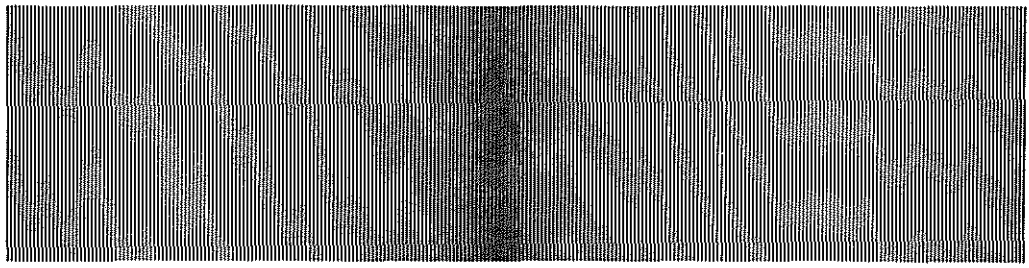


MICRO WAVE NEWS



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A Monthly Report on Non-Ionizing Radiation

September 1983

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Because of the abundance of news this month, the second part of our report on the Bioelectromagnetics Society conference will appear next month.

EMC '83: A Booming Business

Problems due to electromagnetic interference (EMI) continue to intensify. It is as if an electronic domino effect is at work. Signals from FM radio and TV stations disrupt computers, whose own emissions may affect avionic systems. High frequency communications impinge on radars and weapon systems; airport radars upset computer operations. CB radios and walkie talkies spoil TV reception and play havoc with industrial machinery, which in turn interfere with aircraft flying overhead. And all of the above may hurt the performance of medical devices.

How serious are these interactions? No one knows for sure, but more and more calls are going out to EMC engineers for diagnoses and cures.

All in all, it's a good time to be in the electromagnetic compatibility business. Attendance at this year's *International Symposium on Electromagnetic Compatibility*, held in Washington, DC, August 22-25, was at near-record levels, with more than 1,000 EMC engineers registering for the technical sessions and hundreds more exhibiting their wares. And if the growing concern over EMI is any guide, there will be plenty of work to go around, transforming what used to be a somewhat arcane specialty into a technological necessity.

Outlined below are selected highlights from the EMC symposium with details on the myriad types of interactions being reported and what is being done to remedy them.

Computer RFI

The issue of susceptibility of computers to RFI was raised by William Rhoades of Xerox Corp. in El Segundo, CA. In his prepared talk, Rhoades said that as more and more digital equipment is used in high-rise buildings, interference from TV and FM stations "will become a growing problem." Similarly, computers in offices built near airports are suffering from radar interference. He said that it is easy to measure fields of 50 V/m three kilometers from an airport radar. He advises that computers be able to withstand fields greater than 1 V/m.

Xerox is not alone. An IBM engineer sitting in the audience remarked that he had encountered difficulties installing computers near Dulles Airport.

When Rhoades was asked how common computer EMI is, he replied that he knows of 15 to 20 cases involving Xerox computers in the last two years; most of these were resolved by moving the computer to a new spot in the building. But the situation may get worse in the future. The proliferation of walkie-talkies, cellular telephones and paging systems will no doubt increase the incidence of computer RFI, he said.

(continued on p. 2)

ISM Equipment

Emissions from industrial, scientific and medical (ISM) equipment, believed to be the largest source of man-made radio noise, are the subject of intense negotiations in international circles. US manufacturers are resisting voluntary ISM emission limits adopted by the International Special Committee on Radio Interference (CISPR) as too strict and too expensive, even though US standards are widely recognized as overly lax. Some compromise must be reached in the next few years because a resolution passed at the 1979 World Administrative Radio Conference (WARC) mandates that new limits be agreed upon to protect communications technology and aeronautical navigation equipment.

The International Radio Consultative Committee (CCIR) has set up an Interim Working Party 1/4, under the chairmanship of Professor R.G. Strusak of Poland, to recommend new limits. (FCC's Art Wall is representing the US in these talks.) The working party will prepare a report by the end of 1984 for action by CCIR in 1986. New standards will probably be ratified by an international treaty and will be adopted by the Federal Communications Commission (FCC).

Tests to determine the impact of ISM interference on the Instrument Landing System (ILS) are underway at Ohio University's Avionics Engineering Center in Athens. The fourth harmonic (107.83-109.13 MHz) of ISM equipment operating in the 27 MHz band can impinge on the ILS localizer aeronautical service in the 108-112 MHz frequency band. Principal investigator James Nickum at Ohio University is in the process of measuring radiation levels aboard aircraft flying over factories with ISM equipment. A final report should be ready for the Federal Aviation Administration (FAA) by next summer.

An FAA staffer said that a number of complaints of ISM interference have been received but he could not cite precise statistics.

Computers Aboard Aircraft

Another possible hazard to aircraft operations is interference caused by portable computers used by passengers. A lead article in the August 22 *InfoWorld* reports that Eastern Airlines has banned the use of portable computers on its flights and that some commuter airlines have similar prohibitions. But there are no industry-wide rules, and each air carrier has the discretion to set its own policy. In the August 29 issue, *InfoWorld* editors advise: "Until portable computers have been flight-tested in a reasonable fashion by experts from the aviation, electronics and computer industries, passengers would be better off to leave the computer off and, as one critic put it, 'Sit back and enjoy the flight.'"

Computer EMI aboard aircraft was discussed at last May's Executive Committee meeting of the Radio Technical Commission for Aeronautics (RTCA). Aeronautic Radio Inc. (ARINC), based in Annapolis, MD, has been looking into the issue and weighing the possibility of asking RTCA to set up a special committee to review the need for formal

rules. No action has yet been taken however, because, as ARINC's Richard Climie explained to *Microwave News*, "We do not know of any substantiated cases of computers or any other devices causing an [EMI] problem." Climie said that he had heard of some incidents, but they could not be verified. RTCA action is on hold until concrete data are in hand.

Power Lines & Railroads

Railroads have their own EMI problems. Preliminary studies at the IIT Research Institute (IITRI) in Chicago, IL, indicate that power lines sharing the right-of-way with railroads can play havoc with railway signaling systems. In an award-winning paper presented at the EMC meeting, IITRI's Allen Taflove said that he had found a "false clear" failure caused by induced voltages as low as 0.1 volts. A false clear, which occurs when a red light mistakenly changes to green, is the most serious type of signaling error.

While calling these results "most disquieting," Taflove cautioned that his study, funded by the Electric Power Research Institute (EPRI), had only "scratched the surface" of the problem and that his results should be seen as tentative for the present. But he was unequivocal about the need for further testing: "Someone somewhere should do thorough, statistically significant testing—it's a question of public safety."

