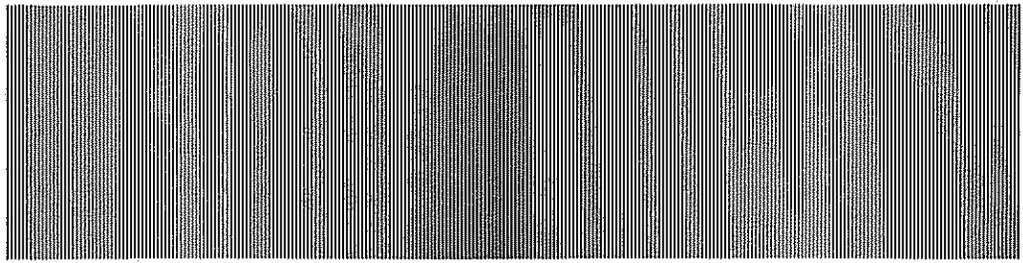


MICRO WAVE NEWS



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A Monthly Report on Non-Ionizing Radiation

November 1983

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Microwave News invites contributions to *From the Field*, our monthly column featuring news and opinions from the RF/MW community. Letters from readers are also welcome.

OSHA Stops Work on RF/MW Standard; Enforcement Stalled

The Occupational Safety and Health Administration (OSHA) has cancelled plans to develop a new safety standard for worker exposure to radiofrequency and microwave (RF/MW) radiation. In addition, informed sources report that OSHA plans to keep its 10 mW/cm² *voluntary* standard in place, thereby barring the agency from enforcing any RF/MW exposure limits.

One OSHA official, who asked for anonymity, said that the state of the RF/MW program is "as bad as it possibly can be."

Word of OSHA's decision to suspend work on a new standard came without explanation or publicity in the agency's most recent regulatory agenda, its semi-annual work schedule. OSHA only noted that its review of non-ionizing radiation had been completed in August 1983 and that RF/MW radiation had been "withdrawn" from its timetable for future action during the next year.

The decision was made by OSHA Administrator Thorne Auchter, according to Chris Graybill, a public information specialist at the agency. No analyses or other details of the decision are available, however. Graybill explained that OSHA did not have enough resources to develop all the health standards it wanted and that other standards had been given a higher priority than non-ionizing radiation.

(continued on p. 12)

Radiation Accident at Alaska BMEWS Radar Station

Six men were overexposed to radiation while working on a tracking radar at Clear Air Force Station near Fairbanks, Alaska, on September 14. The radar, which is part of the Ballistic Missile Early Warning System (BMEWS), was accidentally turned on as the men were doing routine maintenance work.

Six welders and technicians were 80 feet above the ground on the radar's antenna when the power went on. They realized the radar was turned on when they noticed that one of their flashlights was hot to the touch and another flashlight was blinking, even though it was switched off. There were also two electricians at the base of the radar at the time of the accident.

It is not yet known whether human or machine error was responsible for the accident.

(continued on p. 2)

Radiation Accident (continued from p.1)

Two of the six men were hospitalized following the accident for nausea, headaches, dizziness, extreme fatigue and memory loss. Both have been released. Four of the six have been examined by doctors at the Air Force School of Aerospace Medicine at Brooks Air Force Base (AFB) in San Antonio, TX.

A number of interviews with Richard Eldridge, one of the exposed workers, revealed there was a gross misunderstanding about the nature of radar radiation at the air force station and there were extensive delays in providing the exposed men with expert medical attention. Much of Eldridge's story was confirmed by one of his co-workers.

Few Official Details

The air force and its contractor at Clear have released few details about the accident. All requests for information from the air force are being directed to the North American Air Defense (NORAD) Space Command in Colorado Springs, CO. Kay Cormier, a public affairs officer at NORAD, told *Microwave News* that initial tests indicated the workers' exposure was "not life threatening," and that the medical condition of the exposed men will be monitored over the next six months.

Cormier said that the air force's best "guesstimate" was that the radar was turned on for no longer than seven minutes and that the power levels were above the air force's 10 mW/cm² safety standard.

The radar at Clear is maintained and operated by FELEC Services, Inc., a subsidiary of Federal Electric Corp., which in turn is owned by ITT. Four of the exposed men are FELEC employees; the two others were flown in to inspect the radar dish from McClellan AFB in Sacramento, CA, where they are civilian employees of the air force. An ITT spokesman said medical tests indicated that the exposed men could return to work and that they did. He also said their health would be monitored for at least six months.

The workers believe their radiation exposure was much more serious than the official statements suggest. Many of them are anxious about their injuries and suspicious of the treatment they received.

Misled by Radiation Badges

Eldridge, aged 40, is a welder who has worked at Clear for nine years. He was on the radar dish when the power was turned on and was later hospitalized. Eldridge accused FELEC of being lax and misinformed in the way it protected the workers. The safety officials at Clear did not know the difference between ionizing and non-ionizing radiation, he charged.

Eldridge said that he and his co-worker John Jessup had been repeatedly assured for *eight days* after the accident that their radiation badges would indicate the degree of their exposure. A week after the accident, Eldridge and Jessup were notified that lab tests on the badges showed they had not been overexposed. It was not until the following day, at a meeting with air force and FELEC personnel, that they were told the badges only measured exposures to ionizing radiation. Eldridge said that during the seven years he had worn a badge at Clear he had been told that it measured both

ionizing and non-ionizing radiation.

Immediately after the accident, a supervisor wanted Eldridge and Jessup to return to work on the radar dish. They refused. The six men and the two electricians were later given a "Class C" examination by the company nurse. Eldridge described the exam as a check of their vital signs and a visual inspection of their bodies. He said that they were found to have elevated body temperatures and high blood pressure. The shoulders and back of Karl Kepler, one of the technicians from Sacramento, were red and sore. Eldridge had a wrist burn from radiation heating of the metal buttons on his denim shirt.

The next day, the men reported to work as usual. Six hours later, all eight men were sent to Fairbanks Memorial Hospital, where they were examined in the emergency room. Eldridge said that the doctors in Fairbanks told him that they had no experience with radiofrequency radiation injuries.

Jessup was hospitalized and the other seven men were sent home. On the 16th, two days after the accident, Eldridge checked into the hospital, complaining of headaches and partial loss of sight and memory. Eldridge was released on the 18th; Jessup stayed in the hospital for a week.

