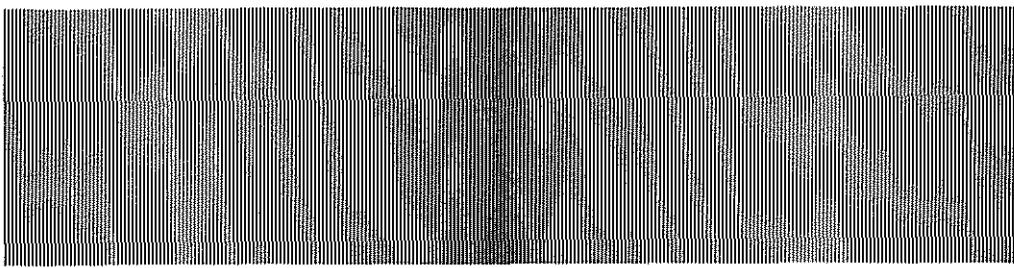


MICRO WAVE NEWS



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Microwave News invites readers to contribute letters or reports for *From the Field*, our monthly column featuring news and opinions from the RF/MW community.

SAB Panel Wants Changes in EPA RF/MW Bioeffects Report

The Environmental Protection Agency's (EPA) draft report on the biological effects of radiofrequency/microwave (RF/MW) radiation will undergo significant revision before a final version is approved. Responding to criticisms from a special review panel, the agency's Office of Research and Development (ORD) has agreed to rewrite its assessment of thermal risks, the backbone of the report.

EPA will use the three-volume literature review and assessment as the basis for a general population exposure standard for RF/MW radiation. The agency's Office of Radiation Programs (ORP) had hoped to release a draft of this "guidance" in September but is now unlikely to publish a proposal until next year. (The EPA guidance will be binding only for federal agencies.) Problems in setting up a Scientific Advisory Board (SAB) panel to evaluate the draft report contributed to the delay in ORP's schedule.

The SAB panel met to discuss the draft report on September 22-23 in Washington, DC. Despite its request for major changes, the panel asked ORD's Dr. Joe Elder, the principal author of the bioeffects document, to complete the revisions by December. Elder said the schedule is optimistic but possible. Elder was "very pleased" with the meeting, stressing that "the bottom line is that ORP has something to use to move forward with the guidance."

Controversy Over Thermoregulatory Thresholds

The panel's section-by-section review went smoothly until it reached Section 4.1 on thermal physiology, prepared by ORD's Dr. Christopher Gordon. The panel found the analysis generally inadequate and directed special criticism at Gordon's extrapolation of thermal threshold response in animals to humans. Several panel members told Gordon that humans are better thermoregulators than the report indicates. The panel as a whole asked Gordon to rewrite the section and several members asked him to recalculate the thresholds using data from different animal experiments and human models.

The debate over thermoregulation was complicated by Dr. Eleanor Adair's criticism that it is impossible to extrapolate from animals to humans in this area. Elder told *Microwave News* that it is too early to tell what effect Adair's opinion will have on either ORD's revisions or the guidance. The onset of thermal effects is one of three approaches used in the report to identify thresholds.

Elder agreed to revise the assessments in Section 6 of the report which are based on Gordon's work. Drs. Barbara Chang, Sol Michaelson and Adair were particularly upset by the conclusion that the thermal activation

(continued on p. 2)

point for humans, calculated in terms of specific absorption rates (SARs), would be approximately 0.27 to 0.81 W/Kg. This translates into power density exposures of 1.2 to 2.6 mW/cm² at resonant frequencies.

The panel's criticisms are echoed in written comments submitted to the SAB by John Mitchell of the Air Force School of Aerospace Medicine and to EPA by John Bergeron of General Electric (see excerpts on p.3).

Panel members were fairly pleased with the rest of the report, except for a subsection on the nervous system which must be rewritten. The contributing authors attending the meeting were generally receptive to the panel's recommendations.

Key Issues

Early in the meeting, Elder asked the panel to consider several key issues in the course of its review, starting with the adequacy of the data base. Most panel members felt that, however incomplete the data, a standard must be set. They went on to discuss whether ORD should have assessed which RF radiation effects are hazardous instead of simply describing where and at what levels the effects occur.

ORP's Dr. David Janes, who is heading EPA's guidance development, told the panel this issue is not up for debate; ORP will make this assessment and consider it, along with a number of other factors, in setting exposure limits. Janes reported that the limits in the draft guidance "are not sufficiently in hand to discuss at this time."

Elder also asked how ORD should handle literature published after 1980, the cutoff date for most of the material included in the report. He said his group considered this issue at an August meeting and found that recent data "substantiated" the conclusions in the report and "served to reinforce the general conclusion that the data base is becoming more solid and more quantitative."

Dr. Michael Marron of the Office of Naval Research briefed the panel on experiments underway at Johns Hopkins University's Applied Physics Lab which indicate the endothelial layer of the cornea can be damaged by pulsed 2450 MHz radiation at power densities below 10 mW/cm². He said the work by Henry Kues and co-workers also provides evidence of cumulative RF/MW radiation effects (see *MWN*, July/August 1983).

Elder cited two human studies completed after 1980. In one, first reported in 1981, Dr. William Morton of Portland, OR, found a correlation between RF/MW levels and the incidence of leukemia in some Portland neighborhoods (see *MWN*, January/February 1982); he confirmed this conclusion in a June 1983 revised report. Peer reviews of both reports found that the author's data did not substantiate his conclusion. The other study, published in the March/April 1982 issue of the *Archives of Environmental Health* by Swedish researchers, found a higher than expected incidence of fetal deaths and malformed infants among physiotherapists who used shortwave diathermy equipment (see *MWN*, June 1982).

Elder also raised the issues of whole body versus localized SARs, potential psychological effects of RF hearing and extrapolation from animals to humans. The panel skip-

ped over the first two items, though Professors Arthur Guy and Stephen Cleary argued over the clinical significance of RF hearing. Problems with extrapolation received considerable attention. ORD was criticized for its assumption, listed in the report's introduction, that humans and other mammals are equally sensitive to RF radiation.

Revision Schedule

Professor Charles Susskind, panel chairman, skillfully kept the meeting on track and on schedule. But in the push to complete final business, the panel had no time to discuss seven questions submitted by ORP's Janes. These are reprinted below.

Susskind requested that EPA's revisions for those sections of the report requiring only minor changes be sent to panel members by October 15 and returned to Elder by October 31. Sections requiring major rewrites should reach the members by November 15 and be returned by November 30. By handling the revision process through the mail, Susskind hopes that only a few panel members will have to meet in December for the final review. Susskind plans to submit a written report on the panel's initial findings to the SAB executive board when it meets October 13-14.

Minutes for the meeting will be available from Dr. Douglas Seba, SAB Executive Secretary, EPA Headquarters, 401 M Street, SW, Washington, DC, (202) 382-2552. A transcript of the entire proceedings is available for \$0.40 per page from the Executive Court Reporters, 8525 Colesville Road, Silver Spring, MD 20910, (301) 565-0054. The transcript is approximately 300 pages.

Copies of ORD's draft report, *Biological Effects of Radiofrequency Radiation*, No. EPA-600/8-83-026A are now available from David Janes at the Office of Radiation Programs, EPA Headquarters, (703) 557-8217. ●

SAB Panel Membership

Dr. Eleanor Adair, John Pierce Foundation, New Haven; Dr. Barbara Chang, Medical College of Georgia, Augusta; Dr. Stephen Cleary, Virginia Commonwealth University, Richmond; Dr. Carl Durney, University of Utah, Salt Lake City; Dr. Arthur Guy, University of Washington, Seattle; Dr. Steven Horvath, University of California, Santa Barbara; Dr. Abraham Lilienfeld, Johns Hopkins University, Baltimore (unable to attend meeting); Dr. Sol Michaelson, University of Rochester; Dr. Mary Ellen O'Connor, University of Tulsa; Dr. Charlotte Silverman, FDA National Center for Devices and Radiological Health, Rockville; Dr. Charles Susskind (Chairman), University of California, Berkeley. Dr. Douglas Seba, SAB Executive Secretary, EPA, Washington.