Taflove was critical of the "total neglect" of this issue, which has cost the utilities millions of dollars. He said that the Department of Transportation (DOT) was unaware of this type of EMI. EPRI will soon issue a three-volume report on the IITRI study.

Taflove did not investigate the EMI to electrified rail systems. This is an area that DOT is addressing. The Rail Transit EMI/EMC Program at DOT's Transportation Systems Center in Cambridge, MA, provides a forum for experts from all over the world to advance the state of the art in subway and trolley transit systems. Those interested in more information should contact Bud Gingrande at the DOT center, (617) 494-2000.

Industrial Machinery

Can stray radio signals affect industrial equipment and robots? John Bloodgood thinks so. Bloodgood, who is a consultant working out of Fond du Lac, WI, is urging expert committees to set standards to relieve a problem he says is "becoming more and more severe."

In a post-symposium presentation to the American National Standards Institute's (ANSI) C63 Committee on Radio-Electrical Coordination, Bloodgood cited these examples: Numerical control equipment at a major producer of farm machinery began starting by itself without any identifiable cause. An investigation later indicated that a CB radio was responsible. In another plant, for no known reason a radio-operated crane began to move on its own, lowering a heavy casting. This latter incident nearly resulted in a loss of life. Bloodgood said that industrial users are worried and are beginning to demand fail-safe systems.

Medical Devices

A task group of ANSI C63 subcommittee 1 is considering the need for setting limits for radiated emissions from medical devices and guidelines for their susceptibility to EMI. Howard Bassen of the Food and Drug Administration (FDA) is in the process of determining whether FDA staff will help develop and write a document on medical device EMI. Al Smith, Jr. of IBM is already preparing a report on test methods for medical devices.

According to Bassen, some years ago McDonnell-Douglas prepared an EMC standard for medical devices under an FDA contract. The standard was heavily criticized, however, and neither the agency nor ANSI adopted it. Industry representatives protested that there was no evident need for it.

Naval Weapons Systems

The US Navy has the most intractable EMI problems. Engineers must find room for scores of radar and communication systems aboard navy ships. Dr. Robert Haislmaier, the navy's EMC coordinator, says this is much harder than siting terrestrial systems. For example, the ship's high frequency (3-30 MHz) transmissions can interfere with radar, TACAN and electronic warfare systems as well as the ship's overall operation.

Haislmaier's strategy is to "institutionalize" EMI control to guarantee combat readiness. The navy has hired half-a-

dozen contractors and has commissioned computer programs to help fix problems quickly. Fleet personnel are being trained to increase their awareness of EMI; according to Haislmaier, preventive maintenance is the key to correcting weaknesses before they deteriorate performance. He told *Microwave News* that the Chief of Naval Operations, to whom he reports, is interested in EMC and has directed his staff to develop a program to remedy the situation. Haislmaier predicted that "if we can keep the momentum up the navy will be in a substantially improved posture in five years."

The same concerns were echoed by Milton Kant of RCA, who works on the Aegis weapon system. "There is no doubt that EMC is important," he said, "it is a recognized and continuously examined factor in the ship-building program." He pointed out that EMI is not a major issue with the Aegis because it was designed with compatibility in mind. But, he added, retrofitting can be very expensive and sometimes ineffective. The Aegis is hardened to electromagnetic pulse (EMP) radiation which takes care of HF communications EMI. Kant said that the present trend is to protect all navy ships from EMP.

Neither Haislmaier nor Kant were willing to detail specific navy EMI concerns because of the risks to national security. In fact, some 20 papers scheduled to be presented at the meeting were pulled due to lack of clearance, and one paper on "EMP Hardening of Navy Ships" was torn out of the bound volume of the symposium record. ●

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Microwave Radiation Information and Action Center offers specialized information resources and legal services regarding exposure to non-ionizing radiation. Contact: J. Stuart Lemle, Executive Director, 1701 K Street, NW, Suite 1000, Washington, DC 20006, (202) 775-0044.

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New Soviet RF/MW Standards; US-USSR Bioeffects Workshop

Safety standards for exposures to radiofrequency and microwave (RF/MW) radiation in the Soviet Union are changing. The new occupational standard is 100 $\mu\text{W}/\text{cm}^2$ for two-hour exposures to radiation in the 300 MHz-300 GHz frequency band. A new standard for the general population is expected, although no official announcement of proposed revisions has been made.

In a paper recently received from the USSR, Professor B.M. Savin and colleagues at the Moscow Institute for Industrial Hygiene and Occupational Diseases of the USSR Academy of Medical Sciences state that the validity of an occupational standard of 100 $\mu\text{W}/\text{cm}^2$ "has been proven by 20 years of practice and supported by experimental studies."

Savin concludes that, "Radiation exposure at low levels can be measured via the energy (W) delivered to the organism and expressed through the product of the power density (P) and the exposure duration (T): $W = P \times T$ " and therefore $P = W/T$. With a 100 $\mu\text{W}/\text{cm}^2$ limit for two hours, the allowed energy load is 200 $\mu\text{W}/\text{cm}^2 \times \text{h}$. For one hour exposures, the maximum exposure is 200 $\mu\text{W}/\text{cm}^2$; for exposures of 6 to 25 minutes, the limit is 1 mW/cm^2 .

The new standard is based on a damage threshold of 1 mW/cm^2 for two hour exposures with a factor of ten safety margin.

These revisions described in "Changes in Microwave Radiation Exposure Standards" are codified in *Amendment No. 1 of 11/182 to State Standard 12.1.006-76 "Electromagnetic Radiofrequency Fields: General Safety Requirements."* These changes are in agreement with reports by US scientists who visited the USSR last year (see *MWN*, November 1982).

Dr. Clifford Mitchell of the National Institute of Environmental Health Sciences (NIEHS) in Research Triangle Park, NC, brought Savin's paper back from the USSR in June. It was translated by Drs. Gabriel Jakobson and David Davidson of GTE Labs in Waltham, MA.

Soviet occupational exposure standards below 300 MHz are still being developed, according to Mitchell. He said that experiments are now underway at these frequencies to form the basis of these new limits.

A new Soviet population standard is also in preparation. In an interview at the June Bioelectromagnetics Society meeting in Colorado, Professor Mikhael Shandala of the A.N. Marzeev Research Institute of General and Communal Hygiene in Kiev said that a document with proposed recommendations should be ready by the end of this year. When completed, it will be forwarded to the Ministry of Health in Moscow and undergo peer review by a committee of experts. Once reviewed, Shandala's group in Kiev will revise the document.

The present RF/MW standard for the general population

is 5 $\mu\text{W}/\text{cm}^2$. Shandala did not disclose what the new standard might be, nor is it clear when the new standard will be promulgated. He did send *Microwave News* some comments on standard setting in the USSR (see "From the Field" p.12).

