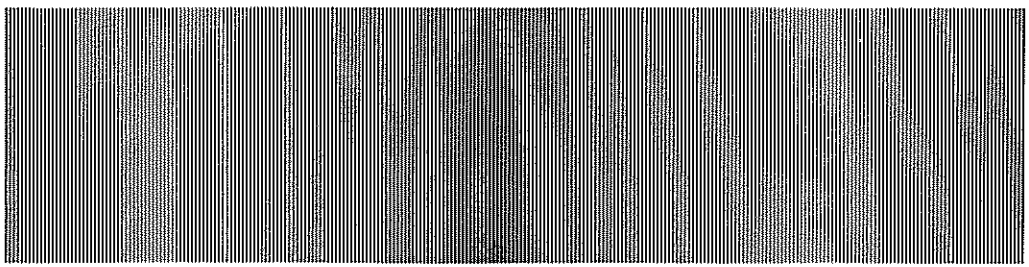


MICRO WAVE NEWS



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A Monthly Report on Non-Ionizing Radiation

December 1983

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VDTs: VLF Measurements

Researchers at the Canadian Center for Occupational Health and Safety (CCOHS) have measured "relatively strong" emissions of very low frequency (VLF) radiation near the flyback transformers of some video display terminals (VDTs). They also have demonstrated a "practical method" for shielding against these emissions.

The center's Dr. Karel Marha and David Charron found that a simply constructed copper foil hood "greatly reduced VLF levels" around the terminals.

These results are described in a draft version of *The Very Low Frequency (VLF) Emissions Testing of CCOHS Video Display Terminals*. The document is currently under review and is scheduled for publication by CCOHS in early 1984.

The VLF electric field exceeded 300 V/m at 20 cm from the casings of several terminals near their flyback transformers, although significantly lower levels were found in front of the screen. Marha and Charron used an IFI EFS-1 meter which goes off scale at 300 V/m and so the maximum readings are unknown.

Emissions from flyback transformers are pulsed, with peak values from five to ten times greater than average readings, according to CCOHS spokesman Jim Purdham. The intensity of the individual pulses was not measured.

Pulsed v. Continuous Waves

Purdham said in a telephone interview that the authors hope their findings will lead to research on the biological effects of pulsed waves as compared to those of continuous waves. He said the draft report "helps define the research that's needed."

(continued on p.7)

NCRP To Study ELF Bioeffects

The Environmental Protection Agency (EPA) has asked the National Council on Radiation Protection and Measurements (NCRP) for a critical review of the biological effects of extremely low frequency (ELF) radiation.

Under a three-year, \$150,000 contract, the NCRP will assemble a committee of experts to evaluate studies from around the world on the effects of ELF electric and magnetic fields, including those from high voltage overhead power lines.

W. Roger Ney, executive director of NCRP, said that the council is now in the process of assembling Scientific Committee No. 79 to write the report for EPA. Nominees for chairman and members of the committee are being weighed and will be presented to NCRP's Board of Directors at its December 13 meeting. (There are usually six to ten experts on NCRP committees.)

Speaking from his office in Bethesda, MD, Ney said that the committee will assess what standards might be needed in addition to surveying the available literature.

(continued on p.7)

EBI v. Inco Case Settled

Electro-Biology Inc. (EBI) has retained its patent for the Bi-Osteogen bone regenerating system after a two-year court battle against three subsidiaries of Inco Ltd. In an out of court settlement, the Fairfield, NJ, company also acquired Inco's patent for treating bone breaks with pulsed electromagnetic fields (PEMFs). The November 11 agreement removes the threat of competing devices entering the market under licensing agreements from Inco.

Although the terms of the settlement are confidential, sources close to the proceedings report that Inco received no money or future royalties because, they speculated, EBI probably would have won its suit.

EBI sought a judgment from the Federal District Court for Southern New York, New York City, in 1981 (81 Civ. 7592) to uphold the validity of its patent, which defines specific electromagnetic signals that enhance bone growth. Inco held an extremely broad patent for PEMF bone treatment. (Inco Ltd. is a Canadian corporation.)

The suit focused on whether EBI obtained the rights to the Bi-Osteogen signal illegally. In a countersuit filed in 1982, Inco accused Dr. Arthur Pilla, one of the founders of EBI, of developing the idea for the Bi-Osteogen generator while still working for the Electric Storage Battery Corp. (ESB), which later became an Inco subsidiary called Exide. During Pilla's four-year tenure at ESB he was obligated to assign all discoveries to ESB. Pilla left ESB in February of 1975; EBI filed a trademark application for its device that June, which claimed the machine had been in existence since April, and Pilla and a colleague filed a patent application for certain PEMFs that fall.

Pilla maintains that the Bi-Osteogen signal was not discovered and patented until mid-1976. In an interview he explained that the 1975 filing was so general that it was rejected by the patent office.

After Pilla left ESB he went to work at Columbia University where John Ryaby and Dr. Andrew Bassett were already on staff. The three researchers started EBI in 1975. Pilla currently works at Columbia part time, and is a professor of orthopedics at Mt. Sinai Medical Center in New York City.

Though not a central issue in EBI v. Inco, the scope of the two patents raises interesting questions about PEMF treatment in general and EBI's formidable market position in particular. Are some signals more effective than others, and which signals fall under EBI's patents? As yet there are no clear answers.

Inco's former patent, filed by ESB employee Michael Manning in 1972 (US Patent No. 3,893,462; 1975), covers the therapeutic use of a wide range of PEMF signals with differing pulse rise and fall times. EBI's patent, on the other hand, specifies very complex signal characteristics defined by Pilla and Ryaby (US Patent No. 4,105,017; 1978). EBI claims the Bi-Osteogen waveform is what makes treatment work, though it does not rule out the possibility that other signals are effective.

Many researchers suspect that the type of signal used to

stimulate bone growth is unimportant. For example, a number of scientists told *Microwave News* that it appears almost any signal will work, from PEMFs to ultrasound, but various systems and signals may be best suited for different applications.

Nevertheless, with Telectronics and a number of other companies now developing bone generators with signals similar to EBI's, new patent infringement claims may be filed. Asked about the Telectronics device, which is already in clinical trials, EBI Vice President Richard Reisner told *Microwave News* that his company "will take appropriate legal action" if the Telectronics signal is covered by the Manning or Ryaby-Pilla patents.

Some observers believe EBI's market position is so strong that it will ignore Bi-Osteogen look-alikes as long as competitor sales remain small. The EBI generator is by far the most widely used bone regenerating device and the only PEMF unit cleared by the Food and Drug Administration which does not require surgically implanted electrodes. According to Reisner, the generator had a 77 percent success rate for the 13,000 bone fractures treated to date. Another 7,000 patients are currently using the device.

Surprisingly, the settlement has done little to boost Wall Street's opinion of EBI. Stock prices for the fast-growing company plunged 60 percent, to about \$12 per share, in late October because of a drop in third quarter earnings. Paul Combs, a stock analyst for Morgan Stanley & Co., explained that at present, a slowdown in the demand for its product outweighs the importance of patent protection for EBI. As we go to press, EBI is trading in the low teens. Its past year high was 34.