Questions on RF/MW Draft Report from ORP's David Janes

1. Should data on perception and shock phenomena be considered in addition to SAR-related effects, particularly at lower frequencies? If yes, is it appropriate for this subject to be addressed in this document or in another independent report?
2. Is the available data adequate to address the effects of pulsed fields, including the hearing phenomenon? Is this topic sufficiently treated in the document? Is the scientific data base sufficiently evolved to permit development of environmental exposure guidance for pulsed fields?

3. Is the available data adequate to address the consequences of time-averaging of SAR-related biological effects? Is this topic sufficiently treated in the document? Is the scientific data base sufficiently evolved to permit development of environmental exposure guidance which includes concepts of time-averaging?

4. Is there enough information currently available to consider the clinical or public health significance of observed biological effects as reported in the document?

5. The onset of thermoregulatory response appears to be a threshold phenomenon. Does the report properly project the SAR for the onset of thermoregulatory responses in humans? If not, what is a better estimate? Are there data, either in the document or else-

where, that argue for the occurrence of adverse effects at levels below those that trigger thermoregulatory responses?

6. To what extent can SAR-related biological effects be projected to define effects at frequencies other than the frequency of study? (Please address extrapolation to frequencies both within and beyond the range of coverage of the document.) If yes, what are the exceptions, if any?

7. Do recent refinements in models, i.e., actual human shapes, cause significant deviations from predictions of SARs based on the spheroidal models used in the document? If yes, should they be treated in the document?

Excerpts from Comments on EPA's External Review Draft Report on RF/MW Bioeffects

The extracts below are taken from six sets of comments on EPA's external review draft of its report Biological Effects of Radiofrequency Radiation, submitted prior to the September 22-23 meeting of SAB's special review panel. EPA's Environmental Criteria and Assessment Office in Research Triangle Park, NC, received comments from Warren Gleseking for AT&T, John Bergeron for General Electric, Daniel Bart for GTE, Kenneth Cox for MCI and John Osepchuk for Raytheon. John Mitchell of the Air Force School of Aerospace Medicine submitted his comments to the agency's Scientific Advisory Board.

Air Force: Any extrapolation from animal data to the human condition should be based on all available data of comparable validity. There are major scientific flaws in mixing different thermoregulatory responses in different species, measured in different ambient conditions and comparing actual data with predictive data from models. Our analysis of some relevant data shows that the extrapolation provided in this document is probably not correct. Ideally, data for a single thermoregulatory response in a single species over a wide range of masses at constant ambient conditions should be used to establish a relationship of threshold SAR to body mass.

AT&T: It is our opinion that this critical and comprehensive review of the available literature on the subject is a thorough and competent effort, and should be a good basis for the EPA to arrive at reasonable and effective environmental exposure standards or recommendations.

General Electric: Although localized internal energy deposition can occur in specific experimental exposures, in real life three factors tend to nullify any such effect: The first is that most exposures will be non-resonant, the second is that normal motion and posture changes will produce fluctuations in the location and intensity of energy deposition, and the third is that real-life environmental exposures entail such low SARs that localized "hot spots" are very unlikely given thermal diffusion and blood circulation. Given these factors, the fear of "hot spots" in real-life exposures seems greatly exaggerated....If EPA were to accept for policy purposes the inappropriate species extrapolations and untested model that underlie [an estimated response threshold that occasionally may be lower than 0.4 W/Kg], the limit obtained would not only be tenuously founded but also would reflect a "no-effect" goal rather than a "no-harm" goal....What is novel in the draft document is the use of resting metabolic rate to scale the relative importance of a given SAR between species, a device that makes it appear initially that man is 6.4-fold more susceptible than the mouse to a given small SAR. It is not incorrect to say that an SAR of 1 W/Kg is propor-

tionately greater with respect to the resting metabolic rate in man than in the mouse, but it is misleading and inappropriate to imply thereby that man is correspondingly at greater risk....Because of the great differences in mechanisms and capacity to thermoregulate between rodents and man, even valid comparisons for a given facet of thermoregulation would be inappropriate guides if taken out of the context of overall thermoregulation.

GTE: The final report should include a summary of known or deduced energy windows or thresholds, along with considerations that suggest the highest permissible peak levels for short exposure....Pertinent to establishment of a standard is an understanding of the variations in power density likely to occur in the far field owing to terrain irregularities and structures. For compliance purposes, suggestions should be included on spatial averaging as a means of establishing a representative power density.

MCI: MCI Communications commends the Environmental Protection Agency on its comprehensive review of the scientific information on the biological effects of radiofrequency (RF) radiation....MCI submits this filing not to comment on the technical accuracy of the report, with which MCI takes no issue, but for the purpose of urging the agency to move expeditiously to address the remaining task of establishing standards for safe exposure to radiofrequency energy....The absence of a generally accepted safe level of exposure for the population at large will continue to have a financial impact on the radio route construction plans of MCI and the other common carriers. An increase in the costs of developing, engineering and constructing radio routes is caused by the need to re-route segments of a radio route in order to overcome construction denials and withholding construction permits.

Raytheon: The review generally adheres to a critical standard of high scientific values and criteria. It emphasizes the hard scientific data, which is on a quantitative basis, with more discriminating attention to soft or speculative material....It is desirable that the frequency range of interest be extended down to 10 kHz from 0.5 MHz in order to include presently relevant public issues used as safety near navy VLF transmitters....The assumption of "equal sensitivity" for man and experimental animal is unwarranted. On the other hand, no account is made of the unique stress associated with the artificial constraints of a laboratory animal vs. the free human being....The general caveat on pulsed fields producing different effects than CW is of doubtful validity....It would appear from the recent literature that there is no substantiation for alleged BBB effects at flux densities less than 10 mW/cm².

NMR: More than Spectroscopy and Imaging

Living systems can have unexpected biochemical and physical properties under conditions of nuclear magnetic resonance (NMR), according to recent experiments at the University of Salford in England. Although NMR spectroscopy has long been used to decipher molecular structure, and NMR imaging is winning a huge following as a diagnostic tool in medicine, this is the first indication that the biology of living organisms is affected by radiation at magnetic resonance frequencies.

The key finding of the Salford group, reported in a paper in the *Journal of Biological Physics*, is that "NMR can induce marked changes in the growth of biological cells." More generally, they found that biological materials are susceptible to specific frequencies, which are easily identified. The implications of the Salford experiments go far beyond the safety of NMR imagers because they show that the resonance frequencies associated with the earth's magnetic field can affect biological systems.

The location of resonance frequencies is a function of a nucleus' magnetic moment and the strength of the applied magnetic field. For example, a hydrogen atom (a proton) in a magnetic field of 400 gauss has a resonance frequency of 1.7 MHz. Thus a FONAR QED-80 imaging system with a 400 gauss permanent magnet uses an RF signal of 1.7 MHz (see p.10). In the earth's magnetic field of 0.5 gauss, the proton resonance frequency is 2.13 kHz.

Each nucleus with a magnetic moment will have its own set of resonance frequencies. Though not all isotopes have nuclear magnetic moments, many do, including carbon-13, nitrogen-14, oxygen-17 and chlorine-35.