Shandala was in the US to attend the *Fourth US-USSR Workshop on the Biological Effects of Physical Factors in the Environment*, held at NIEHS, June 21-22. Thirteen American and five Soviet scientists presented papers and devised a work plan for 1983-1984. A number of Soviet participants, including Professor Inal Akoev of the Institute of Biological Physics in Pushchino, were unable to attend (see *MWN*, June 1983). A fifth workshop will be held in the USSR in 1985. In addition, there are tentative plans to hold a meeting next year, also in the USSR, on the duplicative experiment, in which rats are exposed to 2450 MHz microwaves at 10 mW/cm^2 in both countries (see *MWN*, July/August 1982).

Under the work plan for continued US-USSR cooperation, bioeffects research will continue on the: (1) biological effects of microwave radiation; (2) biological effects of static and low frequency electromagnetic fields; and (3) the duplicative experiment. The new work plan was signed by NIEHS' Dr. Don McRee and Dr. Shandala on June 23.

Specific studies in the US include the development of models of the creation and propagation of solitons in helical proteins; the demodulation of ELF electric fields by cell membranes; behavioral effects of chronic, low-level exposures to 915 MHz radiation; the interaction of microwaves with drugs in the central nervous system; the short and long term effects of ELF (1-60 Hz) on neuron excitability; power frequency electric fields inside the bodies of live rats; and the effects of air ions and electric fields like those from DC transmission lines.

In the USSR, research is planned on the effects of 857 and 1765 MHz pulsed fields; the risks due to exposure to TV broadcast signals (30-300 MHz); the bioeffects, including some studies on mutagenesis, of stationary electric fields (20-80 kV/m), 50 Hz fields (10-100 kV/m) and 7 kHz magnetic fields as well as continued work on the duplicative experiment.

NY Power Lines Project To Fund Two Epidemiological Studies

The Scientific Advisory Panel of the New York State Power Lines Project is negotiating contracts for two epidemiological studies on the relationship between alternating magnetic fields (AMFs) and cancer rates among children and adults.

The panel has selected proposals from Dr. David Savitz of the University of Colorado in Denver and Dr. Lowell Sever of Battelle Pacific Northwest Labs in Richland, WA.

If details can be ironed out, Savitz's project will be similar to Dr. Nancy Wertheimer's study, which indicated an association between AMFs from power lines and childhood cancer. The decision to repeat Wertheimer's 1979 study follows a recommendation by Dr. Annemarie Crocetti, a consultant to the panel (see *MWN*, June 1983). Dr. Richard Hamman will serve as an in-house consultant for Savitz's project. Sever will run a case control study to look at the possible connection between power lines and the rates of a still to be specified type of adult cancer.

According to project administrator Michael Rampolla, budgetary constraints played a key role in the panel's choice. (Proposals from Dr. Tim Byers of the State University of New York at Buffalo and Dr. Jerome Barancik of the Brookhaven National Laboratory in Upton, NY, were also under consideration.) Savitz and Sever have been asked to modify their research designs to trim costs, but the two contracts will still require more than the \$600,000 originally slated for epidemiological research.

Rampolla reports that, barring any last minute complications, contracts will be signed in October.

FCC Inquiry on RF Lighting

The Federal Communications Commission (FCC) has issued a notice of inquiry (NOI) on the potential for radiofrequency (RF) lighting devices to interfere with radio communication services.

The commission is evaluating the need for regulations to minimize potential radiofrequency interference (RFI) from the devices and has asked interested parties to respond to some 42 specific questions by October 31. Reply comments are due December 16. Rather than set its own standards to control RF emissions, the FCC would prefer industry to regulate itself with voluntary standards.

RF lighting, in which 60 Hz AC power is converted to RF energy at a frequency above 20 kHz which excites a fluorescent tube, is much more efficient than conventional incandescent and fluorescent lighting. For instance, General Electric has developed an RF light bulb which fits into a conventional socket but uses only one third the energy of an incandescent bulb and lasts four times as long. Other companies producing various types of RF lighting devices are North American Phillips Lighting Corp., International Energy Conservation Systems and a partnership of Soli-Tronics and Brigham Young University.

With electronic and RF ballasting becoming more cost effective, and with energy costs going up, the FCC anticipates that RF devices could win a significant share of the lighting market, causing more RFI. FCC tests indicate that RF bulbs emit broadband radiation in the frequency range from 10 kHz to 80 MHz which could interfere with AM radio reception.

Under current FCC rules, RF lighting devices are covered under Part 18, Subpart H. The commission believes that these rules were not designed to apply to mass produced consumer goods, and that they are not sufficiently strict to

prevent objectionable RFI. FCC test data indicate that RF bulbs can meet much tighter limits, similar to those controlling computer emissions (Part 15).

In a separate action, the FCC has granted waivers to three companies to test market a limited number of RF lighting devices. Under the ruling, the companies will be free of the FCC requirement to test the devices every three years, but each must submit reports to the FCC on RFI problems every three months.

For more information contact: Herman Garlan, Office of Science and Technology, FCC, Washington, DC 20554, (202) 653-8247. The NOI and the notice of waivers appear in the August 17 *Federal Register*, 48 FR 37235 and 48 FR 37217, respectively.

Massachusetts Adopts RF/MW Standard; Town Rule Overturned

Massachusetts has become the first state to adopt a general population exposure standard for radiofrequency and microwave (RF/MW) radiation. The standard approved by the Public Health Council on August 9 limits exposures for the 30-300 MHz frequency band to 200 uW/cm² and is five times more stringent than the American National Standards Institute's (ANSI) 1982 guidelines.

Immediately after the council's decision, the State Attorney General's office overturned RF/MW regulations for exposures over 5 uW/cm² recently adopted by the town of Wayland (see *MWN*, June 1983). In an August 11 letter, Assistant Attorney General Henry O'Connell told Wayland administrators that under state law the Department of Health's rules for non-ionizing radiation "shall apply *exclusively* throughout the Commonwealth." Citing the new state standard, he concluded that "the proposed [Wayland] bylaw is inconsistent with state action in an area preempted by the state."

The final Massachusetts standard is very similar to earlier drafts (see *MWN*, March and December 1982 and June 1983) but does contain two last-minute additions. Regulators inserted a clause explicitly stating that federal guidelines will supersede state rules, should a conflict arise. Massachusetts has its eyes on the Environmental Protection Agency, which is scheduled to release a draft RF/MW exposure guidance later this year.

The other addition is an assurance that the state will consider other guidelines or regulations not related to public health if requested to do so by Federal Communications Commission (FCC) licensees. Such a request might come from a broadcaster forced to choose between violating FCC power requirements and the standard.

