sor Herman Chernoff, MIT; William Cory, Southwest Research Institute; Professor Donald Gaver, Naval Postgraduate School, Monterey, CA; Professor Walter Karplus, University of California, Los Angeles; Dr. Nancy Mann, University of California Medical School, Los Angeles; Dr. Stewart Personick, TRW Technology Research Center, El Segundo, CA; Professor Allen Peterson, Stanford University; Dr. Henry Pollack, Bell Labs., Murray Hill, NJ; and Professor Nozer Singpurwalla, George Washington University.

Air Force EMC Center to Close

The Air Force's Electromagnetic Compatibility Intrasystem Analysis Program (EMC/IAP) Support Center at the Rome Air Development Center (RADC) will close at the end of September after five years of operation. The support center, which is located at Griffiss Air Force Base in the heart of New York state, develops techniques and computer codes to diagnose and correct system-level and specific EMC problems for the air force and industry.

According to the center's Kenneth Siarkiewicz, the electric field analysis group at Rome will now turn its attention to compatibility and interference issues associated with the new generation of technology based on very-high-speed integrated circuits (VHSIC). Because these chips have higher speeds, higher frequencies, greater "broadbandeness" and closer spacings, they have a greater susceptibility to low-level signals than earlier integrated circuits, he said.

When the center opened in 1978, its services were free. Two years ago a nominal fee was imposed. Now, the government is leaving it up to industry to keep the ball rolling, according to Siarkiewicz. After the EMC/IAP closes, the EMC computer codes will still be available from RADC but there will no longer be any support for users. Some of the computer codes are 19,000 lines long.

There are now about 100-150 active users of the center's services, including Boeing and McDonnell Douglas. (The EMC/IAP mailing list has some 1800 names.) The F-14 and F-15 are examples of equipment tested with EMC/IAP programs.

The EMC/IAP Support Center is run by the IIT Research Institute. IITRI's Program Manager John Dobmeier expressed his disappointment over the air force's decision, but said "we understand the economic realities." Both Dobmeier and Siarkiewicz stressed that the move to close the center was the result of a change in direction and not a budget cut.

Although the navy has used the EMC/IAP center on occasion, it is writing its own computer codes at the Naval Ocean System Center in San Diego, CA. Of special interest to the navy is the problem of below deck EMC. Industry users may now turn to TRW Defense and Space System's Electromagnetic Environmental Effects Branch in Redondo Beach, CA, the developer of the SEMCAP codes, which are similar to the EMC/IAP programs.

FDA Withdraws Diathermy Standard

The Food and Drug Administration (FDA) has withdrawn its proposed performance standard for microwave diathermy devices. The FDA decided to withdraw the rule because few, if any, *new* diathermy units operate in the microwave band and because the agency does not have the authority to set a performance standard for equipment already in use.

The standard, as proposed in July 1980, applied to new diathermy and hyperthermia equipment operating at 915 MHz and 2450 MHz. It specified that the units' applicators must deliver heat efficiently (depositing over 235 W/Kg in standardized phantoms) and not leak more than 10 mW/cm^2 at a distance of 5 cm.

The FDA's National Center for Devices and Radiological Health plans to issue a technical report that could serve as the basis for a voluntary standard for the 15,000 microwave diathermy units in use. No publication date has yet been set, however.

The center will continue to monitor both microwave and shortwave diathermy equipment —the latter is becoming increasingly popular. The center's Dr. Melvyn Altman said that while the agency could not set standards for existing diathermy equipment, it does have the authority to regulate any units that present a health risk.

The proposed standard drew widespread criticism from researchers who feared that it would inhibit the development of improved cancer therapies (see *MWN*, February 1981). Altman pointed out that if the standard had been promulgated, the FDA could have excluded hyperthermia devices. In any case, such equipment is classified as Class III and requires FDA approval prior to marketing, he said.

Notice of the FDA decision appears in the March 11 *Federal Register* (48 *FR* 10373) and the original proposal is in the July 29, 1980 issue (45 *FR* 50359).

FY84 Military Budget: Requests and Dissent

Congress and the Pentagon continue to wrangle over the fiscal year 1984 (FY84) Department of Defense (DoD) budget. Outlined below is a recap of some of the military's requests for radar, communications and weapons systems, with some responses from critics.

Aegis Weapon System: The first Aegis guided missile cruiser, USS Ticonderoga (CG-47), joined the fleet in January and a second, the USS Yorktown, is scheduled for christening in mid-April. Criticisms are mounting as the navy continues to request funds for the progam in FY84 —$16.6 million for R&D on the Aegis system and $3.4 billion for procurement (each cruiser costs more than $1 billion). The General Accounting Office (GAO) has released a digest of a classified report (No. GAO/C-MASAD-83-11, February 22), which found that the Aegis system was inadequately tested before the CG-47 was commissioned and that the ship may be unstable. The GAO recommended a stop to the acquisition of SPS-49 air search radars for future cruisers. DoD responded that the SPS-49 adds to the CG-47's flexibility and that the navy does not believe the CG-47 is "overweight or unsafe." Meanwhile, presidential hopeful Senator Gary Hart (D-CO) is urging a delay in funding three cruisers while a rigorous testing program for the CG-47 and Aegis system is set up. Hart wants to know if the Aegis radar can shoot down a sea-skimming missile, like the Exocet used by the Argentinians against the HMS Sheffield in the Falklands war.