Professor Cyril Smith and co-workers at Salford University found that in the earth's ambient magnetic field there were sharp resonances in the dielectric loss of live yeast cells at the NMR frequencies associated with hydrogen-1, sodium-23, phosphorus-31, chlorine-37 and potassium-39.

They also exposed soil bacteria to proton NMR conditions (a magnetic field of 250 gauss with an RF field of 1.06 MHz) and measured their rate of growth. To their surprise, they found nearly a doubling in the growth rate. The researchers conclude that these "unexpected" results "suggest that proton NMR speeds up DNA replication in the cells, which in turn implies that the test cells are ready to divide at an earlier stage in the cell cycle than the control cells."

They close the paper with an intriguing suggestion: the nuclear magnetic resonances may explain some of the effects claimed to be associated with power lines because, in the earth's magnetic field, the resonance frequency of potassium-39 is only one percent away from the second harmonic of 50 Hz and that of chlorine-35 is near the third harmonic of 60 Hz.

"Dielectric Measurements on Live Biological Materials Under Magnetic Resonance Conditions" by A.H. Jafary-Asl, S.N. Solanki, E. Aarholt and C.W. Smith appears in *Journal of Biological Physics*, 11, 15-22, 1983. The Salford

group promises to elaborate on their findings in a subsequent paper.

Last year two of the authors, Smith and Aarholt, put forward the hypothesis that 50-60 Hz fields could promote the production of opiates in the human body (see *MWN*, April 1983). Their address is: Department of Electronic and Electrical Engineering, University of Salford, Salford, M5 4WT, England.

RTCA To Study RFI Aboard Aircraft

The Radio Technical Commission for Aeronautics (RTCA) has set up a special committee to study the potential for radiofrequency interference (RFI) from electronic and electrical equipment used aboard aircraft. The action came in response to growing concerns that radiation leaking from portable computers and similar devices could affect a plane's navigation and communication systems.

RTCA's Bill Fuchs told *Microwave News* that there are doubts this type of RFI is a problem, but that it is prudent to settle it one way or another.

The RTCA decision, reached at an Executive Committee meeting on September 23, was precipitated by a request from Eastern Airlines' D.W. Crosby, director of quality assurance and chief of engineering. Eastern asked RTCA to set industry-wide standards for use of electronic devices on aircraft. In his August 25 letter, Crosby cited an incident in which a hand-held Pac Man video game caused a jet engine to shut down.

Crosby also pointed to a number of press stories that questioned the safety of allowing passengers to use computers in flight. For instance, a widely circulated cover story in the August 22 *InfoWorld*, "Portable Computers: Hazards in the Air?" noted that Eastern Airlines had banned the use of computers by passengers on its jets as a precaution against RFI (see *MWN*, September 1983).

On September 22, the day before the RTCA Executive Committee meeting, the *Wall Street Journal* reported that American, United, Western and Continental Airlines had issued prohibitions similar to Eastern's. The article also cited an RFI incident aboard a United jet; a portable computer appeared to cause faulty readings in the plane's navigation equipment. Undeterred, Pan Am, Republic and TWA continue to allow their customers to compute in flight. The editorial writers at the *Journal* took a dim view of the ban in the next day's editions, calling it a dangerous case of over-regulation.

RTCA's Special Committee 156 will be chaired by Frank C. White, a technical advisor to RTCA and former staffer at the Air Transport Association of America. The committee's first meeting is scheduled for December 1-2.

The committee will offer recommendations on ways of controlling RFI in aircraft and on possible performance standards, which RTCA will use to revise its report *Interference to Aircraft Electronic Equipment from Devices Carried Aboard*, No. DO-119, issued April 12, 1963.

RTCA is a non-profit association of government and

non-government organizations, based in Washington, DC, with an interest in promoting aviation safety.

GTE Sprint Sues Over Local Microwave Law

GTE Sprint Communications Corp. has gone to court in an attempt to overturn a microwave transmission law enacted by the town of Pompey, NY, where the company operates a point-to-point relay facility. The law, which is intended to protect public health, would prevent GTE Sprint from expanding its operating capacity at the Pompey site.

Local Law No. 2 of 1982, passed by the Pompey Town Board on December 12, 1982, prohibits new commercial broadcasting facilities and requires a town permit for modifications of existing facilities. *A Law Regulating the Emission of Non-Ionizing Electromagnetic Radiation Within the Town of Pompey* also imposes a \$100 annual fee on all commercial operators.

The US District Court for Northern New York issued a preliminary injunction August 30 blocking enforcement of the law. The town agreed to GTE Sprint's request for the injunction.

In its brief to the court, GTE argues that the Federal Communications Commission's (FCC) jurisdiction over microwave transmissions supersedes local laws, making the Pompey law unconstitutional. In any event, the company claims it is exempt from the law under an agreement with the town signed before the law was enacted.

Anthony Rivizzigno, attorney for Pompey, told *Microwave News* that the town's response to the suit was due in court October 3 but refused to comment further on the case.

GTE Sprint is concerned that enforcement of the law would establish a precedent permitting local jurisdictions to regulate the siting and operation of microwave transmitters. According to Bob Sills, an attorney with the New York City firm of Reboul, MacMurray which is representing GTE, this case is the first instance in which GTE Sprint has filed suit for the right to operate as it chooses on an existing site. The company previously has contested zoning challenges, he said.

Citing potential serious health hazards associated with non-ionizing electromagnetic radiation (NEMR), the Pompey law states that, "it is considered appropriate to restrict the increase of NEMR emission facilities." Pompey is located in an area of high ground in New York's Onondaga County which is the site of several microwave transmission facilities. Elsewhere in the county, as well as across the nation, sitings of microwave facilities have created controversies (see *MWN*, October and December 1982).

GTE Sprint's facility began operation in 1970 and is used by the company as a link between its midwestern and eastern telecommunications networks. Sills said that the facility was operating "at capacity" and that it is neither financially nor technically feasible to detour microwave transmissions around Pompey. GTE Sprint will suffer significant commercial losses due to insufficient transmission capacity if

the town law prevents it from expanding the Pompey facility, the attorney said.

Local Law No. 2 was the outcome of a two-year effort by the Pompey Town Board to limit microwave transmissions. A moratorium on construction of commercial broadcast facilities was enacted October 13, 1980 and extended twice.

During the moratorium period, GTE Sprint negotiated an agreement with the town that it says exempted it from future laws as well as existing ones. In return, the company agreed to dismantle the smaller of two towers operating at its Pompey facility, which it did by June 30, 1983.

Six months after the agreement, on December 12, 1982, the Town Board passed Local Law No. 2, which required all commercial broadcasters to file a statement within 90 days providing technical data on operating broadcasting facilities. Also required is the annual fee of \$100 "for the use by the town to conduct tests and studies concerning the emission levels and effects of NEMR and to monitor the levels of NEMR at various sites throughout the town." Sills says that GTE Sprint did not file a statement or pay the fee because it believed the prior agreement excluded it from having to do so.

On August 15, 1983, the town ordered GTE Sprint to comply with the law no later than September 1. The company then filed suit.

US Union Wins Alternative Work for Pregnant VDT Users

A Boston clerical workers' union has won the right for VDT operators to be assigned to non-VDT work during pregnancy in a contract agreement reached with Boston University (BU). This is the first major union contract in the US that allows VDT users to request alternative work for health and safety reasons. Union members ratified the agreement August 3.

Jenny Hochstadt, Health and Safety Officer for the United Auto Workers District 65 local at BU, told *Microwave News* that the contract, "provides very concrete improvements in working conditions at the university." The agreement does not acknowledge health risks associated with VDT use, however, stating that, "research to date has not proven that VDTs are a health and safety hazard."

