to Deyo, the VA spent nearly $2 million on TENS units in 1986.

Electrical Repair... The FDA has issued an *Overview of the Literature on Electrical Bone Repair and Growth Stimulation* (FDA 90-8277). Clinical, animal and in vitro studies on both PEMF and DC treatments are addressed. The report, which was edited by Dr. Mays Swicord, is available for $17.00 from: NTIS, Springfield, VA 22161, (703) 487-4650. Order No. PB90-167255/AS. Though dated July 1989, it was only recently released. See *MWN*, M/A89 for the AMA's assessment of PEMF therapy.

RF and Menstruation...A team of U.K. researchers has found that 27 MHz RF energy can be useful for the treatment of excessive menstruation (menorrhagia). Three different doses were tried: 330, 445 and 660 kJ—the best results were obtained with the highest dose. The researchers note that the "procedure is easy and quick to do" and that it is inherently safe "since the electromagnetic radiation is unable to penetrate deeply...." Their report appears in *The Lancet, 335*, pp.374-376, February 17, 1990.

MEETINGS

VDT Proceedings... Papers from the National Institute of Child

Health and Human Development (NICHD) November 4, 1988 workshop on *Reproductive Effects of VDT Use* (see *MWN*, N/D88) have been published in a special issue of *Reproductive Toxicology*. Among them is a comprehensive survey of research on PMFs and reproductive risks by EPA's Dr. Ezra Berman, who concludes that the weight of evidence supports the contention that PMFs have detrimental effects on the embryonic development of animals. Dr. Michele Marcus emphasizes the need for a prospective epidemiological study with accurate measures of exposure to risk factors such as stress and radiation. After the workshop, NICHD approved funding for the Mount Sinai study Marcus is now leading (see *MWN*, S/O89). NIOSH's Dr. Teresa Schnorr outlines the protocol of her ongoing epidemiological study (see *MWN*, S/O87). And Dr. Marilyn Goldhaber of Kaiser Permanente rebuts some of the criticisms of her 1988 study which showed that women who used VDTs more than 20 hours a week had more than twice as many miscarriages as other office workers (see *MWN*, M/J88). Goldhaber dismisses the possibility that confounders such as pesticide spraying or poor drinking water quality significantly affected her findings. A copy of *Reproductive Toxicology, 4*, No.1, 1990, is available for $48.00 plus $2.00 for postage and handling from: Pergamon Press, Inc., Maxwell House, Fairview Park, Elmsford, NY 10523, (914) 592-7700.

BRAGS Proceedings Offer... In anticipation of its tenth anniversary, the Bioelectrical Repair and Growth Society (BRAGS) is offering a set of the transactions of its first nine annual meetings for $100.00 plus postage. In recent years each volume has cost $45.00. All orders must be prepaid. Contact: Ethel Pollack, BRAGS, PO Box 64-K, Dresher, PA 19025, (215) 659-5180.

PEOPLE

John Villforth, the director of the FDA's Center for Devices and Radiological Health (CDRH), is retiring in August after 29 years in public health service. Villforth will join the Food and Drug Law Institute in Washington, DC, as executive director. ...**Howard Bassen**, the associate chief for engineering in the Department of Microwave Research at the Walter Reed Army Institute of Research, is returning to CDRH after a four-year absence. Bassen will be joining the center's electrophysics branch, but will continue to work for the Army one day a week on EMP measurement and modeling....Dr. **John Dennis**, the assistant director for physical sciences at the U.K.'s National Radiological Protection Board (NRPB), has retired. It is not yet clear who will take over Dennis's work on NIER....**Paul Gailey**, a former EPA engineer more recently with the EC Corp. in Knoxville, TN, has gone back to school. He has joined the doctoral program at the University of Utah's Department of Electrical Engineering, where he will be a student of Professor **Om Gandhi's**. Gailey plans to continue to do free-lance consulting....**Jerry Hellmuth**, the neighborhood organizer and director of the Bucklin Hill School for mentally handicapped children on Bainbridge Island, WA, died on May 10 at the age of 79. In the early 1980s, Hellmuth led a citizens group that blocked a proposed RCA satellite station on the island (see *MWN*, O81 and J/A82).

RESOURCES

Issues in EMFs... Dr. Andrew Bassett, professor emeritus of orthopedic surgery at Columbia University in New York City and a pioneer developer of PEMF therapies, is promoting a major federal research effort on the biological effects of EMFs—with an annual budget on the order of $100 million a year. "Before we start regulating, we need better information on which to base policy," he wrote in the Spring 1990 *Issues in Science and Technology*, in an article titled "Premature Alarm Over Electromagnetic Fields." The editors of the quarterly magazine, which is published by the National Academy of Sciences, asked a number of those participating in the EMF debate to respond to Bassett's article. The Summer 1990 issue features replies from: Dr. Carl Blackman of EPA, Paul Brodeur of *The New Yorker*, Dr. Granger Morgan of Carnegie Mellon University, Congressman Frank Pallone (D-NJ), Dr. Robert Park of the American Physical Society, Dr. Louis Slesin of *Microwave News*, Dr. Thomas Tenforde of the Battelle Pacific Northwest Lab and Morton Winston of NoRad Corp.

STANDARDS

ANSI and CISPR Actions...ANSI recently published an ISM standard on *Recommended Practice for the Measurement of [RF] Emission from Industrial, Scientific and Medical (ISM) Equipment Installed on User's Premises*, ANSI/IEEE 139-1988. Copies are available for $45.00 each from: Sales Department, ANSI, 1430 Broadway, New York, NY 10018....CISPR has issued an IEC draft international standard on *Radio Interference Characteristics of Overhead Power Lines and High Voltage Equipment—Methods for Derivation of Limits for HVDC Lines*, CISPR/C(Central Office)35, September 15, 1990. Copies are available for $18.00 from: ANSI (see above).

VDTs

EEC Regulates VDT Radiation... The Council of the European Communities, which regulates the 12 member states of the European Economic Community (EEC), adopted a directive on May 29 setting minimum health and safety requirements for work with VDTs. The directive specifies that, "All radiation with the exception of the visible part of the electromagnetic spectrum shall be reduced to negligible levels from the point of view of the protection of workers' safety and health." New workstations will not have to comply with the directive until December 31, 1992, and workstations designed before this date will have an additional four years to meet the new standards. Council Directive 90/270/EEC appears in the *Official Journal of the European Communities, 33*, L 156, pp.14-18, June 21, 1990.

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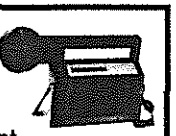
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MICRO WAVE NEWS

Vol. XI No. 4 | A Report on Non-Ionizing Radiation | July/August 1991

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New Support for EMF–Chemical Synergy in Cancer Promotion

Animal and Cellular Data Agree

Extremely low frequency (ELF) magnetic fields can act in concert with toxic chemicals to promote the development of cancer in both live animals and cell cultures, according to new experimental data.

At the *Annual Meeting of the Bioelectromagnetics Society* (BEMS), held in Salt Lake City, UT, June 23-27, Drs. Jack McLean and Maria Stuchly of Health and Welfare Canada in Ottawa, Ontario, announced that 60 Hz magnetic fields and TPA, a known tumor promoter, act synergistically to accelerate the development of skin tumors in mice.

At the same meeting, Dr. Chris Cain of the VA Hospital in Loma Linda, CA, reported that ELF magnetic fields can enhance the action of TPA in cancer cells grown in culture. "It is fascinating that the fields have the same effect in vivo and in vitro," Cain told *Microwave News*. "This may lead us to an understanding of mechanisms of interaction."

The Canadian researchers urged that their findings be interpreted with caution. "These are preliminary results," stressed McLean in an interview. Nevertheless, their data are the first to link ELF magnetic fields to the development of cancer in live animals and thus have already attracted a great deal of interest. The absence of animal data has long undermined the EMF–

(continued on p.12)

Electromagnetic Interference Implicated in Apnea Monitor Deaths

The lifesaving function of apnea monitors—electronic alarms that sound during respiratory failure—can be thwarted by electromagnetic interference (EMI). Low levels of radiofrequency (RF) radiation common in many residential areas and power frequency electromagnetic fields (EMFs) from household appliances can disrupt the monitors.

The failure of apnea monitors has been implicated in scores of fatalities—one model has been linked to at least 70 deaths—and has been the subject of Congressional, Food and Drug Administration (FDA) and General Accounting Office (GAO) investigations.

"It is evident that these monitors need to be redesigned to withstand the ambient field strengths existing in major cities," according to researchers at the FDA's Center for Devices and Radiological Health (CDRH). The agency has issued a warning to the roughly 50,000 users of apnea monitors in the U.S. but will not finalize EMI standards for more than a year.