Over-the-Horizon Backscatter Radar: The air force is requesting $99 million for R&D and $176 million for procurement of the OTH-B radar system. In another classified report (GAO/C-MASAD-83-14, March 15), the GAO found that the air force intends to begin the production of the OTH-B radar before development is complete. Noting that "the air force and the navy plan to develop tactical warning systems for use during the 1990s that will withstand a greater threat environment than the OTH-B," the GAO recommended that the air force "fully reassess the need and justify the decision to acquire the OTH-B radar system." DoD replied that the OTH-B hardware was successfully tested and only refinements to the design are needed.

PAVE PAWS: The air force wants $101 million for procurement and $3.8 million for R&D for the PAVE PAWS radar system, which detects and tracks submarine launched missiles.

Project ELF: The navy has asked for $58.5 million for full-scale development of its submarine communication system in Michigan and Wisconsin. Meanwhile Senator William Proxmire (D-WI)

issued the results of a poll showing that 60.5 percent of his constituents oppose the system.

Other DoD budget requests include: $7.2 million for R&D on EMP radiation at the air force's radiation test facility at Kirtland AFB, NM; $4 million for R&D on the Joint (AF and Army) STARS (Surveillance Target Attack Radar System) program—the old PAVE MOVER program; and $7.3 million for the navy's electromagnetic spectrum management program to reduce interference among deployed systems and run electromagnetic compatibility analyses.

Last month President Reagan added new complexity to the military budget debate by proposing an ambitious plan for developing an anti-ballistic missile (ABM) system based on directed energy weapons. The program is still in the definition phase, but this type of research already has some $500 million in the proposed FY84 budget. According to an article by Jeff Hecht in the December 16 *New Scientist*, about 90 percent of this sum is for high energy lasers, with most of the balance for particle beam systems. About one percent, or $5 million, will be spent on research for new microwave weapons.

As part of its plan to convince the public that a military buildup is needed, DoD has released *Soviet Military Power 1983*. The report opens with an artist's rendering of the new Pushkino ABM phased array radar, which provides 360 degree coverage and is 120 feet high and 500 feet wide.

UPDATES

Biological Effects...A team from Bowman Gray School of Medicine (Winston-Salem, NC) and Tulane University (New Orleans, LA) has found evidence of an intensity window due to exposure to a 60 Hz electric field at 10 kV/m. In a paper published in *Life Sciences (32,* 691, 1983), the researchers report that exposure of rat adrenal tissue *in vitro* to 60 Hz radiation appears to "directly alter an important cellular activity." No statistically significant effects were found at 5, 100 or 1,000 kV/m. Noting that intensity windows have already been reported by Bawin and Adey and confirmed by Blackman, they argue: "Intensity and frequency windows might be a general characteristic for all biological reactions to electromagnetic fields and might help explain many of the inconsistencies and controversies in the literature on biological effects of ELF fields."...Two researchers from the University of Salford in the UK have raised an interesting hypothesis about the effects of power line radiation. In a letter to *Health Physics* (December), C.W. Smith and E. Aarholt suggest that long-term exposure to 50-60 Hz fields could give rise to the production of opiates in the human body: "Thus it is possible that the continuous production of beta-endorphins by electric currents induced in the body for extended periods by environmental circumstances might give rise to unpleasant symptoms only on withdrawal from the field or the cessation of the current."...Dr. Asher Sheppard of Redlands, CA, has submitted his report on *Biological Effects of High Voltage AC Transmission Lines* to the Montana Department of Natural Resources and Conservation's Energy Division in Helena. Sheppard's study specifically addresses the Bonneville Power Administration's 500 kV line, which will be built in Montana as part of the Colstrip Power Project....Two review papers have recently been published: EPA's Drs. Claude Weil and James Kinn's "Advances in Experimental Exposure Methods and Dosimetric Techniques Used in Radiofrequency Radiation Biological Effects Studies" is in the February issue of the *Proceedings of the IEEE;* and University of Illinois Professors Alan Segal and Richard Magin's "Microwaves and the Blood-Brain Barrier" appears in Volume 1, Number 3 of the *Journal of Bioelectricity*. With respect to the BBB, Segal and Magin conclude that "many questions remain unanswered, and more questions are emerging with each new study" and that "there is a definite need to carry out [studies on] long-term chronic exposure to low-level microwaves."...*Microwaves and Thermoregulation*, the proceedings of a symposium held at Yale University in October 1981 (see *MWN*, November 1981) will be published this month by Academic Press. The volume was edited by Dr. Eleanor Adair of the John Pierce Foundation Laboratory at Yale.

Communications...New Jersey Assemblyman Dean Gallo and Assemblywoman Leanna Brown have proposed that the governor's Science Advisory Committee investigate RF/MW bioeffects and that the state impose a 90-day moratorium on new broadcast towers until the study is completed. Their resolution was referred to the assembly's Energy and Natural Resources Committee on March 14....The FCC's Office of Science and Technology has issued *Advanced Technology UHF Receiver Study, Part I, Receiver Performance Measurements*. A limited number of copies are available from the Office of Public Affairs, (202) 254-7674....The FCC has okayed teletext, the one-way transmission of information to home TVs. With a special decoder, viewers will be able to tune into news, games, guides, announcements and more....Comments on the FCC's rules to allow land mobile and fixed services to share some UHF television channels are reviewed in the March 21 *Broadcasting*.... A 300-page report on US long-range goals in international telecommunications and information (No. PB83-175893) has been released by NTIA.