The contract says that, "the university will attempt to reassign a pregnant employee to work which does not require the use of a VDT," at the employee's request. If alternative work is not "practicable" the employee will be eligible for up to three months of unpaid leave in addition to six months unpaid leave already provided for maternity.

Several Canadian unions have won the right for workers to be assigned alternative work. The Communication Workers of Canada was the first when Bell Canada agreed more than 2 years ago to allow pregnant operators to switch jobs or take extended maternity leave (see *MWN*, April 1981). Other major Canadian unions subsequently negotiated similar agreements including the Ontario Public Service Employees Union (see *MWN*, September 1982).

HIGHLIGHTS

The contract also requires that BU make "every reasonable effort to ensure that workstation designs are appropriate for VDT use," reflecting the concern of many operators about musculo-skeletal and minor visual health effects. The university will prepare and distribute to all departments advisory guidelines explaining "appropriate installation and utilization" of VDT equipment. Hochstadt said that the 825-member union will be involved in preparation of the guidelines.

VDT health and safety became "the major issue" of the union's Health and Safety Committee a year ago, Hochstadt said, when four women operators had problem pregnancies (see *MWN*, October, 1982). In the past year another VDT user at the university has had a difficult pregnancy.

Hochstadt said that the new contract language grew out of the university's refusal to reassign a pregnant operator last fall. BU later reversed its decision following complaints from the woman's co-workers, making this a union issue. She said that six women at the university now have requested and been assigned to non-VDT work, all prior to the recent contract agreement. These reassignments set a precedent that Hochstadt said will discourage the university from urging maternity leave rather than providing alternative work.

BEMS '83: Part II

In our July/August issue we surveyed a number of reports from the annual meeting of the Bioelectromagnetics Society (BEMS) which dramatized the importance of the time variable in bioeffect studies. Outlined below are some of the other papers that were presented in Boulder, CO, the week of June 12th.

ELF

- A new type of effect on DNA from extremely low frequency (ELF) radiation exposures was reported by Dr. Abraham Liboff, a visiting scientist at the Naval Medical Research Institute in Bethesda, MD. Liboff used a wide range of frequencies between 10 Hz and 4 kHz and found that magnetic fields at intensities of 0.2-4.0 gauss, on the order of the earth's magnetic field, significantly increased DNA synthesis in human embryonic cells. The enhancement reached a maximum some 20 hours after the start of exposure during the mid-S phase of the cell cycle. Liboff has confirmed the effect with 13 different cell types. While he has been unable to find a consistent trend in the results, Liboff said that the effect was not dependent on heating, induced current (that is, changes in the magnetic field [dB/dt]) or frequency. Liboff plans to continue his experiments when he returns to Oakland University in Rochester, MI, in early October.

- Professor Hans-Arne Hansson of the Institute of Neurobiology at the University of Gothenburg, Sweden, disclosed new details on the "lamellar" bodies induced in Purkinje nerve cells of newborn rabbits by chronic exposure to 50 Hz radiation at an intensity of 14 kV/m (see *Brain Research*, 216, 187, 1981). Though he could not explain the

cause or significance of the lamellar bodies, Hansson said that the effect appears to be species-dependent. He found the same kind of structures in pigs (30 kV/m at 60 Hz) as in rabbits but *not* in rats (14 kV/m at 50 and 60 Hz). The effect was only observed when the exposed animals were housed outdoors, not indoors, leading him to speculate that climatic and stress factors could be important variables.

- Dr. Hana Pafkova of the Institute of Hygiene and Epidemiology in Prague, Czechoslovakia, was unable to present her paper on the effect of electrostatic and 50 Hz fields on chicken embryos; Dr. Don Justesen of the VA Medical Center in Kansas City, MO, read it for her. Pafkova found "no important embryotropic effect" of a 50 Hz field, but did detect a significant retardation in development after repeated exposures (4-6 hours a day for a week) to a 17 kV/m pulsed electrostatic field. Acute exposures to a pulsed electrostatic field had no effect.

- Dr. Carl Blackman and co-workers at EPA's Health Effects Research Lab in Research Triangle Park, NC, have extended their studies on calcium efflux in chick brain tissue (see *MWN*, July/August 1982 and January/February 1983). Since last year's BEMS meeting, Blackman has experimented with frequencies as high as 120 Hz, using multiples of 15 Hz. Blackman reported finding highly significant results at odd multiples of 15 Hz, but that 60 and 90 Hz fields also showed significant efflux as compared to sham exposed animals. Signals at 120 Hz were not effective. Blackman advised that those planning large scale animal experiments should consider those frequency and intensity combinations that are biologically active.

- In an interview at the BEMS meeting, Dr. Jose M.R. Delgado of the Centro Ramon y Cajal in Madrid, Spain, said that he was preparing a new paper, to be published in the *Journal of Anatomy*, discussing the influence of pulse shape on the effects of low level, ELF magnetic fields on chick embryo development (see *MWN*, March 1983). He also said that his group was beginning work on an epidemiological study of workers exposed to 50 Hz radiation.

RF/MW Radiation

- Members of Professor A.W. Guy's lab at the University of Washington, Seattle, gave an advance report on the outcome of their long-term, low level study. Rats were exposed to 2450 MHz, 8 Hz modulated pulsed microwaves (10 us, 800 pps) for 25 months at a power density of 480 uW/cm², with an SAR of about 0.4 W/Kg. The data are now being analyzed; a final report should go to the project sponsor, the air force, by this fall. While a significant enhancement of B and T cells was observed in the interim kill, Dr. Lawrence Kunz reported that there was no change in these cells at the end of the experiment. Dr. Robert Johnson said that the exposed rats had a reduced food intake during the last 20 weeks of the experiment, showed variations in their corticosterone levels (no consistent trend was apparent) and had increased adrenal masses. There was no overall difference in death rate compared to controls. Kunz added that the animals were able to perceive a microwave environment but

that "there is no indication that this change in perception has any effect on the biology of the animal." They conclude: "Although final integration and interpretation of all data are still in progress, it is clear that while various end points show significant changes following exposure to pulsed RF [radiation], they appear to be of minor clinical significance with regard to overall mortality of the exposed population compared to sham exposed populations."

• Dr. Przemyslaw Czerny offered new data on his continuing studies on the mutagenic potential of microwaves. He said that he and Drs. Ewa Manikowska-Czerska and William Leach at FDA's National Center for Devices and Radiological Health in Rockville, MD, had demonstrated changes in chromosomes of male mice during spermatogenesis at 0.915, 2.45 and 9.45 GHz with SARs of 1 and 20 W/Kg. He warned that these results should be interpreted with caution because the effect was a function of dose rate, frequency, pulsing characteristics, method of exposure and sampling procedure. For instance, he explained that other experiments at 27 MHz at SARs of 1 and 3 W/Kg showed no mutagenic effect. He said that more research is needed to see whether the effect is reversible and to determine its biological significance.

• FDA's Dr. John Monahan presented some data on his experiments which are part of the US-USSR identical experiment (see *MWN*, July/August 1982). Researchers in each country are exposing male rats to 2450 MHz radiation at a power level of 10 mW/cm² for 7 hours. He reported that exposed rats displayed "altered behavior," but that it was not clear whether the effect reflected "changes in activity levels, altered emotionality, changes in memory or some other behavioral parameter."

