MICRO WAVE NEWS

Vol. X No. 6 A Report on Non-Ionizing Radiation November/December 1990

INSIDE...

White House Sets Conditions for Release of EPA Cancer Report

Expert Panel's Assessment Delayed

The public release of the Environmental Protection Agency's (EPA) draft assessment of electromagnetic fields (EMFs) and cancer has been delayed following strong objections from the White House and from the U.S. Air Force. In addition, the formal review of the EPA report by the agency's Science Advisory Board (SAB) will not be concluded until a new evaluation has been completed.

On November 26, a day before the draft report was scheduled to be released, Dr. Allan Bromley, the President's science advisor, asked senior EPA officials not to issue the report pending another review by the Committee on Interagency Radiation Research and Policy Coordination (CIRRPC), according to knowledgeable sources. CIRRPC is an offshoot of the White House Office of Science and Technology Policy (OSTP), which is headed by Bromley.

Under a compromise worked out between the White House and EPA, the agency will hold up the public release of the cancer assessment until late December and the SAB panel will review the CIRRPC report when it is completed. The CIRRPC review group is still in formation and is not expected to begin work until January. Its report will take a minimum of six months to be completed—almost certainly longer (see story on p.8).

David Cohen, a spokesman in the office of EPA Administrator William Reilly, confirmed that there had been "negotiations" with the White House. "We felt it was a fair request," he said, referring to the White House's insistence on waiting for the CIRRPC review. Sources indicated that Reilly

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Some Hand-Held Two-Way Radios May Present Health Risk

Computer calculations indicate that hand-held two-way radios can emit radiation levels that exceed health standards. They also call into question the advisability of the exemption for devices with an input power of seven watts (7 W) or less, which is included in many health guidelines.

At last summer's Bioelectromagnetics Society (BEMS) meeting in San Antonio, TX, Dr. Niels Kuster of the Swiss Federal Institute of Technology in Zurich and Dr. Quirino Balzano of Motorola, Inc. in Plantation, FL, reported that their computer models indicate that a 7 W radiation source operating at frequencies above 400 MHz would deposit more than 8 W/Kg in human tissue at a distance of 2.5 cm. At 800-900 MHz, a frequency used

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ELF NEWS

The Talk of Denver

This year's DOE power line review* offered few surprises. There were no bombshells in Denver, CO, as compared to Dr. Gene Matanoski's revelations at last year's meeting in Portland, OR. If there was one lesson to take home from Denver, it was that the electromagnetic field (EMF) problem remains elusive, with no agreement yet on the most important aspect of EMF exposures. To be specific, what is it about the magnetic field that could promote cancer? And are the epidemiologists measuring the right parameters in their attempts to estimate EMF exposures?

The thesis that the pineal gland is sensitive to EMFs got a boost from preliminary data indicating a suppression of nighttime melatonin levels among two species exposed to power line fields. Dr. Fred Stormshak of Oregon State University in Corvallis reported that ewes living under a 500 kV power line—with ambient magnetic fields of 15–50 mG and electric fields of 4–7.5 kV—had a 20–25% reduction in serum melatonin.

Outside the lecture hall, there was talk of even larger reductions among baboons exposed to 60 Hz EMFs at the Southwest Research Institute (SWRI) in San Antonio, TX. SWRI's Dr. Walter Rogers did not formally present these results and refused to discuss them. "I'm not going to talk to you about this. The information belongs to the sponsors," Rogers told *Microwave News* as he walked away from an interview.

The SWRI project is primarily funded by the Central Research Institute of Electric Power Industry (CRIEPI) in Tokyo, Japan. Izumi Nishimura of CRIEPI's Abiko Research Laboratory also declined to discuss the experiment, saying only that there were no results yet.

Dr. Bary Wilson, who, with other members of the Battelle group in Richland, WA, has been working on the pineal–EMF link for over a decade, reported that intermittent exposures to magnetic fields are more effective than continuous exposures in reducing nighttime melatonin in rats.

The importance of intermittent exposures was a thread that ran through many of the talks. Dr. Russel Reiter of the University of Texas Health Science Center in San Antonio presented results suggesting that the on-and-off switching of a magnetic field is a key parameter for explaining observed changes in pineal function (see *MWN*, S/O90). And Dr. Charles Graham of the Midwest Research Institute in Kansas City, MO, reported that he observed the greatest physiological effects among humans exposed to EMFs immediately after the field was turned on and immediately after it was turned off. Like Wilson, Graham concluded that "intermittent exposure may be more biologically active than constant exposures."

These results support those presented some years ago by Drs. Craig Byus of the University of California, Riverside, and Ross Adey of the VA Hospital in Loma Linda, CA, who observed similar trends in their experiments with ornithine decarboxylase (see *MWN*, J/A83 and N/D87).

Intermittent exposures can result from moving in and out of an EMF or from being exposed to a source that switches on and off. Each entails a different type of exposure. Moving in and out of the field may tax the body's homeostatic power to acclimate to new electromagnetic environments. An EMF source that switches on and off, such as an electric blanket, generates EMF pulses that result in exposures not only to extremely low frequency (ELF) fields but to high frequency radiation as well.

Wilson verbalized what was on many people's minds when he advised that, from now on, EMF exposure systems and assessments should include any transient or high frequency components, as well as absolute field strengths.

Dr. Nancy Wertheimer and Ed Leeper, who are based in Boulder, CO, highlighted the importance of another new variable in gauging EMF exposures—the direction of the magnetic field. By adding this information to Dr. David Savitz's childhood data set and Dr. Richard Stevens's adult data set—the two epidemiological studies sponsored by the New York State Power Lines Project (see *MWN*, N/D86)—they found higher risk ratios than were originally reported.

Wertheimer and Leeper stressed that average magnetic fields inclined at less than 60° from the horizontal "may prove to be an index to something else that can be more directly or meaningfully related to cancer risk." For instance, these types of ambient EMFs may often be due to ground currents, which can vary considerably over time, and, as Wertheimer pointed out to *Microwave News*, they might point once again to the importance of intermittent exposures.

A group from the California Department of Health Services in Berkeley also concluded that Savitz had probably underestimated the risk of cancer from EMFs by using spot measurements and wire codes as surrogates for magnetic field exposures. Christianna Williams and coworkers measured EMFs in the San Francisco bay area and compared them to the exposures indicated by the surrogate indices. Williams's pilot study showed that there was probably "considerable misclassification," leading to a conclusion of a smaller cancer risk than would have been observed with more complete exposure information.

The California group will take a more detailed look at how misclassification of exposures can bias risk estimates when they send a team to do measurements in Denver, the site of the original Wertheimer-Leeper and Savitz studies (see *MWN*, J/A89).

Dr. Susan Preston-Martin of the University of Southern California (USC) in Los Angeles also raised the possibility that EMF cancer risks could turn out to be higher than previously believed. She announced that the incidence of astrocytomas (brain tumors) among males occupationally exposed for more than ten years was more than ten times the expected rate; in an earlier published analysis, Preston-Martin had reported a fourfold increased risk after more than five years of EMF exposure (see *MWN*, M/A90). Her finding closely parallels that of Dr. Terry

**The Annual Review of Research on Biological Effects of 50 and 60 Hz Electric and Magnetic Fields*, Denver, CO, November 5-8, 1990. Organized by the U.S. Department of Energy (DOE); cosponsored by the American Public Power Association and the Edison Electric Institute.

Thomas, who found a more than tenfold increase among workers exposed on-the-job for 20 years (see *MWN*, S/O87). Preston-Martin noted that neither soldering nor solvents could account for the increased tumor risk.

The Denver meeting was the first in many years not to be cosponsored by the Electric Power Research Institute (EPRI), but there are indications that the divorce is not working out (see *MWN*, N/D89). Some attendees were disappointed by the absence of many of the EPRI researchers. And those who had been at the EPRI utility meeting a few weeks earlier in Austin, TX, reported that there was some grumbling because of the lack of new results.

There had been suggestions that USC's Dr. John Peters would report on his EMF–childhood cancer study in Austin. He didn't; neither did he attend the Denver meeting. The delay encouraged speculation about what the results might show—especially when those who had been in Austin reported that Peters, when confronted with the perennial question "Would you buy a home next to a power line?" answered that he might, but only if he did not have young children. Some observers were quick to interpret the answer as a clear indication that Peters, like Savitz, had confirmed the original Wertheimer-Leeper EMF link.

When later asked by *Microwave News* if there was any substance to this line of argument, Peters replied with an amused "No." He did say that he hopes to have his results ready for the EPRI epidemiology workshop in February (see p.9).

In an interview with *Microwave News* after the Denver meeting, EPRI's Dr. Leonard Sagan left open the possibility that EPRI will rejoin the annual review. "My preference is that all the participating agencies sponsor the EMF review, including the National Cancer Institute, the National Institute for Occupational Safety and Health and the Environmental Protection Agency," he said.

Despite all the new attention to EMFs over the last year, funding levels have not increased—not even for the study of pineal effects, which many think is the key to finding a mechanism of interaction. "It's really been tough," Reiter said in an interview. "Frankly, I am discouraged by the lack of funding"—he explained that he has yet to receive "a single penny" for EMF research and that he had come to Denver at his own expense. Reiter said that if he had some money, he would work on defining those parameters of the field that are important and the mechanisms involved.

New Power Lines Restricted in Washington and Rhode Island

Unprecedented power line siting restrictions have been imposed on both coasts. In November, Whatcom County, WA, voters chose to confine new power lines above 115 kV to industrially zoned areas, and in October, the East Greenwich, RI, town council passed a three-year moratorium on new lines above 60 kV. In both cases local citizens' groups called for the restrictions in response to utility proposals for new lines.