Compatibility & Interference...Among recent contract awards are: • ESL, Inc., a subsidiary of TRW in Sunnyvale, CA, will investigate the potential for RF interference on the tracking and data relay satellite system (TDRSS) under a $230,000 contract from NASA. According to ESL, the most likely sources of RFI are foreign, mostly military, radar systems operating in the S-band (2-2.3 GHz) and the Ku-band (13.4-15.3 GHz). ESL will evaluate the accuracy and limitations of an already developed RFI synthetic model. • In a study for ONR, Professor J. Reese Roth of the University of Tennessee in Knoxville will do experimental and theoretical research on RF emissions from plasmas, particularly at low frequencies, that are capable of interfering with submarine communications. Roth will place special emphasis on the "newly discovered RF emission at the geometric mean plasma frequency." • The Naval Air Development Center in Warminster, PA, has negotiated an award to Dayton Brown of Bohemia, NY, for the development of techniques to reduce electromagnetic vulnerability and interference in the LAMPS MK III avionic and armament systems. LAMPS stands for Light Airborne Multipurpose System and is designed to enhance the capability of surface ships in anti-submarine and anti-ship warfare by allowing ships and helicopters to work together electronically. • The Southeastern Center for Electrical Engineering Education in St. Cloud, FL, has won a $1 million contract from the Naval Surface Weapons Center, Dahlgren, VA, for a host of studies on electromagnetic environmental effects on aircraft and ships. Among the tasks are the development of ways to improve EMI-EMC programs and an assessment of the shipboard test equipment being developed under the navy's CREAM (combat readiness electromagnetic analysis and measurement) program. • And, the FAA is inviting bids for the measurement of RF emissions from ISM (industrial, scientific and medical) equipment and ILS (instrument landing systems) to ADF (automatic direction finding) receivers. If the FAA fails to receive qualified bids, it will try and extend its contract with Ohio State University, which is now doing similar work for the agency (see *MWN*, January/February 1983)....The National Association of Broadcasters (NAB) is opposing any decrease in the FCC's minimum required mileage separation among FM stations. One of the NAB's concerns is "unnecessary interference" when the separation is at a minimum.

Government...The turmoil at EPA has taken its toll on the agency's senior management: most have resigned under pressure. Their positions remain unfilled as William Ruckelshaus, Reagan's nominee for EPA administrator, awaits Senate confirmation. What all this will mean for the agency's FY84 budget is still unclear. Meanwhile, two congressional subcommittees are looking into the proposed closing of the RF/MW radiation program at the agency's Health Effects Research Laboratory in North Carolina (see *MWN*, January/February 1983). At a March 2 hearing before the subcommittee on HUD-independent agencies of the House Committee on Appropriations, Congressman Bill Green (R-NY) asked EPA managers some pointed questions about the RF/MW cuts: "Why do you believe the job for R&D is over with the completion of [EPA's RF/MW guidance]?

Aren't there areas of radiation which require additional monies?" Acting Assistant Administrator for R&D Courtney Riordan replied in part: "As a result of [past research] programs...we have yet to come up with what we call a potential significant risk and adverse health effects from exposure to non-ionizing radiation....we feel this is not a terribly productive area of research..." Green followed up with: "[Haven't] such things as central nervous system involvement and response to low-level exposures, so-called calcium efflux in neural tissue and behavioral effects as well as immune responses, been demonstrated? Wouldn't these have important health implications?" Later Green asked the EPA team: "Can you give us assurances that work in this area will in fact be picked up and funded by NIEHS or other agencies?" No assurances were offered, though Assistant Administrator for Air, Noise and Radiation Kathleen Bennett said, "We have discovered that DOE and other budgets contain research in this area we can tap into." The subcommittee plans to invite outside experts to discuss the EPA budget at hearings scheduled for late April. The RF/MW research budget cuts were also addressed by Congressman James Scheuer's (D-NY) subcommittee on natural resources, agriculture research & environment of the House Committee on Science and Technology at hearings on March 17. Afterwards, the subcommittee submitted a number of questions to Riordan on RF/MW R&D. The answers were due at the end of March. Overall, congressional staff say there is a good chance that at least some of the RF/MW research funds will be restored. As Green's legislative director John Cuttell explained, the subcommittee is aware of and interested in this issue and there is a general feeling that too much has already been cut from EPA's R&D program. The first real indication of the status of the RF/MW program will come when the appropriations subcommittee marks up the EPA budget bill later this spring. (For a review of the impact of ex-EPA Administrator Anne (Gorsuch) Burford on EPA's R&D program, see Eliot Marshall's article in the March 25 *Science*.)...One of the many irregularities to surface during the congressional investigations at EPA was a "hit list" of scientific consultants. Made up by the incoming Reagan Administration, the list indicates who should stay on EPA's advisory committees and who should go. One member of the RF/MW community is on list: Professor Sol Michaelson of the University of Rochester. Written next to his name is: "reported to be liberal and environmentalist." In an interview with *Microwave News*, Michaelson said he "deplored" the whole idea of the list....President Reagan has nominated David Markey to replace Bernard Wunder as the administrator of NTIA. Markey, a former lobbyist for the National Association of Broadcasters, is serving as a special advisor to Deputy Administrator Susan Stuebing until he is confirmed.