The symptoms reported by the workers are in general agreement with those reported after other radar accidents. For example, at a NATO workshop in 1981, Dr. Bernard Servantie detailed three case histories of radar overexposure. In general, the cases show that radar radiation can lead to overheating, dizziness, nausea, headaches, loss of memory and general asthenia (loss of strength and energy). Servantie is a physician with the French navy, based in Toulon. (Note that the frequency and power levels associated with a given radar can vary greatly.)

Very little is known about the long-term consequences of overexposure to radar radiation. The results of the only US epidemiological study (of navy radar workers) were inconclusive. A number of former radar technicians have won out of court settlements for their injuries, which include cataracts, deafness, pancreatic cancer, neurological disorders and impotence (see *MWN*, December 1982, January/February 1983).

Delays in Expert Medical Care

The men were not offered medical attention by doctors familiar with radiofrequency and microwave radiation until September 23, nine days after the accident. And then, according to Eldridge, they were told that they would have to wait for two more weeks because of a personnel shortage at the School of Aerospace Medicine at Brooks AFB.

The six men who were on the radar were given the opportunity to go to Brooks but two had no faith in the air force's objectivity and refused. As one observer familiar with the accident put it, "They did not think they would get a fair shake."

The two electricians who were at the base of the radar at the time of the accident were not thought to have been overexposed to radiation and were not invited to go to Brooks.

Eldridge and three of the other workers arrived at Brooks between the 10th and the 12th of October. By the 22nd, all the tests had been completed. Eldridge said that his loss in vision was documented at Brooks, as was a partial loss in hearing which developed two weeks after the accident.

According to Eldridge, one of the doctors at Brooks suggested that his medical condition might be attributable to hysteria, anxiety, life-style or depression. The physician never mentioned radiation as a potential cause of his illness.

Eldridge and some of the other men are now seeking additional medical opinions. Since he left Texas, Eldridge has consulted with Dr. Milton Zaret, an ophthalmologist in Scarsdale, NY, who is an expert on non-ionizing radiation.

Lt. Col. George Schwender, chief of the flight medicine branch of the clinical sciences division at Brooks, was in charge of examining the workers. In a telephone interview, he said that the medical reports had not yet been completed. He added that each man would receive a copy of the medical tests for his own use.

A detailed report on the accident is being prepared by the air force's Inspection and Safety Center at Norton AFB in California. It should be completed in December, NORAD's Cormier said.

(Note that: The air force's standard governing exposures to radiofrequency radiation, No. 161-9, cites rules for the "medical investigation of incidents and accidents." In part, it states: "It is essential that every suspected or actual over-exposure to RF radiation be thoroughly investigated and evidence of injury or absence of injury thoroughly documented.... Personnel who may have been overexposed should be evaluated... The evaluation should be made at the nearest USAF medical facility as soon as practical after the event.")

Accident Simulation

A team of "bioenvironmental engineers" was assembled at Clear on September 22 to reconstruct the incident with the help of the workers. According to Cormier, the simulation indicated that the radar was turned on for no longer than seven minutes and that the exposure levels were above 10 mW/cm². She would not elaborate on how high the levels might have been.

Eldridge provided a different and more extensive description of the radar tests and their results. He said that he and his co-workers believe the radar was on a *minimum* of eight minutes and possibly as long as 17 minutes. Their estimate is based on an inspection of the station's power plant records, which indicated that there was a power surge at the time of the accident that lasted 17 minutes.

According to Eldridge, the air force estimated that the men were exposed to power densities of 40-45 mW/cm², but that technicians present during the simulation thought that the exposure levels were closer to 135 mW/cm². Eldridge stressed that the air force did not deny that this higher exposure was possible.

Some of the technicians told Eldridge that the air force was making the most conservative assumptions in recreating the incident and estimating the degree and extent of exposure. The net effect was to minimize the severity of the

accident, he argued. For instance, the simulation was run with the radar operating at a lower power setting than was the case during the accident; Eldridge believes the wrong correction factor was used to extrapolate the exposures from the lower to the higher power setting.

Eldridge criticized the air force for taking eight days to assemble the simulation team in an effort to understand what had happened to him and his co-workers, even though the two experts who ran the tests were already in Alaska.

Unreported Accidents at Clear

David Clarke, an electrician who spent 19 years at Clear until he was terminated in 1979, told *Microwave News* that "there have been numerous unreported accidents at the air force station." Clarke said that radiation safety was essentially ignored while he was at Clear. When radiation levels were measured in the last years he was there, he added, levels over 10 mW/cm² were often found. Describing one incident, Clarke said that "painters found sparks shooting out from their paint brushes."

Clarke is suspicious about a possible cluster of brain tumors among a small number of men he worked with. He said that there were three deaths from brain tumors among the twelve men in his department during approximately a seven year period. (There was some turnover among the men during this time.)

Clarke, now a Seattle, WA, resident, has cataracts on both the posterior and anterior sides of the lenses of his eyes. He also suffers from retinitis pigmentosa, a hereditary condition that limits his field of vision.

AN/FPS-92 Radar

The tracking radar, designated AN/FPS-92, operates at a number of frequencies in the ultra high frequency (UHF) band (300 MHz-1 GHz), with an output power at megawatt levels. It emits 27 pulses per second. The radar has a maximum range of more than 3,000 miles. The AN/FPS-92 is an improved version of the AN/FPS-49 radar which is in operation at the two other BMEWS sites in Greenland and in the United Kingdom.

The radar is housed in a golf ball shaped dome. It has a diameter of about 92 feet, while the dome has a diameter of 140 feet. There was an AN/FPS-49 installation in Moores-town, NJ, next to the New Jersey Turnpike, but the unit was phased out in 1974 and later torn down.

In addition to the tracking radar, there are three stationary screens that also emit radar radiation at Clear. Each of these are, as NORAD's Cormier phrased it, "as big as football fields." ●

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HIGHLIGHTS

Newspaper Guild Study Confirms VDT Health Problems

VDT users are likely to suffer vision problems, musculo-skeletal disorders, headaches and stress according to a study sponsored by the Newspaper Guild. Dr. Arthur Frank, the study director, also concluded that the potential risks of cataracts, skin rashes and reproductive problems cannot be determined on the basis of current scientific data, including his own research.

Frank announced these findings at a congressional hearing on October 18. He told the subcommittee on health and safety of the House Committee on Education and Labor that his survey of 1,047 guild members confirms that eye problems, neck, shoulder and low back pain all "clearly result" from ergonomic factors. These same factors may also cause personality changes, irritability and sleeping problems.

The new study findings confirm previous research by the National Institute for Occupational Safety and Health (NIOSH) (see *MWN*, May 1981).