At least one EMI incident has already led to litigation. In 1989, Michael

(continued on p.13)

« Power Line Talk »

While **EPA**'s Science Advisory Board (**SAB**) concludes its review of the draft report on EMFs and cancer (see p.7), a parallel review by the Committee on Interagency Radiation Research and Policy Coordination (**CIRRPC**) hasn't even begun. White House Science Advisor Dr. **Allan Bromley** ordered the CIRRPC review late last year after persuading EPA to make it a companion to the cancer report (see *MWN*, N/D90). Initially, CIRRPC appointed an outside panel headed by Dr. **Charles Susskind** of the University of California, Berkeley—who is also a member of the SAB panel—but he was soon removed. Now a committee of experts assembled by the Oak Ridge Associated Universities (**ORAU**) has taken over. "This way they can keep the whole business secret," an informed source told *Microwave News*. Diane Flack at ORAU's Washington, DC, office contends that there "is nothing secretive" about the review. Nevertheless, she said that the panel's first meeting in early September will be closed to outsiders. Flack said that she could not tell us who is on the committee but that she would ask the panel's chairman—whom she would only identify as being based in Oak Ridge, TN—to call us. We haven't heard from either of them since. Flack said that the panel hopes to have a draft report within six months. A 1985 CIRRPC review of NIER bioeffects by Dr. **Ross Adey** of the VA Hospital in Loma Linda, CA, was never made public (see *MWN*, N/D85, N/D87 and N/D90).

«« »»

There's more bad news on cancer rates: The National Cancer Institute (**NCI**) reports in its *Cancer Statistics Review, 1973-1988*, that the overall incidence of childhood cancer rose by 4.5% over the 16-year period. The increase was greatest for brain and nervous system cancers among white children, which rose by more than 30%. Leukemia and non-Hodgkin's lymphoma rates were also sharply higher. In an interview with the *New York Times* (June 26), NCI Director of Epidemiology and Biostatistics Dr. **Joseph Fraumeni** said that he thought that "people are less dismissive than they used to be" about the possible relationship between cancer and EMFs. Fraumeni is currently working on a study of childhood leukemia that will include EMFs as a possible risk factor (see *MWN*, J/F89 and S/O89). Previously we reported that the rates of brain cancer for both the elderly and people under 45 have been on the rise (see *MWN*, J/F91).

«« »»

Michigan Rep. **Howard Wolpe** (D) is taking his subcommittee to his home state to learn more about EMFs. A hearing, scheduled for August 6 in Battle Creek, on *EMF and High-Voltage Power Lines: A Case Study in Michigan* is the first of its kind to be held outside of Washington, DC. It will focus on the dispute over a proposed 115-mile, 345 kV transmission line from Battle Creek to Akron, IN (see *MWN*, M/J91). Invited witnesses include Dr. **Leonard Sagan** of EPRI, Dr. **Abe Liboff** of Oakland University in Rochester, MI, **Cathy Smith** of Michigan RAGE, based in Battle Creek, and Dr. **William Farland** of EPA, as well as officials from Consumers Power and local utilities and state representatives. Wolpe, who is chairman of the House Science, Space and Technology Committee's Subcommittee on Investigations and Oversight, wrote to the Federal Energy Regulatory Commission (**FERC**) earlier this year in support of a request by Michigan RAGE that FERC block the line (see *MWN*, M/J91). FERC has since approved the project.

«« »»

The National Association of Regulatory Utility Commissioners (**NARUC**) has endorsed the National EMF Research Program (**NERP**) (see pp.3 and 4). In a resolution adopted July 24, NARUC's executive committee urged member utility commissioners to "encourage public education" about EMFs and to support the NERP. Two of the four members of the NERP steering committee—Chairman **John Coughlin** of Wisconsin and **Michael Wilson** of Florida—are members of NARUC's Committee on Electricity, which initiated the resolution.

«« »»

Architecture magazine's Alex Wilson has some practical advice for designing low EMF homes and offices. In the July issue, he writes that, when possible, structures should be located at least 500 feet from high voltage transmission lines. Wilson also suggests that all incoming conductors be placed close together and that major electrical equipment, such as elevator and HVAC motors, be far from occupied spaces.

«« »»

New York City Mayor **David Dinkins** is concerned about EMFs. In a March 6 letter to EPA Administrator **William Reilly**, Dinkins called on EPA to lead a strong research program, to standardize EMF testing procedures, to formulate exposure standards and to sponsor a meeting for the public. In reply, EPA has scheduled a workshop on measurements and bioeffects for August 14-15 in Albany and a public meeting for October 9 in New York City....New Yorkers are especially concerned over the threat posed by EMFs from **substations**. The City Council held a hearing on June 18 and has promised further action.

«« »»

"How risky are EMFs?" was the question posed to Dr. **Gilbert Omenn**, dean of the school of public health at the University of Washington, Seattle, and the chair of **EPRI**'s EMF scientific advisory panel, at an electric industry seminar. "I have to rank [EMFs] with eating peanut butter" on the spectrum of public health risks, Omenn replied, according to Cyrus Noë, writing in *Clearing Up* (July 3, 1991), a Pacific Northwest utility newsletter. Omenn was referring to aflatoxin, a carcinogenic fungus sometimes found in peanuts.

Commentary

EMF Research: Who's in Charge?

There is one point on which all sides of the EMF debate agree—the need for more research. But even with this unanimity of opinion, there is little hope that a comprehensive research program will begin anytime soon.

The momentum for a National EMF Research Program (NERP) has been building since James Cunningham of the New York Power Authority (NYPA) raised the idea at a congressional hearing in March 1990. All the major industry players—APPA, EEI, EPRI, ESEERCO, LPPC, NEMA, NPPA*—have now endorsed a $20-30 million, three-to-five-year effort to produce "reliable, credible and impartial" results, jointly sponsored by government and industry.

What is missing is government leadership. EPA has just issued a new report with a wish list of 32 high priority EMF projects (see p.9). The DOE has asked for more money for its own research program. And even Dr. Allan Bromley, the President's science advisor—an outspoken skeptic of EMF risks—has conceded that "much remains to be done." Yet none of these government offices has spoken up in favor of the NERP, leaving the states and the utilities to take the lead.

Two key questions remain: Who will run the NERP? And, who will decide who runs it?

Not long ago, it appeared that the Health Effects Institute (HEI) would lead the NERP, but that now seems less likely. HEI has left itself vulnerable to allegations that its asbestos research program (HEI-AR) is tainted by a pro-industry bias. This spring, the National Association of Attorneys General (NAAG) adopted a resolution that expressed "deep concern" that HEI-AR "is incapable of producing an objective, unbiased report...." The NAAG pointed out that HEI has consistently refused to take steps to mitigate these concerns.

Instead of trying to put these charges to rest, HEI President Dr. Andrew Sivak has allowed them to fester. Now, somewhat embarrassed, many NERP backers are distancing themselves from HEI. The NAAG resolution may be what prompted the New York State Department of Public Service to set up a steering committee to establish and oversee the NERP and to reopen the search for an organization to run it (see p.4). In contrast to HEI's desire to restrict attendance at its meetings (see p.5), the steering committee's first action was to open all its deliberations to the public. The committee has already drafted a conflict of interest policy.

Many utilities have endorsed the NERP—some have pledged allegiance directly to HEI. The Los Angeles Department of Water and Power has already given HEI $300,000; Seattle City Light has contributed a lesser amount. (These two utilities, together with the NYPA, were among the original backers of the NERP.) At the same time, others wonder why they should pay for HEI to make up for its lack of EMF experience and why the institute has hired a consulting firm, Gradient Corp., which has other industry EMF clients.

Most utilities will probably follow the NERP steering committee's lead. By federal default, state regulatory officials are calling the shots, and they may deny the power companies the right to charge their rate payers for HEI contributions if it is not designated as the administrator of the NERP.

One persistent refrain heard from all sides is: "Where is EPA?" Not long ago, EPA had the premier EMF research group in the world, but it was disbanded by the Reagan Administration, and now the agency appears utterly incapable of taking on EMFs. A student of bureaucracies would be amazed that an agency would refuse a new multimillion-dollar program. When Congress recently gave EPA $750,000 for EMF research, the agency turned around and gave $525,000 to HEI. The fact that an HEI alumnus, Dr. Ken Sexton, is the director of EPA's Office of Health Research no doubt helps HEI's prospects.

Today, a year after EPA released a draft report linking EMFs to cancer, the agency is still not supporting a single EMF experiment in its own labs—despite its new document calling for a slew of research projects. When the NERP committee invited EPA to explain how it would run the EMF research program, the agency declined to comment.

Much of the responsibility for EPA's paralysis lies with Dr. Erich Bretthauer, the assistant administrator for R&D. A political appointee, Bretthauer is the one who was summoned to the White House when the Bush Administration panicked about the political and economic implications of EPA's cancer report (see *MWN*, N/D90). Clearly, Bretthauer wishes the EMF controversy would go away, but even he realizes that this won't happen. Instead, he wants to hand over the responsibility to HEI—and keep EMFs at arm's length. (When questioned about EPA's commitment to HEI, the official line is that "no decisions have yet been reached.")