Measurement...The first portable isotropic magnetic field meter developed by NBS has been delivered to NIOSH. Although the new MFM-10 meter was designed to measure worker exposures in industrial settings (especially at RF sealer plants), it can measure and display each of the three orthogonal H-field components —ideal for monitoring the fields associated with broadcast antennas. The battery-operated meter operates over a frequency range of 300 kHz to 100 MHz, with an uncertainty of less than ± 1 dB, for magnetic fields of 0.01 to 16 A/m. According to NBS's Joe Cruz, Holaday Industries of Eden Prairie, MN, has expressed an interest in manufacturing the meter. A paper by Cruz and L.D. Driver describing the MFM-10 was presented at the 1982 EMC conference in Santa Clara, CA, and appears in the conference proceedings. Those wishing to get a copy should contact Fred McGehan, Division 360.2, NBS, Boulder, CO 80303, (303) 497-3246....NBS' R.G. FitzGerrell has developed an easy and cheap way of measuring the antenna factor of electrically small antennas. The method is accurate to within ± 2 dB in the 250 kHz-1 GHz frequency range. For more information contact FitzGerrell at NBS, Division 723.04....Narda Microwave Corp. of Hauppauge, NY, is now offering calibration services down to 300 kHz for its broadband isotropic meters. The company is extending the range from 10 MHz in response to the needs presented by the new ANSI RF/MW exposure standard (ANSI C95.1-1982). Priority service is available. For price information contact Narda's Bill Reich, (516) 231-1700....Donald Griffin of the University of Adelaide in South Australia will report on "A Microwave Antenna Method of Measuring the Effect of Metal-Framed Spectacles on Microwaves Near the Eyes" at the *International IEEE/AP-S Symposium and National Radio Science Meeting* on May 24 in Houston, TX.

Medical Applications...What cures asthma, hemorrhoids, stomach cramps, arthritis, whiplash and insomnia? It's *Pocketdoc*. Or so claims its manufacturer, the Igon Corp. of Minden, NV. An Igon leaflet entitled "Relief from Pain Without Drugs" suggests that Pocketdoc "induces healing by the use of low frequency low power electric field." An FDA investigation did indicate that Pocketdoc, which is the size of a cigarette pack, is a very low power ELF generator. But FDA said there is no evidence in the scientific literature that weak ELF fields are a panacea for all these ills. The agency charged Igon with false and misleading labeling and asked the US District Court in Nevada for permission to stop the distribution of the device (Complaint No. CV-R-83-002-BRT, filed January 6, 1983). The judge agreed and on January 20 issued an order for the government to seize all the Pocketdocs FDA could find....Reinhard Knoechel of Phillips Research Lab in Hamburg, West Germany, describes his studies with multi-applicator arrays for hyperthermia treatment in the January issue of *IEEE Transactions on Microwave Theory and Techniques*.

Satellite Communications...KOMO Radio in Seattle, WA, has agreed to provide satellite communications facilities for RCA Americom. The company is seeking a conditional use permit to add three satcom dishes to its facilities on Vashon Island. A public hearing on the request is scheduled for April 26 at the King County Courthouse in Seattle. Americom's proposal to build its own station in Kitsap County was rejected by the Kitsap County Board of Commissioners for the second time early this year....The New York City Planning Commission has approved plans for Teleport, the huge communications complex proposed for Staten Island. An *Electromagnetic Energy Study* prepared by the NYC engineering consulting firm of Ammann & Whitney and the project's final environmental impact statement have been released. The February 1983 Ammann & Whitney report, which includes radiation calculations and frequency coordination data, concludes, "There will be no health effects from radiofrequency energy levels to the public both within and without the Teleport complex. Estimated energy intensities are well below current accepted tolerances and anticipated future standards."

Standards...The new American Conference of Governmental and Industrial Hygienists (ACGIH) exposure standard for RF/MW radiation has cleared a major hurdle on the road to final approval. The ACGIH's Physical Agents TLV Committee voted to accept proposed revisions at a meeting in San Antonio, TX, March 23-24. The new standard is similar to, though less stringent than, ANSI's and will cover frequencies down to 10 kHz (see *MWN*, September 1981 and July/August 1982). For example, the ACGIH will stay with a 10 mW/cm^2 limit above 1 GHz. The committee approved the changes by a vote of 13-1; the one dissenting ballot was cast by Dr. Zory Glaser of the FDA's National Center for Devices and Radiological Health. In a February 3 letter to the committee, Glaser and some of his associates at the center explain that they have objections to the standard's "exposure limits, their frequency dependence, and the lack of an appropriate rationale for these parameters." They note that the 10 mW/cm^2 value "leaves no thermal safety factor at high environmental temperatures and humidities" and state "the belief that thermal effects are the only factors to be accounted for in evaluating health hazards is untenable in the present state of knowledge." In a telephone interview, Herbert Jones, the chairman of the physical agents committee, said that he was happy an agreement was reached. He said that the standard and its accompanying documentation will undergo some minor revisions for "editorial clarification" and be submitted for final approval to the ACGIH Board of Directors and membership at the *American Industrial Hygiene Conference* in Philadelphia, PA, in May....The National Radiological Protection Board (NRPB) in the United Kingdom has proposed a new standard for ELF and RF/MW radiation. The RF/MW exposure limits for *adults* are nearly identical to those of ACGIH, while those for the *general population including children* are like those of ANSI. For power line frequencies (50 Hz), the board "accepts that exposures to power frequency fields of less than 10 kV/m are safe, although the field may be perceptible at lower values, and that exposures to fields of up to 30 kV/m are unlikely to be harmful." Comments on *Proposals for the Health Protection of Workers and Members of the Public Against the Dangers of Extra Low Frequency, Radiofrequency and Microwave Radiations: A Consultative Document* are welcome through July 1. For more information contact: The Secretary, NRPB, Chilton, Didcot, Oxon, OX11 0RQ, UK....The Standards Association of Australia's Committee TE/7 on Hazards of Non-Ionizing Radiation is also proposing a revision to its RF/MW standard. According to an August 1982 draft, occupational exposure limits will be