Millimeter Waves

• A group led by Dr. Friedrich Kremer from the Max Planck Institute for Solid State Physics in Stuttgart, West Germany, reported that they had discovered a "significant" non-thermal effect of millimeter waves at a power level of less than 5 mW/cm² in the 64-69 GHz frequency range. Their experiment, which was run double blind, showed an impairment of the puffing pattern of giant chromosomes of a midge. They hypothesize that the observed effect could be understood in terms of Frohlich's theory of coherent excitations. (This paper has already been published in *Coherent Excitations in Biological Systems*, edited by H. Frohlich and F. Kremer, New York: Springer-Verlag, 1983.)

• US scientists have been unable to find any response to millimeter wave radiation. Professor Shirley Motzkin and co-workers at the Polytechnic Institute of New York in Brooklyn exposed *E. coli* to 45.5-46.1 GHz (6.5-6.59 mm) radiation at power levels of 0.05, 0.5 and 5 mW/cm², looking for enhanced colicin production as had been reported by Soviet researchers. They found no effect. Similarly, L. Furia, Dr. O. Gandhi and Dr. D.W. Hill of the University of Utah in Salt Lake City were unable to observe any change in the growth rate of yeast exposed to 41.82 and 41.84 GHz waves at a power density of 20 mW/cm² in the waveguide. (See also Bioeffects Update on p.9.)

Spectrum Static: Radio & TV RFI

The increasingly crowded radio spectrum is generating more and more complaints of radiofrequency interference (RFI) among users who share frequencies or whose allocations are next to each other. Three RFI cases now pending before the Federal Communications Commission (FCC) illustrate the commission's difficulties in finding equitable solutions which are politically viable. Indeed, the problem may get worse before it gets better.

UHF-Land Mobile

An FCC-backed plan to resolve interference between an Atlanta UHF-TV station and nearby land mobile services is losing momentum. In a June 23 letter the FCC instructed WVEU, Channel 69, to arrange and pay for the frequency relocation of 23 land mobile licensees and ordered the land mobile licensees to cooperate with WVEU. More than three months later little progress has been made.

The problem began in 1981 when WVEU began full power (2,630 kW) testing of its transmitter atop Atlanta's Peachtree Plaza Hotel, also the site of the land mobile repeaters (see *MWN*, December 1982). The proximity of the WVEU signal, at 800-806 MHz, to the land mobile facilities operating at 806-807 MHz produced out-of-band interference that persisted at much lower power levels. The station was ordered to cut power to 2.63 kW, a 30dB or a 1000-fold reduction.

When the FCC rejected WVEU's subsequent petition for half-power operation, the station proposed paying for changing the frequency of the land mobile licensees rather than its own frequency, which it estimated would cost 10 times more. The station says that relocation will not impair the operation of the land mobile repeaters.

The FCC gave WVEU 30 days from June 23 in which to submit a report regarding the "final decision of the affected parties," but an FCC spokesperson told *Microwave News* at the end of September that no report has yet been provided. WVEU officials could not be reached for comment but one indication that things have turned sour is that three land mobile licensees have filed petitions asking the commission to reconsider its support for the WVEU relocation plan.

Cable TV-Amateur Radio Conflict

The American Radio Relay League (ARRL) has renewed its request that the FCC prohibit cable TV from broadcasting on amateur radio frequencies. The National Cable Television Association (NCTA) objected to the League's action in formal comments submitted to the commission. Previously NCTA had called the ARRL plan a "draconian proposal."

Citing the "burgeoning cable TV signal leakage interference problem," ARRL asked the FCC to expedite consideration of its January 1982 petition seeking the frequency exclusion. ARRL contends that NCTA has failed to follow through on joint attempts to resolve interference problems. After the original September 15, 1982 FCC deadline for filing comments on the ARRL plan, NCTA "ceased all

HIGHLIGHTS

efforts to work with the league to resolve interference problems," according to ARRL. The league says that more than 100 cases of cable-amateur radio interference remain unresolved and that "the problem is as acute as, or worse than" it was when the original petition was filed.

Wendell Bailey, Vice President for Science and Technology for NCTA, told *Microwave News* that ARRL is unrealistic in demanding a clear radiofrequency environment. NCTA says that cable-amateur interference is a "two way street" and that cable broadcasters experience interference from amateur radio transmissions. Bailey said that NCTA had worked with ARRL to resolve 42 cases of RFI and that the issue is a "high priority with NCTA."

The cable association asked the FCC to deny ARRL's request to expedite proceedings and also urged that the January 1982 petition be dismissed. An FCC staffer said that the ARRL petition is pending and that no date for commission action has been set.

TV6-FM Interference

Responses to a proposed FCC rule intended to minimize FM radio interference with channel 6 TV (47 *Federal Register* 24144, June 3, 1982) indicate sharp differences between commercial TV and non-commercial FM broadcasters. The FCC's final decision in this case could greatly

affect how the broadcasters do business in the future.

National Public Radio (NPR) and the Corporation for Public Broadcasting (CPB) contend that the "long-term solution" lies in improved TV receiver selectivity. The National Association of Broadcasters (NAB), the Association of Maximum Service Telecasters (AMST) and other commercial broadcast organizations argue for restrictions on FM spectrum allocation and other measures that place the burden on FM stations operating between 88 and 92 MHz, a range allocated to non-commercial educational assignments (for a review of the comments to the FCC, see the September 12 *Broadcasting*).

An FCC spokesperson called this a "no-win situation, a hopeless case." Whichever way it is resolved, he said, one side will be greatly inconvenienced. Review of the comments received will begin in early November and a report is likely by May of next year, he said.

The upper limit of Channel 6 transmissions, at 88 MHz, abuts the noncommercial FM radio frequencies. TV signals are susceptible in large part because they are transmitted over a wide band whereas FM uses smaller bands.

Prior efforts by radio and TV broadcasters to resolve this RFI problem have failed and the debate on the basic issue of who will make the necessary changes remains polarized.

CONFERENCES

November 7-9: Department of Energy and Electric Power Research Institute Contractors Review, Hilton Plaza Inn, Kansas City, MO. Dr. William Wisecup, Aerospace Corp., 955 L'Enfant Plaza, SW, Suite 4000, Washington, DC 20024, (202) 488-6328.

November 7-9: Non-Linear Electromagnetic Interactions with Tissue, University of Maryland, College Park, MD. Contact: Professor Leonard Taylor, Dept. of Electrical Engineering, University of Maryland, College Park, MD 20742, (301) 454-6850.

November 7-9: 1983 Satellite Communications Symposium, Hyatt Regency Hotel, Atlanta, GA. Contact: Betsy Crawley, Symposium Coordinator, 3845 Pleasantdale Rd., Atlanta, GA 30340. (404) 577-1234.

November 8-11: 29th Annual Conference on Magnetism and Magnetic Materials, Hilton Hotel, Pittsburgh, PA. Contact: F.E. Werner, Westinghouse R&D Center, 1310 Beulah Rd., Pittsburgh, PA 15235, (412) 256-3556.

November 13-18: 69th Annual Meeting of the Radiological Society of North America, McCormick Place, Chicago, IL. Contact: George Schyler, RSNA, 1415 W. 22nd St., Suite 11509, Oak Brook, IL 60521, (312) 920-2670.

November 14-17: 1983 Radio Technical Commission for Aeronautics Annual Assembly and Technical Symposium, Marriott Crystal Gateway Hotel, Arlington, VA. Contact: RTCA Secretariat, One McPherson Square, 1425 K St., NW, Suite 500, Washington, DC 20005, (202) 682-0266.

November 16-17: JINA 83, (2emes Journees Internationale de Nice sur les Antennes), Nice, France. Contact: J.L. Guiraud, Centre National d'Etudes des Telecommunications, Centre de La Turbie, 06320 Cap D'Ail, France. (93) 41-17-17.