Frank's data also agree with the results of a literature review done by the National Academy of Sciences (see *MWN*, July/August 1983). Frank and the NAS study panel disagree on how to interpret the findings, however. Frank testified in support of further study. "What this data tells me," Frank said in an interview, "is that the three things we need most are more research, more research and more research."

NAS discouraged further research on VDT safety, while recommending improved workstation design and management practices. The study panel urged that "competing priorities in the field of occupational health be carefully considered" in planning research related to VDTs.

Guild President Charles Perlik, Jr., warned that operators have "lingering and lasting fear and concern" that can be dispelled only by "ongoing, long-term research." David Eisen, research director for the guild, told the subcommittee that the Occupational Safety and Health Administration (OSHA) should be directed by Congress to set ergonomic standards. Similarly, Frank called for an interim standard requiring regular work breaks for operators.

After hearing the testimony, subcommittee chairman Joseph Gaydos (D-PA) acknowledged that "we have a problem" and announced that the subcommittee's work on VDTs will continue. Under consideration are more hearings, a staff investigation and informal discussions with experts in the field.

Other study findings include:

- The "constellation" of ergonomic problems confirmed by the survey may be responsible for a greater loss of work time among VDT users compared to non-users, a problem of "potentially major magnitude with regard to the economics of work."
- A link between VDTs and cataracts is possible. One site produced five cases of cataracts in the five years prior to the survey. Frank urges further investigation of this irregularity, as well as more general research on cataracts among VDT users.

• The matter of reproductive effects is "unsettled." The reproductive histories of men as well as women were studied and more birth defects were found among male users' offspring than among those of females. Further investigation of possible spermatogenesis due to VDT use is recommended.

• There was no noticeable change in sexual activity, but VDT operators commented more than non-users on being irritable, having trouble sleeping and experiencing difficulty waking up. In addition, non-users reported having more energy.

Frank acknowledged "some methodological problems" with the study but defended its scientific validity. He said he now has "one of the largest bodies" of questionnaire data available.

Approximately 3,000 survey questionnaires were distributed at six sites (St. Louis, Memphis, Vancouver, Toronto, Honolulu and New York) to reporters, editors, advertising staff members and clerical employees. A total of 1,109 responses were received, of which 1,047 were usable. Nearly three-fourths of the completed questionnaires came from VDT users, with a nearly equal number of men and women respondents. A higher percentage of men used terminals.

Additional data from ophthalmological examinations of selected survey participants is scheduled for release next spring.

When the study was announced in March 1981, Dr. Frank was affiliated with the Mount Sinai School of Medicine in New York. The study was completed shortly before he left Mount Sinai to become Chairman of the Department of Preventive Medicine and Environmental Health at the University of Kentucky College of Medicine at Lexington.

The oversight and investigation subcommittee of the House Committee on Science and Technology, which in 1981 held the only other congressional hearing on VDTs, is not planning any immediate action (see *MWN*, June 1981). A subcommittee spokesman told *Microwave News* that chairman Albert Gore, Jr. is waiting for the outcome of a planned NIOSH epidemiological study of pregnant VDT operators, for which a study population is being sought (see *MWN*, July/August 1983).

Single copies of the report, *Effects on Health Following Occupational Exposure to Video Display Terminals*, can be obtained from David Eisen at the Newspaper Guild, 1125 15th Street, NW, Washington, DC 20005, (202) 296-2990.

Submillimeter E-Field Probe

Professor Ted Batchman of the University of Virginia has built an electric field probe which is less than one millimeter wide. The new probe is two or three times smaller than currently available models and, when fully operational, will be implantable in living tissue. In addition to applications in biological effects studies, Batchman hopes it will be used for electromagnetic compatibility measurements.

The probe, developed under a grant from the National Science Foundation (NSF), still needs some refinements. In

a telephone interview from his office in Charlottesville, Batchman said that he began with a glass substrate for the probe, but is now using mylar, a flexible nylon material, to make it less bulky.

According to Batchman, the probe can detect a minimum signal of less than 10 V/m. The calculated sensitivity is 4.5 V/m, but he believes it is actually about 1 V/m. According to theoretical calculations, the instrument's frequency range is 13 MHz to 77 GHz. Batchman hopes to have a three-axis probe, with an external diameter of about one millimeter, by early next year.

Batchman's NSF grant will not be renewed when it expires in December, and he is considering setting up a joint venture with a private company to complete the development of the probe. A group in Ottawa, Canada, has expressed an interest in working with him as well. Batchman said his optimism about securing continued financing "varies from day to day."

The Food and Drug Administration (FDA) would also like to see the probe refined. Howard Bassen at FDA's National Center for Devices and Radiological Health said that his agency is seeking interested parties to finance the completion of the probe.

A description of the probe appears in the September issue of *IEEE Transactions on Microwave Theory and Techniques*. Bassen and Glenn Smith of Georgia Institute of Technology, both of whom assisted Batchman in his work, have published "Electric Field Probes—A Review" in the September *IEEE Transactions on Antennas and Propagation*.

NBS RFI Tests on Breath Analyzers

Breath analyzers are a reliable way to check driver sobriety, according to the National Bureau of Standards (NBS) and the National Highway Traffic Safety Administration (NHTSA). Although bureau tests have demonstrated that some of the devices are susceptible to radiofrequency interference (RFI), both organizations have concluded that proper operating procedures can eliminate the risk of interference-induced errors in the measurement of alcohol concentration.

This assurance, published in a May 1983 report, is good news for law enforcement officials who use analyzer readings as evidence in court. NHTSA has advised state and local jurisdictions that they can ensure the legal admissibility of these readings by setting up programs for periodic RFI testing.

Last year several state police departments reported that their analyzers were affected by walkie-talkie and patrol car radio transmissions. The accuracy of one unit, Smith and Wesson's widely used Breathalyzer, was subsequently challenged in a suit brought in Minnesota (Heeden v. Dirkzwager, Ramsey County Second Judicial Court, 1982). Thanks to the state's RFI testing program, the reliability of the Breathalyzer readings was upheld.

Testing programs run in nine states late last year indicated

that interference is in fact very rare. Following instructions and precautionary warnings distributed by NHTSA in January 1983, less than one percent of the units checked by the states were susceptible to RFI in the working environment.

NHTSA's recommendations were adapted from test protocols developed by Smith and Wesson (see *MWN*, March 1983) and by the Minnesota Bureau of Criminal Apprehension.