identical to those of ANSI, while those for the general population will be a factor of 10 lower. Thus at 30-300 MHz, the limits will be 1 mW/cm² for workers and 100 uW/cm² for others. For more information contact the association at 80 Arthur Street, North Sydney, NSW, 2060, Australia....ANSI's Committee C63on Radio-Electrical Coordination is set to meet on April 6 in Washington, DC. On April 6 and 7, C63's subcommittee 1 will review its work on open area test sites, immunity test procedures and a general EMC standard....Canada has proposed amendments to its RFI regulations. Notice No. DGTR-021-82, published in the December 11 *Canada Gazette* prescribes limits for radio noise produced by AC high voltage power systems. For more information contact: Director General, Telecommunication Regulatory Service, 300 Slater Street, Ottawa, Ontario K1A 0C8.

VDTs...The possible effect of VDT use on pregnancies will be examined as part of an extensive two-year study underway in Montreal, Canada. The project, sponsored by the Occupational Health and Safety Research Institute, began last fall and will include information on approximately 50,000 pregnancies. The city's 11 major hospitals and the doctors affiliated with them are helping with the study....FDA's National Center for Devices and Radiological Health has concluded that "the reported clusters of problem pregnancies among VDT users would be expected from chance alone, and it is highly unlikely that they have been caused by low radiation emissions from the machines." This assurance was published in the center's February 22 *Radiological Health Bulletin* in response to inquiries it has received. The center "has found no evidence that the levels of radiation from VDTs are responsible" for clusters, such as the one reported at Surrey Memorial Hospital in Vancouver, BC....A survey of 1,160 Ontario Hydro clerical workers found a significant link between VDT use and complaints of eye irritation, blurred vision and neck and shoulder aches. According to the study's head, Dr. Roland Mallette, confounding factors were carefully weeded out. The Canadian utility plans to do more detailed VDT health studies, particularly on the effects of VDT use on vision. Hydro currently has 1,700 VDTs and plans to have 6,000 by 1990....A number of meetings on VDTs are scheduled for this spring. *The Pandora Connection: Dangers and Hazards of Video Display Terminals*, will be held April 16 in Madison, WI. It is sponsored by the Health Writers, 1127 University Avenue, Madison, WI 53715, and the Madison Federation of Labor. On April 30, the Labor Council of Metropolitan Toronto and the Humber College for Labor Studies are holding a conference on *VDTs and Stress*. For information, call (416) 675-3111, ext. 414. *Vision et Ecran Cathodique* will be addressed by the Quebec Association of Optometrists at their conference in Quebec City on May 6. Contact the association at 465 rue St. Jean, Montreal, Quebec H2Y 2R6, (514) 849-8051. M. Lundquist, a consultant from Milwaukee, WI, will teach a course on "Health Hazards of VDTs" at the *American Industrial Hygiene Conference* on May 22 in Philadelphia, PA. Lundquist does not believe radiation emissions are a problem and will focus on ergonomic issues. In the fall, those willing to do serious traveling can attend the *International Scientific Conference on Ergonomics and Health Aspects of Modern Office Jobs*, November 7-9 in Turin, Italy. The senior American advisor for the gathering sponsored by the International Ergonomics Association is H.L. Davis of the Human Factors Group, Eastman Kodak, in Rochester, NY....If you are in the market for an alternative to the common CRT, IBM has introduced a gas panel display screen for use with its 370, 30XX and 4300 series computers. The 3290 screen has a wire grid with 730,000 intersections surrounded by neon-argon gas; electrical charges in the grid make the gas glow. The panel can be yours for $7,100. Another new screen based on tungsten-oxygen technology is being developed by Professor Paul Holloway at the University of Florida in Gainesville. The screen does not require constant refreshing and requires relatively little power, according to a brief report in the March 14 *Computerworld*....Is VDT screen glare driving you crazy? Anti-Glare Material Inc. claims you can spray it away. The Fort Myers, FL, company says its product will relieve up to 95 percent of the problem and last for three years. ●

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SHORT COURSES

• April 26-28: *Seminars on How to Cope with the FCC and VDE Regulations on Radio Frequency Interference*, Washington, DC. Three one-day seminars on (1) *Regulatory Requirements and Grounding Methods*, (2) *Shielding and Packaging Concepts*, and (3) *Cost Saving Design Techniques for Achieving Compliance*. Fee $250 for any one day; $475 for two days, and $675 for three days. Contact: EMXX Corp., 6706 Deland Drive, Springfield, VA 22152, (703) 451-4619. Repeated • May 3-5, in Dallas, TX; and • May 24-26 in San Diego, CA.

• April 26-29: *Radar System Simulation*, Eglin AFB, FL. Fee: $550. Contact: Marie Saunders, Mark Resources, Inc., 2665 30th St., Santa Monica, CA 90405, (800) 874-8104.

• May 2-4: *Radiowave Propagation in Satellite Communications Systems*, Washington, DC. Fee: $685. Contact: Continuing Engineering Education Program, George Washington University (GWU), Washington, DC 20052, (800) 424-9773.

