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INSIDE...

ELF-Microwaves and Chemical Promoter Yield Cancerous Cells

Extremely low frequency (ELF) modulated microwave radiation and chemical promoters can transform cells from a normal to a cancerous state, according to researchers at the University of Maryland School of Medicine in Baltimore. Once initiated by microwaves, cells exposed to a chemical cancer promoter—TPA—grow abnormally, like those cells exposed to a chemical carcinogen or ionizing radiation.

This new finding supports previous research showing that microwave radiation can act as a co-carcinogen with chemicals. Epidemiological and animal exposure studies also have indicated a cancer-microwave link.

Up to now, however, most researchers have believed that non-ionizing radiation is more likely to be a cancer promoter than an initiator.

In a paper presented at the *11th Annual Meeting of the Bioelectromagnetics Society*, held in Tucson, AZ, in June, Drs. Elizabeth Balcer-Kubiczek and George Harrison reported a dose-dependent relationship between a 24-hour exposure to 2.45 GHz microwaves and cell transformation at specific absorption rates (SARs) of 0.1-4.4 W/Kg. They found a "possible SAR-threshold for initiation of transformation" between 0.1 and 1 W/Kg.

The 2.45 GHz microwave source used to expose the cells emits 120 pulses per second, with an 8.3 msec pulse width, corresponding to a 120 Hz modulation.[1]

After the conference, Balcer-Kubiczek told *Microwave News* that SARs of 0.1 and 4.4 W/Kg correspond to power densities of 0.065 and 2.8 mW/cm^2— levels well below current exposure standards, such as the 1982 American National Standards Institute guidelines.

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OTA on ELF Hazards: "Legitimate Reasons for Concern"

"Electric and magnetic fields produced by electric power systems may pose public health hazards," according to a report by the Congressional Office of Technology Assessment (OTA). The report, which was issued June 19, states that a growing amount of evidence now indicates that, under certain circumstances, even relatively weak extremely low frequency (ELF) fields can cause biological changes and that, although the implications are still unclear, "there are legitimate reasons for concern."

Distribution lines, electric blankets and certain types of wall wiring may play a "far greater role than transmission lines in any public health problem," the report concludes: "To the extent this proves true, it will be important for legislators, regulators and others to take care to think of this

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HIGHLIGHTS

U.S.S.R. Accuses U.K. of Irradiating London Embassy

In June, the Soviet Union charged the British government with beaming high-frequency radio waves at Soviet embassy buildings in London to power listening devices planted in the walls. *Izvestia*, the Soviet government newspaper, charged that the microwave bombardment may have caused the deaths of two Soviet citizens.

In an article headlined "Rays Bring Death," *Izvestia* stated that the five-year-old son of a diplomat and a young journalist who worked at the London embassy died suddenly last year, according to a United Press International report published in the June 5 *Philadelphia Inquirer*.

The Soviet embassy also alleged that a young girl who lived in an embassy residence developed leukemia last year and subsequently left the U.K. in a "grave" condition, the June 5 *Irish Times* reported.

The Soviet allegations come in the wake of a May diplomatic incident in which the British government accused eight Soviet diplomats and three Soviet journalists of spying and expelled them from the U.K. The Soviet Union countered by expelling 11 British subjects on suspicion of espionage.

At a June 3 news conference, Soviet diplomats revealed that recent construction work on embassy buildings uncovered a honeycomb of listening devices planted in the walls and deep underground, according to the Associated Press. The British government, however, has denied knowledge of the bugs. Indeed, U.K. Foreign Secretary Sir Geoffrey Howe told a BBC Radio 4 news program that the Soviet announcement was a "rather amateurish" attempt at media manipulation, the *Independent*, a British newspaper, reported on June 5.

The British have used microwave-controlled listening devices in the past, however. In the 1987 book *Spycatcher*, Peter Wright, a former member of MI5—one of the British secret services—wrote that throughout the 1950s, the British (as well as the Americans, Canadians and Australians) used a bugging system known as SATYR, which employed cavity microphones activated by microwaves. Wright described SATYR as "one of the best methods of obtaining coverage." The Thatcher government tried to suppress the publication of Wright's memoirs.

During that period, the Soviet Union began beaming microwaves at the U.S. embassy in Moscow, a practice which lasted for at least 26 years (see *MWN*, Jan81). The irradiation was resumed for a few months at varying frequencies and intensities over the summer of 1983. At that time, the U.S. Ambassador denied that the microwaves posed a health hazard, but he filed a formal protest "as a matter of principle" (see

"Maze" and Mind Control: A Roman à Clef?

"By employing an ELF modulation of a high frequency radio signal, our researchers have discovered that it is possible to bypass the normal sensory mechanisms of certain of the brain's organisms and to influence the brain directly."

So reads a memorandum written for the KGB in a new novel, *Maze*, by Larry Collins, the author of a number of best-sellers, including *O Jerusalem!* and *Is Paris Burning?*

Maze (Simon and Schuster, $19.95) has all the makings of a conventional espionage thriller, except, in this case, the plot is about how the Soviets are trying to find an electromagnetic "brain bomb"—that is, a way to "unlock the combination of [a man's] electromagnetic code" to send the President of the United States into an uncontrollable rage.

The novel is chock-full of electromagnetic arcana. For example, "An Australian named Adey in California gave us the answer [as to how cells interact with ELF fields]. The cell's membranes are covered with strands of proteins tipped with calcium ions. Each strand has a negative electrical charge. Think of them as like ears of corn waving in a field in a summer breeze." Dr. José Delgado also has a featured role.

The CIA, as portrayed by Collins, does not believe a word of all this. The one exception is the protagonist, Dr. Art Bennington, who heads the agency's Behavioral Sciences Division. He has an uphill battle because, as he explains to the director of the CIA: "Our scientific establishment has always said no, these [ELF] frequencies can't affect human beings for one simple reason; their waves are both non-thermal and non-ionizing. Therefore, no heat, no effect. It's as simple as ABC."

When Bennington assumes his cover at Electrobiological Research Associates, a CIA dummy corporation, he takes on the identity of Capt. Eldon Tyler of the U.S. Navy. Of course, he sees enormous potential for ELF and RF weapons: "Believe me, if an unequivocal correlation is ever established between those fields and human behavior, we're going to be faced with something that makes splitting the atom pale in comparison."

No doubt Collins was aware of the CIA's MKULTRA mind control projects of the 1950s and 1960s, and of the persistent charges and countercharges over beaming microwaves at foreign embassies (see above). He has also delved deeply into the science and politics of EMFs. Perhaps he even talked to Navy Capt. Paul Tyler (retired), who has written about EMF weapons, and to the women at the Greenham Common peace camp in England who have charged that they are being "zapped" (*MWN*, S/O86).

In July, *Maze* made a brief appearance on the *New York Times* best-seller list and then dropped out of sight.

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.

«« »»

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.

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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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