Uncertain Link Between RF/MW and Cancer

Dr. William Morton of the University of Oregon has completed a revised report of his study linking nanowatt-levels (billionths of W/cm²) of radiofrequency and microwave (RF/MW) radiation to leukemia. His analysis of radiation exposure and cancer rates among Portland residents has failed to pass peer review at the Environmental Protection Agency (EPA), however.

The EPA-sponsored study, begun in 1978 and initially completed in late 1981, is the first to link environmental RF/MW exposures to cancer (see *MWN*, January/February 1982). Morton, a professor at the university's Health Sciences Center in Portland, believes his findings for frequencies in the very low frequency (VLF) and FM bands could be significant and recommends further studies among the general population.

[At extremely low frequencies (ELF), Dr. Nancy Wertheimer and Ed Leeper have found an association between power line radiation and leukemia. A similar link has been found in a number of studies of occupationally exposed groups (see *MWN*, March 1983).]

Because of unfavorable peer reviews, EPA will not publish the Portland study. Dr. Joe Elder of the agency's Experimental Biology Division in Research Triangle Park,

NC, told *Microwave News* that Morton's project is being closed out and that the agency has no plans to fund similar investigations. Elder said the difficulty of documenting exposure histories for the public is a key problem.

The agency is currently doing a retrospective study of workers exposed to RF/MW radiation at MIT's radiation research lab. Elder noted that these exposures are certain to be greater than those experienced by the general population.

In an interview Morton said although there were unavoidable problems with his study, he is convinced that only more research will yield adequate exposure guidelines and calm public fears. Morton plans to publish his findings independently of EPA.

Though his 1981 preliminary report indicated a link between radiation levels and adenocarcinoma of the uterus, breast cancer and leukemia, further analysis revealed an association only with leukemia.

Radiation levels for the low VHF (54-88 MHz), FM (88-108 MHz) and high VHF (176-216 MHz) bands were extrapolated from EPA measurements made in 1977. According to these measurements, the average RF/MW level in Portland is 0.02 uW/cm². Morton assumed that the levels were constant over the 1963-1977 period for which cancer incidence and mortality were checked. No information is available on how RF/MW radiation patterns in Portland changed over this period.

Soviets Again Beam Microwaves at US Embassy in Moscow

The Soviet Union resumed beaming microwaves at the US embassy in Moscow last summer, according to US Ambassador Arthur Hartman. The irradiation was intermittent with average power levels outside the embassy of 2 uW/cm². The microwaves were detected on average for two hours a day (never longer than four hours a day) between July 14 and October 19.

At a press briefing in Moscow on November 10, Hartman said that the microwaves were not a health hazard but that he had filed a formal protest with the Soviet Foreign Ministry "as a matter of principle." Two days later Reuters reported that the Foreign Ministry denied that microwaves were being aimed at the US embassy.

This is the first acknowledged resumption of the Moscow signal since the summer of 1979. The irradiation of the embassy was first discovered in 1953 and continued periodically at various frequencies and intensities for the next 26 years. In 1976 protective screening was installed on the windows at the embassy.

An informed source told *Microwave News* that the new signal comes from a single source, south of the embassy. The microwaves were primarily 7 GHz, with some components as low as 2 GHz, he said. The two-microwatt intensity was measured on the embassy roof.

The reason for the Soviets' use of microwaves remains unknown, though theories abound. Among the most popular hypotheses are that they are trying to interfere with embassy communications or are eavesdropping on conversations in-

side the embassy building. (Hartman said that the new signals did not cause any interference.)

In a new book, Martin Ebon takes the speculation one step further: the Soviets may be trying to alter the minds of embassy personnel or even read their minds by "tuning microwaves to the level of brain waves, possibly amplifying their intensity, then effecting a 'feedback' that could range from remote monitoring of brain wave activity to recording emotions, images or thoughts."

Ebon thinks that the Soviets' continued use of microwaves over so many years testifies to their utility and that "the potential of microwave technology in intelligence-gathering and brain manipulation is, literally, unimaginable." He even suggests that President Carter was subjected to some esoteric form of brain manipulation during the Vienna SALT II conference to explain what he calls Carter's "erratic, virtually manic-depressive" behavior when he returned home from Vienna.

One expert commented that he would be surprised if the Soviets could pull off something like this. "It's pretty far out," he said.

Ebon's *Psychic Warfare: Threat or Illusion* was published by McGraw-Hill (\$15.95).

ELF Fields Inside Homes Near Power Lines

Household wiring makes a significant contribution to the ambient electric fields inside homes located near power lines, according to two new studies.

GE and PSE&G

In a collaborative effort between General Electric (GE) and New Jersey Public Service Electric and Gas (PSE&G), measurements were taken in a house located 95 meters from a 500 kV transmission line and 49 meters from a 13 kV distribution line. The electric field was measured while the transmission line and house power were each "on" and "off." The results indicate that E-fields "created by the house wiring were a significant part of the total field inside the homes."

For those combinations of transmission line and house power in which at least one was "on," the measured E-fields were in the 1-10 V/m range, with maxima of 14-24 V/m. When both the transmission line and house power were turned "off," the E-fields were below 1 V/m. A limited number of measurements of magnetic (H) fields and space potentials were also made.

E-fields measured in a house located a mile from the 500 kV power line were essentially the same as those within 100 meters of the line. The maximum reading was 16 V/m.

Interestingly, the E-field was often greater in the house near the power line when the transmission line was turned off. In a telephone interview, GE's Dr. Don Deno explained that when household and power line fields combine, they can do so "in unpredictable ways." The important point, he said, is that the contributions from the wiring and the transmission line to the E-fields are of the same order of magnitude.

HIGHLIGHTS

Deno said that measuring space potentials is preferable to E-fields. He added that the unique element in this study is that the transmission line had been turned off. "That's an expensive proposition," Deno said.

Among the other results, Deno and co-workers found that houses can shield external electric fields by a factor of eight. That is, if the E-field outside a house is 80 V/m, the field inside is 10 V/m. In addition, they measured the fields generated by appliances. For example, the E-field is 250 V/m at 30 cm from an electric blanket and 90 V/m at the same distance from a stereo. Deno's paper appears in the October issue of *IEEE Transactions on Power Apparatus and Systems*.

Deno said that he is preparing two detailed reports on E-field measurements and is also collaborating with Michael Silva of ENERTECH in Pittsburgh, PA, on a measurement study for the Electric Power Research Institute (EPRI).

SRI International

Ray Vincent of SRI International, Menlo Park, CA, presented similar data to those of GE and PSE&G on November 7 at the Department of Energy-EPRI contractors meeting in Kansas City, MO. In measurements taken for EPRI, Vincent and collaborator Jane Clemmensen found that the E- and H-fields in a house 7-10 meters from a 69 kV transmission line and a 13 kV distribution line were primarily due to the house wiring and consumer appliances. Similar results were obtained for homes near only a 13 kV distribution line.

The SRI researchers also conclude that it is important to measure both the E- and H-fields for 60 Hz radiation because one is always in the source's inductive zone. Also, they argue that whenever possible harmonics and sub-harmonics should be measured.