• May 2-4: *Spread Spectrum and Anti-Jam Communication*, Los Angeles, CA. Fee: $750. Contact: Continuing Education Institute, 10889 Wilshire Blvd., Los Angeles, CA 90024, (213) 824-9545.

• May 2&4: *EMI Test and Evaluation*, San Jose, CA. Fee: NA. Contact: Don White Consultants, Inc., Star Route 625, PO Box D, Gainesville, VA 22065, (703) 347-0030. This course will be given at the *Test & Measurement World Expo*. A number of other courses and workshops are also scheduled. Contact: Meg Bowen, (617) 254-1445.

• May 2-6: *HF Spectrum: New Concepts and Technologies*, Washington, DC. Fee: $855. Contact: GWU, see May 2 above.

• May 2-6: *EMI Design and Testing*, Chicago, IL. Three one-day sessions on *Requirements & Testing per FCC Docket 20780, Designing to Meet FCC Docket 20780* and *Printed Circuit Board and Wiring Design for EMI Control*. And one two-day session on *Grounding, Bonding and Shielding*. Fee: $260 for one-day sessions and $495 for two-day session. Contact: R&B Enterprises, 1050 Colwell Lane, Conshohocken, PA 19428, (215) 828-6236. Repeated • May 9-13 in Boston, MA.

• May 9-11: *Trends in Military Satellite Communication Systems*, Vienna, VA. Fee: $650. Contact: Satellite Systems & Technology Inc., 3134 Juniper Lane, Falls Church, VA 22044, (703) 532-6274. Repeated • May 23-25 in Torrance, CA.

• May 16-20: *Spread Spectrum Communications Systems*, Washington, DC. Fee: $855. Contact: GWU, see May 2 above.

• May 16-20: *Basic Radiological Health Course*, San Antonio, TX. Fee: $450. Contact: University of Texas (UT) Health Science Center, Medical School Continuing Education Services, 7703 Floyd Curl Drive, San Antonio, TX 78284, (512) 691-6295.

• May 22: *Recognition, Evaluation and Control of RF/MW Radiation Hazards*, Philadelphia, PA. Fee: NA. The three-hour course will be held at the *American Industrial Hygiene Conference*. Contact: AIHA, 475 Wolf Ledges Parkway, Akron, OH 44311, (216) 762-7294.

• May 23-24: *Grounding, Bonding and Shielding*, Washington, DC. Fee: $625. Contact: GWU, see May 2 above.

• May 23-27: *Radar Systems and Technology*, Washington, DC. Fee: $855. Contact: GWU, see May 2 above.

• May 26-27: *Satellite Fundamentals*, Washington, DC. Fee: $445. Contact: Walter Morgan, Communications Center of Clarksburg, 2723 Green Valley Road, Clarksburg, MD 20871, (301) 428-9000. Repeated • June 6-7 in Los Angeles, CA, and • August 19-20 in St. Louis, MO.

• June 2-3: *FCC Regulation of Computing Devices: EMI Design, Testing and Compliance with Part 15 Subpart J Rules*, Washington, DC. Fee: $315. Contact: GWU, see May 2 above.

• June 6-8: *Electromagnetic Pulse and Its Effects on Systems*, Washington, DC. Fee: $685. Contact: GWU, see May 2 above.

• June 13-17: *The Modern Geometrical Theory of Diffraction*, Columbus, OH. Fee: $750. Contact: Ohio State University, Engineering Short Courses, 2070 Neil Avenue, Columbus, OH 43210, (614) 422-6153.

• June 14-15: *Radar Principles for the Non-Specialist*, Washington, DC. Fee: $625. Contact: GWU, see May 2 above.

• June 27-29: *Microwave Technology and Applications for Industry*, Central NJ. Fee: $695. Contact: Center for Professional Advancement, PO Box 964, East Brunswick, NJ 08816, (201) 249-1400.

• July 10-15: *Design Against RF Emission*, University of Sussex, UK. Fee: NA. Contact: Institution of Electrical Engineers (IEE), Savoy Place, London WC2R 0BL, United Kingdom, 01-240-1871, ext. 272 or 282.

• August 8-12: *Non-Ionizing Radiations: Biophysical and Biological Basis, Applications and Hazards in Medicine and Industry*, Cambridge, MA. Fee: $850. Contact: Director of Summer Sessions, Room E19-356, MIT, Cambridge, MA 02139.

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Microwave News invites contributions to *From the Field,* our monthly column featuring news and opinions from the non-ionizing radiation community. Letters from readers are also welcome.

RF Hazards in Honolulu

The Environmental Protection Agency (EPA) will measure radiofrequency (RF) radiation levels in Honolulu, HI, where public exposures are estimated to fall in the 1-10 mW/cm^2 range in certain locations. If confirmed, these levels would be well above the safety limits EPA plans to propose this June and the highest ever documented in an urban area in the United States. The potential hazards in Hawaii will force the federal government to establish a precedent for the enforcement of EPA's "guidance," the nation's first general population standard for RF radiation.

Although EPA has been aware of the exposure conditions in Honolulu since 1975, it had been unwilling to take measurements until last month. Now, in response to a February 14 request from the Federal Communications Commission (FCC), EPA has agreed to a field survey, which EPA Administrator William Ruckelshaus believes will provide an "opportunity for both our agencies to work together on the problems of [RF guidance] implementation."

Interviews with officials at both agencies indicate that these problems could be considerable. The issue of public safety may be sidelined as the agencies work out their respective responsibilities for enforcing RF exposure limits.