According to Robert Watkins of the state's Radiation Control Program, the regulations will not affect any existing RF/MW sources. Operators intending to alter their facilities, as well as applicants for new sources, must demonstrate compliance, however. The standard covers the spectrum from 300 kHz to 100 GHz: 200 uW/cm² for the 30-300 MHz band rising to 1 mW/cm² for frequencies above

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1500 MHz and to 20 mW/cm² for those below 3 MHz.

The standard, which goes into effect October 1, was published in the *Massachusetts Register*, No. 379, on September 1. The register is available for \$1.90, prepaid by check, from the Statehouse Bookstore, Room 116, Massachusetts Statehouse, Boston, MA 02133.

FCC Test Methods for Computer RFI Simplified

The Federal Communications Commission (FCC) has clarified its recommended procedures for measuring radiofrequency (RF) emissions from computers. The procedures were adopted in 1981 to help manufacturers demonstrate compliance with regulations to control RF interference.

The minor alterations released in late July came in response to a 1981 petition from the Computer and Business Manufacturers Association (CBEMA). In addition to adopting several of the trade group's suggestions, the commission announced its intention to publish the measurement procedures as a separate bulletin rather than keep them as an appendix to its Part 15, Subpart J regulations for computer radiofrequency interference.

According to the FCC's Julius Knapp, the changes should add more "flexibility" to the test procedures.

CBEMA spokesman Bill Hanrahan said the group is pleased with the changes, though it does not support separating the suggested measurement methods from the RF emission regulations themselves. CBEMA feels the move will make it more difficult for manufacturers to keep up with future guideline revisions. The commission maintains that separate publication is more efficient because the interested audience is very small.

Among the clarifications and revisions in the recommended test procedures:

- Equipment should be configured to maximize emissions, but not necessarily to an absolute "worst case" condition cited in the original text. The specific configuration is left to the test engineer.
- Manufacturers are no longer advised to test equipment with each cable that may be used. Instead, the commission recommends testing with cable lengths likely to produce maximum radiation emissions.
- Emissions from Class A devices (used by industry or business) may now be measured at a distance of up to 30 meters. The commission recommends limiting the distance for Class B devices (intended for residential use) to 3 meters, but greater distances are acceptable if justified. CBEMA had recommended deleting the original 3-meter distance requirement for both classes.
- The commission clarified how it will treat equipment tested before its RF interference requirements went into effect on July 1, 1981. It reserves the right to evaluate test procedures and to investigate reported problems. As in the original rules, these devices do not need to be retested.

The FCC notice also answers questions submitted over the past two years by other parties.

As noted in the August 1 *Federal Register* (48 FR 34748), the test methods will be available soon as Office of Science and Technology Measurement Procedure MP-4, *FCC Methods of Measurement of Radio Noise Emissions From Computing Devices*. The original FCC guidelines were published on April 24, 1981 (46 FR 23240). For further information, contact Julius Knapp, Office of Science and Technology, FCC, Washington, DC 20554, (202) 653-8247.

NRPB Reports on RF/MW Sources and Standards

A new report by the UK's National Radiological Protection Board (NRPB) examines exposures from radiofrequency and microwave (RF/MW) radiation sources relative to suggested revisions in safety standards. The NRPB anticipates that the new standards, proposed by the board late last year, would have only minimal impact on radiation emitting technologies. Some industrial heating equipment and radar and weapons systems are possible exceptions.

The Board states that, under the proposed limits, industrial heating is "likely" to be "more costly and possibly impracticable" in certain operations unless it can be established that the human body absorbs much less energy in the near field than in the far field (assuming the same external field strength). The same problems may also exist for some portable and mobile broadcast equipment—unless emission standards are set.

With respect to radar and weapons systems, the NRPB concludes that lowering exposure standards for the general population from 10 mW/cm² to 5 mW/cm² "may require an extension of the existing boundary limits of some controlled areas by 40 percent from the source." But, the board notes this may not be necessary if allowances are made for the "rotation or nodding" movement of the radiating source.

The board calls for further study of "rates of energy absorption related to field intensities at distances well within a wavelength from the radiating sources," and suggests more attention be directed to how the near field is modified by environmental factors.

The NRPB report follows last year's recommendations for revisions in RF/MW safety standards which proposed two sets of exposure limits: one for occupationally exposed adults and one for the general population, including children. The two are identical in the 3-100 MHz frequency band, but the latter is more stringent above 100 MHz. For workers, the maximum allowed exposure would be 1 mW/cm² for 3-100 MHz, rising to 10 mW/cm² at 1 GHz. For the general population, the allowable level would remain at 1 mW/cm² up to 300 MHz and then only rise to 5 mW/cm² at 1.5 GHz. The proposal extends the frequencies covered by the standards from 30 MHz-30 GHz to 3 kHz-100 GHz.

The occupational limits are identical to those adopted by

the American Conference of Government and Industrial Hygienists (ACGIH) in May. Those for the general public are the same as the 1982 American National Standards Institute guidelines.

In a personal communication to *Microwave News*, NRPB's Frank Harlen said that no timetable has yet been set for the adoption of the new standards.

The new limits are based on the assumption that "exposures resulting in a mean specific energy absorption rate in the whole body of less than 0.4 W/kg" are "acceptable" and provide "an adequate margin of safety."

The NRPB also states that exposures to power line frequency (50 Hz in the UK) fields of less than 10 kV/m are

"safe although the field may be perceptible at lower values." In addition, the board advises that exposures to fields as high as 30 kV/m are "unlikely to be harmful."

Sources of Exposure to Radiofrequency and Microwave Radiations in the UK (No. NRPB-R144) by S.G. Allen and F. Harlen, *Proposals for the Health Protection of Workers and Members of the Public Against the Dangers for Extra Low Frequency, Radiofrequency and Microwave Radiations: A Consultative Document* and a summary of the proposed standard by F. Harlen and J.A. Dennis published in the NRPB's May 1983 *Radiological Protection Bulletin* (No. 52) are all available from the NRPB, Chilton, Didcot, Oxon, OX11 0RQ, England.

CONFERENCES

September 28-30: International Workshop on Electrostatics: How to Manage Electrostatic Problems, Hazards and Applications, Llandudno, North Wales, UK. Contact: Ms. Helen Raquet, Oyez Scientific and Technical Services, Ltd. Bath House, 56 Holborn Viaduct, London EC1A 2EX, England.

October 2-5: 3rd Annual Meeting of the Bioelectrical Repair and Growth Society, Golden Gateway Holiday Inn, San Francisco, CA. Contact: BRAGS, 425 Medical Education Building, 36th & Hamilton Walk, Philadelphia, PA 19104.