If the trend towards regulating power lines on a local level continues to gain momentum, it could become a problem for the utility industry, according to Richard Loughery, manager of environmental programs at the Edison Electric Institute in Washington, DC. "We would prefer a single state standard. Potentially it could become a nightmare if we have a multitude of local standards to deal with," Loughery told *Microwave News*. Several states have imposed electromagnetic field (EMF) limits for the edge of utility right-of-ways (ROWs), and during the most recent session of congress, Rep. Frank Pallone (D-NJ) discussed a national EMF limit for ROWs (see *MWN*, M/A90 and J/A90).

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Ballot Initiative in Washington

Voters in Whatcom County, WA, approved a citizens' initiative restricting power lines exceeding 115 kV to industrial areas. Citizens Initiative No.4-90 marks the first successful power line siting referendum in the U.S. The immediate effect will be to disrupt Puget Power & Light Company plans to build two new 230 kV transmission lines to carry hydroelectric power from Canada.

The measure could be overturned in court because county laws forbid zoning by initiative. No challenge is expected, however. "You won't see us in court filing suit over this issue anytime soon," Puget Power representative Jude Noland told *Microwave News*.

"People are telling us something," said County Planning Director Dan Taylor, adding that, "No matter how the measure fares in court, there is a message there that we have to pay attention to."

The Whatcom County vote stood out in a year in which many other environmental referendums were rejected. California's "Big Green" and New York's environmental bond propositions both failed, yet the Whatcom County power line initiative passed by a nearly two-to-one margin.

Before the election, Bellingham Neighbors Opposing Power Encroachment (NOPE) successfully persuaded Puget Power to run the northern parts of the lines through an existing Bonneville Power Authority (BPA) right-of-way rather than create a new corridor near a number of homes. But NOPE continued to object to Puget Power's intention to run the rest of the lines through

heavily populated areas of Bellingham, and is using the initiative to force the utility to employ the existing BPA corridor for the rest of the lines as well. NOPE collected over 6,000 signatures to qualify the measure for the November ballot.

Puget Power allocated $100,000 to fight the NOPE initiative. Noland said that the utility is currently considering a number of alternatives to the lines.

Three-Year Moratorium in Rhode Island

On October 9 the town council of East Greenwich, RI, banned all new power lines above 60 kV for three years. The ordinance came about in response to widespread citizen concern about the EMFs from proposed new 345 kV and 115 kV lines which the Narragansett Electric Company plans to run through parts of East Greenwich. This is the first moratorium on power line construction in the U.S.

Narragansett Electric has appealed the decision to the Rhode Island Public Utilities Commission (PUC), contending that the 345 kV line is needed by 1994 and that the three-year moratorium could prevent it from adequately providing power to western Rhode Island.

Public concern over power line safety had previously prompted Governor Edward DiPrete to set up a committee—headed by PUC Chairman James Malachowski—to study EMF health effects. An interim report, issued in September, recommended further study and a policy of prudent avoidance to limit exposures.

Reducing EMFs in Oregon

Pacific Power and Light, an Oregon utility, recently announced that it will use a "delta" tower design that will nearly halve the EMF levels along the edge of the right-of-way (ROW) of a proposed 500 kV power line.

The total additional cost of the new towers is approximately $2.4 million, about 3.5% of the total cost of the project.

David Stewart-Smith of the Oregon Department of Energy (DOE) told *Microwave News* that the new delta design will reduce levels at the edge of the ROW to 30–35 mG, down from the earlier estimates of 56 mG for the original "flat" tower design. Electric field levels will also be almost halved. The new towers will be 20 feet taller than those originally planned.

Puget Power, which received a permit to build the 130-mile Eugene–Medford line in 1982, hit a roadblock when residents living near the proposed line banded together to fight the utility's plans. The ensuing controversy led the DOE to assemble a panel of experts to review the literature on ELF health effects (see p.13).

On October 26, the state Energy Facility Siting Council unanimously approved the utility's proposed changes for the line, which also include a one-year extension of the site certificate deadline to December 31, 1994.

Prudent Avoidance in California

The California Public Utilities Commission (PUC) has ordered the Southern California Edison Company (SCE) to follow a policy of "prudent avoidance" to limit EMFs from a proposed 220 kV power line in the Mojave Desert. The PUC also mandated that SCE provide those living, working and playing near the new line's right-of-way with literature on EMF health risks, but did not specify a source for the written material.

The proposed 38-mile line is expected to cost over $50 million and to be in operation by late 1992. In its September 12 decision, the PUC advised caution with regard to EMFs, stating that, "All that is certain is that we do not know enough to dismiss the issue entirely....until the scientific findings are more definitive, we will require SCE to take responsible, low-cost steps to avoid unnecessarily exposing people to these fields."

Rhode Islanders for Safe Power (RISP) pushed for the three-year moratorium because of the need for further research on the health effects of EMFs and because it "was the least noxious formula and the most likely to be sustained by the PUC," RISP's Ed Seiler told *Microwave News*. If the moratorium is overturned, RISP may request the town council to order the more expensive alternative of burying the lines, Seiler said.

In an interview, Narragansett Electric spokesman Charles Moran said that the company has not started to develop an alternative route for the $44 million 345 kV project and is counting on the PUC to overturn the moratorium. Moran said that EMF levels at the edge of the ROW of the 345 kV line would not exceed 20 mG.

RISP, which was formed in January 1990, has some 300 members. RISP President Jeff Jacober and East Greenwich Town Solicitor Daniel Procaccini described RISP's work at the power line congressional hearing last July (see *MWN*, J/A90).

U.K.'s National Grid Funds EMF Cellular Studies

The U.K.'s National Grid Company has awarded six contracts to British universities and research institutes to study the effects of power frequency electromagnetic fields (EMFs) on cellular interactions. The total amount of the contracts, which will run for two or three years, is about £600,000 (approximately $1.2 million).

The National Grid Company, one of the four successor companies to the Central Electricity Generating Board (CEGB), which was dissolved in March 1990, is responsible for the transmission of electric power in England and Wales. (Distribution is the responsibility of regional electricity companies.) It has also taken charge of the CEGB's EMF research program.

The projects—which were selected by an independent steering committee chaired by Dr. Charles Suckling, a member

of the Royal Commission on Environmental Pollution and formerly a general manager of research and technology at ICI, plc—are as follows:

- *"The Effects of Low Frequency EMFs on Cellular Transcription in Sciara and Drosophila Salivary Glands"*—Drs. M. Anderson and A.J. Birley, School of Biological Sciences, University of Birmingham;
- *"Rapid Biochemical Responses in Cultured Cells to Power Frequency EMFs"*—Drs. J.C. Metcalfe and T.R. Hesketh, Department of Biochemistry, University of Cambridge;
- *"Effects of Low Frequency Magnetic Fields on Single Ion Channels"*—Dr. S.B. Hladky, Department of Pharmacology, University of Cambridge;
- *"Effects of Low Frequency Alternating Magnetic Fields on Short-Term Responses of Haemopoietic Stem and Progenitor Cells to Specific Growth Factors"*—Prof. T.M. Dexter and Dr. R.E. Dale, Paterson Institute for Cancer Research, Manchester;
- *"The Uptake of Ca^{++} in a Frequency Dependent or 'Resonant' Manner as Indicated by Changes in the Mobility of Diatom Strains Sensitive to the Ca^{++} Concentration in Their Support Medium"*—Dr. R. Dixey, St. Bartholomew's Hospital, London, and Dr. J.C. Green, Plymouth Marine Laboratory;
- *"Influence of Low Frequency EMFs on Ion Flux Through Reconstituted Membrane Channels"*—Prof. R. Pethig and Dr. H. Morgan, Institute of Molecular and Biomolecular Electronics, University College of North Wales, Bangor.

The National Grid Company is also funding in-house exposure assessments. In 1988, the CEGB launched a major epidemiological initiative to study new diagnosed childhood cancer cases in England and Wales (see *MWN*, M/A88). Results of two EMF–childhood cancer studies at the University of Leeds (see *MWN*, N/D89) are expected to appear in the *British Journal of Cancer* "in due course," according to a company spokesman.

$1 Million Stray Voltage Award; Major Study in Wisconsin

A jury in Minnesota has awarded $1 million to a family of dairy farmers who contended that their cows' milk production was substantially decreased by stray electrical voltage. On October 9, after a two-and-a-half-week trial in the Sibley County District Court, the jury agreed with Dale ZumBerge and his family that Northern States Power (NSP) Company had been negligent in not correcting a 13-year chronic stray voltage problem.

The utility has filed a posttrial motion objecting to a number of aspects of the case. The stray voltage levels at the ZumBerge farm "could not have had an impact on dairy production," NSP attorney Jim Altman told *Microwave News*.

The return wire of the ZumBerges' distribution system was the source of the problem, James Kaster, the family's Minneapolis, MN-based attorney, said in a telephone interview. Readings inside the family's barn were as high as 2.5 V in 1984. Subsequent complaints by the ZumBerges prompted NSP to attempt to eliminate the stray voltage. Yet the levels were still 1.5 V in 1987 and 1 V in 1989, according to Kaster.

In neighboring Wisconsin, the state Public Utilities Commission (PUC) is initiating an ambitious study of the effects of the electrical environment on dairy livestock. Stray Voltage Analysis Team leader Daniel Dasho told *Microwave News* that the study will "look beyond the normal stray voltage problem" by examining the individual and combined effects of electromagnetic fields (EMFs), ground currents and direct currents. Dasho added that, in light of the international attention being paid to the EMF issue, the Wisconsin PUC wants to contribute to the "nationwide information base."

HIGHLIGHTS

Two Cancer Victims File Suit Against RF/MW Companies

In separate actions in October, two men who claim that they developed cancer from exposure to radiofrequency and microwave (RF/MW) radiation filed $25 million product liability suits in New York against the equipment manufacturers and operators. Thomas Ford, a former U.S. Navy radar technician, claims that exposure to shipboard radars caused him to develop chronic health problems and, ultimately, non-Hodgkin's lymphoma (NHL). Michael Dowgiallo, an electrician, alleges that acute exposure to RF/MW radiation caused his stomach cancer.