Clemmensen said that, in general, the SRI results are "consistent" with Deno's. But she does not agree with Deno's preference for measuring the space potential. "It is not a quantity defined by the IEEE," she said, "so you are better off sticking with the E- and H-fields."

The SRI measurement study will be published as an EPRI report.

Is There Any CW Radiation?

"There is essentially no CW radiation in domestic, industrial or military environments." With these words, Dr. Ross Adey has challenged the relevance of a paper in *Science* that supports the new ANSI standard and the Environmental Protection Agency's (EPA) recent draft report on the bioeffects of radiofrequency and microwave (RF/MW) radiation.

At a meeting of Department of Energy (DOE) and Electric Power Research Institute (EPRI) contractors in Kansas City, MO, on November 8, Adey argued that the conclusions of a study by a research group at the University of Rochester were misleading. Drs. Norbert Roberts, Jr., Shin-Tsu Lu and Sol Michaelson examined the viability and function of white blood cells after a two-hour exposure to

2450 MHz continuous wave (CW) radiation (see *MWN*, May 1983). The results, which were published in the April 15 issue of *Science*, were supportive of the new American National Standards Institute (ANSI) RF/MW safety standard.

Adey said that "2450 MHz CW radiation does not occur outside the lab; it has no relevance to the real world." For example, he added, not even microwave ovens emit CW radiation. Adey said he decided to speak out because the Rochester paper had been widely cited in the press.

Michaelson, who was in the audience, replied that Adey's comments were "totally irrelevant to the proceedings of the meeting." He refused to respond beyond saying that he found them "personally insulting." The DOE-EPRI meeting was a forum on the bioeffects of high voltage power lines.

Turning to EPA, Adey said that the agency's emphasis on the thermal effects of RF/MW radiation in its criteria document is "totally inappropriate" (see *MWN*, October 1983). In addition, he charged that the membership of the special panel of the Scientific Advisory Board (SAB) assembled to review the EPA report was too heavily weighted with experts on thermal effects, with insufficient representation by those knowledgeable about non-thermal effects (see Adey's letter to EPA p.8).

EPA's David Janes replied that "it would be premature to say how the agency will set standards for public exposures to RF/MW radiation, but we want all the help we can get." The SAB panel is not the only source of EPA advice, Janes added.

NAS Briefing on Non-Ionizing Radiation

The Board on Research on the Effects of Radiation at the National Academy of Sciences (NAS) has scheduled a briefing on non-ionizing radiation for December 5 in Washington, DC. Dr. Stephen Cleary of Virginia Commonwealth University in Richmond, Dr. Przemyslaw Czerski of FDA's National Center for Devices and Radiological Health and Dr. Michael Marron of the Office of Naval Research have been invited to address the board.

June Ewing, the board's staff officer, said that the background briefing was in line with the board's oversight function: to monitor radiation issues and to advise the academy on developments as they occur. The five-member board chaired by Institute Professor Salvador Luria of MIT has no ongoing program or funding for non-ionizing radiation.

According to Ewing, the briefing was prompted by recent press reports on non-ionizing radiation in general and the New York State Power Lines Project in particular.

The review of current research on the biological effects of non-ionizing radiation and federal regulatory activities is only one part of the agenda. The briefing will be closed to the public, although representatives of federal agencies will attend as observers. Ewing left open the possibility of a public meeting sometime in the future.

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CONFERENCES

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.

January 30-February 3: IEEE Power Engineering Society: 1984 Winter Meeting, Hilton Hotel, Dallas, TX. Contact: Gerson Berman, Texas Power & Light Co., 1511 Bryan, PO Box 6331, Dallas, TX 75222, (214) 748-5411, ext. 5666.

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 23-25: Biological Effects and Therapeutic Applications of ELF Electromagnetic Fields, Venice, Italy. Contact: Dr. Luigi Zecca, Association for Biomedical Applications of Electromagnetism, Via Gentilino 9/a, 20136 Milan, Italy, (02) 8321655.

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.

April 2-5: 3rd Annual Test & Measurement World Expo, Brooks Hall, San Francisco, CA. Contact: Meg Bowen, 215 Brighton Ave., Boston, MA 02134, (617) 254-1445.

April 4-5: 20th Annual Meeting of the National Council on Radiation Protection and Measurements, Washington, DC. Contact: NCRP, Suite 1016, 7910 Woodmont Ave., Bethesda, MD 20814, (301) 657-2652.

April 14-19: 19th Annual Association for the Advancement of Medical Instrumentation Meeting and Exhibit, Washington Hilton, Washington, DC. Contact: AAMI, 1901 North Fort Myer Drive, Suite 602, Arlington, VA 22209, (703) 525-4890.

April 24-26: IEEE 1984 National Symposium on Electromagnetic Compatibility, Hyatt Regency Hotel, San Antonio, TX. Contact: William McGinnis, Southwest Research Institute, PO Drawer 28510, San Antonio, TX 78284, (512) 684-5111, ext. 2721.

April 29-May 4: 9th Conference & Exposition on Overhead and Underground Transmission and Distribution, Bartle Exposition Hall, Kansas City, MO. Contact: Walter Ros, GE, Bldg. 2, Rm 507, 1 River Rd., Schenectady, NY 12345.

April 30-May 3: 5th Annual Meeting of the Canadian Radiation Protection Association, Banff, Alberta. Contact: Stuart Hunt, C-7 Civil Electrical Engineering Bldg., University of Alberta, Edmonton, Alberta T6G 2G7, Canada.

May 7-9: 1984 Microwave Power Tube Conference, Naval Postgraduate School, Monterey, CA. Contact: John Skowron, Raytheon Co., Foundry Ave., Waltham, MA 02254, (617) 899-8400, ext. 4311.

May 7-11: Nuclear Magnetic Resonance 1984: National Symposium, Hyatt Regency Grand Cypress Resort, Orlando, FL. Contact: Ms. Norine Karwel, Educational Symposia, PO Box 17241, Tampa, FL 33682, (813) 879-8765.

May 7-12: 6th International Radiation Protection Association (IRPA) Congress, International Congress Center, Berlin, West Germany. Contact: R. Neider, Bundesanstalt für Materialprüfung (BAM), Unter den Eichen 87, D-1000 Berlin 45, West Germany.

May 30-June 1: IEEE MTT-S International Microwave Symposium, San Francisco, CA. Contact: Dr. Ferdo Ivanek, Harris Corp., Farinon Division, 1691 Bayport Avenue, San Carlos, CA 94070, (415) 594-3529. The 1984 IEEE Microwave and Millimeter Wave Monolithic Circuits Symposium will be held in San Francisco May 29-30 in conjunction with the MTT-S meeting.

June 3-8: 29th Annual Meeting of the Health Physics Society, Hyatt Regency, New Orleans, LA. Contact: Richard Burk, Jr., HPS, 4720 Montgomery Lane, Suite 506, Bethesda, MD 20814, (301) 654-3080.