October 4-6: LPTV '83 East, Sheraton Washington, Washington, DC. Contact: Conference Management Corp., 17 Washington St., PO Box 4990, Norwalk, CT 06856.

October 4-6: 7th International Colloquium on Prevention of Occupational Risks due to Electricity: The Prevention of Electrical Accidents by Influencing Human Behavior, Cologne, West Germany. Contact: Secretariat of ISSA-Section and Colloquium, Berufsgenossenschaft der Feinmechanik und Elektrotechnik, Gustav-Heinemann-Ufer 130, D-5000 Koln 51, West Germany.

October 16-20: Conference on Electrical Insulation and Dielectric Phenomena, Buck Hill Inn, Buck Hill Falls, PA. Contact: Dr. J.K. Nelson, Center for Electric Power Engineering, Rensselaer Polytechnic Institute, Troy, NY 12181.

October 27-28: Studying Problems Associated with Video Display Systems, Skyline Ottawa Hotel, Ottawa, Canada. Contact: Planetary Association for Clean Energy, 77 Metcalfe St., Suite 607A, Ottawa, Ontario, K1P 5L6, Canada.

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

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

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

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

November 16-17: JINA 83, (2emes Journees Internationales de Nice sur les Antennes), Nice, France. Contact: J.L. Guiraud, Centre National

d'Etudes des Telecommunications, Centre de La Turbie, 06320 Cap D'Ail, France.

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.

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.

1984

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.

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.

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.

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

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.

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

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.

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.

BIOLOGICAL EFFECTS

New AF Contracts...The Air Force School of Aerospace Medicine at Brooks AFB, TX, has awarded two contracts for studies on VLF (10 kHz to 3 MHz) radiation hazards (see *MWN*, May 1983). Dr. A.W. Guy of the University of Washington, Seattle has received \$170,000 and Dr. Om Gandhi of the University of Utah, Salt Lake City has received \$90,000 for the 13-month research projects....And the AF has awarded Dr. Robert Lebovitz of the University of Texas Health Science Center in Dallas approximately \$150,000 for a two-year study of the effects of microwaves on the reproductive function of rats. Lebovitz will expose rats to 1.3 GHz radiation at SARs of 0.5-10 W/Kg and will investigate sperm production and morphology.

Polycythemia Follow-Up...Last August, 25 cases of polycythemia vera were reported near the Savannah River plant in South Carolina, where weapons-grade plutonium is produced. The implication was that ionizing radiation was responsible for this abnormal incidence of blood disease (see *MWN*, September 1982). Officials from the Center for Disease Control (CDC) set out to track down the cases and to see if there was a common thread linking them. The report caught the attention of the RF/MW community because in 1981 an army pathologist reported what he believed to be an association between microwave exposure and polycythemia (see *MWN*, March 1981). After a year of field work, CDC investigators have failed to locate most of the 25 people involved. CDC's Dr. Jeffrey Lybarger was able to confirm only a very small number of cases —many of them were discredited. CDC's interest lies not only in checking out this cluster but also in doing basic research on polycythemia. Lybarger said that an epidemiological study could still be done, if it is deemed worthwhile by senior CDC staff.

Resources...Allan Frey of Randomline Inc. in Huntingdon Valley, PA, and Alan Segal and Richard Magin of the University of Illinois in Urbana-Champaign exchange views on research on the effects of microwaves on the blood-brain barrier in Volume 2, Number 1 of the *Journal of Bioelectricity*....Dr. Herbert Pollack's paper, "Medical Aspects of Exposure of Radiofrequency Radiation Including Microwaves," appears in the June issue of the *Southern Medical Journal*. Pollack, who is associated with the George Washington University School of Medicine, wrote the article for the general medical practitioner....Drs. Richard Olsen of the Naval Aerospace Medical Research Lab in Pensacola, FL, and James Lin of the University of Illinois in Chicago have published "Microwave-Induced Pressure Waves in Mammalian Brains" in the May issue of the *IEEE Transactions on Biomedical Engineering*....There was a session on microwave standards at the annual convention of the American Psychological Association held in Anaheim, CA, in late August. Drs. Eleanor Adair, Don Justesen, Richard

Lovely, Mary Ellen O'Connor and F. Kristian Storm participated in the discussions that were held under the general title "Physiological Psychology Does Impact on Public Concern and Policy."

COMPATIBILITY & INTERFERENCE

More on Immunity...Don Heirman of AT&T Information Systems (the new name for American Bell) presented a status report on ANSI C63's ad hoc committee, which is studying ways of reducing RFI to home electronic equipment, at a C63 meeting on August 26 in Washington, DC (see *MWN*, May and July/August 1983). Heirman plans to have a draft interim standard on radiated immunity, methods of measurement and preliminary performance limits by next April 1. At the C63 meeting there was some discussion of which types of equipment should be addressed after work is completed on the number one priority items, TVs and VCRs. The consensus was that the next order of business should be telephone equipment, including cordless telephones, followed by home security devices. GE's Harold Gauper Jr. has become the ad hoc group's vice-chairman; its next meeting is planned for October 26. The date of the next meeting of ANSI C63 was left up in the air —either next January or April. (See also EMC story on p.1 for some details on C63 deliberations.)

Radio Noise Meeting...There will be a two-day meeting on radio noise in Washington, DC, in mid-October sponsored by the US government. On the agenda will be reviews of available noise models and measurements as well as future R&D needs. Attendance will be limited to American citizens with a "Secret" security clearance. For more information, contact: Ms. J. Brown, SRI International, 1611 N. Kent St., Arlington, VA 22209.

Resources...The IEEE EMC Society has published indexes of all papers published in the *IEEE Transactions on Electromagnetic Compatibility* from 1959 to 1982 and those presented at EMC symposia from 1962 to 1982. The indexes, prepared by Richard Schulz and Andrew Farrar, together with a brief history of the EMC Society on the occasion of its 25th anniversary appear in the August issue of the *EMC Transactions*. Copies are \$6 for IEEE members and \$12 for non-members from the IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854....The proceedings of the 8th International Aerospace and Ground Conference on Lightning and Static Electricity, held in Fort Worth, TX, June 21-23, are available from the National Technical Information Service (NTIS), Springfield, VA 22161. Report No. DOT/FAA/CT83/25....Robert Olsen of Washington State University in Pullman has published "Radio Noise Fields Generated by Corona Streamers on a Power Line" in the May-June issue of *Radio Science*....The Electronic Industries Association has released *Interference Criteria for Mic-*

rowave Systems in the Private Radio Services, EIA Telecommunications Systems Bulletin 10-D. It covers both digital and video criteria in addition to analog message interference criteria and should be of interest to licensees and planners of FCC Part 94 microwave systems, as well as those licensees who may be displaced from the 12.2-12.7 GHz band as a result of action in FCC Docket 82-334. Bulletin 10-D, which replaces the 1976 Bulletin IEB 10-C, is available for \$17 from EIA's Engineering Dept., 2001 Eye St., NW, Washington, DC 20006.