Ford and Dowgiallo are represented by John Sweeney of Sweeney & Pafundi in Agoura Hills, CA. Sweeney has handled other RF/MW cases in the past, including that of a former Navy radar technician with cataracts who received a $131,000 settlement in 1988 (see *MWN*, M/A88). Kenneth Henrie of Henrie & O'Boyle in Wantagh, NY, is serving as Sweeney's local counsel.

In a telephone interview, Sweeney predicted that there will be more and more litigation, noting that "there is a growing awareness that electromagnetic fields (EMFs) are connected to cancer."

Radar Exposure off the Vietnam Coast

Thomas Ford served aboard a Navy destroyer between 1965 and 1967. According to his wife, Kathy, who is a co-plaintiff, Ford was positioned directly beneath the ship's main navigational radar units and in front of the gun control radar unit for an average of 16 hours a day. For a period of six months when his ship was on maneuvers off the coast of Vietnam, the gun control radar was on almost all the time.

Two years after his discharge from the Navy, Ford began to show signs of immune system impairment. In 1988, at the age of 41, he was diagnosed with NHL. Ford was denied a "service-connected" disability claim from the Veterans Administration (VA) in 1989 on the ground that, "There is no scientific evidence to suggest a link between non-ionizing radiation exposure from

radar and cancer."

This year, however, the VA announced that it will honor all NHL-related disability claims from Vietnam veterans—following the March 1990 release of a Centers for Disease Control study showing that Vietnam veterans are at an increased risk for NHL. Those serving on ships off the Vietnam coast have the highest risk, according to the report. Kathy Ford expects her husband's claim will now be approved, but the Fords have not yet received official notification.

Ford's legal complaint, which was served on October 17, names AT&T, GE, Raytheon, GTE Products Corp. and Lockheed, all makers of shipboard radars for the Navy, as defendants.

Sweeney expects that the defendants will try to use the military contractors' defense authorized by a 1988 U.S. Supreme Court decision, *Boyle v. United Technologies*, but he believes that the case is "clearly outside the limits of the doctrine," primarily due to the contractors' failure to warn the government of the real risks involved.

"I have no doubt of the causal relationship between Ford's exposure and his illness. He had a particularly intense exposure, unusual even for a military man," Sweeney told *Microwave News*.

Atop the Chrysler Building

For several months in 1980, Michael Dowgiallo installed lights on the exterior of the tower of the Chrysler Building in New York City. During that time, Dowgiallo claims that he was exposed to high levels of RF/MW radiation from FM antennas and MW transmitters, often just a few inches away from him.

Dowgiallo's supervisor had expressed concerns about the safety of working near the RF/MW transmitters, according to Dowgiallo, but was subsequently assured by Eastern Communications of Long Island City, NY, the owner of the equipment, that the transmitters posed no hazard to workers. In a December 15, 1980 letter to JKC Realty, the owner of the Chrysler Building, however, Eastern stated that its antennas were "HOT" and could be "considered dangerous up to a ten-foot radius" and that, "Exposure to this type of radiation at a distance of less than eight to ten feet for protracted periods of time may have effects that will not show up for years."

In 1979, an employee collapsed while working near FM transmitting equipment on the 77th floor of the Chrysler Building. The Occupational Safety and Health Administration (OSHA) did an RF survey and found a maximum level of 2.5 mW/cm^2 about six feet from an antenna element. OSHA concluded—based on its then current standards—that workers inside the building were not at risk from excessive RF exposure, but recommended that workers not be allowed within six feet of the radiating antenna element.

Dowgiallo was diagnosed with stomach cancer in 1988 at the age of 39. Although it has not typically been linked to EMF exposures, Dr. Genevieve Matanoski of Johns Hopkins University reported in 1989 four cases of stomach cancer among approximately 9,000 New York Telephone Co. central office technicians (who were exposed to complex EMFs), where none were expected (see *MWN*, N/D89).

Dowgiallo's complaint was served on October 25. Dowgiallo and his wife Sharon name JKC Realty, Eastern Communications, the International Brotherhood of Electrical Workers Local No.3 and Robert B. Samuels, Inc. (his employer) as defendants. They have also filed a workers' compensation claim.

For more on RF/MW litigation, see *MWN*, D82, J/F83, Jn84, My85, S/O85, J/F86, M/J86, S/O86, M/A88, M/J89 and S/O89.

White House Holds Up EPA Report (continued from p.1)

himself was involved in the negotiations.

An earlier draft of the EPA report, *Evaluation of the Potential Carcinogenicity of Electromagnetic Fields*, released last June, concluded that studies of extremely low frequency (ELF) EMFs and leukemia, lymphoma and brain cancer among children and workers "show a consistent pattern of response that suggests, but does not prove, a causal link" (see *MWN*, M/J90). The report attracted widespread public interest when *Microwave News* reported that EPA staffers had recommended that ELF EMFs be classified as "probable human carcinogens" and radiofrequency and microwave radiation be classified as "possible human carcinogens." The report was issued without any classifications following a March meeting at the White House.

The forthcoming draft of the EPA report—called the "external review draft"—also does not include any classifications of the carcinogenicity of EMFs because of "uncertainties" about the mechanism of interaction. The draft concludes that epidemiological studies "show a consistent pattern of response which suggests a causal link" (see p.7 for excerpts).

Three EPA officials attended the November 26 meeting at the White House: Drs. Erich Bretthauer, the assistant administrator for research and development, William Farland, the director of the Office of Health and Environmental Assessment (OHEA) and Robert McGaughy, the lead author of the document. Bretthauer refused to be interviewed by *Microwave News*, Farland did not respond to phone calls and McGaughy said that he could not comment on the meeting.

Calls to Bromley's office were referred to OSTP's Dr. Kenneth Yale, who did not answer requests for comment.

The White House request for EPA to wait for the CIRRPC review follows a similar request from the Air Force (see p.7). In an October 2 letter to EPA, Brigadier General Paul Gleason of the Office of the Air Force Surgeon General opposed publication of the EPA report until both the CIRRPC review and an analysis by the National Research Council of the Air Force's Ground Wave Emergency Network (see p.9) are completed.

Gleason's letter accompanied a 33-page blistering critique of the EPA report which charges the authors with having "biased the entire document toward EMF-induced carcinogenicity." The Air Force concludes that, "It is astonishing that the

Excerpts from EPA's EMF Report

The following is excerpted from the Executive Summary of the forthcoming external review draft of EPA's report, Evaluation of the Potential Carcinogenicity of Electromagnetic Fields, *dated October 1990 and obtained by* Microwave News *in November.*

In conclusion, several studies showing leukemia, lymphoma and cancer of the nervous system in children exposed to magnetic fields from residential 60 Hz electrical power distribution systems, supported by similar findings in adults in several occupational studies also involving electrical power frequency exposures, show a consistent pattern of response which suggests a causal link....

At this time, such a characterization regarding the link between cancer and exposure to EMFs is not appropriate because the nature of the interaction between EMFs and biological processes leading to cancer is not understood....

Because of these uncertainties, it would be inappropriate at this time to classify the carcinogenicity of EMFs in the same way as the agency does for chemical carcinogens....With our current understanding, we can identify 60 Hz magnetic fields from power lines and perhaps other sources in the home as a possible, but not proven, cause of cancer in humans....

U.S. EPA would place its imprimatur on this report."

Gleason stated that, "If published, the report will contribute to needless public anxiety, and have serious impacts on capabilities and costs of Air Force programs."

The SAB will assemble a panel of experts to review the draft report at a public meeting in the Washington area on January 14-15 and, if necessary, January 16 (if the release of the report is not delayed further). Dr. Genevieve Matanoski of the Johns Hopkins University School of Hygiene and Public Health in Baltimore, MD, will chair the SAB's Non-Ionizing Electric and Magnetic Fields Subcommittee of the Radiation Advisory Committee. Dr. David Bates of Vancouver, Canada, will be the vice chairman.

Kathleen Conway, the SAB staff officer responsible for the review, told *Microwave News* that there will be as many as 18 experts on the panel. At press time, the selection process had not yet been completed.

Conway said that she had received numerous nominations for membership on the panel. For example, she said that EPA had been sent recommendations from the Edison Electric Institute, the Electric Power Research Institute, the White House (see p.8) and Crowell & Moring, a Washington, DC, law firm which has represented a number of utilities in power line siting battles. "We considered over 200 experts," Conway said.

The SAB is being cautious about the makeup of the EMF panel because of the attention being paid to another SAB committee, which is investigating the health risks of environmental (passive) tobacco smoke. A number of the members of that committee are consultants to the cigarette industry and EPA came close to removing one antismoking advocate from the panel after complaints from the Tobacco Institute.

Copies of EPA's draft report will be available from: Dr. Robert McGaughy, [RD-689], OHEA, EPA, 401 M St., SW, Washington, DC 20460, (202) 382-5898.

U.S. Air Force Labels EPA Report Biased and Political

The October 2 Air Force review of the Environmental Protection Agency (EPA) cancer assessment document—prepared by a team of "radiofrequency (RF) effects scientists" led by Drs. David Erwin and James Merritt at the Brooks Air Force Base School of Aerospace Medicine, TX—begins with a quote from the Roman historian Tacitus: "Some believe all manner of hearsay evidence; others twist truth into fiction; and both sorts of error are magnified by time." The Air Force argues that the EPA authors present "no evidence of causation between electromagnetic fields (EMFs) and cancer, but rather argue as if this hypothesis were accepted fact."

The Air Force claims that the authors "consistently neglect the majority of negative studies and concentrate most of their discussion on weak positives of dubious value." Blasting the report's statements on the "consistency" of the evidence and on the need for more research, the Air Force charges that "these are political statements and not scientifically derived conclusions."