EXCERPTS

The Federal Communications Commission (FCC) received nine sets of comments on how to regulate radiofrequency (RF) lighting to minimize interference problems. The comments came in response to a commission notice of inquiry (NOI) published in the August 17 *Federal Register* (48 FR 37235) (see *MWN*, September 1983). Energy efficient RF bulbs are expected to come into widespread use in the near future.

Not everyone agrees with the commission's view that

industry rather than government should police RF lighting emissions. Anova Electronics, AT&T, the National Association of Broadcasters and the National Radio Broadcasters Association told the commission RF lighting could create significant interference and supported federal standards.

Industry self-regulation was favored by General Electric, the National Electrical Manufacturers Association and the Lighting Systems Research Program at Lawrence Berkeley Laboratory and the American Radio Relay League.

Comments on FCC Inquiry on RF Lighting RFI

American Radio Relay League: It is apparent that the interference potential of this type [North American Phillips SL-18 bulb] of RF lighting device is most acute at medium frequencies such as the AM broadcast band. It might be assumed that some potential for interference exists with respect to household carrier current electronic systems, such as intercoms or some security systems....From the point of view of interference potential to amateur radio stations, the league believes it both necessary and sufficient for the commission to require labeling of each RF light bulb to provide user information to educate consumers and users about interference potential to radio receivers.

Anova Electronics: Anova Electronics has developed a fully integrated intelligent system for communications, control and protection within the home and small businesses. RF lighting has the potential for interfering with the operation of the Anova system and others which utilize power line carrier technology....Anova urges the commission to adopt a regulatory scheme for RF lighting devices which would protect communications users of the radio spectrum both radiated and via power line carrier, from interference caused by RF lighting devices.

AT&T: In summary, our position is that the commission, not the lighting industry, should regulate the RF emission of such devices, and FCC regulation should be accomplished under Part 15, rather than Part 18 of the [FCC] rules....We believe the central issue of RF interference requires the commission to apply appropriate regulatory requirements to control potential interference and harm to radio licensees and telephone equipment operators. The lighting industry simply will not adopt emission limits and related interference control mechanisms that would provide the same degree of protection that is afforded by the commission's rules. With incentives obviously different from those of the commission, the lighting industry would likely establish more liberal limits for RF emission, thus creating a higher potential for interference to other equipment operators.

General Electric: The FCC favors the use of industry-supported voluntary standards on RF design limits, and GE strongly agrees. GE recognizes the importance of a sound approach to interference control for what will become widely used lighting sources. The industry appears to be on a path of promoting good practices for interference control which, coupled with the voluntary industry standard, should minimize potential problems....Pending the adoption of a voluntary industry standard or FCC regulations appropriate to lighting sources, we recommend that the Part 18 certification requirement be eliminated. In its place, GE recommends

that manufacturers be allowed to verify that their products comply with the proposed emanation limits and then to market their products, subject only to a labeling requirement....General Electric Company, which manufactures and uses equipment in the different frequency spectrums, has a particularly high interest in promoting good RF lighting practices.

Lawrence Berkeley Laboratory: We believe the FCC should give the lighting industry a chance to develop voluntary industry standards through an organization such as NEMA....Limits should reflect different environments because the appliances in each would differ, i.e., commercial buildings have computers and communications systems; residential environments have radios, TV sets, etc. In commercial buildings wiring is in conduits; in homes power lines are not shielded.

Motorola: LORAN-C is a low frequency navigation system which operates on a center frequency of 100 kHz. The associated receivers are susceptible to interference in the band from about 75 kHz to 125 kHz. Harmonic energy from the RF lighting devices described in the instant proceeding represents a potential source of interference in this band for terrestrial LORAN-C users. It seems unlikely that direct radiation at this low frequency from these devices will be of significance. There is, however, some possibility that energy may feed onto and throughout the power distribution system and then radiate at points quite removed from the devices themselves.

National Association of Broadcasters: It is clearly probable that AM radio reception will suffer interference when used by persons who live and/or work in multi-unit complexes where RF bulbs may constitute the main source of lighting. Moreover, because the radiated energy emitted by RF lighting pollutes the electrical wiring of a building, AM radio stations that use power lines to transmit broadcast signals ("carrier current radio") may be ineffective in buildings where even just one RF light bulb is plugged into an outlet....RF lighting poses a significant problem of interference to AM radio and to possibly other broadcast and communications services operating in the 10 kHz to 80 MHz range. NAB believes that the commission should not defer to the lighting industry the authority to regulate the interference potential of these devices....The RF lighting industry has little incentive, if any, to adopt voluntary standards to reduce harmful interference to licensed broadcast communication services.

National Electrical Manufacturers Association: NEMA feels strongly that such a voluntary standard should be given an opportunity to prove effective and completely supports the commission's

position that regulatory requirements should be enacted only as a last alternative....It is the position of NEMA such RF lighting devices do not represent a serious potential for interference to authorized communication services....NEMA's position is that evidence to date supports a conclusion that [broadband emissions from RF light bulbs] do not represent a serious interference potential, nor do they represent a threat to safety and air navigation services....The technical standards designed to limit emissions from ISM equipment in general as presently exists in Part 18 is most definitely inadequate. Limits roughly approximate to the recently enacted computer rules are felt to provide very adequate protection for authorized communication services from harmful interference from RF lighting devices....

National Radio Broadcasters Association: It is imperative for the FCC, rather than the industry, to regulate the development and use of these new devices....The results of preliminary lab tests are alarming. They demonstrate that AM radios can receive objectionable radiation interference as far away as several meters from RF light bulbs.

VDTs: VLF Measurements

(continued from p.1)

Earlier this year, a CCOHS report suggested that "pulse-modulated fields could be biologically more harmful than [unmodulated] fields." The center recommended an interim limit of 60 V/m at 30 cm for all non-ionizing radiation from VDTs (see *MWN*, January/February 1983).

CCOHS scientists, including Marha, have suggested that pulsed VLF may be one of the agents suspected of causing miscarriages and fetal abnormalities among VDT operators. Clusters of pregnancy-related problems have been documented at eight sites (see *MWN*, July/August 1982).

Non-Uniform Fields

CCOHS's Purdham also discussed the effect the new measurements could have on where VDTs are placed in automated offices. An operator seated near the flyback transformer of a neighboring terminal might be exposed to VLF emissions if the terminal is not shielded. Purdham said that "if problems are being caused by VLF radiation—and we don't know that they are—configuration of VDTs becomes an important factor." VLF levels are significantly lower away from the flyback transformer.

CCOHS researchers measured 38 VDTs used at the center. Of these, 13 Hewlett-Packard units gave the high-level VLF readings. Much lower levels were produced by 25 Wang terminals, which require "no further attention," the report states. The Wang units contain a thin metallic lining inside their plastic casing to block non-ionizing radiation.

The investigators took readings at graduated distances from the terminals and at various heights above, below and level with them. The EFS-1 is a broadband (10 kHz to 200 MHz) electric field meter with sensitivity from 1 V/m to 300 V/m. It is made by Instruments for Industry of Farmingdale, NY.