December 8-9: Radiation and Energy: Confronting the Challenges of the Eighties - Law, Regulation, Risk Liability, Litigation and Compensation, New York, NY. Contact: James Lawrence, Lloyd's of London Press, 817 Broadway, New York, NY 10003, (212) 673-4700.

December 12-17: 8th Annual IEEE International Conference on Infrared and Millimeter Waves, Carillon Hotel, Miami Beach, FL. Contact: Dr. K.J. Button, National Magnet Laboratory, Building NW-14, MIT, Cambridge, MA 02139, (617) 253-5561.

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January 11-14: National Radio Science Meeting, University of Colorado, Boulder. Contact: S.W. Maley, Dept. of Electrical Engineering, University of Colorado, Boulder, CO, 80309, (303) 492-7004.

January 16-20: Microwave Signatures in Remote Sensing, URSI Commission F Specialist Meeting, Toulouse, France. Contact: Dr. Richard Moore, Remote Sensing Laboratory, University of Kansas Center for Research, 2291 Irving Hill Drive, Lawrence, KS 66045, (913) 864-4836.

January 17-19: Instrumentation & Measurement Society Technology Conference (IMTC) 1984, Aboard the Queen Mary, Long Beach, CA. Contact: Robert Myers, 1700 Westwood Blvd., Suite 101, Los Angeles, CA 90024, (213) 475-4571.

January 27-29: Symposium on NMR Imaging, Fontainebleau Hotel, Miami Beach, FL. Contact: American College of Radiology, 6900 Wisconsin Ave., Chevy Chase, MD 20815, (301) 654-6900.

February 6-8: NIH Consensus Development Conference on Use of Diagnostic Ultrasound Imaging in Pregnancy, National Institutes of Health, Bethesda, MD. Contact: Michaela Richardson, NIHCD, Bldg. 31, Room 2A32, 9000 Rockville Pike, Bethesda, MD 20205, (301) 496-5133.

February 20-22: Office Automation & You, Los Angeles Convention Center, CA. Contact: American Federation of Information Processing Societies, Inc., 1815 N. Lynn St., Arlington, VA 22209, (703) 558-3617.

March 13-14: 1984 National Radar Conference: Radar Technology for the 80's, Atlanta, GA. Contact: Dr. Edward Reedy, Georgia Institute of Technology, Engineering Experiment Station, Radar & Instrumentation Lab, Atlanta, GA 30332 (404) 424-9621.

BIOLOGICAL EFFECTS

Birth Defects...It is well known that heat is a teratogen, and that high doses of RF/MW radiation, which cause heating, can hurt the growth and development of the embryo and fetus. Still unresolved, however, is whether RF/MW radiation can be teratogenic if it does *not* cause a temperature increase. Two new studies by researchers at NIOSH in Cincinnati, OH, affirm that temperature rise in the exposed organism is the key variable. In a paper published in the most recent issue of *Bioelectromagnetics* (Volume 4, Number 3, 1983), a group headed by Dr. Joseph Lary reports that the temperature of the dam and the length of time the temperature is elevated determine the incidence of teratogenic and embryotoxic effects: the longer the exposure, the smaller the temperature rise necessary to cause abnormalities. The NIOSH team used fairly high levels, SARs of 11 W/Kg at a frequency of 27.12 MHz. In a second paper, appearing in the May issue of the *Scandinavian Journal of Work, Environment and Health*, Lary and co-workers exposed animals to lower levels of radiation which did not cause any heating, 0.4 W/Kg at 100 MHz, and observed no adverse effects. In a telephone interview, Lary said that, based on known mechanisms, it is "highly unlikely" that there would be a teratological effect without a temperature rise, although he would not totally eliminate the possibility of some kind of athermal response. The question of whether there is a threshold remains unresolved, Lary added. The NIOSH results are in general agreement with those from EPA's Health Effects Research Lab and from Dr. Ronald Jensch's group at Thomas Jefferson University.

Millimeter Waves...Thirty-nine scientists from eight countries participated at the URSI symposium on *Techniques in Studies of Biological Effects of Low Level Millimeter Waves*, September 4-6. Dr. Fritz Keilman of the Max Planck Institute for Solid State Physics (Festkörperforschung), the chairman of the symposium, was pleased with the opportunity for "lively discussions," as were other attendees such as Professor Saul Rosenthal of the Polytechnic Institute of New York, who was the US organizer of the meeting. Keilman was especially happy that Dr. O.V. Betsky, a member of N.D. Devyatkov's group of the USSR Academy of Sciences in Moscow, was able to attend. We plan to have a more detailed report of the symposium in a later issue....Those trying to keep up with the Soviet work at these frequencies will be interested in the new issue of *Biological Effects of Non-Ionizing Radiation: A Digest of Current Literature*, Volume VII, Number 2-4. The issue contains a complete translation of "Effect of Millimeter Band Electromagnetic Radiation on Bacterial Cells" by A.Z. Smolianskaia, which appeared in *Non-Thermal Effects of Millimeter Band Radiation* edited by N.D. Devyatkov and published by the USSR Academy of Sciences in 1981.

Non-Linear Interactions...Professor Leonard Taylor of the University of Maryland is hosting a two-day workshop on *Non-Linear Electromagnetic Interactions with Tissue*.

The workshop, supported by FDA and ONR, will review the theoretical background and the latest progress towards understanding the physical basis for non-linear phenomena and will consist of both tutorials and poster papers with plenty of time for open discussion. Attendance is limited to about 75 participants and by invitation only. Taylor expects to publish a summary report of the meeting. For more information contact Taylor at the Dept. of Electrical Engineering, University of Maryland, College Park, MD 20742, (301) 454-6850....Some non-linear phenomena are governed by Chaos Theory, which has been getting some attention in technical and lay journals recently. Here are some references: "Simplicity and Universality in the Transition to Chaos" by Alan Wolf and "Chaos in Complicated Systems" by Arun Holden in *Nature*, September 15, 1983; "Pathways to Chaos" by Ivars Peterson in *Science News*, July 30, 1983; and "Connoisseurs of Chaos" by Judith Hooper in *Omni*, June 1983.

COMPATIBILITY & INTERFERENCE

ASTM Emergency Standard...ASTM (the American Society for Testing and Materials) Committee D-9 is developing an emergency standard at the request of the Society of Plastics Industry, *Standard Test Method for Electromagnetic Shielding Effectiveness of Planar Materials*. According to ASTM's James Dwyer, it is rare for the society to issue emergency standards. This one was prompted by the FCC regulations on computer emissions. Copies of the standard will be available as soon as the committee completes its balloting and gives its final approval. Meanwhile ANSI Committee C63 has set up a special task group, under the leadership of EMACO's Herb Mertel, to review the ASTM standard.

RFI from ISM Sources...Dr. Satish Kashyap reviews RF/MW emissions from ISM sources and compares them to the limits set by the US, Canada and CISPR for controlling RFI in the June issue of the *Journal of Microwave Power* (Volume 18, Number 2). Kashyap, who is with the Electromagnetic Engineering Section of the National Research Council of Canada and is the editor of the *Journal*, presents some interesting facts. For instance, some 75,000 kW of high frequency dielectric heating is used in industrial applications in the US, and induction heating has ten times the power of dielectric heating. Kashyap also found that the total amount of high frequency power used for ISM applications most probably exceeds the total kilowatts used for communications. He points out an apparent inconsistency: while it is widely believed that ISM equipment is the largest source of radio noise, the number of documented cases of ISM interference is less than one percent of all the RFI complaints. In 1981, there were 35,063 RFI complaints in Canada but only 69 of these were related to ISM equipment....The ad hoc committee for the CCIR Interim Working Party 1/4 on ISM equipment interference limits will meet on October 13 at the FCC to discuss the US position on new limits. A task force, chaired by T. Lamont Wilson, has

UPDATES

been studying a preliminary US proposal and is preparing a progress report for the meeting.