"Our reviewers of this document are convinced that there is no suggestion that EMFs present in the environment today induce or promote cancer," the Air Force concludes.

The Air Force dismisses the report's section on extremely low frequency (ELF) epidemiological studies, claiming that, "The overall weight of epidemiologic evidence is so slight as to be almost nonexistent; certainly not sufficient to justify further large expenditures of scarce research resources."

With regard to the report's survey of animal studies, the Air Force argues that any credible effects are most likely due to heat-induced stress, rather than to "some other property of RF radiation." The Air Force even suggests that ELF effects on the pineal gland are heat-related.

In contrast to most EMF researchers, government officials and industry representatives, the Air Force maintains that, "In general, there is sufficient research being carried out in various laboratories commensurate with the urgency of the problem."

Letter-Writing Campaign

One member of the Air Force team that wrote the report appears to be on a one-man crusade to correct what he perceives as published errors about EMFs. Dr. James Jauchem has had a flurry of letters published in popular and scientific journals—for instance, *Nature* (October 4), *The Lancet* (October 6), *The Bulletin of the Atomic Scientists* (November 1990), *Science* (November 9) and the *British Journal of Haematology* (see p.9). In general, Jauchem criticizes the "lay media" for providing "misinformation on the alleged hazards of EMFs." Not surprisingly, his statements closely parallel some of the arguments presented in the Air Force review of the EPA cancer assessment. Jauchem, a research physiologist, has written a number of papers in recent years on the thermal effects of RF radiation.

Interagency Panel Asks for New EMF Health Review

The Committee on Interagency Radiation Research and Policy Coordination (CIRRPC), an offshoot of the White House Office of Science and Technology Policy, is undertaking a new review of electromagnetic field (EMF) health effects.

A new subpanel on the health effects of EMFs is being chaired by Dr. Robert McGaughy of the Environmental Protection Agency (EPA), the lead author of EPA's EMF cancer assessment (see p.1 and *MWN*, M/J90). In an interview with *Microwave News*, McGaughy said that the subpanel has been asked to assemble "an authoritative review of the health effects of low frequency EMFs"—at both power line (15–180 Hz) and VDT (10–30 kHz) frequencies—"to guide federal agencies on what should be done about this problem."

One of the panel's first decisions was to commission a literature review by an outside group of experts. Dr. Charles Susskind of the University of California, Berkeley, will chair the review group. McGaughy noted that Susskind's survey will include not only cancer but also central nervous system, reproductive and developmental effects. Susskind is also a member of EPA's Science Advisory Board.

White House Recommendations to EPA on EMF Experts

Reprinted below is a memorandum from Dr. Allan Bromley, President Bush's science advisor, to William Reilly, the administrator of the Environmental Protection Agency (EPA). No attempt has been made to correct any of Bromley's errors of fact—for instance, Dr. Toler is in the midst of a major study of microwave effects on mice—not ELF effects on rats.

Bob Adair, referred to by Bromley, is Dr. Robert Adair, a professor of physics at Yale University and an outspoken skeptic about ELF field effects (see MWN, *J/F90 and M/J90). Before moving to Washington, DC, Bromley was also a Yale physics professor.*

THE WHITE HOUSE
WASHINGTON

August 2, 1990

Memorandum for the Honorable William K. Reilly
From: D. Allan Bromley
Subject: ELF Studies

As promised, I am sending you herewith a list of people whom I would recommend as persons whom you might consider as very knowledgeable ones in the area of alleged non-ionizing, non-thermal biological effects of low intensity, low frequency electromagnetic radiation. They cover a wide range of age, experience, background, etc.

I also enclose, to keep your file of Adair papers up-to-date, a recent comment regarding alleged biological effects of static magnetic fields. Bob Adair is also someone whom you might want to keep in mind. He is very bright, uninhibited and someone who can be abrasive when he feels that the situation deserves it.

This is a very difficult area that I am sure you agree requires careful treatment if we are to serve the public well.

Some Good People for ELF Studies

A.W. (Bill) Guy (about 60), Prof. of Electrical Engineering and Bioengineering, University of Washington, Seattle. Guy is very competent, very low-key, highly respected in the field. Formerly president of the Bioelectromagnetics Society, second awardee of their D'Arsonval Medal. Expert on antenna theory, microwaves, etc., especially energy depositions of microwaves in humans. Guy was PI in an extensive study funded by the Air Force (School of Aerospace Medicine, Brooks Air Force Base, San Antonio) of effects of microwaves on rats where rats were exposed for their lifetimes—one and two years—and about 150 biological endpoints were measured.

Kenneth Foster (about 35), Associate Prof. of Bioengineering, University of Pennsylvania. Foster is a very bright, very sound, younger biophysicist specializing in the electrical properties of biological materials—especially at the cellular level. (I believe that his PhD is in physics.)

William Pickard (about 50), Prof. of Electrical Engineering at Washington University, St. Louis. Pickard has made substantial contributions to our knowledge of the electrical properties of biological materials, experimental and theoretical. Bill is a Harvard PhD in applied physics and is very bright and very sound. (Pickard and Foster wrote a *Scientific American* article to the effect that there are no significant biological effects from low intensity microwaves.)

John deLorge (about 50), Naval Aerospace Medical Research Laboratory, Pensacola, Florida. Psychologist, radiation effects on primates. Director of programs, alternate to Skip Kerschner on CIRRPC committee [see above].

W. Gregory Lotz (about 38), NAMRL, Pensacola, Florida. Endocrinologist who works with whole animals, primates, etc. Conducted excellent ELF study on rhesus monkeys. Intelligent and sensible, very able.

John Bergeron (about 55), General Electric. Biophysicist, very good.

Herman Schwan (72), Prof. Emeritus Department of Bioengineering, University of Rochester, member National Academy of Engineering. Almost father of the field in the U.S.

Sol M. Michaelson (about 65), Prof. Dept. of Radiation Biology and Biophysics, University of Rochester. A grand old man of the field.

Mort Miller (about 40), Prof. Radiation Biology and Biophysics, University of Rochester. Biophysics with emphasis on biology. Very good.

E.L. Carstenson, Prof. Electrical Engineering, University of Rochester. Has written decent semipopular book on effects of ambient electromagnetic fields.

Eleanor Adair, Fellow John B. Pierce Foundation, New Haven. Ellie has some interesting capabilities concerning the effects of magnetic fields on primates.

Allan Grodzinski, MIT. Was funded by Air Force (but they ran out of money). Good man with excellent research facilities.

James Toler, Georgia Tech. Funded by Air Force to conduct major study of ELF fields on rats.

In a telephone interview, Susskind said that he is working with McGaughy's subpanel in selecting the other members of his committee, which he hopes to assemble by January. McGaughy would like Susskind's report in six months. "The federal agencies want this report pretty fast," McGaughy said. When asked about the schedule, Susskind would only say that, "We will try to complete the report during 1991."

This is the second time CIRRPC has commissioned a review on non-ionizing radiation. In 1985, Dr. Ross Adey of the VA Hospital in Loma Linda, CA, was asked to review the current state of knowledge (see *MWN*, N/D85), but CIRRPC later refused to release his report. In a July 24, 1990 memorandum, Dr. Alvin Young of the Department of Agriculture, the chairman of CIRRPC, noted that Adey's report was not published "because of its lack of balance," with too much emphasis placed on non-thermal effects. In 1987, Adey included many of the recommendations from his draft CIRRPC report in his testimony before a congressional subcommittee (see *MWN*, N/D87).

The other members of the CIRRPC subpanel are: Dr. Imre Gyuk of the Department of Energy; Dr. Charlotte Silverman and John Monahan of the Food and Drug Administration; Dr. Sheldon Weiner of the Occupational Safety and Health Administration; and Lt. Commander H.F. Kerschner of the U.S. Navy, representing the Department of Defense. According to McGaughy, Weiner originally requested the new EMF review.

UPDATES

BIOLOGICAL EFFECTS

EMF–Chemical Synergy..."Bioelectromagnetic research reveals clear evidence of joint actions at cell membranes of chemical cancer promoters and environmental electromagnetic fields. The union of these two disciplines has resulted in the first major new approach to tumor formation in 75 years...," according to Dr. Ross Adey of the VA Medical Center in Loma Linda, CA. Reviewing current research on the bioeffects of ELF fields and RF/MW-modulated radiation—with a special emphasis on cell membrane interactions—Adey argues that it is "increasingly clear" that EMFs acting alone or with chemical environmental pollutants "may constitute a potential health hazard," and that "it is of paramount importance that the significance of these issues no longer be ignored." See "Joint Actions of Environmental Non-Ionizing Electromagnetic Fields and Chemical Pollution in Cancer Promotion," *Environmental Health Perspectives, 86*, pp.297-305, 1990.

MWs and Leukemia Debated... Two recent letters in the *British Journal of Haematology* question the conclusions of a case report on acute leukemia following exposure to MW radiation by French physicians in the October 1989 issue (see *MWN*, N/D89). Dr. James Jauchem of the Air Force School of Aerospace Medicine (see p.7) argues that MW effects in other research cited by the authors could have been thermally induced. He concludes that "inadequately reported single incidents of supposed links between microwaves and cancer serve to confuse rather than enlighten researchers and the lay public." In response, Dr. Eric Archimbaud of the Hôpital Edouard Herriot in Lyon, the lead author of the case report, cites more recent studies of MW-induced genetic damage and points out that currently recognized risk factors for this type of leukemia were first suspected in isolated cases before being confirmed by formal studies. The journal also includes a letter from Drs. B. Hocking of Telecom Australia in Melbourne and M. Garson of St. Vincents Hospital in Fitzroy, Victoria, criticizing the findings of Archimbaud and his colleagues. See "Leukaemia Following Exposure to Microwaves: Analysis of a Case Report," *British Journal of Haematology, 76*, pp.312-314, 1990.