Robert Bouzon, a spokesman for Hewlett-Packard (HP), told *Microwave News* the HP terminals tested by CCOHS are approximately seven years old and that HP's more recent units are shielded with metallic linings. He said that the company began using containment shielding in 1980 to prevent radiofrequency interference (RFI) and that new HP units meet RFI standards set recently by the Federal Communications Commission.

Bouzon said the CCOHS study was "curious" because the investigators did not test newer HP terminals although he acknowledged that "many thousands" of the older models are still in use. He refused to disclose a precise figure.

CCOHS's Purdham said the tests were run to gather information about terminals used at the center, not to evaluate a range of VDTs. The center owns HP terminal models 2621A and 2621P. The "P" model has a printer built into the top of its casing, which Marha and Charron say blocks emissions. The "A" model produced slightly higher readings on the side near the flyback transformer.

A Wang spokeswoman said that the company would not comment until it had seen the report.

Dr. Hari Sharma of the University of Waterloo, Ontario, said in a telephone interview that the CCOHS measurements generally are in line with readings he has taken. Sharma's tests at Surrey Memorial Hospital in Vancouver, British Columbia, found comparable VLF levels (see *MWN*, April 1983). A final report on his measurements is expected soon. ●

NCRP (continued from p.1)

The EPA contract follows soon after a congressional subcommittee asked the agency to look into the bioeffects of radiation from power lines (see *MWN*, June 1983). EPA is in the process of developing a standard for public exposures to non-ionizing radiation, but excluding ELF. In the preamble to the NCRP contract, EPA notes that its Office of Radiation Programs is contemplating a complimentary standard for ELF.

Another NCRP committee (No. 53) has completed a draft of a report on the bioeffects of radiofrequency and microwave (RF/MW) radiation (see *MWN*, October 1981). Ney said that the draft is now being reviewed by the full council membership. He predicted that the study, which has been under way since 1977, will be released in the fall of 1984. ●

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FROM THE FIELD

Letter to EPA from Dr. W. Ross Adey

On November 1, Dr. W. Ross Adey wrote to William Ruckelshaus, Administrator of the Environmental Protection Agency (EPA), concerning the agency's recently released Biological Effects of Radiofrequency Radiation (see MWN, July/August and October 1983). Reprinted below is the full text of Adey's letter (see also story p.4).

Dear Mr. Ruckelshaus:

The Environmental Protection Agency has recently issued a draft report on biological effects of radiofrequency/microwave (RF/MW) radiation as a step towards establishing a general exposure standard. I write as a research scientist with more than 20 years experience in this field, and as the leader of interdisciplinary and interinstitutional teams that have made many pioneering contributions to our knowledge of biological effects of low level non-ionizing electromagnetic fields including microwaves.

When finally established, this standard would be expected to fill important needs in defining acceptable limits for human exposure. To be effective and credible, it would therefore seem of the utmost importance that, on the one hand, this standard be based on the most comprehensive scientific information available, and on the other, that it should utilize the most relevant and realistic scientific models.

I respectfully submit that this draft report has serious deficiencies in both criteria; deficiencies that may be expected to hamper initial acceptance of the proposed standard and to grievously impede its further development as new and important scientific information becomes available.

The cutoff date for scientific material evaluated in the report is stated to be December 1980. In this rapidly growing scientific field, much new work has appeared in the past three years on biological effects of low level RF/MW fields. Many of these findings bear directly on the establishment of safety standards.

Evaluation of the scientific literature in the draft and the models developed by EPA's Office of Research and Development as a basis for the proposed standard are primarily concerned with heating as the principal cause of harmful effects in man and other living organisms. It is proposed to extrapolate down to "non-thermal" levels of exposure from thermalizing levels as the basis for a safety standard.

I respectfully submit that there is no scientific validity in this approach. Moreover, there is now unequivocal evidence that many significant neurologic, endocrine and immunologic responses occur in living tissues exposed to RF/MW fields at levels below those producing frank heating. These data have been evaluated in a recently completed study by the National Council on Radiation Protection (Panel 53), extending over the past seven years. This panel report emphasizes the unique character of the mechanisms underlying these interactions which are considered to rest on quantum mechanical mechanisms as distinct from the equilibrium thermodynamics that describes heating responses.

Amongst the findings in research since 1980 pertinent to a safety standard for RF/MW field exposure is the disclosure of effects at cell membranes mediated by pulsed and sinusoidally modulated microwave fields at non-thermalizing levels, and the coupling of these effects at cell surfaces to the cell interior. They involve the susceptibility of cell membranes to neurotransmitters, hormones and antibodies. There is impressive evidence of modification of immune functions of blood and tissue white cells by microwave fields below frank heating levels. Millimetric microwave fields have been shown to increase and decrease cell growth by exposure

at closely adjacent wavelengths, and similar fields alter the genetic structure of mammalian sex cells. Although the full significance of these findings in such problems as aging and cancer must await future research, the sequence of administrative steps to the establishment of safety standards should proceed with current knowledge of low level interactions as essential cornerstones, rather than by extrapolation from irrelevant premises derived from the unrelated field of thermoregulatory pathophysiology.

It is clear that the proportion of the US population exposed to even a single heating dose of microwaves over an entire lifetime is negligible. I submit that this alone makes an approach to standard setting through heating models quite inappropriate. At the same time, there is strong evidence that many of these interactions between tissues and low level microwave fields have a specific character that relates to pulsed and other forms of amplitude modulation of the imposed field. Therefore, an appropriate biophysical model for standard setting should take account of known modulation-dependent bioeffects. These modulation patterns are produced by virtually all military, industrial and domestic microwave devices.

Membership of the Scientific Advisory Board Panel of the Office of Research and Development, chaired by Professor Charles Susskind, is restricted to those with backgrounds in thermoregulatory physiology and in the engineering aspects of tissue heating. In no way does this panel reflect the clear importance of specific consideration of so called "athermal" microwave bioeffects. It is to these weak fields that the US population will be exposed over a lifetime. Prudence would suggest that serious consideration should be given to evidence suggesting the potentially hazardous character of certain of these fields.

Standards established on this basis might be slightly lower than those derived from thermal models. However, they would not be expected to interfere with operation of any existing military, industrial or domestic systems. Of profound importance for future developments in standard setting, there would be a rational scientific basis for continuing review of new knowledge of biological effects attributable to low level exposures.

Thank you for your consideration.

Sincerely,

W. Ross Adey, MD

Associate Chief of Staff for Research and Development
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AF's Summary of Circumstances for Radar Accident at Clear AF Station

Last month, we reported on a radiation accident at Clear Air Force Station near Fairbanks, Alaska, in which a tracking radar—part of the Ballistic Missile Early Warning System—was accidentally turned on. On November 22, we received the following statement from Vincent Murone of the Directorate of Aerospace Safety in the Air Force's Inspection and Safety Center at Norton Air Force Base in California.

At approximately 3:35 pm on September 14, 1983, nine personnel at the Clear Air Force Station site were possibly exposed for about seven minutes to high frequency radio radiation. Of the nine, seven were employees of FELEC Services, Incorporated, the company that has the Air Force contract for maintenance and operation of the radar facility at the site, and two were US government employees from the Sacramento California, Air Logistics Center.