According to the report prepared by the bureau's Law Enforcement Standards Laboratory and released by NHTSA, nine out of sixteen units tested by NBS were affected by a 10 V/m field at one or more frequencies. Only three of the nine units registered more than a ± 10 percent change in readings when placed in a field, however. The bureau's Colorado lab exposed analyzers to four frequencies (46, 160, 460 and 850 MHz) used by law enforcement agencies. The 10 V/m field strength used approximates the environmental levels one meter from a 5-watt walkie-talkie or 10 meters from a 100-watt mobile radio. (NBS warns that its data cannot be extrapolated to other frequencies, field strengths, multiple frequency fields or other units of the same models.)

Commenting on the RFI controversy, Gerald Klein of Smith and Wesson said NBS and state tests indicate that the chance of interference in the field is extremely slight. According to Klein, the company's test procedures, which were released before the NBS report, can eliminate just about all risks of RFI.

Since problems were first reported two years ago, Smith and Wesson has retrofitted its Model 1000 Breathalyzer with a new electronic circuit to reduce possible interference. The Model 900 is not susceptible to RFI, but Klein said more caution is advisable when operating the 900A.

Smith and Wesson is not the only company to respond to user fears about RFI. Federal Signal Corp., for example, has advertised that its Intoxilyzer models produce "reliable, court-accepted evidence that RFI can't distort under normal operating conditions."

The 33-page NHTSA technical report, *Limited Electromagnetic Interference Testing of Evidential Breath Testers*, May 1983, DOT HS-806-400, is available from the National Technical Information Service, Springfield, VA 22161.

State RF/MW Standards Planned in New Jersey and Connecticut

Officials in New Jersey and Connecticut expect to propose general population exposure standards for radiofrequency and microwave (RF/MW) radiation next year. If the measures are approved, the states will join Massachusetts and several local jurisdictions which have already imposed exposure limits.

Last month, New Jersey's Commission on Radiation Protection recommended that the state formally adopt the new American National Standards Institute's (ANSI) guidelines. At about the same time, Connecticut legislators held a hear-

HIGHLIGHTS

ing to weigh the merits of ANSI's standard against Massachusetts', which is five times more stringent (see *MWN*, September 1982 and September 1983.) For the most strictly regulated frequencies, 30-300 MHz, the ANSI limit is 1 mW/cm² while the Massachusetts limit is 200 uW/cm².

According to Jim Ross of the NJ Department of Environmental Protection (DEP), the state currently uses ANSI as its benchmark for evaluating RF/MW hazards and has found no public exposures anywhere near 1 mW/cm². A proposal to adopt ANSI and a schedule for public hearings are expected to appear in the state's *Register* within the next six months. (It would not apply to occupational exposures.)

The state standard will be replaced by federal limits as soon as they are set. In explaining the need for interim action, Ross echoed other officials in New Jersey and Connecticut who expressed disappointment over the pace of federal standards development.

In Connecticut, State Representative Moira Lyons is lead-

ing the Environment Committee's drive to propose a standard during the 1984 legislative session. Lyons is chairwoman of a special task force studying RF/MW hazards. As a first step toward developing a standard, the group held an invitational hearing on October 20 at which representatives from the Connecticut Citizen Action Group, Northeast Utilities, Raytheon, Southern New England Telephone and the Veterans Administration Medical Center testified.

The Connecticut task force is now trying to schedule a December meeting with representatives from Massachusetts' Radiation Control Program and the National Institute for Occupational Safety and Health before submitting its recommendations to the Environment Committee.

It is uncertain at this point what type of standard will emerge from the committee. After the October meeting, however, Lyons said she believes the broadcast and cable industry could live with limits well below the ANSI guidelines.

CONFERENCES

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.

1984

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 23-25: Biological Effects and Therapeutic Applications of ELF Electromagnetic Fields, Venice, Italy. Contact: Dr. Luigi Zecca, Association for Biomedical Applications of Electromagnetism, Via Gentilione 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.

March 23: Microwave and Millimeter Wave Solid State Devices and

Circuits, RCA Labs, Princeton, NJ. Contact: Dr. Walter Slusark, RCA Labs, 201 Washington Rd., Princeton, NJ 08540, (609) 734-2946.

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 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 7-11: 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 3-7: 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.

BIOLOGICAL EFFECTS

Thermal v. Non-Thermal (again)...The argument over whether there are non-thermal effects of RF/MW radiation continues. The latest round involves the World Health Organization's (WHO) *Environmental Health Criteria 16: Radiofrequency and Microwaves* (see *MWN*, March 1982) and a review by Professor Sol Michaelson which criticized WHO's "unqualified acceptance of postulated non-thermal bioeffects" (see *MWN*, December 1982). Four members of the WHO panel that prepared the report challenge Michaelson's critique as being "seriously biased by his commitment to the thermal mechanism of microwave-tissue interaction." Charges and countercharges appear in the August 1983 issue of *Radiation Research*. Noting that it has been four years since the document was written, the panel members state that today "a stronger case might be made for the significance and existence of non-thermal effects." Michaelson replies that "I have no commitment to any concept except scientific objectivity...I am not committed to thermal interactions" (emphasis Michaelson's). Another example from the exchange: The WHO panelists cite the transactions of 1981 and 1982 Biological Repair and Growth Society (BRAGS) meetings as indications that non-thermal effects exist. Michaelson answers that the transactions are irrelevant....As the dispute drags on, experimental evidence supporting non-thermal effects accumulates. Writing in the September 26 *Physical Review Letters*, Drs. W. Grundler and F. Keilmann report that they have confirmed their earlier findings, which indicated "non-thermal resonant action of millimeter microwaves on the growth of yeast cultures." Their statistical analysis shows there is a "negligible probability" that the observed response, with peaks at 41.697 and 41.782 GHz, could be frequency-independent. The West German scientists conclude: "Our result enhances the weight of reports on other systems and poses the question of generality of this sensitivity in biology. Uncovering its origin will provide a fascinating interdisciplinary task."...There is more supporting data from Spain...

Delgado Varies Pulse Shape...Last March we reported that Dr. Jose M.R. Delgado's research group in Madrid, Spain, had found that extremely weak, 1.2-120 milligauss, pulsed magnetic fields can have a "consistent and powerful" effect on the development of chicken embryos. In a follow-up paper to be published soon in the *Journal of Anatomy*, the group looks at the influence of the shape of the pulse on chick embryos during their first 48 hours of development. The researchers used four different pulses, with varying rise and fall times, at approximately the same field intensities as in the original experiments. Among their findings: "Exposure to electromagnetic fields with a pulse rise time of 100 microseconds produced teratogenic changes when intensities of [10 and 139 milligauss] were used but not with lower or higher intensities, demonstrating a 'window' effect and ruling out the possible influence of a rise in internal embryonic temperature....When embryos were exposed to intensities of [4 and 10 milligauss] with 2.0 and 42 microsecond pulse rise times, teratogenic effects were greater

and alterations involved all developing systems. The most powerful effects were obtained with [10 milligauss] and 42 microsecond rise time." They conclude that the pulse shape may be the "decisive parameter determining strong, slight or no modification of embryonic development," and that "mechanisms of action of electromagnetic fields are still unclear, but induced alterations in extracellular glycosaminoglycans could be a causal factor in the observed malformations."