Those who look to Congress for a resolution will be disappointed. Rep. Frank Pallone's (D-NJ) funding bill is going nowhere. A number of senior members of the House of Representatives have shown an interest in EMFs, but most are content to hold hearings rather than to press for action. For some unexplained reason, Reps. George Brown (D-CA) and James Scheuer (D-NY) have endorsed the idea of farming out EMF research to an organization outside the government—perhaps HEI.

Everyone's patience is running out: The organizational issues are simple compared to the unresolved scientific questions and the slow start does not bode well for finding any answers soon. Dr. Genevieve Matanoski, the chair of the Science Advisory Board's EMF panel, predicted that the only way to win the public's confidence is to put the research in the hands of the National Institutes of Health. She is clearly on the right track: There will be no real progress until the federal government starts to do its job.

* American Public Power Association (APPA), Edison Electric Institute (EEI), Electric Power Research Institute (EPRI), Empire State Electric Energy Research Corp. (ESEERCO), Large Public Power Council (LPPC), National Electrical Manufacturers Association (NEMA), Northeast Public Power Association (NPPA).

Telephone Linemen Study Now Finds ELF–Leukemia Link

A major epidemiological study from Johns Hopkins University (JHU) in Baltimore, MD, indicates that some telephone linemen exposed to extremely low frequency (ELF) electromagnetic fields (EMFs) had higher death rates from leukemia than other telephone company employees.

Drs. Genevieve Matanoski, Patrick Breysse, Elizabeth Elliott and colleagues at JHU's School of Hygiene and Public Health compared the records of 124 male AT&T workers who had died of acute myelogenous leukemia between 1975 and 1980 with those of 337 matched controls.

Speaking at the *Annual Meeting of the Bioelectromagnetics Society* in Salt Lake City, UT, on June 24, Matanoski reported that, "The risk is greatest for the younger workers," explaining that there is a latency period before the leukemia is observed and that early exposures are important. In a background paper, the Electric Power Research Institute (EPRI), which funded the study, noted that "some relatively high odds ratios" were seen when a 10-15-year latency period was taken into account.

"There is some suggestion of a trend of increased risk with increased exposure," Matanoski said in an interview. Exposure was estimated using a "score" defined as the product of the average daily exposure and the number of years on the job. Those workers with a higher-than-median exposure score had a 2.5 times greater risk of dying of leukemia than those with lower exposure scores.

The association was greater when peak—rather than median—EMFs were used to gauge exposures. Also, when workers were assigned to one of four categories of peak exposures, there was a trend toward higher leukemia risks with increasing exposures. Cable splicers and central office technicians who used older switching equipment had the highest peak EMF exposures.

The results counter the preliminary conclusions of no increased leukemia risk reported by Matanoski in 1988 (see *MWN*, N/D88). "There has been a change," Matanoski told *Microwave News*, explaining that on reviewing the raw data she had found a number of misclassified exposures. When these were corrected, the higher risks were identified. She noted that her data set is still incomplete.

The elevated risk among young workers is supported by a related study on leukemia incidence—in contrast to mortality—by the same JHU researchers. In that effort, first reported in 1989, they observed that young cable splicers had significantly higher rates of leukemia and lymphoma—as well as all types of cancer—than other telephone workers (see *MWN*, N/D89).

Magnetic field measurements taken in 1988-89 among telephone employees showed that average (and peak) exposures were 4.3 (99.2) mG for cable splicers, 2.5 (21) mG for central office technicians, 1.7 (31) mG for installers, 1.6 (26.9) mG for outside plant technicians and 1.5 (29.1) mG for non-linemen.

New National EMF Research Committee Established

A committee of government officials is being assembled to coordinate a $20-30 million National Electromagnetic Field Research Program (NERP). The New York State Department of Public Service (NYDPS) is setting up the committee, with the assistance of the Large Public Power Council (LPPC), to oversee a research effort to be funded jointly with private and public funds.

The NERP is the product of the independent efforts of the NYDPS to follow up on both the New York Power Lines Project (see *MWN*, N/D88) and the LPPC's call in March 1990 for a joint private–public effort (see *MWN*, M/J90).

The steering committee's first task is to select an organization to administer the NERP. The administrative organization will, in turn, select the studies to be funded, operate the project day-to-day and oversee the scientific review of research results. At the moment, the NERP will only investigate extremely low frequency (ELF) electromagnetic field (EMF) effects.

At the NERP committee's first meeting, held June 27-28 in Washington, DC, committee member Susan Tierney stressed that the program must be free of real and perceived conflicts of interest. This is "one of the most important objectives of this panel," she said. Tierney is the Massachusetts secretary of environmental affairs.

John Coughlin, a Public Service commissioner in Wisconsin, is the chairman of the committee. The other members are Charles Imbrecht, chairman of the California Energy Commission, and Michael Wilson, a Public Service commissioner in Florida. (Imbrecht and Wilson could not attend the meeting but sent representatives in their places.) The steering committee expects to add four to six members, including federal officials and, possibly, representatives from citizens' groups, according to Larry DeWitt of the NYDPS.

At the meeting, the committee heard presentations from three of the organizations that the NYDPS had identified as possible administrators of the NERP: the Health Effects Institute (HEI), based in Cambridge, MA; the National Research Council (NRC), an arm of the National Academy of Sciences; and the Institute for Evaluating Health Risks (IEHR)—the latter two are in Washington, DC. Only HEI showed a serious interest in running the program.

Both NRC's John Burris and IEHR's Jack Moore said that their organizations would be interested in helping develop a

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research agenda but that HEI would be better qualified to administer the overall program.

The NYDPS had invited the Environmental Protection Agency (EPA) and the Department of Energy (DOE) to make presentations, but both declined.

The committee members grilled HEI over its controversial asbestos research program (HEI–AR). They were particularly concerned about the National Association of Attorneys General's condemnation of HEI–AR's refusal to answer allegations of conflicts of interest (see p.3). In interviews with *Microwave News*, a number of NYDPS staffers expressed deep concern about HEI's ability to run an open and objective EMF research program. They stressed that HEI might not be selected if the charges cannot be resolved.

At the meeting, DeWitt publicly stated that, "We have to be as concerned with the problem of appearance of a conflict" as with actual conflicts.

New York Power Authority Senior Vice President James Cunningham, who has led the LPPC effort to set up a national research program, urged the committee to act quickly: "I am sure that all utilities, businesses and individuals who have had to deal with this issue...believe it is absolutely essential that this study begin soon." Chairman Coughlin said that the panel will work "as rapidly as possible, but we don't want to get off to a false start."

The steering committee is scheduled to meet again on September 12 in Washington, DC.

HEI Moves Forward in Bid for EMF Research Program

Moving aggressively in its bid to run a national electromagnetic field (EMF) research program, the Health Effects Institute (HEI) convened a group of scientists to evaluate research needs on June 11-12 in Boston, MA. HEI, based in Cambridge, MA, is the leading contender to run a multimillion-dollar, multiyear research effort to be funded by federal and state governments and by the utility industry (see *MWN*, M/A91 and pp.3 and 4).

Dr. Richard Setlow of the Brookhaven National Labs in Upton, NY, the chairman of HEI's 13-member feasibility study committee, said that his panel is seeking to provide the institute with "an informed idea of how an HEI research program would advance our understanding" of EMF health effects. The committee will prepare brief reports identifying key scientific questions and potential research projects. A second, 12-member observers committee will review the documents and provide guidance. (For a list of members of the feasibility committee, see *MWN*, M/J91.)

Once the two EMF committees have made their recommendations, the institute's independent advisory committee will select the projects to be funded, according to HEI President Dr. Andrew Sivak. In an interview with *Microwave News*, Sivak said that he may ask some members of the feasibility and observers groups to serve on the advisory committee to make up for its lack of expertise in physics, engineering and endocrinology.

HEI and the Press

A recurring concern that has dogged HEI is the lack of openness of its research program (see p.3). When NIST's Misakian asked Sivak if HEI would prohibit researchers from talking to the press before their work is peer-reviewed, Sivak replied, "We don't go public until our review process is done." He then said, "We'll have to think about it for our management in the future." HEI would not prevent an investigator from presenting data at a meeting prior to publication, he noted.

Sivak initially denied *Microwave News* permission to cover the June meeting, stating that he thought the presence of the press would inhibit "candid, open discussion" among the committee members (see *MWN*, M/J91). He later relented, putting the issue to a vote at the opening of the session. However, he indicated that the August 26-27 meeting, at which research priorities will be decided, would be closed.