One individual was positively not exposed because he was outside the area. Therefore, the other eight are undergoing medical evaluation.

During a normal shutdown of the tracker radar assembly, crews were sent in to perform preventive maintenance work. The tracker had been locked off to prevent RF energy from entering the feedhorn of the tracker and the area where they were to work. Then, the site crew, joined by civil engineering welders and civil service employees who were inspecting the tracker screen, entered the tracker. Work continued throughout most of the day. At about 3:35 pm, two technicians discovered that the transmitter was working and that there was RF energy being fed through the feedhorn toward their work area. They then signaled everyone to evacuate the tracker pedestal where they were working. Preliminary indication is that a key lockoff position on the transmitter was opened by a technician without standard and proper safeguards being employed.

Initially, the eight workers were examined at the FELEC Services, Incorporated, clinic at Clear Air Force Station and then on Thursday, September 15, they were transported to Fairbanks' by government vehicle where additional medical examinations were

done at the Fairbanks Memorial Hospital. Initial examinations indicated that their medical conditions were not life threatening, long term debilitating or chronic. Blood, chest X-rays and eye checks were made by physicians and an ophthalmologist at Fairbanks Memorial Hospital. Preliminary results indicate no apparent ophthalmological problems. The physicians suggested funduscopy (eye examinations) for the next six months and a neurological examination. Complete physical examinations at the hospital did not reveal any obvious abnormal findings.

On Thursday, September 15, one individual who did not feel well was admitted for observation. The other seven individuals were released and instructed to return for additional examination if any problems developed. These people returned to work. A second individual returned to the hospital on Monday, September 19, for further observation.

A thorough investigation is currently underway, looking into how the breakdown in safety procedures occurred and how safety procedures can be improved. Although there are certain data existing surrounding the event, it is impossible to determine exact exposure time or level; best estimate is that no one was exposed for more than 8 minutes.

UPDATES

BIOLOGICAL EFFECTS

Potential Epidemiology Populations...A recent EPA report identifies eight population groups exposed to radiation as potential subjects for epidemiological studies. *Potential Human Study Populations for Non-Ionizing (Radiofrequency) Radiation Health Effects* (Report No. EPA-600/S1-82-017) recommends: RF heat sealer operators, high frequency (HF) tube welders, medical diathermy operators in VA hospitals and in rehabilitation facilities, children attending schools near broadcast towers, state policemen, security guards and radar technicians. The report, which was prepared for EPA by JRB Associates of McLean, VA, cautions that no single study group is ideal. An agency staffer said that EPA is "fairly cautious" about moving forward and added that it is not a given that a "Problem Definition Study," the next step toward an epidemiological study, will be taken. The EPA report (Order No. PB 83-147447) is available for \$14.50 from the National Technical Information Service, Springfield, VA 22161.

COMPATIBILITY & INTERFERENCE

Resources...Richard Schulz, editor of the *IEEE Transactions on EMC*, has left IITRI in Annapolis, MD, to join Xerox's Office Products Division. Schulz will work with Xerox's Regulatory Agency Requirements group in Dallas. His new address is: Mail Stop 114, Xerox Corp., 1341 West Mockingbird Lane, Dallas, TX 75247.... Although the 1982 *Wroclaw EMC Symposium* was never held, the papers that would have been presented have now been published. The two-volume record includes 74 papers (41 in English and 33 in Russian) and runs 750 pages. A copy is available for \$30.00 in the US and Canada and \$36.00 elsewhere. Order

from James Hill, EMXX Corp., 6706 Deland Dr., Springfield, VA 22152. Checks should be made out to "IEEE-EMC Society."... The Electric Power Research Institute (EPRI) has been sponsoring research on ways to avoid interference caused by induced voltages on pipelines and railroad signal wires from power lines (see *MWN*, June and September 1983). The research is now complete and the EPRI reports prepared. For pipelines, the report (RP742-2), *Power Line—Induced AC Potential on Natural Gas Pipelines for Complex Right-of-Way Configurations*, has three volumes: Volume 1 (\$29.50) describes the development of analytic methods for solving EMI problems; Volume 2 (\$34.00) is a handbook for graphic analysis for those without access to a computer; and Volume 3 (\$10.00) is a user's guide to a newly developed computer program, PIPELINE, to calculate induced voltages with sample examples. The printing of the final report (RP 1902-1) on railroads, *Mutual Design of Overhead Transmission Lines and Railroad Communications and Signal Systems*, has been delayed for a few months. It also comes in three volumes: Volume 1 is an engineering analysis for designing a mutually acceptable siting design, with technical appendices in Volume 2. Volume 3 is a user's manual for a computer program, TRAIN. The price of the latter set of reports has yet to be set. Order from: Research Reports Center, PO Box 50490, Palo Alto, CA 94303, (415) 965-4081.... The FCC's Office of Science and Technology has issued *Analysis of Technical Possibilities for Further Sharing of the UHF Television Band by the Land Mobile Services in the Top Ten Land Mobile Markets*, (No. FCC/OST R83-3). A copy is available from the International Transcription Services, FCC, Room 248, 1919 M St., NW, Washington, DC 20554. For more information, contact FCC's Victor Tawil at (202) 653-8113.

GOVERNMENT

Advisory Committees...DOE has set up a new advisory committee, the Health and Environmental Research Advisory Committee, to help address the impacts of energy projects and to recommend levels of funding within the health and environment research program. The committee's charter was approved on November 22; its chairman and membership have yet to be named. A committee staffer said that he did not think the committee would review research on transmission lines. But, he added, plans are still in their formative stages. For more information, contact DOE's Gloria Decker, (202) 252-8990....The Radio Technical Commission for Aeronautics' (RTCA) Special Committee 156 on Potential Interference to Aircraft Electronic Equipment from Devices Carried Aboard will meet in Washington, DC, December 1-2, to discuss the extent of the RFI problem caused by the use of portable computers and games on planes (see *MWN*, October 1983) and to develop a work schedule for the committee. For more information, contact RTCA, (202) 682-0266....NTIA's Frequency Management Advisory Council (FMAC) will meet in Washington, DC, on December 6. The agenda is the same as it was for its last meeting on September 21: the constitution and convention of the International Telecommunications Union (ITU), High Definition Television and government and industry coordination to minimize interference from radiation devices. For more information, contact Charles Hutchison, (202) 377-0805.

MILITARY SYSTEMS

Developments at Clear...The Air Force has disclosed that human error caused the accident in which workers were overexposed to radiation at Clear Air Force Station near Fairbanks, Alaska (see *MWN*, November 1983). A technician turned on the tracking radar (see *From the Field* p.8). One of the exposed workers, Richard Eldridge, has been fired by FELEC Services Inc., a subsidiary of ITT. Eldridge told *Microwave News* that he was informed that he lost his job because he had violated his employment contract by being absent from work without permission. In fact, he said, he and his doctor had notified FELEC that he would take medical leave to seek expert medical advice. A spokesman for FELEC said that Eldridge was fired for reasons that had nothing to do with the radiation incident. He refused to reveal the specific reasons because, he said, ITT policy prevents him from discussing personnel matters. ...Alaskan Senator Ted Stevens (R) has become interested in the accident and is making inquiries about how it happened and how future incidents can be prevented....FELEC is preparing a High Accident Potential (HAP) mishap report; it was due to be released by the end of November, but has been delayed for about a month.