GOVERNMENT

FMAC...A Frequency Management Advisory Council (FMAC) meeting on July 29 brought members up to date on EPA's RF/MW guidance development and on the recent flurry of major international conferences on spectrum management. An FMAC group headed by Ed Weppeler is now developing recommendations to help NTIA aid industry in avoiding RFI problems. A report on NTIA's efforts should be ready by FMAC's next meeting on September 21. High definition TV and the next International Telecommunications Convention are also on the September agenda.

MEASUREMENT

Satcom Earth Stations...NBS' Electromagnetic Fields Division has revised its *Earth Terminal Measurement Systems Operations Manual* (NBSIR 83-1679). The manual describes in simple English how to measure satellite earth stations for noise and other engineering parameters and can be used even by those unacquainted with the NBS measurement system. A copy is available from the National Technical Information Service, Springfield, VA 22161 for \$28. Order No. PB 83-189928.

In the Near Field...In our January/February 1983 issue, we reported that NBS researchers had shown the theoretical feasibility of building a meter that can measure the electric and magnetic fields simultaneously in the near field. Now NBS' Dr. Motohisa Kanda has written a detailed report, complete with illustrations, describing the theory behind this new sensor. NBS Technical Note 1062: *An Electric and Magnetic Field Sensor for Simultaneous Electromagnetic Near Field Measurements - Theory* is available from the Superintendent of Documents, US Government Printing Office, Washington, DC 20402 for \$4.50.

MEDICAL APPLICATIONS

Hyperthermia Operator Safety...Operators of the Magnetron hyperthermia unit who stay more than 1 meter away from the device will not be exposed to radiation levels in excess of the ANSI safety recommendations (4.9 mW/cm^2), according to a report in the July 1983 *Health Physics*. The Magnetron unit, which operates at 13.56 MHz with an

output power of up to 1,000 watts, is used in cancer therapy. M.A. Stuchly, M.H. Repacholi and D.W. Lecuyer ran tests using human-scale phantoms placed inside the Magnetron's whole body electrode. The minimum safety distance is 2 meters under the Canadian safety code (1 mW/cm^2). They found smaller minimum distances at lower than a 1,000 W power setting, as well as when the unit's neck or thigh electrodes are used. The researchers from the Canadian Radiation Protection Bureau show that magnetic field strengths near the unit are consistently higher than electric field strengths. "To assess whether exposure to the operator is within the recommended limits, it is sufficient to examine the intensities of the magnetic field," they report.

Ultrasound During Pregnancy...NIH and FDA are sponsoring a three-day *NIH Consensus Development Conference on Use of Diagnostic Ultrasound Imaging in Pregnancy*, at NIH in Bethesda, MD, February 6-8. The meeting will address the types of ultrasound in obstetric practice and their risks to mother and fetus. For more information, contact Michaela Richardson, NIHCD, Bldg. 31, Room 2A32, 9000 Rockville Pike, Bethesda, MD 20205, (301) 496-5133.

MILITARY SYSTEMS

Project ELF Suit...The US District Court for Western Wisconsin will hear arguments in the state of Wisconsin's suit against the navy's Project ELF submarine communications system beginning September 20 (see *MWN*, July/August 1983). The judge has scheduled a hearing on Wisconsin's motion for an injunction against the ELF system until the navy prepares a new environmental impact statement as well as a trial on the merits. The state of Michigan has not joined Wisconsin in the case, but Michigan's Marquette County does plan to intervene as a co-plaintiff. Among those testifying for Wisconsin are Drs. Robert Becker and Nancy Wertheimer. The navy plans to call Drs. Annemarie Crocetti, Don Justesen and Anthony Valentino and a number of navy, GTE and IITRI personnel.

More on Microwave Weapons...Last May, we ran an item on the growing interest in EMP and RF/MW weapons. AP reporter Barton Reppert has been looking into this and confirms that the US "is quietly stepping up research on microwave beam weapons." In his August 12 story, Reppert writes that, according to Pentagon researcher John Bachkosky, high power microwave weapons involve fewer technological hurdles than either high energy lasers or particle beams. Bachkosky said that US research efforts in the microwave area are aimed largely at studying the vulnerability of various electronic components and weapon systems to high intensity microwave bombardment. Reppert also cites Edward Brown of the army's Harry Diamond Labs on progress towards the development of a tactical microwave weapon system: "We're in the realm of the possible. We're not in the realm of the probable, yet."

POWER LINES

More from Montana...A deal struck between three environmental groups and the Montana Power Company has cleared the last obstacle to building a 500 kV power line from Garrison, ND to Spokane, OR. The Montana Wildlife Federation, the National Wildlife Federation and Trout Unlimited dropped an appeal to force the National Forest Service to reconsider whether certain land along the route in Montana should be declared a wilderness area in exchange for a \$1.65 million fund to limit the line's environmental impact. Montana Power and four other utilities involved in the project will provide the money. The Forest Service issued construction permits to the line's builder, the Bonneville Power Administration (BPA), immediately after the agreement was reached in August. In a separate action reported in our July/August issue, Montana's Board of Natural Resources and Conservation this summer adopted a 1 kV electric field limit at the edge of the line's right-of-way (ROW) on residential or subdivided property. According to BPA's Deputy Chief Engineer Jerry Flick, BPA has not responded to the new requirement because it only applies to the Garrison-Spokane line, which will not pass through any land affected by the ruling. He said BPA would contest the 1 kV limit as too restrictive if the board starts proceedings to make it a state-wide standard. The board made a point of addressing health hazards with the 1 kV limit requiring a 160 foot ROW, but in fact mandated an even greater ROW, to 205 feet in developed areas, to limit noise levels.

DOE-EPRI Meeting...This year, the Department of Energy (DOE) and the Electric Power Research Institute (EPRI) are holding a *joint* meeting to review the research of their contractors. The open meeting will be held at the Hilton Plaza Inn in Kansas City, MO, November 7-9. Abstracts of the reports to be presented will be available before the meeting. Anyone planning to attend or who would like a copy of the abstracts should contact Dr. William Wisecup of The Aerospace Corp. in Washington, DC, as soon as possible, (202) 488-6328.