A number of the committee members made presentations on EMF research efforts in the U.S. and in the U.K.: Dr. Larry Anderson on the Battelle Pacific Northwest Lab's programs; Dr. Gary Boorman of the National Institute of Environmental Health Sciences on the National Toxicology Program's upcoming animal studies (see *MWN*, S/O90); Dr. Brian Maddock of the U.K.'s National Grid Co. on research in the U.K.; Dr. Russel Reiter of the University of Texas Health Science Center, San Antonio, on his EMF–pineal and melatonin research; Dr. Bonnie Richter on the Department of Energy's plans for in-house epidemiological studies; Dr. Walter Rogers of the Southwest Research Institute on behavioral effects; Dr. Jeffrey Saffer of the Jackson Laboratory on cell and molecular experiments; Dr. David Savitz of the University of North Carolina on epidemiology; and Dr. Stan Sussman on the Electric Power Research Institute's programs.

HEI has received $525,000 from the Environmental Protection Agency, $125,000 of which will be used for the feasibility study. Sivak said that in the next fiscal year, HEI hopes to get $800,000-$1 million for research.

When feasibility committee member Dr. Martin Misakian of the National Institute of Standards and Technology (NIST) in Gaithersburg, MD, expressed concern over HEI's administrative costs, Sivak assured him that HEI's overhead will be about 12% (see p.9). Misakian suggested that HEI use the New York Power Lines Project as a model, citing the project's minimum overhead and good quality control.

HEI will hold a second meeting August 26-27 at its headquarters to review committee reports and to design a research strategy. Setlow, Sivak and Dr. Peter Valberg of Gradient Corp. will then draft a research proposal to take to the HEI board. Gradient Corp., also in Cambridge, is coordinating the feasibility study for HEI.

Sivak said that the feasibility committee's report and the independent advisory review will be published by HEI in late October or early November.

Parents Sue Utility Over Child's Kidney Cancer

A San Diego, CA, couple is suing San Diego Gas & Electric Co. (SDG&E), charging that electromagnetic fields (EMFs) from distribution and transmission lines caused their daughter to develop kidney cancer. In a suit filed on May 29 in California Superior Court in San Diego, Michelle and Ted Zuidema also contend that the power lines lowered the value of their house, which they sold in 1990.

The Zuidemas allege that their four-year-old daughter, Mallory, developed Wilms' tumor and nephroblastomatosis as a result of EMF exposure in utero. "Mallory Zuidema's fetal development was adversely affected, her cells and chromosomes were altered and she developed cancer," the suit charges. At approximately 26 months of age, Mallory had seven golf ball-sized tumors removed from her kidneys, according to one of the family's attorneys, Frederick Schenk of Casey, Gerry, Casey, Westbrook, Reed & Hughes in San Diego.

One side of the family's former home is about 15 feet from a 12 kV distribution line. Michelle Zuidema reportedly often slept on a sofa at the corner of the house closest to the line during her pregnancy. The house also is 80 feet from a right-of-way for five transmission lines (three 69 kV lines, one 138 kV line and one 230 kV line).

After measurements inside their home revealed magnetic fields of 3.5-17 mG, the Zuidemas moved from the house in early 1990 and sold it later in the year. The selling price was $150,000—$50,000 more than they paid in 1985 but $50,000 less than what they claim the house was worth. According to another of the Zuidemas' attorneys, Michael Withey of the Seattle, WA, firm of Schroeter, Goldmark & Bender, the family had notified prospective buyers of the EMF levels, in accordance with California laws. The house was sold to a group of investors led by Ted Zuidema's brother, and it now is being rented by a family with no young children.

Withey and Schenk are working on the case with Aaron Simon of Kazan, McClain, Edises & Simon in Oakland, CA. Withey and Simon are members of the Electromagnetic Radiation Case Evaluation Team (EMRCET), a national network of ten lawyers working on EMF-related cases (*see MWN*, M/A91).

The Zuidemas are seeking an unspecified award on the grounds of emotional distress, negligence, nuisance, product liability and trespass.

SDG&E responded on July 5 with a motion to dismiss the suit. The utility is arguing that the California Public Utilities Commission (PUC) has sole jurisdiction over power line EMF health effects: "The PUC's assertion of jurisdiction on the question of potential health effects associated with electric and magnetic fields is binding on the court and requires the dismissal of this action." The PUC is currently studying EMF health effects (see *MWN*, J/F91) and held a public hearing on July 26. A second hearing is scheduled for August 26 in San Francisco.

SDG&E also seeks dismissal on numerous technical grounds, including the allegation that the Zuidemas' suit was not filed until after the statute of limitations expired for several of the counts. According to the utility, Judge Ben Hamerick will rule on the motion on August 23 without hearing oral arguments from either side.

An SDG&E spokesman would not discuss the specifics of the suit. But in a telephone interview, John Dawsey, a senior environmental analyst with the utility, said that EMF biological effects are a "bona fide scientific issue," adding that nothing in the scientific literature would support the type of claim made by the Zuidemas.

John Britton of SDG&E's public relations office said that more than half of the calls and letters he receives about EMFs are concerned with property values.

Alabama Family Seeks $750 Million for EMF Risks

A family is seeking $750 million from the Alabama Power Co. for physical injury, risk of cancer, mental anguish and punitive damages. Johnnie and Sharon Allen, whose property is traversed by a 230 kV transmission line which was built in 1989, contend that the utility intentionally misled them into believing that reports of health risks from EMFs were unfounded.

In their suit, filed May 3 in the Circuit Court of Jefferson County, AL, the Allens charge that Alabama Power "has engaged in a pattern and practice of concealing the dangers of EMFs from them and from the public generally." The Allens are being represented by Bill Thomason of the Bessemer, AL, law firm Paden & Thomason, and Clay Ragsdale of the Birmingham, AL, law firm Starnes & Atchison.

Alabama Power, in a written response to interrogatories from the Allens' lawyers, states that, "It is our understanding that the preponderance...of the credible scientific evidence does not support any cause–effect relation between exposure to [extremely low frequency] EMFs and health problems." The utility filed its response on June 24.

The Allens built their home in September 1987. In August 1988, Alabama Power began condemnation proceedings after the two sides were unable to reach an agreement on the sale of land that the utility wanted to use for a right-of-way. During their negotiations, according to the Allens, a utility official told Johnnie Allen that "the claims made by the super environmentalists and liberals that the transmission lines presented a danger were entirely frivolous" and that he should not be concerned about them.

The suit argues that the utility is liable for negligence, loss of property value, emotional distress, nuisance, fraudulent concealment of its knowledge of EMF risks and strict liability. In addition, the Allens are seeking an injunction to stop the operation of the line.

Australia and U.K. To Begin Major Childhood Epi Studies

Researchers in Australia and in the U.K. will soon start large-scale epidemiological studies on the possible link between power line electromagnetic fields (EMFs) and childhood cancer.

In Australia, Dr. Michael Repacholi of the Royal Adelaide Hospital will coordinate a study for the Australian Radiation Laboratory in Yallambie. The study will include 500-1,000 cases of all types of childhood cancer, with special emphasis on brain tumors and leukemia, Repacholi told *Microwave News*.

The Electricity Commission of New South Wales will sponsor the study, which is expected to cost $1.5 million (Aus.)—about $1.2 million U.S.—and to take three to five years to complete.

"This effort is a response to the Gibbs inquiry's recommendation for more research," Repacholi said. In February, Sir Harry Gibbs, a former High Court Chief Justice, concluded that the link between EMFs and health effects is inconclusive but recommended prudent avoidance and more research (see *MWN*, M/J91).

In the U.K., the Coordinating Committee on Cancer Research, based in London, is developing its own childhood cancer–EMF epidemiological study, according to Dr. Brian Maddock of The National Grid Co. This study "is still in the planning stages," Maddock told *Microwave News*.

The National Grid Co., which operates the transmission lines in the U.K. and is based in Leatherhead, will assist with the study's magnetic field measurements, and the National Radiological Protection Board will play a technical role, Maddock said.

In an epidemiological study published in late 1990, Dr. A.D. Clayden and coworkers at the U.K.'s University of Leeds reported finding no association between EMFs and childhood cancer, though the exposures were extremely low—below 0.1 mG (see *MWN*, J/F91).

State and Local EMF Actions: Recent Developments

Connecticut...Senate Majority Leader Cornelius O'Leary's SB 633, mandating that public utilities contribute $150,000 to the state's EMF Task Force, passed both branches of the legislature and was signed into law by Governor Lowell Weicker on June 25. The funds will be used to hire experts to develop a policy of prudent avoidance and for an EMF literature review to set state research priorities (see *MWN*, M/J91). The task force must submit an interim report to the legislature by February 1, 1992.

Oregon...The House of Representatives and the Senate approved Senator Grattan Kerans's SB 861 by votes of 57-1 and 21-0, respectively, and Governor Barbara Roberts signed it on July 11. The bill requires the state's Energy Facility Siting Council to form a committee of representatives from the public, utilities and government to monitor EMF research and to report back to the council and to the legislature (see *MWN*, M/J91). The law will take effect on September 29.