MEETINGS

EPRI on Epidemiology & Dosimetry...EPRI will sponsor two EMF workshops in early 1991, one on epidemiological studies and the other on exposure assessment. The epidemiology session will be held February 5-8 in Carmel, CA, and will be chaired by Dr. Patricia Buffler. The purpose of the workshop is "to plan the third generation studies," according to EPRI's Dr. Leonard Sagan. Dr. John Peters told *Microwave News* that he hopes to present the results of his EMF–childhood leukemia study at the workshop (see *MWN*, N/D89 and S/O90 and p.3). The second workshop, which will also be in Carmel, will address the understanding of dose at the cellular and subcellular levels. The organizers of the meeting, to be held March 19-22, are Drs. Richard Phillips (chairman), Charles Rafferty, Thomas Tenforde and Howard Wachtel.

MILITARY

NRC's GWEN Committee... The National Research Council (NRC), an arm of the National Academy of Sciences, has assembled a panel of experts to assess the potential health effects of VLF radiation from the USAF Ground Wave Emergency Network (GWEN). The NRC's move was prompted by a request from the USAF, which was acting on concerns raised by Congressmen Lewis Payne (D-VA) and Les Aspin (D-WI) (see *MWN*, M/J90). Dr. Thomas Tenforde of Battelle Pacific Northwest Labs, Richland, WA, is the chairman of the panel. The other members are: Dr. Keith Florig of the Arms Control & Disarmament Agency, Washington, DC; Dr. Om Gandhi of the University of Utah, Salt Lake City; Dr. Michael Ginevan of Versar, Inc., Springfield, VA; Dr. George Harrison of the University of Maryland Medical School, Baltimore; Dr. Maureen Henderson of the Fred Hutchinson Cancer Research Center, Seattle, WA; Dr. Ross MacDonald of the University of North Carolina, Chapel Hill; Dr. Regina Santella of Columbia University, New York, NY; Dr. Thomas Slaga of the University of Texas System Cancer Center, Smithville; Dr. Jan Stolwijk of the John Pierce Foundation, New Haven, CT; and Dr. Howard

Wachtel of the University of Colorado, Boulder (currently a visiting scientist at EPRI). Dr. Raymond Cooper, the study director at the NRC, told *Microwave News* that the panel held its first meeting on December 14, 1990 and that its report should be completed by September 30, 1991.

USAF OKs PAVE PAWS Modification... The USAF says that it has solved its problem with the PAVE PAWS radar at Robins Air Force Base in Georgia. In 1988, the USAF admitted that radiation from the phased array radar could accidentally ignite electro-explosive devices (EEDs) aboard aircraft landing at the base (see *MWN*, J/A88, N/D88, J/F89 and N/D89). Raytheon, which built the PAVE PAWS radars, has been awarded an $8.6 million contract to install an auxiliary tracker, which will automatically shut off the radar when aircraft pass within a prescribed distance. An environmental assessment has been completed and concludes that the modification will have no significant impact.

OVENS

Popcorn Hazards and More... Drs. Patrick DeRespinis and Larry Frohman, of the University of Medicine and Dentistry of New Jersey, report in the *New England Journal of Medicine* (*323*, p.1212, October 25, 1990) that the overeager consumer of microwave popcorn risks searing his or her eyes, face and hands from a hot burst of steam which can escape from the popcorn bag if it is opened immediately after cooking. DeRespinis and Frohman describe three such cases, two of which were serious enough to require treatment. All of the victims eventually recovered completely. This is not the first report of such injuries—a 1986 letter in the *New England Journal of Medicine* reported that a 10-year-old boy severely burned his eyelids when opening a bag of microwave popcorn (see *MWN*, J/F87)....The November 1990 issue of *Consumer Reports* features a section on microwave ovens, including "Microwave Worries," which explains how to avoid some common operational problems.

PATENTS

EMFs To Regulate Growth... Two patents have been granted to a group of scientists for devices that use magnetic fields to control cellular processes and regulate tissue growth. The first patent (No.4818697, granted April 4, 1989) describes a method for generating a local magnetic field of a particular magnitude and direction to enhance the permeability of ions through membranes. The second patent (No.4932951, granted June 12, 1990) describes a way to use magnetic fields to regulate tissue growth. Both patents were assigned to Life Resonances, Inc., in Bozeman, MT. In the second patent, Drs. Abe Liboff of Oakland University in Rochester, MI, Bruce McLeod of Montana State University in Bozeman and Stephen Smith of the University of Kentucky in Lexington cite particular frequencies and average flux densities as most effective—16 Hz at 2.09×10^{-5} T for stimulating bone growth and 16 Hz at 4.09×10^{-5} T for retarding bone growth. In the second patent, they write that, "While the exact mechanism by which growth characteristics of the target tissue are affected by the present invention is not fully understood...remarkable results are achieved."

The Cookie Monster... Microwave cooking could become a spectator sport with the advent of the "exploding cookie." Donald Boehm and Richard Fazzolare's patented design (No.4948602, granted August 14, 1990) describes a biscuit with a hollow inside filled with chocolate. When cooked in a microwave oven, the filling boils over the top and flows down the sides of the cookie, giving "the appearance of a volcano erupting." If all that excitement leaves you in need of a comforting cup of coffee, you might try a recently patented "tea bag" (No.4948601, also granted August 14) for brewing coffee one cup at a time. According to the inventor, retired NASA astrophysicist Gideon Serbu, the microwave radiation heats the coffee grains faster than the water surrounding them, creating the natural turbulence necessary to brew coffee. A detachable frame holds the bag below water level to keep it from floating to the top of the cup and losing its flavor to the air. Copies of the patents can be obtained for $1.50 each from: Patent and Trademark Office, Washington, DC 20231.

PEOPLE

Dr. **Samuel Milham Jr.** of the Washington state Department of Health is the recipient of the Robert Strom Foundation's first annual Humanitarian Award for making the greatest contribution to the public's understanding of EMF bioeffects. **Robert Strom**, a Boeing EMP technician who developed leukemia, launched the foundation with funds he received in a settlement with Boeing (see *MWN*, S/O90)....Dr. **Jocelyne Leal** of the Ramón y Cajal Hospital in Madrid, Spain, the president of the European Bioelectromagnetics Association, who had an accident in Madrid last June, is now back working in her lab....For their five-part series in the April 9–13 *Potomac News* on the Army's EMP testing at Woodbridge, VA (see *MWN*, M/J90), **Gary Craig** and **Kevin Carmody** have won the Southern Journalism Award for environmental reporting among newspapers with a circulation of 30,000 or less. Craig is now at the *Times Union* in Rochester, NY, and Carmody is at the *Daily Progress* in Charlottesville, VA....The newest senator from Minnesota is **Paul Wellstone**, coauthor (with Barry Casper) of the 1981 book, ***Powerline: The First Battle of America's Energy War***, an account of a heated siting conflict in rural Minnesota in the 1970s....Dr. **Joseph Bowman**, who worked on EMF epidemiological studies at the University of Southern California, will leave in January for NIOSH in Cincinnati, OH, where he will continue to study occupational exposures to ELF EMFs....Dr. **Ernest Albert** of George Washington University Medical Center died in late August due to complications following a liver transplant. A past president of the Bioelectromagnetics Society, Albert was also a member of the Scientific Advisory Panel of the New York State Power Lines Project.

RESOURCES

More from Paul Brodeur... The November 19 issue of *The New Yorker* features an update by Brodeur to his July 9 piece on the Guilford, CT, cancer cluster. The piece, titled "Department of Amplification," is also a response to criticism from the Connecticut Department of Health Services (CDHS), among others. Brodeur cites as further evidence of a cluster a CDHS map—originally displayed at an August public meeting (see *MWN*, S/O90)—of the locations of the homes of 29 Guilford residents who had brain and/or central nervous system tumors between 1968 and 1988. He points out that 17 of these 29 cases were among people living near high-voltage or high-current lines. At the end of November, the CDHS announced that it would ask the Connecticut Academy of Science and Engineering to investigate the pattern of brain tumor cases in Guilford.

VDTs

Macworld* Goes to Washington...Macworld* has forcefully renewed its demand for more government ELF EMF research and regulation. Editor Jerry Borrell kicked off the campaign with a special report in the July issue—"Could Your Computer Be Killing You?"—which included EMF measurements of Macintosh-compatible monitors and an article by Paul Brodeur. The latest salvo, in the December issue, includes two new articles, one by Borrell and the other by "Conspicuous Consumer" columnist Deborah Branscum. In addition, all 500,000 copies include two fluorescent orange write-in cards. Some readers will receive cards addressed to Senator Barbara Mikulski (D-MD), chairwoman of the appropriations committee that oversees the Environmental Protection Agency, and to Senator Albert Gore (D-TN). Others will get cards addressed to Dr. Allan Bromley, science advisor to the President (see p.1), and to Rep. Robert Roe (D-NJ), chairman of the House Committee on Science, Space and Technology. Each of the cards reads, in part: "I am writing to express my concern about the federal government's lack of activity on the issue of ELF (extremely low frequency) emissions from personal computer monitors. I urge you in the strongest possible terms to direct the appropriate groups...to develop an interim standard that will limit the exposure of users of personal computers to ELF emissions."

Hand-Held Radio Risk *(continued from p.1)*

by many cellular phones (though at power levels less than 7 W), the specific absorption rate (SAR) would be 14–17 W/Kg in eye lens tissue and 19–21 W/Kg in brain tissue. At 1.5 GHz, the SARs would be 32 W/Kg and 29 W/Kg for eye lens tissue and brain tissue, respectively.

Kuster and Balzano's model points to an inconsistency in the 1982 American National Standards Institute (ANSI) limits for human exposures to radiofrequency and microwave (RF/MW) radiation, which specify both a maximum partial body exposure of 8 W/Kg, and an exemption for devices with an input power of 7 W or less operating at 300 kHz–1 GHz.