COMMUNICATIONS

Siting Problems in New Jersey...Vernon, NJ, has apparently tempered its view of potential RF hazards. Since last year, a community group worried about RF health effects has blocked RCA Americom's plans for a new point-to-point tower at its Vernon satcom station (see *MWN*, November 1982 and March 1983). Although RCA still doesn't have official approval for its low power antenna, on October 20 the town zoning board granted the American Satellite Company a variance to add a 13-meter dish to its Vernon station. RCA now plans to submit a new application for upgrading its facilities. Amsat brought in consultants on RF safety, and after six hearings the board unanimously approved its request. Three conditions were attached to the variance, however: 1) Power densities at the edge of Amsat's property cannot exceed 1 uW/cm²; 2) RF levels at the perimeter of the station must be measured annually for three years; 3) Amsat must install mechanical locks on the antenna to ensure that its elevation angle is always greater than 12.5 degrees. Joan Griffin, an attorney with the Rockville, MD, company, said that construction has already begun. Meanwhile, the NJ Department of Health is finishing up its study of birth defect rates in Vernon during the years following construction of the satcom stations in the 1970s. The investigation began early this year at the urging of Citizens Against the Tower, a community group opposing any additional RF/MW sources in the area (see *MWN*, December 1982).

Cellular Mobile Phone Service Begins...Ameritech Mobile Communications Inc. became the first company to offer cellular mobile phone service with the start-up of its Chicago-area system last month. Similar systems will open in other major cities soon, each with the capacity to service thousands of car phones rather than the hundreds now in use. Through a network of low-power transmitters, cellular technology allows the same frequency to be used simultaneously by drivers in different areas. Though this technology provides an efficient way to utilize the limited spectrum available for mobile communications, the FCC has warned there may be some tradeoffs. In its August 1983 report, *Future Private Land Mobile Telecommunications Requirements*, the commission's Private Radio Bureau states that call quality may suffer from the low signal strengths of network transmitters and that co-channel and adjacent channel interference may limit the capacity of cellular systems. For the present, however, any big city resident with \$3,000 for a mobile phone will be able to make high quality calls

UPDATES

while on the road. A limited number of copies of the FCC's report are available from its Office of Public Affairs, Room 207, 1919 M Street, NW, Washington, DC 20554, (202) 254-7674.

COMPATIBILITY & INTERFERENCE

FCC Survey of RF Device Compliance...The FCC has found a small improvement in the number of RF devices that meet its RFI regulations. In the last six months, the agency has sent its engineers to 144 retail stores in more than 50 cities across the country to inspect computers, walkie-talkies, cordless phones, TVs, video games and other RF-emitting equipment. The survey of 1,746 devices found that 31 percent of computer equipment and 18 percent of coin-operated video games were improperly labeled and thus in violation of commission rules. Nine percent of the devices had no label at all, indicating they did not meet FCC emission limits. The FCC considers these results "disturbing," but is looking at the bright side because they represent a four percent improvement over last year's survey results. Joseph Casey, chief of the FCC Field Operations Bureau's Inspections and Investigations Branch, promises to continue his efforts to force compliance, levying "substantial" fines when necessary.

Green Light for Radio Marti...Congress has approved and the President has signed the "Radio Broadcasting to Cuba Act." It authorizes the creation of Radio Marti within the US Information Agency's Voice of America (VOA), to broadcast "accurate, objective and comprehensive news" to Cuba. Reagan signed S.602 into Public Law 98-111 on October 4. The compromise measure, which emerged after nearly two years of controversy, requires Radio Marti to use VOA's AM frequencies, primarily 1180 kHz. Will Cuba respond by trying to jam Radio Marti, as broadcasters have long feared? If so, the law allows the new station to lease time from other AM stations to broadcast over their frequencies. Also, the government can compensate station owners for losses due to interference from Cuba. For more information, see Senate Report No. 98-156, June 21, 1983, available from the Senate Document Room, Washington, DC 20510.

Resources...NBS has published *A Method to Quantify the Radiation Characteristics of an Unknown Interference Source*, (TN 1059), which describes the theory and experimental details for making measurements with a transverse electromagnetic (TEM) cell. A copy is available for \$4.75, prepaid, from the US Government Printing Office, Washington, DC 20402. Order No. 003-003-02441-4....The Radio Technical Commission for Aeronautics (RTCA) Special Committee No. SC-148 on "Airborne Radio Communications Equipment Operating Within the Radiofrequency Range 117.975-137.000 MHz" plans to discuss ways of mitigating FM interference to airborne communications devices at its October 26-28 meeting....When power lines are built near AM radio broadcast antennas, large cur-

rents may be induced on the line. These can re-radiate a field and cause a major change in the antenna's radiation pattern. A group of Canadian researchers explore ways of minimizing these interactions by adding "detuners" to the power line to reduce the re-radiated field. They detail such corrective measures in a paper in the August issue of *IEEE Transactions on Electromagnetic Compatibility*....Tecknit has published an *EMI Shielding Design Guide*, which is available for \$10.00 from the company at 129 Dermody St., Cranford, NJ 07016, (201) 272-5500.