Rhode Island...The proposed statewide three-year moratorium on construction of transmission lines above 60 kV, introduced by Rep. Steve Hernandez (H-5016) and by Senator Michael Lenihan (S-26), passed 74-1 in the House of Representatives, but was tabled by the Senate. Despite this setback, the bill "probably had the support to pass the Senate if it had come to a vote," Hernandez told *Microwave News*. He said that the bill will be reintroduced in the next legislative session, which starts in January. On July 2, Governor Bruce Sundlun announced that a newly appointed EMF task force, chaired by Scott Wolf, an aide to the governor, will consider the moratorium. Meanwhile, RI Superior Court Judge Patricia Hurst has stayed her decision to nullify a local power line moratorium in East Greenwich, and the case will be heard by the state Supreme Court. Until the high court ruling, which is not expected until next year, the Narragansett Electric Company will be forced to delay construction of the East Greenwich portion of a new 115 kV line, a company spokesman told *Microwave News*. (See also *MWN*, N/D90, J/F91 and M/J91.)

HIGHLIGHTS

SAB Panel Calls for Rewrite of EPA EMF–Cancer Report

The Environmental Protection Agency's (EPA) draft report on cancer and electromagnetic fields (EMFs) has "serious deficiencies and should be rewritten," an EPA Science Advisory Board (SAB) panel has recommended. At the same time, the panel members issued a unanimous statement that the question of EMF biological effects is "important and exceptionally challenging."

As expected, the members of the SAB's Non-Ionizing EMF Subcommittee asked EPA to tone down its conclusion that EMFs are a "possible, but not proven, cause of cancer in humans." Instead, they counseled that, "Currently available information is insufficient to conclude that [EMFs] are carcinogenic."

By the end of its third—and final—meeting, held July 23-25 in Crystal City, VA (outside of Washington, DC), the SAB panel had completed its review of EPA's draft report, *Evaluation of the Potential Carcinogenicity of Electromagnetic Fields*, for EPA Administrator William Reilly. Previous meetings were held in January and April (see *MWN*, J/F91 and M/J91).

EPA's Dr. Robert McGaughy, the principal author of the EPA cancer report, called the panel's advice "comprehensive and very authoritative." In an interview, he said that, "We're really pretty much in agreement with their evaluation." EPA sources told *Microwave News* that rewriting the report could take up to a year.

While the panel paid the most attention to power frequency EMFs, the members issued a special warning on radiofrequency and microwave (RF/MW) radiation "hazards," recommending that EPA resume work on its stalled RF/MW exposure guidelines (see *MWN*, S/O88 and box on p.8).

Among the other conclusions reached by the panel were:

- The carcinogenicity of EMFs should not be classified using the system devised for chemicals because of "major uncertainties."

• "There is insufficient information to designate specific values of magnetic field strength that may be hazardous to human health."
• "The epidemiological evidence is suggestive of an association between surrogate measurements of magnetic field exposure and certain cancer outcomes." But the lack of clear exposure information and of an understanding of key exposure parameters combined with a limited understanding of potential mechanisms "weakens the inference of cancer causality from these associations."
• The incidence of cancer may be affected by non-mutagenic agents which do not interfere directly with DNA—for example, hormone imbalances caused by disruptions in the pineal gland's melatonin cycle (see *MWN*, J/A90).
• "If effects on living systems at lower fields do occur, the assumptions leading to estimations of physical constraints for effects on isolated small spherical cells...may not be applicable to larger cells or cell systems such as neurons or neuronal networks."

Several panel members raised other concerns:
• Dr. Genevieve Matanoski of Johns Hopkins University in Baltimore, MD, the chair of the panel, noted that EPA should have integrated the human epidemiological data and the biological data to reach general inferences about EMF risks.
• Dr. Bary Wilson of the Battelle Pacific Northwest Lab in Richland, WA, emphasized the importance of exposure parameters such as transients and time-varying fields, arguing that the issue should be brought directly to the attention of the EPA administrator and not be buried in the report.
• Prompted by the public testimony, Dr. Nan Laird of the Harvard University School of Public Health in Boston, MA, pointed out that neither the subcommittee report nor EPA's research

SAB Conclusions and Recommendations on EPA's EMF–Cancer Report

The SAB's EMF panel is finalizing its critique of EPA's EMF–cancer report. The following excerpts include revisions made at the July 23-25 meeting.

Currently available information is insufficient to conclude that [EMFs] are carcinogenic. Human epidemiologic data report an association between surrogates for [EMF] exposure and an increased incidence of some types of cancer, but 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....

Some of the in vitro and in vivo data on unmodulated RF have suggested the existence of mechanisms by which human health effects, but not carcinogenicity, may be inferred. Both unmodulated and ELF-modulated RF fields of sufficient intensity can give rise to thermal effects. Non-thermal biological effects also have been reported in animals exposed to RF fields. It is well established that in vitro and in vivo experiments on ELF have shown non-thermal biologic effects at fields of moderate intensity and there are suggestive effects at lower levels. Furthermore, ELF-modulated RF fields assumed to be non-thermal can produce many of the biological effects of ELF fields alone. Hypothetical constructs relating observed biological effects to possible health effects (specifically, increased cancer risk) have been delineated. However, there are at present insufficient data on many of the critical steps in the linkage to infer causality on the basis of animal or cellular data....

[T]he EPA has not evaluated how the findings on biological effects and non-ionizing field and tissue interaction mechanisms relate to the interpretation of human studies. The strength of epidemiologic data depends on identification of supporting evidence from in vitro and in vivo data. This has not been developed in the report. The critiques of studies of biological effects are contained in the discussions of the several chapters....

The heading of chapter 5, *Supporting Evidence of Carcinogenicity*, is inappropriate. The interpretation of the biological effects in the in vitro systems as presented by the report does not make a case for carcinogenicity. Specific individual experiments need critical review....

Non-ionizing [EMFs] should not be classified together under the EPA's chemical carcinogenesis system because of present major uncertainties. These involve an incomplete understanding of which aspects of field–tissue interactions give rise to biological effects. Properties of the various [EMFs] such as phase angle, polarization, transients and frequency range may contribute to different biologic effects. For these reasons, the use of the EPA's classification scheme at this time would be inappropriate and confusing....

There is insufficient information to designate specific values of magnetic field strength that may be hazardous to human health for two reasons. a) There is insufficient evidence from the human epidemiology data and from animal/cell experiments to establish unequivocal cause-and-effect relationships between low frequency EMF exposure and human health effects and cancer. b) The precise nature of the environmental low frequency EMFs potentially related to human disease remains to be elucidated. In addition to field strength, parameters such as the time-varying nature of the magnetic fields and the relevant time/exposure parameters need to be determined.

The subcommittee also wishes to express two specific policy recommendations that in its view follow inescapably from the scientific recommendations....:

Policy Recommendation No.1: The subcommittee is unanimous in its belief that the question of [EMF] effects on biological systems is important and exceptionally challenging; and that the subcommittee's advice to the EPA should be that the report should be rewritten by EPA, and then rereviewed by the Science Advisory Board.

Policy Recommendation No.2: EPA should complete its efforts with regard to RF [EMFs] (including [MWs]) and issue exposure guidelines independent of present issues pertaining to lower frequencies. The current EPA report inadvertently leads even the careful reader to conclude that the potential carcinogenicity of [EMFs] of ELF (i.e., power line) frequencies is the only—or at least the principal—subject of concern with regard to non-ionizing fields. Such a conclusion would reinforce the skewed and somewhat sensationalized picture presented to the public in recent years by the news media and government agencies responding to this publicity. The report should therefore declare explicitly that the attention given to non-ionizing [EMFs] derives in the first place from long-standing concern over the hazards of RF (including [MW]) radiation. EPA has expended substantial resources on the study of such radiation over a period dating back to the EPA's inception, and EPA should complete its efforts directed toward the issuance of RF exposure guidelines. RF fields present long-known and well-understood hazards against which users and the general public must be warned and protected.

Childhood Brain Tumor Cluster in West Virginia

Five children living near a 345 kV transmission line have developed brain cancer in the last two years, according to Dr. Martha Gelderman, a family practitioner in Union, WV. In a presentation to the SAB panel, she pleaded for assistance. "We have nowhere to turn for help," she said.

Gelderman said that the five cases occurred in a rural school district serving 1,000 children. SAB panel Chair Dr. Genevieve Matanoski, an epidemiologist, called the numbers "overwhelming."

People are staying home at night reading the EPA EMF–cancer report looking for answers instead of watching television, Gelderman told the panel. "They're afraid for their children," she said. She urged the subcommittee to help "humanize" the report and called for a clearinghouse where average citizens could get accurate information.

Dr. Gayle Sharp, also from Union, told *Microwave News* that there are transformers outside of every home in the rural area and that there are three transformers within 50 feet of the home of a 12-year-old girl who recently died of brain cancer. Sharp added that the community is trying to stop a proposed 765 kV line.