All Eyes on Coleco Certification....It is not often that the FCC's rules on computer RFI emissions are the subject of daily national news stories, but then Coleco Industries' new Adam home computer is not a typical computer. Coleco has been one of Wall Street's favorite stocks and the Adam system, which includes a letter quality printer and 80K of RAM for only \$600, may bolster Coleco's fortunes at a time when many small computer companies are going bust. But before the Adam could be shipped to stores for the Christmas buying rush, the FCC had to certify that it did not emit excessive amounts of RF radiation. (All personal computers designed for home use are "Class B" devices and must win FCC certification.) Coleco was having problems debugging Adam's software for the printer, causing FCC to delay its RFI tests. Industry analysts who had predicted a big market for Adam started getting nervous. As Gary Putka reported in the September 21 *Wall Street Journal*, Coleco "shares have been gyrating wildly lately, as rumors and counterrumors have spread about the production and shipment schedules for Adam." News stories about the RFI tests were probably only surrogates for progress reports on Coleco's success in resolving programming bugs, nevertheless it generated an unusual amount of interest in the FCC's RFI rules. On September 22 the FCC certified Adam and daily coverage subsided. The consumer will now decide whether all the interest was justified.

Resources...In last month's issue, we referred to a proposed EMC standard prepared for the FDA by McDonnell-Douglas. The title of the document is *Electromagnetic Compatibility Standard for Medical Devices, MDS-201-0004*, October 1, 1979....The 1983 *Electrical Overstress/Electrostatic Discharge Symposium* was held in Las Vegas, NV, September 27-29. A copy of the proceedings will be available next January for \$24 (US) or \$34 (non-US) from the Reliability Analysis Center, RADC/RAC, Griffiss AFB, NY 13441, (315) 330-4151. Ask for Catalog No. EOS-5. All orders must be prepaid....The Radio Technical Commission for Aeronautics (RTCA) has released *TCAS I: Functional Guidelines*, Document No. RTCA/DO-184 prepared by Special Committee 147, May 1983. It contains functional guidelines for the surveillance, proximity warning and cross-link elements of the Traffic Alert and Collision Avoidance System I (TCAS I), primarily used in general aviation aircraft. The report addresses minimum performance requirements for EMC and equipment test procedures. It is available for \$16 (prepaid) from RTCA Secretariat, One McPherson Square, Suite 500, 1425 K Street, NW, Washington, DC 20005. RTCA has also set up a new special committee to prepare minimum operational performance standards for airborne microwave landing system (MLS) area navigation equipment. Robert Schwab of the Boeing Airplane Co. has been appointed the chairman of Special Committee 151....The FCC has proposed rules to give AM stations in Alaska more protection from interference. The commission acted in response to a petition from

the Alaska Broadcasters Association. The FCC proposal appears in the August 10 *Federal Register*, (48 FR 36278).

MEDICAL APPLICATIONS

Notes on NMR...Patient and operator exposures to static and RF magnetic fields from an NMR imager are far below recommended guidelines, according to a report in *Magnetic Resonance Imaging*, a new Pergamon Press journal. Dr. Whit Athey and Paul Ruggera of FDA's National Center for Devices and Radiological Health in Rockville, MD, and Dr. Ronald Ross of Diagnostic Imaging Associates (DIA) in Cleveland, OH, measured the electric and magnetic fields from FONAR Corp.'s QED-80 imaging system and found that patients are exposed to time-averaged magnetic fields of 4.6 A/m at 1.7 MHz—resulting in an SAR of 0.017 W/Kg. The electric field was below 10 V/m, the detection limit of the Holaday 3002 meter used in the survey. Last year the FDA recommended guidelines for exposures from NMR (see *MWN*, April 1982), specifying a maximum power deposition of 0.4 W/Kg. (The FDA limits do not take into account frequency specific effects. These may be more important than previously believed, see story on p.4.) Operator exposures are "at least an order of magnitude lower than for the subject, even at the point of closest approach." With respect to the static magnetic field, this Fonar imager has a permanent magnetic field of about 0.04 Tesla (400 gauss), well below the FDA's 2 Tesla exposure limit. The FONAR QED-80 does not use time varying magnetic fields, so the third FDA exposure criterion which covers these does not apply. In a telephone interview, Athey said that FDA had no immediate plans to do additional surveys, partly because such data are submitted to the agency by the manufacturers in their pre-market approval applications. Athey added a note of caution on overinterpreting his findings; the FONAR unit studied will not be marketed. While DIA began the first clinical trials of an NMR imaging system in the US in late 1980 with the QED-80 unit, the company is now developing a newer model for commercial production. The survey appears in Volume 1, Number 3 of *Magnetic Resonance Imaging*, which, though dated 1982, only appeared in July 1983....The American College of Radiology has published a *Glossary of NMR Terms*. It is available for \$4.00 from the college's Publication Service, 6900 Wisconsin Avenue, Chevy Chase, MD 20815.

MILITARY SYSTEMS

Project ELF Litigation....Expert witnesses testified before District Court Judge Barbara Crabb on September 20-22 in the case of *State of Wisconsin v. Weinberger*. The court will decide whether the navy must prepare a new environmental impact statement for its Project ELF communication system (see *MWN*, July/August 1983). Duwayne Gebken of the Wisconsin Department of Natural Resources, Professor John Moulder of the Medical College

of Wisconsin in Milwaukee and Dr. Nancy Wertheimer of the University of Colorado Medical Center appeared for Wisconsin. Dr. Robert Becker came down with pneumonia and was unable to testify. The navy pared down its witnesses to four: Admiral William Smith, the former Director of Naval Communications in the Office of the Chief of Naval Operations, Martin Abromavage of IITRI, Dr. Don Justesen of the VA Medical Center in Kansas City, MO, and Dr. Karl Straub of the VA Hospital in Little Rock, AR. The court is scheduled to hear Becker's testimony followed by the navy's rebuttal during the week of October 17. A date has not yet been set. Meanwhile, the navy will soon release an environmental impact assessment on its ELF activities in Michigan. The navy has told the court that it will not begin construction until 30 days after the document's release, to allow for public comment.

POWER LINES

DC Bioeffects Report...In the last few issues we have reported on Bonneville Power Administration's (BPA) 500 kV AC transmission line from Garrison, ND to Spokane, OR. While there are no plans to convert the line to DC, BPA had raised this as a possibility when the line was announced and the necessary permits were sought. As a result, the Montana Department of Natural Resources and Conservation in Helena commissioned Dr. Asher Sheppard of the VA Hospital in Loma Linda, CA, to study the health implications of a DC line. Sheppard's *Biological Effects of High Voltage Direct Current Transmission Lines*, a companion volume to his earlier AC report, is now available from the National Technical Information Service (NTIS). Sheppard reviews the bioeffects literature on air ions and electric and magnetic fields as well as shock hazards and possible interference to cardiac pacemakers. Report No. PB 207258 costs \$13.00 for a paper copy or \$4.50 for microfiche from NTIS, Springfield, VA 22161.