INTERNATIONAL

Australian Union Group...The Occupational Health and Safety Unit of the Australian Council of Trade Unions and the Victorian Trades Hall Council (ACTU/VTHC) has issued *Guidelines on Health Hazards of Electromagnetic Radiation*, a consultative document (Health and Safety Bulletin No. 31) with recommended exposure standards for ELF, RF/MW, IR, visible, UV and laser radiation. The unit finds that, "the claim that biological effects of EMR are exerted through heating mechanisms alone is without foundation, and therefore any standards based on these thermal effects alone offer no protection against cancer, genetic effects or cataracts of the eye." It advocates a preventive approach to radiation hazards and endorses a policy that exposures "should be reduced to the lowest levels technically achievable." Specifically, the unit recommends maximum exposures of 500 V/m for 0-100 Hz and 100 uW/cm² for 100 Hz-300 GHz. For IR and visible radiation the limits are 1 mW/cm². In addition, it advocates an emission standard of 1 mW/cm² for all new radiation emitting equipment (measured at 5 cm). The document is now circulating among affiliated unions for comment. According to the unit's research officer, Dr. John Matthews, a formal ACTU/VTHC policy will be adopted within six months to "guide unions in their negotiations with employers to reduce workers' exposure to EMR." (In August 1982, the Standards Association of Australia (SAA) proposed occupational exposure standards for RF/MW radiation (30 kHz-300 GHz) identical to those adopted by ANSI in 1982 and suggested limits for the general public a factor of ten lower than ANSI's. ACTU criticized the SAA proposal in comments filed this spring.) The ACTU-VTHC unit went through a similar consultative process with its policy for *Screen-Based Equipment*. A proposal for VDTs and related equipment was issued in May 1982 and a final policy statement was released in March 1983 (Health and Safety Bulletin No. 26).

New Association and Institute...The *Association for Biomedical Applications of Electromagnetism* has been formed in Milan, Italy, to promote scientific research on the bioeffects and medical applications of EM fields. ABAEM is planning its first congress, *Biological Effects and Therapeutic Applications of ELF Electromagnetic Fields*, to be held in Venice, February 23-25, 1984. For further information, contact the association's vice-president, Dr. Luigi

Zecca, Via Gentilino 9/a, 20136 Milan, Italy....Dr. Richard Bentall has set up the *Institute of BioElectrical Research* in Peebleshire, south of Edinburgh, Scotland. Bentall said in an interview that the non-profit institute will investigate the effects of EM fields on *all* living systems. For instance, he is interested in horticultural research: the effects on barley and other food crops. Bentall is also concentrating on soft tissue medical applications, such as the healing of wounds and burns. Contact: Bentall, Director, IBER, Romanno House Farm, Romannobridge, West Linton, Peebleshire EH46 7BY, United Kingdom.

MILITARY SYSTEMS

Project ELF..The last witness, Dr. Robert Becker, testified at the Project ELF trial in Wisconsin on October 19 and the attorneys for the state and the navy are now completing their final written arguments. A decision on whether the navy will have to prepare a new environmental impact statement (EIS) will come after November 21 when the Wisconsin Attorney General files his last brief. Some observers expect the decision to be handed down in January. On October 19, Judge Barbara Crabb denied a preliminary injunction, which would have stopped the navy from beginning construction on the ELF antenna until she issued a ruling. The judge found that the state would not be irreparably harmed if the work gets under way, but she warned the navy would be building at its own risk....The navy has released its environmental impact assessment (EIA) for construction of the ELF's Michigan facility in Dickinson and Marquette Counties. It deals primarily with the installation of the antenna lines and not their operation because the navy argues that it has continuously reviewed new scientific information on ELF propagation since the release of its 1977 EIS, and has concluded that "there is no credible evidence of adverse effect to human health or the environment." A limited number of copies of the EIA are available from Capt. R.L. Koontz, PME 110E, Naval Electronic Systems Command, Washington, DC 20363, (202) 692-8871.

MM Waves Setback...The US Air Force has cancelled its WASP millimeter wave, air-to-ground guided missile program. The move, requested by the Senate Armed Services Committee, is seen as a setback for the application of millimeter waves. As one expert put it, the market for millimeter wave technology is small and any such cancellation will hurt its development. An air force spokesman said that the Wide Area Anti-Armor Munitions (WAAM) program, designed to improve the ability of aircraft to destroy tanks, will move forward. The WASP missile was only one of a number of WAAM concepts. The WASP was being developed by Hughes Aircraft Co.'s Missile Systems Group, which is also working on a smaller missile with millimeter wave radar for the army's multiple launch rocket system. No other air force weapon system using millimeter waves is as advanced as WASP, but *Aviation Week* reported on October 3 that a mock-up of the Tactical Avionics Low-Level Navigation and Strike (TALONS) millimeter wave radar was

shown at the recent Air Force Association Convention. This project is being developed by United Technologies' Norden System for both the air force and the army.

POWER LINES

Epidemiological Studies Chosen by NY...The New York State Power Lines Project has signed contracts for two epidemiological studies on the relationship between alternating magnetic fields (AMFs) and cancer rates (see *MWN*, September 1983). Dr. David Savitz of the University of Colorado in Denver will investigate the incidence of childhood cancer and its possible association with AMFs in a project modeled after Dr. Nancy Wertheimer's work. Dr. Lowell Sever of Battelle Pacific Northwest Labs in Richland, WA, will investigate adult myelocytic leukemia and AMFs. Approximately \$700,000 is budgeted for the studies. Copies of the final study proposals are available for 25 cents per page from Michael Rampolla, Power Lines Project Administrator, New York State Department of Health, Center for Laboratories and Research, Empire State Plaza, Albany, NY 12201, (518) 474-7888.

VDTs

Ohio Legislation...A bill that would set health and safety standards for VDTs has been introduced in the Ohio General Assembly. This brings to five the number of states with VDT legislation pending (New York, Oregon, Massachusetts, Illinois and Ohio). Maine and Connecticut passed bills earlier this year (see *MWN*, June 1983). The Ohio bill (No. 552), introduced October 14 by State Representative Barbara Pringle, would require adjustable, flexible work stations, measures to reduce glare, regular thorough eye examinations for operators and metal shielding of terminals to block radiation emissions. Also included are regular rest breaks, daily limits on the time spent operating a VDT, the right to non-VDT work during pregnancy and a prohibition against using terminals to monitor productivity or measure work performance of individual operators. Pringle says she is most concerned about reported pregnancy problems. The legislation, which would affect public and private employers in the state, is not likely to be acted on this year. Copies of the legislation are available from Rep. Pringle, Ohio House of Representatives, Columbus, OH 43215, (614) 466-6107.

International...The Canadian Labor Relations Board (CLRB) has rejected the request of a pregnant VDT operator for alternative work. Canadian union representatives are concerned that the decision could set a precedent, reversing a trend that started when employees of Bell Canada and members of the Ontario Public Service Employees Union (OPSEU) won the right to non-VDT work during pregnancy (see *MWN*, April 1981 and September 1982, respectively). Jean Sibley, an employee of Atomic Energy of Canada (AEC), claimed that VDT use placed her in "imminent danger" during her pregnancy, qualifying her for protection

(continued on p.11)

FROM THE FIELD

Last June, Dr. Robert O. Becker wrote to the Food and Drug Administration (FDA) to express his apprehension over the growing use of medical devices that apply direct currents (DCs) and pulsed electromagnetic fields (PEMFs) to stimulate bone growth. Reprinted below is an edited version of Becker's letter. Until his retirement in 1981, Becker was a research professor at the SUNY Upstate Medical Center in Syracuse, NY, and chief of orthopedic surgery at the Syracuse VA Hospital. He is the editor of *Mechanisms of Growth Control* (1981), and the author, with Dr. Andrew Marino, of *Electromagnetism and Life* (1982).