A growing number of studies have linked EMF exposures at home and at work to the development of brain tumors (see *MWN*, M/A90).

agenda adequately address the public's concerns. She argued that it is "irresponsible" to say that there is something to investigate without providing guidance. Many panelists agreed that EPA should issue a citizen's guide on EMF risks. In a statement, John Rice and Sandy Travis of Annapolis, MD, who had blocked the expansion of an electrical substation, noted that EPA's draft report was essentially the only guidance they had.

• Matanoski and Dr. Charles Susskind of the University of California, Berkeley, both spoke in favor of a government-coordinated national research program. "You're not going to solve the problems of public perceptions until you put the research into the hands of the National Institutes of Health," Matanoski said. Susskind pointed out, "It would be far better for this work to be coordinated by a government agency such as the National Institute of Environmental Health Sciences."

Near the end of the meeting, some panelists expressed reservations about the prospect of the Health Effects Institute's (HEI) proposed public–private research effort (see pp.3 and 5). "HEI has absolutely inadequate experience and credentials" in EMF research, Bary Wilson said. Susskind noted that HEI's overhead costs would take a "substantial bite" out of the research budget.

In an attempt to allay these concerns, HEI's Dr. Andrew Sivak stated that HEI's strength lies in its ability to "bring together and work with key people in the field" rather than "in our knowledge and experience." He said that the institute's overhead is about 14% (see p.5).

Speaking in support of HEI, panelist Dr. Granger Morgan of Carnegie Mellon University in Pittsburgh, PA, argued that EPA has had "extraordinary difficulty" in sustaining its research efforts, and that HEI would provide a "buffer" enabling the agency to engage in long-term research. He noted, however, that he would not want the HEI project to divert funds from existing federal EMF programs. "I will be very unhappy about that outcome," he said.

The last panel meeting, originally scheduled for September 9-10, has been canceled. Although some of the revisions were not finalized, the panel will complete its work by mail. (For a complete list of the members, see *MWN*, M/J91.)

The SAB Radiation Advisory Committee (RAC), the panel's parent group, will consider the panel's report at a September 20 meeting. If the RAC gives its approval, the SAB executive committee will review the report at its October 29-30 meeting.

SAB Panel Critical of EPA's EMF Research Strategy

The Environmental Protection Agency's (EPA) plan for research on electromagnetic field (EMF) effects drew a barrage of criticism when it was released to members of the agency's Science Advisory Board (SAB) EMF panel at a July 23-25 public meeting in Crystal City, VA.

The report, *A Research Strategy for Electric and Magnetic Fields: Research Needs and Priorities*, lists 32 specific recommendations for future studies. It was prepared at the request of EPA Administrator William Reilly by a working group under the direction of Dr. Joe Elder of EPA's Health Effects Research Laboratory in Research Triangle Park, NC. The strategy was intended as a companion to the EPA EMF–cancer report, which is being reviewed by the SAB panel (see p.7).

EPA assigned the highest priorities to research on cancer, biophysical mechanisms of interaction and exposure assessment. Studies of reproductive and developmental effects as well as of nervous system effects were labeled as "medium" priorities, with research on immune system effects and control technology as "low" priorities.

Many of the SAB panelists argued that the research recommendations are too sweeping and lack focus. "It's not a useful document," said Dr. Richard Wilson of Harvard University in Cambridge, MA. "I think the only thing missing is lower back pain," commented Dr. Kelly Clifton of the University of Wisconsin, Madison.

The panel members charged that EPA has failed to explain how the research would be done. "While the document as it stands is not a work plan, the broad implementation of EPA's research agenda should be delineated," said Dr. Karim Ahmed of Princeton, NJ. "They must address implementation," agreed Dr. Genevieve Matanoski of Johns Hopkins University in Baltimore, MD, the chair of the SAB panel.

A number of the SAB panelists asked why EPA has not been

more explicit about its role and that of the Health Effects Institute (HEI) (see pp.3 and 5). "Who is intended to do the research?" asked Dr. Mary Ellen O'Connor of the University of Tulsa, OK, noting that, "EPA has no [EMF] research program." Dr. Charles Susskind of the University of California, Berkeley, wondered aloud why the draft says nothing about implementation when it was clear that "considerable thought [had] already [been] given to it at EPA."

Dr. Ken Sexton, the director of EPA's Office of Health Research, tried to defuse the criticism by suggesting an alternative title for the report: *A Research Domain for [EMFs]: Research for Health Effects from an EPA Perspective.* He later explained that, "We made a serious mistake by not clarifying that the nature of the document had changed during the [development] process." He said that "no decision has yet been made" as to whether EPA or some other organization, such as HEI, would do the research.

Many senior EPA officials clearly see the research report as controversial. In a June 26 presentation on the EPA strategy at the Bioelectromagnetics Society meeting in Salt Lake City, UT, portions of Elder's slides were deleted, even though the report had already been printed and was ready for distribution.

Susskind, who was a member of a previous SAB panel on radiofrequency and microwave (RF/MW) radiation health effects, observed that that panel had also assembled a research strategy in 1984 (see *MWN*, J/F84). "We haven't heard anything since then—I wish you good luck with your current strategy," he told Sexton in Crystal City.

Dr. Granger Morgan of Carnegie Mellon University in Pittsburgh, PA, called the draft "a C- effort that could be edited [at best] into a C+." He recommended that, "The document needs to place a greater emphasis on the importance of developing a basic scientific understanding [of EMF interactions]." Dr. Clark Heath of the American Cancer Society in Atlanta, GA, also argued that EPA should emphasize "the more fundamental and far-reaching need of furthering our basic understanding of biologic effects and mechanisms. Without such basic knowledge, research regarding cancer risks and exposure parameters is likely to remain shallow."

The report addresses EMFs up to 500 kHz: "Although exposure to EMFs at frequencies above [500 kHz] is also a health concern, the lower range is emphasized because of the heightened concern for possible health effects from exposure to 60 Hz EMFs from power lines and to commonly used devices in the home and workplace...." EPA states that the draft report comes in response to "widespread media attention" and "public and private concerns."

Some of the research priorities listed by EPA are:

- Evaluation of confounding factors which may distort the EMF–health effects association suggested in epidemiological studies.
- Examination of populations exposed to other than electric power frequency (50/60 Hz) EMFs.
- Animal research to determine whether EMFs can induce cancer.
- Studies of EMF effects on the behavior of laboratory animals, emphasizing learned tasks and drug interactions.
- Confirmation of EMF effects on immune response in vitro.
- Analysis of EMF interactions to determine whether biological effects are due to currents induced by time-varying magnetic fields, and whether currents induced by electric fields have categorically different effects than those produced by magnetic fields.
- Development of models of possible mechanisms of interaction, including evaluation of exposure characteristics reported to have therapeutic action in biological systems.
- Identification of sources of electric and magnetic field exposures.
- Training of individuals responsible for field measurements and the development of measurement protocols.
- Three-dimensional maps to characterize EMFs from residential appliances and industrial equipment.
- New materials to shield magnetic fields and mitigate exposures.

Canada Issues RF/MW Exposure Standard

The Canadian government has published its revised limits for occupational and public exposures to radiofrequency and microwave (RF/MW) radiation in the 10 kHz-300 GHz range. The standard includes limits for contact currents for frequencies between 10 kHz and 30 MHz.

Like the 1982 American National Standards Institute (ANSI) RF/MW guidelines, the Canadian exposure limits change as a function of frequency—forming the now common "well shape." For workers, the strictest limit is 1 mW/cm^2 from 30-300 MHz, rising to 5 mW/cm^2 at 1.5 GHz and above. At the lower frequencies 10 kHz–1 MHz, the electric and magnetic field limits are 600 V/m and 4.9 A/m, respectively. For the general public, maximum power density limits are five times lower—200 μW/cm^2 from 30-300 MHz and 1 mW/cm^2 from 1.5-300 GHz. At 10 kHz-1 MHz, the limits are 280 V/m and 2.19 A/m.

The maximum allowable contact currents are, for occupational exposures, 400f mA for 10 kHz-100 kHz and 40 mA for 100 kHz-30 MHz and, for the general public, 150f mA and 15 mA in the two frequency ranges, respectively, where f represents frequency in MHz.

Portable transmitters operating below 1 GHz with an output power of seven watts or less are exempt from the limits.

The standard has been simplified since it was first proposed in 1987 (see *MWN*, S/O87 and N/D87). For instance, there are now fewer frequency ranges—but the safety levels are essentially the same, according to Dr. Maria Stuchly, who developed the standard for Health and Welfare Canada.

The new standard is intended for use by federal agencies. But David Charron of the Ontario Ministry of Labor's Radiation Protection Service told *Microwave News* that several provincial governments may also adopt it.