SE and SW PAVE PAWS Radars...Raytheon Co.'s Equipment Division of Wayland, MA, has won a \$77 million contract to build, install and test the Air Force's third PAVE PAWS radar at Robins AFB in Georgia. The phased

array radar is designed to detect sea-launched ballistic missiles at a range of up to 3,000 miles off the US's southeastern coast and can also track satellites in earth orbit. Work is scheduled to begin in the spring of 1984 and the radar should be operational in late 1986. Raytheon built the first two PAVE PAWS radars, now in operation at Otis Air Guard Base on Cape Cod, MA, and at Beale AFB, CA. It also has an option for the fourth PAVE PAWS system planned for Goodfellow AFB, TX....SRI International prepared the environmental assessment for the AF's southwest radar system at Goodfellow (Report No. USAFSAM-TR-83-13). It concluded that chronic exposure of humans to the RF radiation outside the exclusion fence "is not likely to be harmful." With respect to RFI, it found that there may be some interference with TV reception and other home electronic systems and with UHF land mobile and amateur radios, depending on which site is selected. In addition, SRI predicted that there would be no hazards associated with fuel handling or cardiac pacemakers at ground level beyond the exclusion fence and that electroexplosive devices could be safely used beyond about 1.2 miles for the basic system and 2.4 miles for the optional, higher power system.

Under the Ice...Tests run last year indicate that the navy's ELF communications system can send messages to submarines under the North Pole ice cap, according to Vice Admiral Gordon Nagler, director of command and control in the office of the Chief of Naval Operations. This is the suggestion of Nagler's testimony to a closed hearing of the House Appropriations Committee's subcommittee on defense last March. What Nagler actually said is uncertain because the recently released transcript of the hearing has been heavily censored....James B. Schultz reviews the progress being made on an alternative submarine communications system, blue-green lasers, in the November *Defense Electronics*.

EMP in Michigan...There was a pulse of sixties-style activism at the University of Michigan's Ann Arbor campus when demonstrators took over an engineering lab to protest research on EMP being carried out by Professor Thomas Senior. The students want to stop all military research at the university.

OCCUPATIONAL HEALTH

RF Sealer Studies...Two new RF sealer studies are under way. The Swedish National Board of Occupational Safety and Health will begin testing 100 RF sealer operators in January for potential ill effects of radiation exposure. Among the tests to be administered is one designed to check finger motion—the fingers are closest to the radiation source. Data collection will take about a year. In an interview Dr. Kjell Mild, the principal investigator for the study, said that he had not yet decided whether the worker population would be male or female. Most of the RF sealers in Sweden operate at 27 MHz, though some use 13 or 40 MHz. Mild is based in Umea on Sweden's eastern coast, about

300 miles north of Stockholm....The FDA has issued a contract to the Maryland Department of Health and Mental Hygiene's Office of Environment Health to locate most of the RF sealers used in the state. During the first year of a planned two-year study, the researchers will measure the RF exposure levels in the work places and assess other potential hazards. Next year, if FDA funds are available, a study population of exposed operators will be identified and the feasibility of completing an epidemiological study will be determined.

Cancer in the Electronics Industry...A Swedish study on the incidence of cancer in the electronics industry has identified a "slight excess risk of cancer" in the industry as a whole. But "blue collar workers in the industry had twice the risk of getting pharyngeal cancer compared with the working population in general." There may also be a "slight excess risk of lung cancer." Dr. D. Vagero of Huddinge University Hospital and Dr. R. Olin of Stockholm's Royal Institute of Technology report that when they looked at specific categories within the Swedish electronics industry, "certain clusters appeared." For instance, there was a raised relative risk of nasopharyngeal cancer among men in the radio and TV industry, and cancer of the nasal cavities for other electronic workers. The researchers are quick to point out that methodological problems should be considered when their results are interpreted. The study appears in the *British Journal of Industrial Medicine*, 40, 188, 1983.

POWER LINES

Resources...The Aerospace Corp. has prepared a report summarizing the status of research projects being funded by DOE, the Electric Power Research Institute and the New York State Power Lines Project on (1) 60 Hz electric and magnetic fields, (2) DC electric fields and ions and (3) spark discharges and conducted currents. The report includes recommendations for future research. A limited number of copies of *Biological Effects from High-Voltage Transmission Lines: Research Guidance*, No. DOE/CE/76007-1, September 1983, are available from Kenneth Klein, Electric Energy Systems Division, CE-143, Forrestal Bldg., Mail Stop 5E052, DOE, Washington, DC, 20585....Researchers at the Tennessee Valley Authority (TVA) have been measuring electric and magnetic fields in the vicinity of its high voltage transmission lines and have developed a model for calculating fields for various types of terrain and ground cover. They found their predictions agreed with actual measurements. *TVA's 500 kV Electric and Magnetic Fields: Measurements and Analyses*, No. DOE/ET/29016-1, September 1983, is available from the National Technical Information Service, Springfield, VA 22161....One of the criticisms leveled against Dr. Nancy Wertheimer and Ed Leeper's epidemiological studies relating cancer to power lines is that they have no precise data on exposures to the 60 Hz fields. The two researchers respond to this argument in a letter published in the November 18 issue of *Science*.

STANDARDS

IEC & EIA...The International Electrotechnical Commission (IEC) has published two new standards: *CISPR 18-1-1982, Radio Interference Characteristics of Overhead Power Lines and High Voltage Equipment—Part 1: Description and Phenomena* (\$72.00); and *CISPR 19-1983, Guidance on the Use of the Substitution Method for Measurements of Radiation from Microwave Ovens for Frequencies above 1 GHz* (\$11.00). IEC has also released the following three six-month draft rules: *77A(Central Office)3, Amendment to Publication 552-2: Disturbances in Supply Systems Caused by Household Appliances and Similar Electrical Equipment—Part 2: Harmonics* (\$5.00); *12F(Central Office)81, Publications 489-2 and 489-4, Appendix D and Publications 489-3 and 489-5, Appendix H: Guide for Construction of a 3-Meter Radiation Test Site for Measurements above 100 MHz of Equipment Emitting RF Electromagnetic Energy* (\$5.00); and *12F(Central Office)83, Publication 489-3, Appendix G and Publication 489-5, Appendix G: Guide for Construction of a 30-Meter Radiation Test Site for Equipment Receiving RF Electromagnetic Energy* (\$5.00). Copies are available pre-paid from the International Sales Dept., ANSI, 1430 Broadway, New York, NY 10018....The Electronic Industries Association (EIA) has approved a new standard, *Recommended Practice for the Measurement of X-Radiation from Direct-View TV Picture Tubes*, (No. RS-503). A copy is available for \$5.00 from Standard Sales Dept., EIA, 2001 Eye St., NW, Washington, DC 20006.