Radiation...The Computer and Business Equipment Manufacturers Association (CBEMA) may file a petition with the Federal Trade Commission (FTC) to stop what it believes to be false claims about health and safety risks of VDTs. The trade group has launched an information-gathering campaign to aid in research. According to CBEMA general counsel John Voorhees, advertisements for products claiming to protect against emissions from VDTs make "false claims." Voorhees said that, "In fact, there are no dangerous X-rays or emissions coming from visual display units." CBEMA is asking people to submit advertisements for products that purport to block radiation emissions from VDTs. The group says that when appropriate it will contact the advertisers and ask for retractions. An FTC petition will be filed "if we establish a pattern of false advertising," Voorhees said....Studies of extremely low frequency (ELF) and radiofrequency (RF) emissions from VDTs done as part of a Canadian government study released earlier this year appear in the September *Health Physics* (Volume 45, Number 3). "Extremely Low Frequency Electromagnetic Emissions from Video Display Terminals and Other Devices" and "Radiofrequency Emissions From Video Display Terminals" were based on research used in preparation of *Investigation of Radiation Emissions from Video Display Terminals* (see *MWN*, July/August 1983) published by Canada's Department of National Health and Welfare.

Ergonomics...The Australian Bank Employees Union's State Bank Division has instructed its members not to help install or implement the use of new VDTs at the State Bank of Victoria until the bank agrees to a set of ergonomic standards. The union has a policy requiring an assessment of terminals and associated furniture, according to the September 12 *Computerworld*....The Canadian Standards Association's (CSA) draft *Guidance on Ergonomics of the Office Environment* has been delayed at least until January, (continued p.12)

CLASSIFIEDS

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a CSA spokesperson told *Microwave News*. The draft had been scheduled for a September release (see *MWN*, July/August 1983). CSA established a Technical Committee on Ergonomics of the Office earlier this year to undertake preparation of the guidance. The committee now plans to produce a final guidance next fall....The International Ergonomics Association (IEA) will hold an "International Scientific Conference on Ergonomics and Health Aspects of Modern Office Jobs" November 7-9 in Turin, Italy. The conference will address VDTs and other office equipment as well as toxic agents and indoor air quality. For more information contact Mr. H.L. Davis, General Secretary, IEA, Human Factors Group, Eastman Kodak, Rochester, NY. The conference will be in English.

Research and Reports...After four meetings, the new *Technology in the Workplace* committee formed by CBEMA this summer announced it will concentrate on six general areas. One of the topics to be addressed is the health and safety of new information technologies, including VDTs. The committee, chaired by Earl Behm of 3M, has no plans to release any details of its work until next year....The final report of an extensive study of Ontario Hydro clerical workers will be presented to the company's board of directors in early October, a spokesperson for the company told *Microwave News*. A lengthy (1,000-page) draft of the report has been completed but is being condensed for the board and for the general public. A prior study at Ontario Hydro found a significant link between VDT use and complaints of eye irritation, blurred vision and neck and shoulder aches (see *MWN*, April 1983). The full report probably will be made available to interested researchers. For more information, contact the Office of Safety Services, Ontario Hydro, 757 McKay Road, Pickering, Ontario, Canada, LIW 3C8.

CORRECTIONS

Narda...In our July/August issue, we reported that Narda Microwave of Hauppauge, NY, had introduced a new electric field probe, Model 8682, capable of measuring radiation levels relative to the new ANSI RF/MW safety standard. The listed price for the probe was incorrect. It costs \$2,500....**CCOHS...**In the same issue, the mission of a new section on physical hazards formed by the Canadian Center for Occupational Health and Safety in Hamilton, Ontario, was misdefined. The section will focus on non-ionizing radiation in general and electromagnetic fields in particular.

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SHORT COURSES

November 1-3: An Introduction to EMI/RFI/EMC, Los Angeles, CA. Fee: \$815. Contact: Don White Consultants, Inc. (DWCI), State Route 625, PO Box D, Gainesville, VA 22065, (703) 347-0030.

November 1-4: Advanced Radar Concepts, Rockville, MD. Fee: \$720. Contact: Linda Billard, Technology Service Corp. (TSC), 8555 16th St., Suite 300, Silver Spring, MD 20910, (800) 638-2628.

November 1-4: Grounding & Shielding, Philadelphia, PA. Fee: \$815. Contact: DWCI, see November 1 above. Repeated • January 24-27: Phoenix, AZ.

November 2-4: Millimeter Wave Systems, Devices and Markets, Mountain View, CA. Fee: \$595. Contact: Microwave Training Institute (MTI), 444 Castro St., Mountain View, CA 94041, (415) 969-7363.

November 7-9: Digital Communications: Satellite/Earth Station, Terrestrial Microwave, Mobile Radio & Cable Systems, Toronto, Canada. Fee: \$700 (Canadian). Contact: Ms. E. Lepage-Feher, DIGTECH, 3003 Southmore Dr. East, Ottawa, Ontario K1V 6Z5, Canada, (613) 733-7105. Repeated • November 30-December 2: Palo Alto, CA. Fee: \$700 (US) Contact: Ms. Marie Huang, (408) 268-4312.

November 7-9: Strategic/Tactical Communications by Satellites, Vienna, VA. Fee: \$675. Contact: Satellite Systems & Technology Inc., 3134 Juniper Lane, Falls Church, VA 22044, (703) 532-6274. Repeated • November 14-16: Palo Alto, CA.

November 7-11: Synthetic Array and Imaging Radars, Los Angeles, CA. Fee: \$875. Contact: Short Course Program Office, UCLA Extension, PO Box 24901, Los Angeles, CA 90024, (213) 825-1295.

November 8-10: EDP Equipment Design Seminar on Coping with the FCC/NDE Regulations on RFI, San Francisco, CA. Contact: EMXX Corp., 6706 Deland Drive, Springfield, VA 22152, (703) 451-4619

November 11: Product Safety Seminar: National and International Aspects, San Francisco, CA. Fee: \$275. Contact: EMXX, see November 8 above.

November 14-18: Protection Against MW/RF Radiations, Electric and Magnetic Fields, Ispra, Italy. Fee: 350,000 Lira. Contact: Secretariat ISPRA Courses, Centro Commune di Ricerca, 21020 ISPRA (Varese), Italy, (0332) 781128.

November 14-18: Principles of Modern Radar, Atlanta, GA. Fee: NA. Contact: Department of Continuing Education, Georgia Institute of Technology (GIT), Atlanta, GA 30332, (404) 894-2547.

November 15-25: Biological Effects and Dosimetry of Non-Ionizing Radiation: Static and ELF Electromagnetic Fields, Erice, Italy. Fee: \$500. Contact: Professor Martino Grandolfo, Istituto Superiore di Sanita, Viale Regina Elena, 299, 00161 Rome, Italy.

November 21-23: Hazardous RF Electromagnetic Radiation, Washington, DC. Fee: \$685. Contact: Continuing Engineering Education, George Washington University (GWU), Washington, DC 20052, (800) 424-9773.

November 22: Microwave Components Market Forecast Seminar, Mountain View, CA. Fee: \$295. Contact: MTI, see November 2 above.

November 28-30: Electromagnetic Pulse, London, England. Fee: \$785. Contact: GWU, see November 21 above.

November 30-December 2: Microwave Testing, Mountain View, CA. Fee: \$595. Contact: MTI, see November 2 above.

December 5-6: EMI Workshop, Philadelphia, PA. Fee: \$575. Contact: R&B Enterprises, 20 Clipper Road, W. Conshohocken, PA 19428, (215) 825-1960.

December 5-9: Microwave Circuits: Theory & Applications, Sunnysvale, CA. Fee: \$850. Contact: Continuing Education Institute, Suite 1000, 10889 Wilshire Blvd., Los Angeles, CA 90024, (213) 824-9545 or (301) 596-0111.

December 5-9: EMC Design & Measurement for Control of EMI, Los Angeles, CA. Fee: \$995. Contact: DWCI, see November 1 above.

December 6: Electrostatic Discharge Control Seminar, Phoenix, AZ. Fee: \$275. Contact: EMXX, see November 8 above.