Limits of Exposure to Radiofrequency Fields at Frequencies from 10 kHz-300 GHz (Safety Code 6) is available for $4.95 (Cdn), $5.95 (U.S.) from: Canada Communication Group–Publishing, Ottawa, Ontario K1A 0S9, Canada, (613) 956-4802. The catalog number is H46-2/90-160E.

FROM THE FIELD

Medical Microwaves in Yugoslavia

The 1st International Scientific Meeting: Microwaves in Medicine '91 *was held April 8-11 in Belgrade, Yugoslavia. The conference was conceived by the Yugoslav chapter of the Institute of Electrical and Electronics Engineers' (IEEE) Microwave Theory and Techniques Society (MTT-S) and organized jointly by the MTT-S, the Scientific Committee of Serbia and the Institute of Microwave Techniques and Electronics (IMTEL), based in Belgrade. The following report was prepared for* Microwave News *by IMTEL's Branka Jokanovic, Dr. Stanislaw Szmigielski of the Center for Radiobiology and Radiation Safety in Warsaw, Poland, and Professor Roberto De Leo of the University of Ancona, Italy. A limited number of copies of the 304-page conference proceedings are available for $65.00 (U.S.) each from: Branka Jokanovic, IMTEL, Bulevar Lenjina 165b, 11070 Belgrade, Yugoslavia, (38+11) 135420, Fax: (38+11) 138928.* *See also p.14 for details of a conference on millimeter waves in medicine to be held in Moscow in September.*

About 100 participants from Belgium, Bulgaria, Czechoslovakia, Hungary, Italy, Japan, Poland, South Africa, the U.S., the U.S.S.R. and Yugoslavia attended the conference, which featured five invited presentations and 42 papers. There were sessions on medical applications of microwaves, dosimetry and instrumentation, biological effects, health hazards and safety standards and the use of polarized light. The meeting also included a roundtable discussion of electromagnetic compatibility techniques led by Professor De Leo, and a review of potential medical applications of printed antennas led by Professor Aleksandar Nesic of IMTEL. The last two sessions were made possible by the Italian Embassy in Belgrade and mark the first step toward greater cooperation between Italy and Yugoslavia in this area.

An invited paper, "Microwave Acupuncture as Stimulus for the Interaction Between Electromagnetic Fields (EMFs) and the Nervous System," by Professor Andre Vander Vorst of the Catholic University of Louvain in Louvain-la-Neuve, Belgium, as well as a series of papers from the U.S.S.R., described the use of millimeter waves (40-80 GHz) to stimulate acupuncture points, a technique based on traditional Chinese medicine. According to Mikhail Golant and Vera Nadejeva from RPA "Istok" in Moscow, this form of acupuncture is widely used in the U.S.S.R., where 40,000 patients with conditions ranging from stomach polyps, duodenal ulcers, arterial hypertension and angina pectoris to traumas and advanced neoplasms have been treated using commercially available devices. Despite the excellent results claimed by the Russian researchers, this form of nonconventional therapy cannot be evaluated in terms of modern medicine, because, according to Drs. Yuri Kholodov and Natalia Lebedeva of the Institute of Higher Nervous Activity and Neurophysiology at the U.S.S.R. Academy of Sciences in Moscow, there are presently no accepted mechanisms of interaction between millimeter waves and the central nervous system.

Yugoslav, Czech and South African engineers have developed several interesting devices using microwave energy. For instance, Dr. B. Downing of the University of Cape Town, South Africa, has designed a low-cost microwave system, operating at 2.45 GHz, for deactivating HIV—the virus associated with AIDS—in breast milk collected to feed premature newborns. And Dr. Slobodan Manola and coworkers at the Institute of Physics in Belgrade presented a way of using microwave-induced low-energy gas plasmas to sterilize medical instruments and plastic items at 75-80° C.

Professor Paul Walinsky of the Department of Medicine at Thomas Jefferson University Hospital in Philadelphia, PA, reported that microwave balloon angioplasty of the coronary and peripheral blood vessels is a promising form of therapy for atherosclerotic vascular disease. In his invited talk, he concluded that microwave angioplasty is more effective than conventional angioplasty in maintaining vascular patency in the presence of thrombus.

The treatment of an enlarged prostate using microwave hyperthermia was addressed by Dr. Hyder Arastu and associates at the Albert Einstein Medical Center in Philadelphia, PA, in their invited lecture, "The Efficacy of Transurethral Interstitial Microwave Hyperthermia in the Management of Benign Prostatic Hyperplasia [BPH]," and by Dr. Bronislaw Stawarz and colleagues at the MMA Postgraduate Medical School in Warsaw, Poland, in a paper on the treatment of BPH with intrarectal and intraurethral microwave applicators. The two presentations indicated that intraurethral microwave hyperthermia in advanced BPH is an efficient and safe alternative to surgery.

With respect to microwave hyperthermia, Dr. Branko Kolundzija of the University of Belgrade, Yugoslavia, presented a mathematical model for plotting energy deposition and temperature distributions, and Drs. Yoshio Nikawa and Fumiaki Okada of Japan's National Defense Academy in Yokosuka described an innovative applicator. In addition, Dr. Evgeni Khizhnyak of the Institute of Cell Biophysics of the U.S.S.R. Academy of Sciences in Pushchino and a group led by Professor Fernando Bardati of the University of Rome, Italy, described non-invasive techniques to map heating during hyperthermia. The dielectric properties of biological tissues were described from a theoretical point of view by Dr. Salvatore Caorsi and coworkers at the University of Genoa, Italy, and from an experimental point of view by IMTEL's Dr. Veljko Napijalo and Branka Jokanovic.

In a series of three papers, Dr. Zdravko Stojanovic of the Institute of Aviation Medicine in Belgrade, Drs. Zoran and Milan Djordjevic of the Pacemaker Center at the University Clinical Center in Belgrade and Dr. Zdravko Kelecevic, also of the Institute of Aviation Medicine, described their work on microwave-induced health effects and protective clothing. Stojanovic, a medical doctor, presented the results of a clinical study of 253 radar operators which showed a higher incidence of irregularities in the lymphocytes and the nervous systems of workers chronically exposed to microwaves.

In a review of the possible link between EMFs and cancer, Dr. Stanislaw Szmigielski concluded that EMFs should be classified as "possible" carcinogens.

Dr. Zlatko Koren of the Department of Electrical Engineering at the University of Zagreb, Yugoslavia, recently received a grant of 3.4 million ECU [European Currency Units—approximately $4 million, U.S.] from the Committee of Science and Technology of the European Community to coordinate bioelectromagnetic research in European countries and to establish common safety standards for all European countries. The research project is expected to take four years, beginning with a series of workshops to plan for international cooperation in epidemiological, medical and experimental studies related to the biological effects of non-ionizing radiation. Prospective epidemiological studies of cancer morbidity, as well as medical examinations of personnel occupationally exposed to radiofrequency and microwave radiation, are being planned for this effort.

The Belgrade meeting, the first conference on microwave applications in medicine, was an opportunity to introduce recent developments in this field. The organizers hope that it will stimulate further research, particularly because this field is potentially one of the most important for nonmilitary uses of microwave technology.

The *2nd International Scientific Meeting: Microwaves in Medicine '93* will be held in Italy. Those interested in attending should contact Professor Roberto De Leo, University of Ancona, Via Brecce Bianche, 60131 Ancona, Italy, Fax: (39+071) 2204 835.

cancer promotion hypothesis.

"The study is important and interesting and could be very significant," Dr. Leonard Sagan told *Microwave News* after the BEMS meeting. Sagan, the program manager for radiation studies at the Electric Power Research Institute (EPRI) in Palo Alto, CA, said that he was reluctant to offer a detailed opinion, given that the results are preliminary and that the number of animals involved was small.

"This copromotion study is potentially highly significant," observed Dr. Craig Byus of the University of California, Riverside, who is a member of the Environmental Protection Agency's (EPA) Science Advisory Board (SAB) panel that is reviewing EPA's EMF cancer assessment (see p.7). Byus added that, "It may be that you can see the EMF effect more clearly in the copromotion model than through straight promotion—both approaches should continue to be pursued." Dr. Bary Wilson of the Battelle Lab in Richland, WA, another SAB panelist, agreed: "If this study continues to be positive, it will change the playing field."

Synergy between chemicals and ELF EMFs has been the subject of increasing attention over the last few years. In a recent review paper on experiments with both ELF EMFs and ELF-modulated microwaves, Dr. Ross Adey, in whose lab Cain works, noted that, "Bioelectromagnetic research reveals clear evidence of joint actions at cell membranes of chemical cancer promoters and environmental [EMFs]. The union of these two disciplines has resulted in the first major new approach to tumor formation in 75 years" (see *MWN*, N/D90).