When contacted by Microwave News, Dr. Alan Andersen, the deputy director of the Office of Standards and Regulations at FDA's National Center for Devices and Radiological Health, said that the agency was preparing a response to Becker. Microwave News will publish FDA's reply in a future issue.

Meanwhile, we invite all interested parties to comment on Becker's letter.

Bone has been the one tissue most extensively studied from the point of view of its electrical properties and its growth response to electromagnetic fields. The response of bone to mechanical stress (Wolff's Law) has been ascribed to its innate piezoelectric properties [1,2], and the healing of fractures has been related to electrical properties common to regenerative growth in general [3,4].

When bone growth devices were first approved, it was assumed that, because of its unique properties, bone would be the only tissue responding to such electrical parameters.

The DC devices (eg, Zimmer's and Telectronics'), which use cathodes implanted at the treatment site, were intended to duplicate the naturally occurring electrical potentials observed during fracture healing. It was postulated that they would stimulate the cell populations required to form new bone. However, neither the responsible cell lines (periosteal, endosteal or marrow) nor the cellular mechanisms involved were identified with precision. Literature reviews [5,6] indicate that the DC devices produce de-differentiation of some marrow with subsequent re-differentiation into bone. This is a duplication of a portion of the natural fracture healing sequence.

The PEMF devices (eg, Electrobiolgy's [EBI] external coil system) operate in two distinct "modes" [7] each with a highly specific field pulse and a corresponding specific induced current pulse. No claims were made for direct growth stimulation; one mode was claimed to produce increased fibrogenesis and the other to produce efflux of calcium ions. Acting in concert they purport to form new bone [8]. The magnetic field is considered to be free of biological activity [9]. Recent evidence indicates that both modes have identical effects [10].

Both DC and PEMF devices expose tissue other than the target bone to the active stimuli. The Zimmer unit exposes the greatest amount by virtue of the bulk conduction of the current between the implanted cathode and the remote surface anode. The EBI device generates a magnetic field that penetrates all tissue between the coils and, by virtue of the fringing field, a considerably greater bulk although at diminished strength. The Telectronics device exposes the least amount of tissue because the implanted electrodes are closer together, although the current density is considerably greater than with the other devices.

When the FDA approved these devices, there were no studies on the effects of electrical currents or magnetic fields on embryonic growth and development or malignant growth. Evidence obtained over the past few years indicates that both electrical currents and magnetic fields have direct cellular effects which are, to a certain extent, dependent upon the type of cells exposed and their functional state. Neither effect is limited to bone or bone forming cells.

Direct electrical currents at levels obtainable within the bulk transmission area of the clinical devices (360 nA) increase the mitotic rate of human fibrosarcoma cells (HT 1080) *in vitro*, by a minimum of 300 percent [11].

The action of time-varying magnetic fields in general, including the specific pulses of the EBI device as well as simple ELF and VLF sine waves, can now be ascribed to a stimulation of mitotic activity [12]. The effect can be produced by magnetic fields as low as the Earth's (0.5 gauss) [13]. The magnetic field itself and not the induced current has been identified as the responsible agent [13,14]. There is evidence that RF frequencies modulated at ELF frequencies have identical effects [15].

Time-varying magnetic fields of similarly low strengths have been shown to induce severe embryological abnormalities in chick embryos [16]. This report has not yet been substantiated in detail, but another paper has indicated the production of such abnormalities in chick embryos exposed to PEMFs and incubated at a slightly higher than normal temperature or subjected to relatively minor surgical trauma [17]. An enhancement of mitotic activity of human leukemia cells by time-varying magnetic fields of similar strength and frequency has also been reported [18].

It should be noted that a number of retrospective epidemiological studies have indicated a higher than normal incidence of leukemias in individuals occupationally exposed to electromagnetic fields (primarily 60 Hz) [19], and a number of clusters of fetal abnormalities have been reported in female workers using VDTs [20].

It is evident that the exact mechanisms of action of DCs and PEMFs are different from originally proposed and require further evaluation. It is also evident that both modalities may have the capacity to enhance malignant growth. While it has not been demonstrated that either modality has a direct carcinogenic activity, the enhancement effect upon malignant cells could be considered to "tip the scales" in favor of such processes over the normal immunological resistance factors, thus encouraging the growth of small areas of malignant or pre-malignant transformation that otherwise would be destroyed.

A number of reports indicate a prolongation of survival times in animals with implanted tumors and treated with PEMFs [21]. This effect, however, is ascribable to the well established activation of the stress response system by whole-body exposure to time-varying magnetic fields [22]. In fact the most recent study states that such activation of the immune system is the mechanism responsible for the prolongation of survival [23].

I am aware that every device evaluation must involve a risk-benefit analysis. The ubiquitous presence of time-varying ELF magnetic fields in the environment is a necessary concomitant of our electrical power transmission systems, which are obviously of great social and economic importance. Such fields may be associated with a number of deleterious health effects and any risk-benefit analysis must await adequate epidemiological studies. At the present time, the use of time-varying magnetic fields in clinical therapy has no such constraints since there are other more conservative treatments available for the same conditions.

The therapeutic use of DCs and PEMFs as well as other electrically derived techniques holds great promise for many areas of medical practice. The ability to stimulate and control growth processes and to influence neuronal mechanisms has applications far beyond the stimulation of bone growth. The entire field must be thoroughly explored, mechanisms of action identified and side effects determined prior to widespread use. Unrestricted use of devices presently approved, or pending approval, could well result in an unfortunate incident thus delaying the ultimate application of the entire technology.

I urge that a moratorium be placed upon all clinical applications until adequate investigation has been completed.