STANDARDS

Toward a Population RF/MW Guidance...A special panel of EPA's Scientific Advisory Board (SAB) will meet September 22-23 in Washington, DC, for the first public review of the agency's draft report on RF/MW bioeffects. The report will be the basis of EPA's general population exposure guidance (see *MWN*, July/August 1983). The meeting will start at 9:15 AM in Room 2123 at EPA headquarters, 401 M Street, SW. Those wishing to present comments should contact SAB's Dr. Terry Yosie at (202) 382-4126 or Dr. Douglas Seba at (202) 382-2552. To meet a greater than anticipated demand, EPA has printed more copies of its report, *Biological Effects of Radiofrequency Radiation*, No. EPA-600/8-83-026A, which is available from the Center for Environmental Research Information, EPA, Cincinnati, OH 45268, (513) 684-7562....Dr. Daniel

Cahill, who preceded Dr. Joe Elder as head of the Experimental Biology Division at EPA's Health Research Lab, has suggested setting an interim federal RF/MW exposure guidance for the general public that is five times lower than ANSI's 1982 revised levels and identical to Massachusetts' recently adopted standard (see story on p.5). In an article appearing in the July *Health Physics*, Cahill concludes that, based on EPA's bioeffects literature review, a maximum specific absorption rate of 0.04 W/kg (equivalent to 200 uW/cm² for the 30-300 MHz band and higher for frequencies above and below this range) would provide a factor of ten safety margin against "potentially significant health effects—any increase in core temperature or activation of thermoregulatory response and the development of areas of localized temperature elevations." He warns, however, that the proposed standard "does not mean that further research is not needed, particularly in the areas of mechanisms and frequency-specific and modulation effects." Cahill did not consider these factors because, "The evidence to support [their existence] is too incomplete at this time to influence exposure guidelines." His proposal is based on the assumption that the public is primarily exposed to continuous wave radiation in the far field. Cahill left EPA in late 1981 to work at Carolina Power and Light's Harris Energy and Environment Center in New Hill, NC. Opinions presented in the paper are Cahill's and are not official EPA policy.

New Standards...The Consumer Product Safety Commission's safety standard for all omnidirectional CB base station antennas went into effect May 24. The regulations were originally scheduled to apply on February 25, but were delayed until Congress' prerogative to veto them expired. For details see the June 28 *Federal Register* (48 FR 29682)...Comments are being solicited for a proposed revision of ANSI/IEEE 145-1973: *Definitions of Terms for Antennas*, which covers both transmitting and receiving antennas. A copy of BSR/IEEE 145-1983 is available for \$7 from Ms. M. Lynch, IEEE, 345 East 47th St., New York, NY 10017. Comments are due October 18....The International Electrotechnical Commission's (IEC) Technical Committee 77 on EMC Between Electrical Equipment Including Networks has issued two six-month draft rules: 77(Central Office)20 *Guide to Methods of Measurement of Short Duration Transients on Low Voltage Power and Signal Lines* (\$15) and 77A(Central Office)2 *Supporting and Explanatory Guide to Voltage Fluctuation Limits to Household Appliances* (\$7). These are available pre-paid from the International Sales Dept., ANSI, 1430 Broadway, New York, NY 10018.

VDTs

UK VDT Study...England's Health and Safety Executive (HSE) has published a booklet on VDT worker health and safety. HSE concludes that, "there is no increased risk from radiation emanating from VDUs [visual display units] over and above that which exists already in office workplaces." The document also downplays VDTs as a cause of photo-

sensitive epilepsy and states that it is unclear whether facial rashes are caused by the units. These topics and additional information on radiation issues are covered in the first part of the booklet. Part two offers guidance on human factors involved in VDT use. Recommendations include early planning for introduction of VDTs, close attention to the quality of the screen image, adjustable seating, detachable keyboards and use of document holders. Proper lighting is also emphasized. HSE concludes that these and other ergonomic measures, "can considerably improve the acceptability of the system as well as its overall effectiveness." *Visual Display Units* is available from the Health and Safety Executive, Baynards House, 1 Chepstow Place, London, W2 4TF, England.

Response to NAS...The National Academy of Sciences report that found VDTs safe for workers' vision (see *MWN*, July/August, 1983) was challenged by the head of the Biomedical and Behavior Science Division at NIOSH, which requested the study in 1981. Dr. Barry Johnson disagreed with NAS's suggestion that further research is unnecessary, though he supported the report's basic findings. Johnson put distance between the study and NIOSH, a move some observers believe is intended to help the agency maintain funding of VDT-related work. The NIOSH scientist won praise for his statement in an August 29 editorial in *Computerworld*. In addition, the editorial emphasized the importance of media coverage of the VDT debate: "as long as the question [of VDT health and safety] remains open, we consider it the media's responsibility to cover the issue in full until the final chapter on VDT safety has been written. There is no telling how long that might take." NIOSH's Johnson was not alone in criticizing the NAS report. The Newspaper Guild's President, Charles A. Perlik, Jr., said the report is misleading and its timing unfortunate—coming before the guild's own eye study is completed. Perlik criticized the study's recommendation against mandatory standards for VDTs and VDT workplaces, and protested that the report is likely to be interpreted as finding no health hazards associated with VDTs "and that's not true at all." A representative of the Communications Workers of America (CWA) said the NAS report is a "real cop-out." David LeGrande called the recommendation against research on the possible tie between VDTs and cataracts "irresponsible," and said the report's finding that radiation emissions are less dangerous than ambient radiation is "an oversimplification of a very difficult concept." Copies of the NAS study, *Video Displays, Work and Vision* are available for \$14.50 from the National Academy of Sciences, Room 700, 2101 Constitution Avenue, NW, Washington, DC 20418.

Eyes and Vision...What seems to be distorted color perception after hours of VDT work may be the result of a well-known psychological illusion known as the McCollough effect. A letter to the August 4 *New England Journal of Medicine* explains that one of the authors, an architect at Northwestern University, experienced "an unusual and vivid visual illusion" after several hours of VDT work. "Ordinary white letters and lines on a contrasting back-

ground appear to have a pink color," she and two of her colleagues at the university write. Plain white paper might appear to have a pink tint at its edges. The McCollough effect can last for weeks although it is believed to be harmless. Susan L. Greenwald, and Drs. Mark J. Greenwald and Randolph Blake caution that, "physicians should be aware of the phenomenon so as not to mistake it for a hysterical symptom or a manifestation of neurologic disease."...A study of VDT operators' vision commissioned by a manufacturer of ergonomic office furniture found "no direct relationship between serious temporary or permanent eye pathology and VDT use." Dr. Dennis Arinella, an ophthalmologist at the University of Massachusetts Medical Center at Worcester, studied 21 female VDT operators at Wright Line, Inc. All 21 spent at least 30 hours per week at terminals. Arinella and Lee White, Supervisor of Office Services for the company, conclude that minor, correctable problems do exist, "which appear to increase the incidence of eye strain, including lightly pigmented irises, minimal uncorrected refractive errors, mild muscle imbalance and decreased tear production." The study will be presented October 12 at the meeting of the Office Automation Management Association in Washington, DC...The American Optometric Association (AOA) has published *Vision and the VDT Operator*, a brochure offering "advice on how to make VDT work easier on the eyes." The AOA warns that "VDT use can aggravate moderate and more severe vision problems," and recommends a safety checklist to protect terminal user vision. The list includes annual eye examinations, lighting and glare control and 15-minute breaks every two hours.