EPA staffers maintain that exposure conditions similar to those in Honolulu are possible elsewhere, although the number and magnitude of potential problems in the city are probably unmatched. Since Honolulu's zoning laws bar transmitters from the surrounding hills, broadcasters have nestled antennas in the midst of the high-rise city. A number of antennas are at eye level with apartments in adjacent buildings, and, in some cases, recreation areas share rooftops with multiple antennas.

An EPA official has estimated that the survey will cost less than $5,000.

Exposure Guidance

EPA's exposure guidance is rumored to set a 100 uW/cm^2 limit for the 30 MHz to 1 GHz band, which includes most broadcast frequencies. This limit is approximately fifty times lower than the estimated exposures in Honolulu and a factor of ten lower than the 1982 American National Standards Institute (ANSI) 1 mW/cm^2 guideline, which EPA is using as a benchmark until the guidance is proposed.

The guidance will be enforced independently by all federal agencies. Once it is signed by the President, each agency will be responsible for assuring compliance by RF and microwave sources under its jurisdiction. In his letter to FCC Chairman Mark Fowler, Ruckelshaus wrote that once the RF survey is completed, "I believe the commission should then act to correct any detected problems."

The FCC has yet to announce how it will interpret its responsibility to enforce the standard among its licensees, or more specifically, how it will respond if measurements show that exposures in Honolulu fall between the forthcoming guidance and the ANSI limit. Nor is it clear who will pay for the costs of any regulatory actions.

(continued on p.7)

HIGHLIGHTS

NCRP Study on RF Measurements

The National Council on Radiation Protection and Measurements (NCRP) has initiated a study tentatively titled "A Practical Guide to the Determination of Human Exposure to RF Radiation."

NCRP's newly established Scientific Committee (SC) 78 will develop easy-to-use guidelines for making measurements in the 10 kHz to 100 GHz frequency range and for interpreting them in light of present knowledge of biological effects. The committee, which is chaired by Richard Tell of the Environmental Protection Agency (EPA), will also investigate how to handle variations in polarization, work in the near field and allow for time averaging of signals.

In addition to Tell, the members of SC 78 are: Howard Bassen of the Food and Drug Administration's National Center for Devices and Radiological Health, Jules Cohen of Cohen and Associates, Dr. David Conover of the National Institute for Occupational Safety and Health, Dr. Carl Durney of the University of Utah (presently visiting MIT) and Ronald Petersen of AT&T Bell Labs.

NCRP Executive Director Roger Ney said that the new committee will continue the work described in NCRP Report No. 67, *Radiofrequency Electromagnetic Fields: Properties, Quantities and Units, Biophysical Interaction and Measurements* (see *MWN*, October 1981).

In a telephone interview from his office in Las Vegas, NV, Tell said that the committee plans to finish a draft report in about a year. "If we are successful," he added, "a user of a given standard will have a practical methodology to apply it."

Progress Report on New York Power Lines Studies

The Scientific Advisory Panel of the New York State Power Lines Project met in Albany, March 25-26, to review the status of 16 ongoing studies on the biological effects of 60 Hz fields. None of the studies are complete, but the preliminary findings of two investigators are causing some excitement.

The most surprising results were those of Dr. Wendell Winters, who found that exposures to electromagnetic fields at levels comparable to those under some power lines significantly enhanced the growth of cultured human tumor cells. The panel plans to ask other researchers already under contract to the project to replicate Winters's experiments.

Winters's team at the University of Texas Health Sciences Center in San Antonio exposed tumor cells grown in culture to 60 Hz electric and magnetic fields, singly and in combination, for periods of up to 24 hours. The current densities ranged from 0 to 300 mA/m^2 (a density approximately associated with an electric field of 30 kV/m) and magnetic fields from 0 to 1 gauss. Examination of cells 10-14 days after exposure indicated that the growth of tumor cells was enhanced by magnetic fields alone and by a combination of electric and magnetic fields, but not by electric fields alone.

According to project Administrator Michael Rampolla, assistance in replicating the work will be sought from Drs. Maimon Cohen of the University of Maryland School of Medicine in Baltimore and Arland Carsten of Brookhaven National Lab in Upton, NY.

In a telephone interview, Winters said that he has repeatedly achieved the same enhancement effect, which he called "quite unexpected." Winters will present his findings at the Bioelectromagnetics Society (BEMS) meeting in July.

The second set of results that sparked the panel's interest were those of Dr. Klaus-Peter Ossenkopp on low intensity ELF magnetic fields and epilepsy. Ossenkopp found that exposure for one hour to a 60 Hz alternating magnetic field of 1 gauss had a beneficial effect: it reduced the severity, duration and number of seizures in epileptic rodents treated with a seizure-inducing drug. The panel asked Ossenkopp, who is at the University of Western Ontario in London, Canada, to expand his dose-response data.

A semiannual progress report on all the studies was released before the March meeting. Though the majority of the studies are still in the preparatory stage, preliminary findings were also reported by Dr. Charles Graham of the Midwest Research Institute in Kansas City, MO, and Dr. Gordon Livingston of the University of Utah Medical Center in Salt Lake City, UT.

Graham has completed the first part of his $465,000 study on the "Influence of 60 Hz Fields on Human Behavior, Physiology and Biochemistry." According to the status report, "The results of the electric and magnetic field perception study have indicated the feasibility of conducting a valid, double blind investigation of field effects."