Robert O. Becker, MD
Star Route, Lowville, NY 13367

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under the Canada Labor Code and permitting her to demand work away from a terminal. Her request for non-VDT work was denied by a federal Labor Canada safety officer, leading her to appeal to the CLRB. The board concluded that there is no "hard evidence" of pregnancy risks associated with VDTs and cited several studies which state that no risks exist. For this reason, it would be "unreasonable to so stretch" the Canada Labor Code to cover Sibley's request, the board ruled. Working at AEC's Glace Bay, Nova Scotia facility, Sibley was given a lead apron by AEC to wear while her appeal was pending despite prior protests by the company that there was no need for her to wear one. Copies of the board ruling (Decision No. 431, Board file 950-19) can be ordered from the Canadian Labor Relations Board, Ottawa, Ontario, Canada, K1A 0X8, (613) 996-9466....Some Australian journalists will now be entitled to take regular, 10-minute rest breaks from their VDTs after two hours' work as a result of recent arbitration, the US Newspaper Guild reports. The federal Australian Conciliation Commission ruled that 2,500 journalists at metropolitan daily newspapers can take paid breaks from their terminals as of September 1, but employers may assign other work during these periods. In emergencies, the commission said, terminal users can work no longer than two-and-a-half hours without a rest period.

Resources...A report on Swedish union responses to VDT and other work environment issues has been prepared by Dr. Olov Ostberg, a visiting scientist at NIOSH in Cincinnati. *Work Environment Issues of Swedish Office Workers: A Union Perspective*, will be included in a book scheduled for 1984 publication. Ostberg credits Swedish unions, notably TCO, the Central Organization of Salaried Employees, with primary credit for the Swedish Work Environment Act of 1977 and a new federal ordinance that will require ergonomically correct viewing conditions and individualized visual aids for workers beginning January 1. Ostberg emphasizes ergonomics as the "predominant" cause of all occupational diseases. His paper will appear as a chapter in *Human Aspects in Office Automation*, to be published by Elsevier (Amsterdam)....The VDT telephone hotline operated by 9 to 5, National Association of Working Women, closed November 1 after receiving more than 5,000 calls (see *MWN*, June 1983). The Cleveland 9 to 5 affiliate has announced that it will establish a local hotline to provide information and resources....Local 925 of the Service Employees International Union (SEIU, AFL-CIO) has published model language for unions interested in including VDT provisions in their contracts. Sample wordings are provided in nine areas including work breaks, workstation design, employer-paid eye examinations and long-term study of the health effects of VDTs. Requests for copies should be directed to District 925, SEIU, AFL-CIO, 2020 K Street, NW, Washington, DC 20006, (202) 452-8750.

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Auchter's determination was reached informally, according to a series of interviews with agency officials, all of whom asked that their names not be used. RF/MW radiation was not deemed important enough to warrant further attention. Other options, such as adopting the 1982 American National Standards Institute (ANSI) RF/MW exposure limits, were considered but rejected.

Voluntary Standard To Remain

OSHA's current 10 mW/cm² health standard is voluntary and has been ruled unenforceable by the courts (see *MWN*, April 1982). The agency used to have another option: enforcing standards set by other organizations, such as ANSI, under the Occupational Safety and Health Act's general duty clause, Section 5(a)(1), which requires that every work place be free of recognized hazards. But in March 1982, Auchter ruled that OSHA inspectors cannot enforce voluntary standards under the general duty clause (see *MWN*, April 1982). As a result, OSHA stopped monitoring worker exposure to RF/MW radiation.

In May 1982, OSHA proposed deleting its voluntary standards, including the one for RF/MW radiation (47 *Federal Register* 23479, May 28, 1983). According to the October regulatory timetable, a final rule for these deletions is scheduled for November 1983. OSHA's Graybill said that while this deadline might still be met, the rule is more likely to appear in December.

Microwave News has learned that OSHA does not plan to delete the 10 mW/cm² RF/MW standard. Informed sources said that the RF/MW standard is not listed among the voluntary standards to be scrapped in the current draft of the final rules. Graybill would neither confirm nor deny this fact, but did say that OSHA rules should not be construed as final until they appear in the *Federal Register*.

If the 10 mW/cm² standard remains in the rules, OSHA inspectors will be barred from issuing citations for worker overexposure to non-ionizing radiation.

Joe Velasquez, the executive director of the Worker Institute for Safety and Health said that he was not surprised by this development; "It fits a pattern by the Reagan Administration to weaken worker protection."

ANPRM Never Published

At the end of last year, the OSHA staff prepared an advanced notice of proposed rule making (ANPRM) for a new RF/MW standard for review by the agency's senior management (see *MWN*, October 1982). The proposal was still under consideration as late as last spring, but it was never approved or published in the *Federal Register*.

The National Institute for Occupational Safety and Health (NIOSH) has been preparing a criteria document for RF/MW radiation since the mid-1970s. The document, which would be the basis for an OSHA standard, has suffered a series of setbacks and is still not finished. According to a NIOSH staffer, a review draft of criteria document should be completed by the end of 1983. ☐

SHORT COURSES

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, Sunnyvale, 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, Fee: \$995. Contact: Don White Consultants, Inc., (DWCI), State Route 625, PO Box D, Gainesville, VA 22065, (703) 347-0030.

December 6: Electrostatic Discharge Control Seminar, Phoenix, AZ. Fee: \$275. Contact: EMXX Corp., 6706 Deland Drive, Springfield, VA 22152, (703) 451-4619.

December 6: Hospital Electrical Safety, New York, NY. Fee: \$180 (AAMI members), \$200 (others). Contact: Association for the Advancement of Medical Instrumentation (AAMI), Suite 602, 1901 North Fort Myer Dr., Arlington, VA 22209, (703) 525-4890.

December 6-9: Antenna Measurement Techniques, Atlanta, GA. Fee: \$660. Contact: Technology Service Corp. (TSC), 8555 16th St., Suite 300, Silver Spring, MD 20910, (800) 638-2628.

December 6-9: Radar Systems Engineering, Fort Walton Beach, FL. Fee: \$660. Contact: TSC, see December 6 above.

December 12-16: Electromagnetic Interference and Control, Washington, DC. Fee: \$875. Contact: Continuing Engineering Education, George Washington University (GWU), Washington, DC 20052, (800) 424-9773.

December 14-15: EMI Diagnostics and Fixes, Philadelphia, PA. Fee: \$635. Contact: DWCI, see December 5 above. Repeated **January 25-26**: San Diego, CA.

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January 9-13: 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.

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: GWU, see December 12 above.

January 31-February 2: Millimeter Wave Systems & Technology, Atlanta, GA. Fee: NA. 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: NA. Contact: GIT, see January 31 above.

February 16-17: Grounding, Bonding & Shielding, San Diego, CA. Fee: \$625. Contact: GWU, see December 12 above. Repeated **April 9-10**: Washington, DC.

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 December 12 above.

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

March 15-16: Lightning Protection, Orlando, FL. Fee: \$625. Contact: GWU, see December 12 above.

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