Some Statistics...Color terminals are rapidly gaining popularity due to falling prices and a growing supply of color-utilizing software, according to a special report prepared for *Computerworld*. Color terminals can cost less than \$1,300, compared to more than \$10,000 only a short time ago, reports John Witherow in the August 29 issue. Color terminals are likely to replace or complement standard VDTs in many offices, Witherow says. The report notes that, "users working on color terminals reported fewer instances of eye strain as compared to those working on conventional CRTs."...The number of VDT office workstations is expected to increase almost 700 percent, from 3 million currently to more than 20 million by 1992 according to a report on office automation produced by an independent market research organization. *Office Automation Systems Market in the US*, Report No. A1092, is available for \$1,275 from Frost & Sullivan, Inc., 106 Fulton Street, New York, NY 10038.

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FROM THE FIELD

Letter from the Soviet Union

Professor Mikhael G. Shandala of the A.N. Marzeev Institute of General and Communal Hygiene in Kiev visited the US last June (see story p.4). Before he left, he sent Microwave News the following notes on radiofrequency and microwave radiation standard setting in the Soviet Union.

We thank Christopher Dodge of the Congressional Research Service's Science Policy Research Division at the Library of Congress in Washington, DC, for translating Dr. Shandala's letter.

The basic objective of investigations into the biological and health effects of electromagnetic fields (EMFs) in the USSR is to set safety standards on the basis of sound science. Studies are designed to determine the dose dependency of a number of reported biological responses to EMFs. Dose response data are then applied to realistic radiation exposure scenarios. Experience from occupational histories is one route taken to establish exposure standards for the general population, also taking into consideration younger people, pregnant women and the elderly.

The observation of a new biological response to EMFs is not necessarily construed to mean that it is deleterious in nature. The nature of the response must be evaluated in terms of its significance to the entire organism. We distinguish two responses: adaptive and compensatory. Compensatory responses, characterized by functional stresses over a prolonged period of time, can lead to negative consequences for the organism. Accordingly, occupational exposure standards, involving relatively circumscribed daily times of exposure to EMFs over long periods of time, are based on compensatory responses. On the other hand, adaptive responses (threshold effects) are taken into account in establishing exposure standards for the general population.

Together with the above principles, we also use a number of methodological concepts which include the following:

- Risk-benefit analysis (with emphasis on biomedical data as opposed to economic issues).
- Re-evaluation of present standards and preventive measures.
- Evaluation of basic biological interactions with other physical and chemical factors in the environment.
- Consideration of the entire organism in its natural, domestic and occupational settings.
- Maximum permissible limits of exposure to chemical and physical factors as a function of the parameters of exposure (e.g. frequency, duration, intensity, etc.).
- Thresholds of responses to physical and chemical factors.
- Delayed effects of physical and chemical factors.
- Exposure standards evaluated (peer-review), refined, promulgated and enforced.

Professor Mikhael G. Shandala

A.N. Marzeev Research Institute of General and Communal Hygiene, Ministry of Health of Ukrainian SSR, Kiev, USSR.

SHORT COURSES

October 11-13: EDP Equipment Design Seminar on Coping with the FCC/DE Regulations on RFI, Boston, MA. Fee: \$695. Contact: EMXX Corp., 6706 Deland Drive, Springfield, VA 22152, (703) 451-4619. Repeated • November 8-10: San Francisco, CA.

October 11-13: Current Issues and Trends in Controlling Occupational Exposures to RF/Microwave Radiation, Salt Lake City, UT. Fee: NA. Contact: K. Blosch, Rocky Mountain Center for Occupational and Environmental Health, University of Utah, Salt Lake City, UT 84112 (801) 581-5710.

October 17-18: EMI Workshop, Philadelphia, PA. Fee: \$575. Contact: R&B Enterprises, 20 Clipper Road, W. Coshohocken, PA 19428, (215) 825-1960. Repeated • December 5-6.

October 17-21: Communications Satellite Engineering, Washington, DC. Fee: \$855. Contact: Continuing Engineering Education, George Washington University (GWU), Washington, DC 20052, (800) 424-9773.

October 18-21: Electromagnetic Compatibility Engineering, San Mateo, CA. Fee: \$900. Contact: Center for Professional Advancement, PO Box 964, East Brunswick, NJ 08816, (201) 249-1400.

October 19-21: Fundamental EMI Control Design and Tests, Philadelphia, PA. Fee: \$695. Contact: R&B, see October 17 above. Repeated • October 26-28: Boston, MA.

October 22: Physics and Engineering of NMR Imaging, San Francisco, CA. Fee: \$85 (IEEE members), \$105 (others). Contact: Paul Phelps, Lawrence Livermore National Laboratory, PO Box 5504, L-156, Livermore, CA 94550, (415) 422-8312.

October 24: EMI Control: Emission & Immunity, Oak Brook, IL. Fee: \$85. Held at the *National Communications Forum*. Contact: NCF, Suite 4808, 505 N. Lake Shore Drive, Chicago, IL 60611, (312) 828-0491.

October 24-25: EMC Laboratory Experience Workshop, Mariposa, CA. Fee: \$695. Contact: EMXX, see October 11 above.

October 24-28: Antennas and Arrays, Washington, DC. Fee: \$855. Contact: GWU, see October 17 above.

October 25-28: Grounding and Shielding, Sunnyvale, CA. Fee: \$815. Contact: Don White Consultants, Inc. (DWCI), State Route 625, PO Box D, Gainesville, VA 22065, (703) 347-0030. Repeated • November 1-4: Philadelphia, PA; • January 24-27: Phoenix, AZ.

October 25-28: Millimeter Wave Radar, Washington, DC. Fee: \$780. Contact: GWU, see October 17 above.

November 1-3: An Introduction to EMI/RFI/EMC, Los Angeles, CA. Fee: \$815. Contact: DWCI, see October 25 above.

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

November 4-18: Microwave and High-Speed Digital Integrated Circuits Manufacturing and Applications, Tokyo, Japan. Fee: \$4,955. Contact: Kazuo Moro, Technology Transfer Institute, 624 S. Grand Ave., Suite 2407, Los Angeles, CA 90017, (213) 628-9381.

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

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

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

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

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