Whether to retain the 7 W exclusion clause is one of the most contentious issues in the ongoing revision of the ANSI limits. In 1989, it was deleted by the subcommittee charged with rewriting the standard at a meeting held in Tucson, AZ (see *MWN*, S/O89). Balzano, a member of the subcommittee, argued against retaining the exclusion and voted for its deletion—even though Motorola is the leading manufacturer of land mobile equipment in the world, including hand-held two-way radios and cellular telephones.

The exclusion clause was reinstated at a poorly attended meeting held in Seattle, WA, later last year in what one subcommittee member called "a peculiar process"—indeed, many subcommittee members could not say how and why it had been revived. The "final draft" of the proposed revision, as circulated last June, specifies both the partial body limit* of 8 W/Kg and the 7 W exemption, which was even extended to encompass the frequency range 100 kHz–1.5 GHz.

"I strongly oppose the exclusion clause because it could authorize devices which can induce SARs of 100 W/Kg or greater in the eye tissue," Kuster told *Microwave News*. "The electromagnetic fields from hand-held radios and cellular phones are the strongest high frequency fields to which the public is exposed, so it is ridiculous, if not negligent, to allow exclusion clauses for these devices based on a limited number of experiments," he said.

Balzano and Kuster expressed surprise that there was so little interest in their results at the BEMS meeting—while the ANSI limits were still under debate.

Last year, Drs. Robert Cleveland of the Federal Communications Commission and Whit Athey of the Food and Drug Administration reported that experiments with models of the human head indicated that ANSI's 8 W/Kg limit could theoretically be exceeded with 800 MHz hand-held radios operating at power levels as low as 3–4 W (see *MWN*, S/O89 and *Bioelectromagnetics, 10*, pp.173-186, 1989). They concluded, however, that users of such communication devices would ordinarily not transmit for periods long enough to cause the six-minute time-averaged exclusion limit to be exceeded.

Hand-held radios (transceivers) operate at various frequencies, including 150 MHz, 450 MHz and 800-900 MHz, with power levels normally ranging from about 1–2 W. Some units use higher powers, including many military units. Most hand-held cellular telephones operate at power levels of 0.6 W, while those which have their antennas mounted apart from the mouthpieces typically operate at power levels of 3 W. Cellular telephones operate at 800-900 MHz.

*Under the proposed revision, the 8 W/Kg limit applies to critical tissues like the eye and the brain and to "controlled environments." In "uncontrolled environments," the limit is 1.6 W/Kg. In each case, the dose is averaged over 10 grams of tissue. It is not clear whether the use of a hand-held communication device constitutes a controlled or an uncontrolled environment. A number of subcommittee members contacted by *Microwave News* said that they are not sure.

NEW PUBLICATIONS

Books

M.J. Allen, S.F. Cleary and F.M. Hawkridge, ***Charge and Field Effects in Biosystems—2,*** New York, NY: Plenum Press, 1989, 389 pp., $89.50. This collection of papers from a June 1989 symposium includes several on EMF bioeffects, with notable contributions from Soviet, Chinese and Japanese researchers (see *MWN*, S/O89).

Roger Coghill, ***Electropollution: How To Protect Yourself from It,*** Wellingborough, U.K.: Thorsons Publishing Group, 1990, 192 pp., $9.95. A review of the nature of EMFs and their health effects by a British consultant based in Wales, with suggestions for reducing exposures.

S.B. Field and J.W. Hand, editors, ***An Introduction to the Practical Aspects of Clinical Hyperthermia,*** London, U.K.: Taylor & Francis, 1990, 572 pp., $143.00. A comprehensive treatment of the clinical applications of hyperthermia, with a chapter on safety considerations for patients and operating personnel by Dr. C.K. Chou.

Giorgio Franceschetti, Om P. Gandhi and Martino Grandolfo, editors, ***Electromagnetic Biointeraction: Mechanisms, Safety Standards, Protection Guides,*** New York, NY: Plenum Press, 1989, 223 pp., $49.50. Among these lectures from a May 1988 meeting on *Worldwide Non-Ionizing Radiation Safety Standards: Their Rationales and Problems* in Capri, Italy, are a comparison of international RF/MW safety standards by Drs. Grandolfo and Kjell Hansson Mild and an overview of RF bioeffects by Dr. Stephen Cleary.

A.J. Baden Fuller, ***Microwaves: An Introduction to Microwave Theory and Techniques,*** 3rd edition, Oxford, U.K.: Pergamon Press, 1990, 310 pp., $56.00 (hardcover), $28.00 (paperback). Devoted primarily to microwave theory, circuits and waveguides. The author recommends that exposure limits for the general population be lower than 200 $\mu W/cm^2$, the level adopted by IRPA, NCRP and several states.

Om P. Gandhi, editor, ***Biological Effects and Medical Applications of Electromagnetic Energy,*** Englewood Cliffs, NJ: Prentice Hall, 1990, 573 pp., $75.00. A collection of reviews of EMF bioeffects, touching on everything from nomenclature to guidelines and standards.

John W. Gofman, ***Radiation-Induced Cancer from Low-Dose Exposure: An Independent Analysis,*** San Francisco, CA: Committee for Nuclear Responsibility, Inc., 1990, 455 pp., $29.95. A critique of the motives and methods of the "radiation community" by a well-known radiation expert who is a professor emeritus of medical physics at the University of California, Berkeley. He argues that small doses of ionizing radiation over a long period of time are no less dangerous than acute exposures, and that estimates of cancer risk from low-level exposures are inadequate for public safety.

Sanford Lakoff and Herbert F. York, ***A Shield in Space? Technology, Politics and the Strategic Defense Initiative,*** Berkeley, CA: University of California Press, 1989, 409 pp., $35.00. The authors argue that the decision to pursue "Star Wars" was motivated by politics, not science.

Y.T. Lo and S.W. Lee, ***Antenna Handbook: Theory, Applications and Design,*** New York, NY: Van Nostrand Reinhold, 1988, >1,800 pp., $149.95. A textbook on antennas, including chapters on medical applications, interference, EMP and measurements.

M.E. O'Connor, R.H.C. Bentall and J.C. Monahan, editors, ***Emerging Electromagnetic Medicine,*** New York, NY: Springer-Verlag, 1990, 307 pp., $45.00. Seventeen well-illustrated papers from a May 1989 FDA conference at the University of Tulsa, OK (see *MWN*, M/J89), on EMF theory and mechanisms, cellular and animal studies and clinical applications.

Fritz-Albert Popp et al., editors, ***Electromagnetic Bio-Information,*** 2nd edition, Baltimore, MD: Urban & Schwarzenberg, 1989, 259 pp., $72.50. An in-depth examination of some of the possible mechanisms by which organisms might use and be affected by EMFs. Ten years after the first edition and with interest growing rapidly, the foreword concludes that this once controversial discipline is now "on the right track."

Banmali Rawat and Zhou Siyong, editors, ***Proceedings of the 2nd International Symposium on Recent Advances in Microwave Technology,*** Oxford, U.K.: Pergamon Press, 1990, 660 pp., $184.00. A collection of papers on microwave measurements, measuring systems and medical applications from a 1989 meeting in Beijing, China.

Merrill Skolnik, editor, ***Radar Handbook,*** 2nd edition, New York, NY: McGraw-Hill Publishing Co., 1990, 1,199 pp., $87.50. A reference book on radar technology, including phased array and over-the-horizon systems.

U.S. Congress, Office of Technology Assessment, ***Neurotoxicity: Identifying and Controlling Poisons of the Nervous System,*** OTA-BA-436, Washington, DC: U.S. Government Printing Office, 1990, 361 pp., $15.00. A review of research on, and regulation of, neurotoxic chemicals.

Tim Weiner, ***Blank Check: The Pentagon's Black Budget,*** New York, NY: Warner Books, 1990, 272 pp., $21.95. On billion-dollar defense projects that are kept secret from the public.

Patricia M. Whitaker-Azmitia and Stephen J. Peroutka, editors, ***The Neuropharmacology of Serotonin, Annals of the New York Academy of Sciences, 600,*** 718 pp., 1990. A collection of papers on the role of serotonin in physical and behavioral functions and dysfunctions, including depression, anxiety and suicide (see also *MWN*, M/J88).

Reports

American Statistical Association (ASA), ***ASA Conference on Radiation and Health VIII: Health Effects of Electric and Magnetic Fields: Statistical Support for Research Strategies,*** Final Report, May 1990. Copies are available for $15.00 from: Lee Decker, ASA, 1429 Duke St., Alexandria, VA 22314, (703) 684-1221. A broad overview of the research to date on the health effects of EMFs. Drs. Dan Bracken, Granger Morgan, Lee Rosen, Mays Swicord and Gilles Theriault, among others, discuss epidemiological, experimental and animal research, and outline the problems to be considered when designing future research projects. The role of statistics in facilitating measurement, analysis and risk assessment is emphasized.

David Charron, ***Magnetic Fields in the Workplace*** (P90-5E), Canadian Centre for Occupational Health and Safety (CCOHS), March 1990; ***Radiofrequency Radiation in the Workplace*** (P89-24E), CCOHS, November 1989. Copies are available free in Canada, for $3.50 in the U.S. and for $4.00 elsewhere from: CCOHS, 250 Main St. East, Hamilton, Ontario L8N 1H6, Canada, (416) 572-2981. These two reports on non-ionizing radiation health risks to workers include summaries of the exposure limits in Canada and elsewhere and recommendations on how to avoid unnecessary exposure.