VDTs

IEEE Survey...An informal readers' poll by *The Institute*, a monthly publication of The Institute of Electrical and Electronics Engineers, found that 17 percent of the respondents experienced eyestrain, headaches or back and neck aches that they associated with VDT use. Eighty-two percent identified no health problems due to work at VDTs. In September, *The Institute* asked readers to report their VDT experiences in an item accompanying a report on the National Academy of Sciences VDT report released earlier this year (see *MWN*, July/August 1983). Three-fourths of those who responded were regular VDT users, and six out of ten of this group described their terminals as well designed.

Conference Report...A new call for an interim occupational standard governing VDT non-ionizing radiation emissions came out of the PACE conference on VDTs held in Toronto, October 27-28. It was one of several consensus recommendations adopted at a conference-closing session, moderated by Chris Dodge, a science policy specialist with the US Library of Congress. Conference participants also urged that ELF research comparing VDT users and non-operators be accorded "highest priority" by government agencies. Finally, more rapid development of non-CRT display technologies that would produce less non-ionizing radiation was endorsed. At an earlier session, Dodge told

UPDATES

participants that weak ELF fields have been shown to induce a host of ailments....A new hypothesis that might help explain VDT-related ailments was presented at the conference, as well. Eric McLuhan, a communications consultant in Ontario, said that VDT-induced stress disorders result from a clash between the right and left hemispheres of the brain. While a visual image, such as a screen display, stimulates the right half of the brain, language or information on the screen reaches the left side. What results, according to McLuhan, is a "war in the brain," causing severe stress. For more information about the conference contact PACE's president, Andrew Michrowski, 100 Bronson Ave., Rm. 1001, Ottawa, Ontario K1R 6G8, Canada, (613) 236-6265.

Resources...The American Council on Science and Health (ACSH) has published *Health and Safety Aspects of Video Display Terminals*, a 22-page pamphlet intended to "present the current scientific evidence" on VDTs. ACSH concludes that alleged radiation hazards do not exist, reported cataracts and pregnancy problems apparently are due to chance and vision and musculo-skeletal difficulties can be "caused or aggravated" by ergonomic factors. It costs \$2.00 from ACSH, 1995 Broadway, New York, NY 10023, (212) 362-7044....The risks of X-ray and microwave radiation from VDTs are discounted, and ELF emissions are only slightly more suspect in an analysis offered by a radiation protection officer from MIT. James L. Jones writes that "research suggests that any effects [of ELF], if found, will be subtle and low-level." *Video Radiation: Fears Out of*

Focus is published in the *MIT Technology Review*, October 1983....The National Academy of Sciences is sending an errata sheet to recipients of its report *Video Displays, Work, and Vision*. The results of a report done by the Newspaper Guild are incorrectly presented. Contact NAS's Pepper Leeper, 2101 Constitution Ave., NW, Washington, DC 20418, (202) 334-2000 for a copy of the corrections.

ETC...

IMPI Publications...International Microwave Power Institute (IMPI) has issued the proceedings of its symposium held in Philadelphia, PA, last July (see *MWN*, July/August 1983). The collection consists primarily of abstracts of the original papers, though some of the contributions are more detailed. A copy is available for \$20 from Barbara Jean Frye, IMPI, Tower Suite 520, 301 Maple Ave., Vienna, VA 22180, (703) 281-1515....IMPI has also published its first *International Directory of Electromagnetic Heating and Instrumentation 1983/4* for \$15.00 (members) or \$18 (non-members)....The March 1983 issue of *The Journal of Microwave Power* (an IMPI publication) features a collection of papers on "Electromagnetic Techniques in Energy Applications." Topics include RF/MW radiation applications for heavy oils, oil shale and coal....The September 1983 issue is devoted to "Electromagnetic Techniques in Medical Diagnosis and Imaging." Topics include NMR, thermography, millimeter waves and measuring lung water content.

SHORT COURSES

January 16-20: Fundamentals of Radar Cross Section, St. Cloud, FL. Fee: \$695. Contact: Southeastern Center for Electrical Engineering Education (SCEEE), Central Florida Facility, 1101 Massachusetts Ave., St. Cloud, FL 32769, (305) 892-6146. Repeated **April 30-May 4**: Los Angeles, CA (\$745).

January 17: EMC: The FCC Means Business, San Francisco, CA. Fee: \$595. Contact: Carol Clark, McGraw-Hill Seminar Center, 331 Madison Avenue, Suite 603, New York, NY 10017, (212) 687-0243. Repeated **April 3**: Boston, MA.

January 23-27: Microwave High-Power Tubes and Transmitters, Los Angeles, CA. Fee: \$875. Contact: Continuing Engineering Education, George Washington University (GWU), Washington, DC 20052, (800) 424-9773.

January 31-February 2: Millimeter Wave Systems & Technology, Atlanta, GA. Fee: \$535. Optional fourth day on millimeter wave radar for \$180. Contact: Dept. of Continuing Education, Georgia Institute of Technology (GIT), Atlanta, GA 30332, (404) 894-2547.

February 8-9: Microwave Devices & Sources, Atlanta, GA. Fee: \$475. Contact: GIT, see January 31 above.

February 13-17: Advanced Radar Technology, Orlando, FL. Fee: \$795. Contact: Linda Billard, Technology Service Corp. (TSC), 8555 16th St., Suite 300, Silver Spring, MD 20910, (800) 638-2628.

February 14-17: Modern Microwave Techniques, San Diego, CA. Fee: \$675. Contact: TSC, see February 13 above.

February 16-17: Grounding, Bonding & Shielding, San Diego, CA. Fee: \$625. Contact: GWU, see January 23 above. Repeated **April 9-10**: Washington, DC; **May 17-18**: Ottawa, Canada; **May 21-25**: Hamburg, West Germany.

February 21-24: Microwave Solid State Devices and Circuits, Los Angeles, CA. Fee: \$895. Contact: UCLA Extension Short Course Program, PO Box 24901, 6266 Boelter Hall, Los Angeles, CA 90024, (213) 825-1047.

February 27-March 2: Spread Spectrum Systems and Interference Rejection Techniques, Los Angeles, CA. Fee: \$895. Contact: UCLA, see February 21 above.

March 5-7: Planning & Implementing an NMR Imaging Facility, Washington, DC. Fee: \$695. Contact: GWU, see January 23 above.

March 12-16: Radiowave Propagation for Communications Systems Design, Orlando, FL. Fee: \$875. Contact: GWU, see January 23 above.

March 15-16: Lightning Protection, Orlando, FL. Fee: \$625. Contact: GWU, see January 23 above. Repeated **June 4-5**: Washington, DC.

March 19-23: Flat-Panel and CRT Technologies, Los Angeles, CA. Fee: \$895. Contact: UCLA, see February 21 above.

March 22-24: NMR: A Primer for Radiologists, Hilton Head Island, SC. Fee: \$375. Contact: K.V. Pyles, Foundation for Education in Magnetic Resonance, 111 Glade Park East, Kittanning, PA 16201, (415) 545-7085.

April 30-May 4: High Frequency Spectrum: New Concepts and Technologies, Washington, DC. Fee: \$875. Contact: GWU, see January 23 above.