McLean and Stuchly, in collaboration with Dr. Ronald Mitchel of Atomic Energy of Canada in Chalk River, Ontario, painted the skin of 96 female mice with DMBA, a known cancer initiating agent, and soon afterwards treated 48 of them with 0.3 μg TPA and the other 48 with the TPA and a 20 G, 60 Hz magnetic field. The TPA was applied once a week and the field was turned on for six hours a day, five days a week. After 17 weeks, there were more than three times as many mice with tumors—a statistically significant increase—among those exposed to the TPA–magnetic field combination than in the mice only treated with TPA. There was a similar and equally significant increase in the number of tumors per mouse. The exposures are continuing—"It is still too early to say what the actual findings will be," Stuchly said in an interview at the BEMS meeting.

Indeed, as *Microwave News* goes to press, Stuchly reports that, after 23 weeks of exposure, the mice only exposed to TPA had developed more tumors and that the differences between the two groups were no longer statistically significant. Nevertheless, the number of mice with tumors and the number of tumors per mouse were still higher in the TPA–EMF-exposed group. "It appears that the field accelerates the tumor development process," Stuchly said in late July. She also noted that there was considerable variation in the number of tumors per animal. "Some mice had only one tumor, while others had up to 20," she said.

In a previous study, the Canadian team exposed mice to the 60 Hz magnetic field without TPA, after using DMBA to initiate cancer, but found no change in tumor development. Those results have been accepted for publication in a future issue of *Bioelectromagnetics*. Similar studies in Sweden by Dr. Bo Holmberg and coworkers at the National Institute of Occupational Health in Solna have also failed to show a promotional effect of a 50 Hz magnetic field—without TPA—in the development of skin cancer in mice.

"I'll breathe easier when our study is replicated both in our lab and in another lab," McLean said. Indeed, the Health and Welfare team is not waiting for the experiment to be completed before planning a new set of exposures. McLean and Stuchly said that they will begin repeating the study in September and plan future experiments with lower exposures—5 G and/or 10 G—in an effort to determine a dose–response relationship. "If the effect is real, we must know where the threshold for the magnetic field effect is," Stuchly said, adding that she would also like to test the response of the mice exposed to an intermittent field—for instance, one that turns on or off every 15 minutes.

The Canadian researchers are also investigating the mice's immune response as part of the same study. These results were not ready for release at the BEMS meeting. In their earlier study, they showed a statistically significant decrease in natural killer (NK) cell activity among mice exposed to TPA and 60 Hz fields. Those findings suggest that "the magnetic field may affect tumor growth by suppressing an immune surveillance system (NK cell activity) that would otherwise prevent or retard the growth of some tumor or leukemia cells."

Dr. Stanislaw Szmigielski of the Center for Radiobiology and Radiation Safety in Warsaw, Poland, previously reported synergistic effects between microwave radiation and benzopyrene on the development of skin tumors in mice (see *MWN*, My81 and J/A82).

Cain's cellular findings parallel the Canadian animal results: The magnetic field enhanced the action of the TPA. Cain used a co-culture of two different cell types: C3H10T1/2 fibroblasts and mutant cells—offspring of the fibroblasts that had been transformed by UV radiation. When these two cell types are grown together in the same dish, they coexist as a monolayer, but in the presence of TPA the harmony is lost and the cancer cells grow on top of one another. "Essentially, the parent cells keep the daughters in line," Cain explained to *Microwave News*. "When you add TPA, the daughter cancer cells pile up." Cain found that the number of cancer cells doubled when the co-culture was exposed to both TPA and a 1 G, 60 Hz magnetic field for one hour every six hours, every day for four weeks—as compared to TPA exposure alone.

Both Cain and Stuchly agreed that their findings are complementary. "They are two pieces of the same puzzle," Cain said. "They point in the same direction," Stuchly concurred.

In a series of experiments, Drs. Elizabeth Balcer-Kubiczek and George Harrison of the University of Maryland School of Medicine in Baltimore have shown that ELF-modulated microwaves and chemicals can initiate cancer in normal cells (see *MWN*, J/A89). "These new co-promotion results coupled with those from our lab indicate that the carcinogenicity of EMFs must be taken very seriously," Balcer-Kubiczek told *Microwave News*.

and Cory Davis of Corpus Christi, TX, sued Aequitron Medical, Inc., of Minneapolis, MN, after their infant son died—an Aequitron Model 8200 monitor had failed to warn them that the child had stopped breathing. The terms of the March 1990 out-of-court settlement were not disclosed.

"The lawsuit contended that EMI was a major factor in the failure of the monitor and that the manufacturer failed to adequately warn of any potential problem," Cage Wavell, the Davises' Corpus Christi-based attorney, told *Microwave News*. The family lived in an apartment building several miles from the Corpus Christi Naval Air Station. Wavell noted, however, that in the absence of detailed measurements, EMI from household appliances, particularly an electric fan near the infant's bed, could not be discounted.

"The company knew for years that the monitors had alarm problems and that many babies had probably died," the Davises told a congressional subcommittee chaired by Rep. Henry Waxman (D-CA) at a November 1989 hearing in Washington, DC. Depositions from the Davis case indicate that Aequitron knew of the EMI problem as early as 1983, Wavell said. In the course of the litigation, the company provided documentation of several hundred failures of Aequitron monitors, he said.

A May 1990 GAO report to the subcommittee, *Underreporting of Serious Problems with a Home Apnea Monitor* (GAO/PEMD-90-17), reproduced one Aequitron document linking the Model 8200 to 68 deaths from 1983 through 1989. A GAO examination of company records revealed at least two other allegations of fatalities. Prior to the GAO investigation, the company had reported only five deaths associated with the monitor to the FDA, however.

When contacted by *Microwave News*, Aequitron refused to comment other than to say that the Davis suit had been settled.

Apnea monitors measure cardiorespiratory activity through electrodes attached to a patient's chest. Laboratory studies and field surveys of eight models made by four manufacturers "demonstrated that EMI can cause disruption of apnea monitors at relatively low field strengths and at common communication frequencies," according to an FDA report, authored by Paul Ruggera and Eugene O'Bryan, which will be presented at the Institute of Electrical and Electronics Engineers' (IEEE) *Annual Meeting of the Engineering in Medicine and Biology Society* in late October.

In the lab, the alarm of the most sensitive model failed when exposed to fields below 0.1 V/m at FM broadcast frequencies (88-108 MHz). Other models were found to be sensitive to very high frequency (VHF) television signals (54-88 and 174-216 MHz). Every monitor tested registered false breaths and heartbeats—which could prevent the alarm from sounding—at relatively low field strengths, according to the FDA researchers.

Field tests at 15 sites in Washington, DC, Omaha, NE, and Portland, OR, generally confirmed the lab results. At one location more than a mile from the nearest FM radio transmitter, with a maximum single signal of 1.7 V/m, erroneous breaths and heartbeats were detected by most monitors, they reported.

Based on these results and on RF measurements in several U.S. cities by the Environmental Protection Agency, the FDA concluded that a "significant percentage of the U.S. population lives in areas likely to experience EMI levels that could interfere with the most sensitive of these apnea monitors." A preliminary report on the FDA's findings appeared in the April issue of *Radiological Health Bulletin* and in the May issue of *Medical Devices Bulletin*, both published by the CDRH.

Though RF broadcast signals are the major focus of concern, an FDA "Safety Alert" titled *Important Tips for Apnea Monitor Users* warns that EMFs from electrical appliances or cellular telephones could affect the devices, and that even "draperies or rugs...can also cause interference with the monitor due to static electricity."

This fall, the FDA will circulate the third draft of a technical standard for apnea monitors, which will include an extensive section on EMI. A final standard is not expected for at least another year, however. Though many manufacturers are already redesigning or retrofitting their devices to address the problem, a recall is still possible, a knowledgeable source at the FDA told *Microwave News*.

A working group of the International Electrotechnical Committee proposed a 3 V/m immunity requirement for medical devices from 26 MHz to 1 GHz in a December 1990 draft, *Medical Device Electromagnetic Compatibility Standard*.

EMI to medical devices has been the subject of increasing concern over the last few years (see *MWN*, S/O85, N/D85, M/J88, S/O88 and M/A90).

UPDATES

GOVERNMENT

Radiation Control Directors... Recent research findings on ELF EMFs and cancer "must compel the urgent attention of the radiological health community." This was the warning issued by Dr. Leonard Solon, who recently retired as the director of the New York City Bureau for Radiation Control, to participants at the *23rd Annual Meeting of the Conference of Radiation Control Program Directors* (CRCPD) in Wichita, KS, in mid-May. In his prepared paper, Solon outlined the research data and sketched several options for CRCPD members, who traditionally have focused on ionizing radiation. According to another participant, Ken Barat of the Arizona Radiation Regulatory Agency in Phoenix, there was agreement among participants at the meeting's NIER workshop that, "State radiation programs need to start dealing with [NIER] health issues." In a telephone interview, Barat explained that NIER is now being handled by various agencies in different states. "If we don't get involved, we're going to get passed by," he said.

LITIGATION

Waterbed Injury...A Tennessee teenage girl and her parents claim that "chronic exposure to electrical voltage she received