Lynne De Merritt, ***Siting of Power Lines and Communication Tow-***

ers: A Bibliography on the Potential Health Effects of Electric and Magnetic Fields (CPL Bibliography 257), Council of Planning Librarians, March 1990. Copies are available for $16.00 plus shipping from: American Planning Association, 1313 E. 60th St., Chicago, IL 60637, (312) 955-9100. A compilation of references—targeted to planning professionals—that provides sources of information to assist those addressing community concerns on the location of communication towers and power lines. Includes references to both the scientific and the nonscientific literature.

IIT Research Institute, ***Compilation of 1989 Annual Reports of the Navy ELF Communications System Ecological Monitoring Program*** (Technical Report E06620-4), three volumes, August 1990. Order from: National Technical Information Service (NTIS), U.S. Department of Commerce, 5285 Port Royal Rd., Springfield, VA 22161. The most recent findings from the ongoing program to determine if the U.S. Navy's ELF submarine communications system is affecting the ecology of Wisconsin and Michigan. Data collection for the study of the Wisconsin transmitting facility was completed in 1989; this report includes the results and conclusions of the bird community research. Summary reports for the rest of the Wisconsin studies were published separately and are also available from NTIS. A final report based on the data collected over the entire term of the project should be available by the end of this year.

Paul Landsbergis and Eric Scherzer, ***A Worker's Guide to Electromagnetic Radiation,*** Oil, Chemical and Atomic Workers (OCAW) Union 8 Resource Center, 1990. Copies are available for $5.00 from: OCAW District 8 Resource Center, 1155 W. Chestnut St., Union, NJ 07083, (201) 687-1322. A booklet to provide workers with a basic understanding of what is currently known about the hazards of EMF exposure. It covers the controversies surrounding research and regulations relating to health effects, including a useful discussion of the problems inherent in epidemiological research, and concludes with a section on how local unions can begin to confront the problem.

Alvin Leonard et al., ***Electric and Magnetic Fields: Measurements and Possible Effects on Human Health, from Appliances, Power Lines and Other Common Sources,*** Special Epidemiological Studies Program (SESP), California Department of Health Services (CDHS), 1990. Order from: SESP-CDHS, 2151 Berkeley Way, Room 704, Berkeley, CA 94704, (415) 540-2669. Subtitled "What we know, what we don't know in 1990," this report concentrates on EMFs in the home. It includes a number of tables and charts as well as a section on a suggested protocol for measuring residential EMFs. The authors conclude that a strategy of prudent avoidance should be adopted by concerned home owners.

Rolf Lindgren, ***High Voltage Power Lines, Health and Environment, Current Knowledge and Research Status 1989,*** Vattenfall Kraftledningar AB, first published in 1986, revised 1990. Single copies of the report are available free from: Rolf Lindgren, Vattenfall Kraftledningar AB, Nya Tingstadsgatan 1, S-422 44 Hisings Backa, Sweden, (41+31) 51.37.60. Published by the Swedish State Power Board (Vattenfall), this is a layman's guide to understanding EMF issues. The well-illustrated glossy report provides a thorough explanation of what EMFs are and where they come from and addresses the question of whether EMFs pose a threat to human health.

Oregon Department of Energy, ***Report on Human Health Effects from Exposure to 60 Hz [EMFs] from High Voltage Power Lines,*** April 1990. A limited number of copies are available free from: Dr. Tom Meehan, Oregon Department of Energy, 625 Marion St. NE, Salem, OR 97310. This report, which was prepared by a panel of five experts, was presented to the Energy Facility Siting Council, an independent state agency with the authority to set standards (see *MWN*, M/A89 and p.4). Several panel members felt that there is now "credible evidence which suggests that low levels of ELF EMFs may cause health risks to people"; the evidence is "weak, incomplete, often inconsistent and inconclusive. But it cannot be ignored." The panel members concluded that "not enough is known to set definitive or permanent standards now." They recommended limiting power line EMF exposures to status quo levels. Members of the panel included Drs. Clarissa Beatty (retired) and William Morton, Oregon Health Sciences University; Dr. Bill Guy, University of Washington School of Medicine; and Drs. Jose Reyes and René Spée, Oregon State University.

U.S. Congress, ***Electric Power Lines: Health and Public Policy Implications*** (No.101-13), Oversight Hearing Before the Subcommittee on General Oversight and Investigations of the Committee on Interior and Insular Affairs, U.S. House of Representatives, 101st Congress, Second Session, March 8, 1990. A limited number of copies are available from the subcommittee, Washington, DC 20515. The transcript of the March 8 congressional hearing called by Rep. Peter Kostmayer (D-PA), the chairman of the subcommittee (see *MWN*, M/A90). It includes the prepared testimony of research experts, industry representatives, government officials and individual citizens, their responses to questions and some written statements and letters to the subcommittee which were submitted after the hearing took place.

U.S. Congress, ***Federal Research on Electromagnetic Radiation*** (No.136), Hearing Before the Subcommittee on Natural Resources, Agriculture Research and Environment of the Committee on Science, Space and Technology, U.S. House of Representatives, 101st Congress, Second Session, July 25, 1990. A limited number of copies are available from the subcommittee, Washington, DC 20515. The expert testimony of scientific researchers, industry representatives and regulatory officials present at this July hearing, called by subcommittee chairman Rep. James Scheuer (D-NY). Included is a draft of the bill, H.R. 4801, introduced by Rep. Frank Pallone (D-NJ), which would have required the Department of Energy to investigate ways of reducing EMF exposure at home and in the workplace and to establish a comprehensive public information program on issues related to EMFs (see *MWN*, J/A90). No action was taken on the bill before Congress adjourned.

Khizar Wasti, ***Monitoring of Ongoing Research on the Health Effects of High Voltage Transmission Lines,*** Bureau of Toxic Substances Information, Virginia Department of Health (DOH) and State Corporation Commission, March 15, 1990. Order from: Virginia DOH, James Madison Building, 109 Governor St., Room 918-922, Richmond, VA 23219, (804) 786-1763. "[I]t has not been established that [EMFs] can cause an increased incidence of leukemia in humans," concluded Dr. Khizar Wasti in the Virginia DOH's fifth annual report on EMF bioeffects research (see *MWN*, M/A89). The 29-page report is a survey of bioeffects literature published in 1988-89, including reports from the Office of Technology Assessment, the California Public Utilities Commission and the IEEE Task Force (on power frequency EMFs), as well as IRPA's interim guidelines for 50/60 Hz EMFs.

New Reports from EPRI will be featured in our next issue.

CONFERENCES

1991 Conference Calendar

January 15-19: **Coherent and Emergent Phenomena in Biomolecular Systems,** NATO Advanced Research Workshop, University of Arizona, Tucson, AZ. Contact: Stuart Hameroff, Advanced Biotechnology Lab, University of Arizona, Tucson, AZ 85724, (602) 626-6295.

January 16-18: **Hazardous Radiofrequency Electromagnetic Radiation: Evaluation, Control, Effects and Standards,** Washington, DC. Contact: Shirley Forlenzo, Continuing Engineering Education Program, George Washington University, 801 22nd St., NW, #T308, Washington, DC 20052, (202) 994-8530, or (800) 424-9773.

January 17-18: **Exploring the EMF Dilemma: Prudent Avoidance & Public Involvement,** San Francisco Airport Marriott, Burlingame, CA. Contact: NewsData Corp., Box C900928, Queen Anne Station, Seattle, WA 98109, (206) 285-4848.

January 30-31: **Scientific Workshop on the Health Effects of Electromagnetic Radiation on Workers,** Cincinnati, OH. Contact: Phil Bierbaum (R-2), National Institute for Occupational Safety and Health, 4676 Columbia Parkway, Cincinnati, OH 45226, (513) 841-4321.

February 3-7: **IEEE Power Engineering Society (PES) Winter Meeting,** Penta Hotel, New York, NY. Contact: IEEE Society Special Services, 445 Hoes Lane, PO Box 1331, Piscataway, NJ 08855, (201) 562-3882.

February 4-8: **Health Physics of Non-Ionizing Radiation,** Battelle Conference Center, Seattle, WA. Contact: Dr. John Leonowich, Mail Stop K3-70, Battelle Pacific Northwest Labs, PO Box 999, Richland, WA 99352, (509) 375-6849.

February 11: **Workshop on Recent Developments in the Health Consequences and Clinical Applications of Low Frequency Electromagnetic Fields,** NIEHS, Research Triangle Park, NC. Contact: Dr. Lee Rosen, NIH, 5333 Westbard Ave., Room 2A11B, Bethesda, MD 20892, (301) 496-7568.

February 25-26: **The Debate: Electric & Magnetic Fields—An Issue for the 1990s,** Arlington, VA. Contact: Transmission & Distribution Magazine, EMF Conference, 5072 West Chester Pike, Box 556, Edgemont, PA 19028, (215) 359-1249.

February 28-March 3: **9th Annual International Symposium on Man and His Environment in Health and Disease,** ***Special Focus on EMF Health Effects,*** Dallas, TX. Contact: American Environmental Health Foundation, 8345 Walnut Hill Lane, Suite 205, Dallas, TX 75231, (214) 361-9515.

March 12-13: **IEEE 1991 National Radar Conference,** Airport Marriott, Los Angeles, CA. Contact: Radar Conference, PO Box 1827, Venice, CA 90294, (213) 647-9346.

March 12-14: **9th International Symposium and Technical Exhibition on Electromagnetic Compatibility,** Zürich, Switzerland. Contact: Prof. P.E. Leuthold, ETH Zentrum-IKT, 8092 Zürich, Switzerland, (41+1) 256-2790.

April 3-4: **27th Annual Meeting of the National Council on Radiation Protection and Measurements (NCRP),** Mayflower Hotel, Washington, DC. Contact: NCRP, 7910 Woodmont Ave., Suite 800, Bethesda, MD 20814, (301) 657-2652.

April 4-5: **17th Annual Northeast Bioengineering Conference,** Hartford, CT. Contact: Dr. Martin D. Fox, Electrical and Systems Engineering, University of Connecticut, 260 Glenbrook Rd., U-157, Storrs, CT 06269.

April 11-16: **3rd Annual Meeting of the International Society of Environmental Epidemiology,** Jerusalem, Israel. Contact: Nez Tamara Deutsch, Conference Secretariat, PO Box 61282, Jerusalem, Israel, (972+2) 243577.

April 15-18: **7th International Conference on Antennas and Propagation,** University of York, U.K. Contact: Conference Services, Institution of Electrical Engineers (IEE), Savoy Pl., London WC2R 0BL, U.K., (44+71) 240-1871, ext. 222.

April 15-18: **69th Annual Convention of the National Association of Broadcasters (NAB),** Convention Center, Las Vegas, NV. Contact: NAB Services, 1771 N St., NW, Washington, DC 20036, (800) 342-2460.

April 16-19: **International Conference on Lightning and Static Electricity,** Cocoa Beach, FL. Contact: William Jafferis, Conference Chairman, DL-ESS-22, NASA, Kennedy Space Center, FL 32899, (407) 867-4438.

April 21-25: **Symposia on Cancer, Electromagnetic Fields and Biological Systems,** as part of the **75th Annual Meeting of the Federation of American Societies for Experimental Biology (FASEB),** World Congress Center, Atlanta, GA. Contact: Patricia Burnett, Dept. of Orthopedic Surgery, LSU Medical Center, PO Box 33932, Shreveport, LA 71130, (318) 674-6179.

April 22-24: **7th Annual Meeting of the Electromagnetic Energy Policy Alliance (EEPA),** Radisson Mark Plaza Hotel, Alexandria, VA. Contact: Richard Ekfelt, EEPA, 1255 23rd St., NW, Washington, DC 20037, (202) 452-1070.

April 22-26: **11th International Conference on Electricity Distribution,** Palais des Congrès, Liège, Belgium. Contact: Secretariat, A.I.M., Rue Saint Gilles, 31, B-4000 Liège, Belgium, (32+41) 222946.

April 28-May 2: **Symposium on Microwaves: Theory and Application in Materials Processing,** Cincinnati, OH. Contact: D.E. Clark, Dept. of Mathematical Science and Engineering, 136 MAE, University of Florida, Gainesville, FL 32611, (904) 392-7660.

May 11-15: **26th Annual Meeting & Exposition of the Association for the Advancement of Medical Instrumentation (AAMI),** Washington, DC. Contact: AAMI Education Dept., 3330 Washington Blvd., Suite 400, Arlington, VA 22201, (703) 525-4890.

May 14-16: **Instrumentation/Measurement Technology Conference (IMTC/91),** Omni Hotel, Atlanta, GA. Contact: Robert Myers, IMTC/91 Conference Coordinator, 3685 Motor Ave., Suite 240, Los Angeles, CA 90034, (213) 287-1463.

May 15-17: **Biological Effects and Safety Aspects of Nuclear Magnetic Resonance Imaging and Spectroscopy,** Hyatt Regency, Bethesda, MD. Contact: New York Academy of Sciences, 2 E. 63rd St., New York, NY 10021, (212) 838-0230.

May 29-31: **45th Annual Frequency Control Symposium,** Airport Marriott, Los Angeles, CA. Contact: Clark Wardrip, PO Box 6147, Vandenberg AFB, CA 93437, (805) 865-3214.

June 11-14: **IEEE MTT-S International Microwave Symposium,** Boston, MA. Contact: MTT-Symposium 1991, c/o LRW Associates, 1218 Balfour Dr., Arnold, MD 21012.

June 13-14: **3rd Annual Meeting of the Society for Light Treatment and Biological Rhythms (SLTBR),** Toronto, Ontario, Canada. Contact: Marty McCullough, SLTBR, PO Box 478, Wilsonville, OR 97070, (503) 694-2404.

June 18-21: **5th Joint Magnetism and Magnetic Materials–Intermag Conference,** Pittsburgh, PA. Contact: Diane Suiters, Conference Coordinator, 655 15th St., NW, Suite 300, Washington, DC 20005, (202) 639-5088.

June 23-27: **13th Annual Meeting of the Bioelectromagnetics Society (BEMS),** Little America Hotel, Salt Lake City, UT. Contact: BEMS, 120 W. Church St., Frederick, MD 21701, (301) 663-4252.

June 24-28: **1991 North American Radio Science Meeting and International IEEE/AP-S Symposium,** University of Western Ontario, London, Ontario, Canada. Contact: D. Ruest, Conference Services, National Research Council Canada, Ottawa, Ontario K1A 0R6, Canada.

July 7-12: **9th International Congress of Radiation Research (ICRR),** Sheraton Centre, Toronto, Ontario, Canada. (Includes meetings of the North American Hyperthermia Group and the Radiation Research Society.) Contact: 9th ICRR, 1891 Preston White Dr., Reston, VA 22091, (703) 648-3780.

July 15-19: **28th Annual International Nuclear and Space Radiation Effects Conference,** Town and Country Hotel, San Diego, CA. Contact: Charles Barnes, Jet Propulsion Lab, MS 303-220, 4800 Oak Grove Dr.,

Pasadena, CA 91109, (818) 354-4467.

July 21-26: **36th Annual Meeting of the Health Physics Society (HPS),** Sheraton Washington Hotel, Washington, DC. Contact: HPS, 8000 Westpark Dr., Suite 400, McLean, VA 22102, (703) 790-1745.

July 21-27: **International Symposium on Charge and Field Effects in Biosystems,** Richmond, VA. Contact: Diane Holmes, Virginia Commonwealth University, Dept. of Chemistry, 1001 W. Main St., Box 2006, Richmond, VA 23284, (804) 367-1298.

July 22-25: **International Microwave Conference/Brazil,** Rio Palace Hotel, Rio de Janeiro, Brazil. Contact: Mauro Assis, Embratel-DDH, Rua da Assembléia, 10-Sala 2201, 20011-Rio de Janeiro-RJ, Brazil, (55+21) 2167108.

July 22-26: **Non-Ionizing Radiations: Health Physics and Radiation Protection,** Massachusetts Institute of Technology (MIT), Cambridge, MA. Contact: Director of Summer Sessions, Room E19-356, MIT, Cambridge, MA 02139.

July 28-August 1: **1991 IEEE Power Engineering Society (PES) Summer Meeting,** San Diego, CA. Contact: IEEE, see February 3-7 above.

August 5-7: **26th Annual Symposium of the International Microwave Power Institute (IMPI),** Hyatt Hotel, Buffalo, NY. Contact: Robert LaGasse, IMPI, 13542 Union Village Circle, Clifton, VA 22024, (703) 830-5588.

August 10-16: **Annual Meeting and Exhibition of the Society of Magnetic Resonance in Medicine (SMRM),** San Francisco Hilton and Towers, San Francisco, CA. Contact: SMRM, 1918 University Ave., Suite 3C, Berkeley, CA 94704, (415) 841-1899.

August 13-15: **IEEE 1991 International Symposium on Electromagnetic Compatibility (EMC),** Hyatt Cherry Hill, Cherry Hill, NJ. Contact: IEEE 1991 International Symposium on EMC, PO Box 609, Lincroft, NJ 07738.

September 17-20: **5th International Conference on AC and DC Power Transmission,** London, U.K. Contact: IEE, see April 15-18 above.

September 22-27: **12th IEEE/PES Transmission and Distribution Conference and Exposition,** Dallas Convention Center, Dallas, TX. Contact: Sarma Maruvada, IREQ, 1800 Montee Ste-Julie. Varennes, Quebec J3X 1S1, Canada, (514) 652-8201.

September 24-26: **13th Annual Electrical Overstress/Electrostatic Discharge Symposium,** Riviera Hotel, Las Vegas, NV. Contact: Terry Welsher, AT&T Bell Labs, 600 Mountain Ave., Rm.3B-321, Murray Hill, NJ 07974, (201) 582-5279.

September 29-October 2: **11th Annual Meeting of the Bioelectrical Repair and Growth Society (BRAGS),** Orange Tree Resort, Scottsdale, AZ. Contact: Ethel Pollack, BRAGS, PO Box 64, Dresher, PA 19025, (215) 659-5180.

September 30-October 3: **Radiation Protection for Man and Environment,** Aachen, Germany. (The meeting commemorates the 25th anniversary of the founding of the German-Swiss Society for Radiation Protection.) Contact: Dr. H. Jacobs, Forschungszentrum, Jülich GmbH, Postfach 1913, 5170 Jülich, Germany, (49+2461) 3188.

October 8-10: **International Conference on Microwaves and High Frequencies,** Nice, France. Contact: Comité Français de L'Électricité, Tour Atlantique – Cedex 06, 92080 Paris–La Défense, France, (33+1) 47.73.66.15.

October 15-18: **1991 EPRI EMF Utility Seminar,** San Jose, CA. Contact: Radiation Studies Program, Electric Power Research Institute, Palo Alto, CA, (415) 855-2320.

October 31-November 3: **13th Annual International Conference, IEEE Engineering in Medicine and Biology Society,** Orlando, FL. Contact: Dr. Joachim Nagel, Dept. of Biomedical Engineering, University of Miami, PO Box 248294, Coral Gables, FL 33124, (305) 284-2442.

December 9-12: **6th International Conference on Mobile Radio and Personal Communications,** Warwick, U.K. Contact: IEE, see April 15-18 above.

Dates and Locations To Be Announced

November: **Annual Department of Energy Contractors Review.** Contact: W/L Associates, 120 W. Church St., Frederick, MD 21701, (301) 663-1915.

December: **1st Meeting of the European Bioelectromagnetics Association.** Contact: Dr. Jocelyne Leal, Departamento de Investigacion, Hospital Ramón y Cajal, Madrid 28034, Spain, (34+1) 358-1365.

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