Livingston has failed to find an effect in his $162,000 study of "Reproductive Integrity of Mammalian Cells Exposed to 60 Hz Electromagnetic Fields." Livingston is studying human and rodent cells to see whether exposure could cause damage to cellular DNA or disturb cell growth. Human lymphocytes were exposed to a current density of 0.003-3 mA/cm^2 and a magnetic field of 2 gauss. The project summary states that Livingston found a consistent "absence of treatment effect as measured by sister chromatid exchange frequency or replication index in the human lymphocytes."

The project's two epidemiolgical studies on the possible relationship between certain types of cancer and electromagnetic fields were not far enough along to appear in the current report but will be included in the next report, due in August.

To obtain copies of the status report and the minutes of the March 25-26 meeting, contact Rampolla at the Center for Laboratories and Research, New York State Department of Health, Albany, NY 12201, (518) 474-7888.

Aircraft RFI Tests

The Federal Aviation Administration (FAA), computer manufacturers, aircraft companies and airlines are running a large number of tests to determine whether electronic devices, especially portable computers, can cause harmful

radiofrequency interference (RFI) to aircraft navigation and communication systems.

The preliminary results do not permit firm conclusions, but the magnitude of the investigation is impressive. Outlined below are some of the findings presented at the second meeting of the Radio Technical Commission for Aeronautics' (RTCA) Special Committee 156 on "Potential Interference to Aircraft Electronics Equipment from Devices Carried Aboard" held in Washington, DC, on February 28-29.

The FAA has collected path loss data aboard a Boeing 727 and concluded that an interfering signal is more likely to originate from outside the plane than from inside. In the tests run inside the plane, the signal source was placed in the aisle, however, and not next to the windows. More tests may be needed to determine if the location of the source inside the aircraft affects the likelihood of interference.

Eastern Airlines presented the results of its tests aboard Lockheed 1011, Airbus 300, McDonnell Douglas DC-9 and Boeing 727 planes in a hangar and of much more limited tests in flight. Some RFI was reported on the ground under very controlled conditions — with the interfering source outside the plane and near the target antennas. No interference was found when the plane was in flight.

Boeing and McDonnell Douglas have also completed tests, but the results were not ready in time and will be on the committee's agenda for its next meeting on June 12-13. Air Canada, United, Western and Delta Airlines also have testing programs in progress.

Representatives from Radio Shack, Apple Computer and Hewlett Packard all presented data from their respective emission tests. The findings indicate that computer peripheral equipment, such as disk drives, printers and displays, are the worst emitters and that cabling between devices is usually not shielded and could therefore amplify such emissions.

Another part of the RTCA's investigation is the search for known incidents of RFI caused by electronic equipment brought aboard the aircraft. Statistics from NASA's Aviation Safety Reporting System (ASRS), presented at the February meeting, show that there has only been one aircraft RFI incident in 30,000 safety reports. (It should be noted that ASRS is a voluntary program and there are no penalties for failing to report an unusual event.)

The incident occurred on a December 10, 1982 Eastern flight. The minutes of the RTCA meeting describe what happened: "The crew of the DC-9 had reported that all three of their navigation receivers were unreliable. Maintenance personnel had checked these receivers out and had reported no apparent problems with the navigation equipment. During the flight, flight attendants had checked the cabin area to see if any passengers were using electronic devices and had not found anyone using such devices. It was suspected that two large cases in the cargo area may have contained some sort of electronic devices or that a passenger's luggage may have contained some devices which were turned on. In any case, no positive conclusion could be reached on the cause of this interference...."

It was this incident, not previously reported in any detail, which played a role in initiating the RTCA study (see *MWN*, October 1983). For a number of months, Eastern banned the use of computers on its flights, but the airline lifted the restriction in late January (see *MWN*, March 1984).

A newly reported RFI incident was also reported at the meeting by Mr. E. Hoare of British Airways: on November 8, 1983, there were strong indications that a Sony Walkman affected the performance of an Omega system aboard a Brittania Airways Boeing 737. (Omega is a worldwide radionavigation system.)

Frank White, chairman of the RTCA committee, cautioned that these two incidents do not provide positive proof that passenger-operated devices were the sources of RFI. But, he added, they do indicate the need for more testing.

More work is planned before the June meeting. Among the assignments are additional tests with a Sony Walkman and collection of emission data from computer watches and other types of computing devices.

In general, all air carriers have been asked to test a variety of devices on aircraft to see if they cause interference. Also, one of the committee members will investigate the possibility of studying airplanes leased by the press to see if they have experienced RFI from the devices used by reporters on the road.

NJ Adopts and CT Proposes ANSI Standard

The state of New Jersey has adopted the American National Standards Institute (ANSI) guidelines for general population exposure to radiofrequency and microwave (RF/MW) radiation, a move which Connecticut may follow later this spring. The standard, which at its strictest level limits exposures to 1 mW/cm^2, will not affect commercial broadcasters, the primary source of environmental nonionizing radiation.

New Jersey

New Jersey's Commission on Radiation Protection adopted the ANSI standard at a March 28 meeting. The measure sets limits for public exposures to 300 kHz to 100 GHz radiation and establishes emission limits for microwave ovens. (Emissions are limited to 5 mW/cm^2 measured at a distance of 5 cm for units manufactured after 1971 and to 10 mW/cm^2 for units made before then.) The commission exempted emergency mobile communication services, such as police radios, from compliance. In public hearings held before the final commission vote, a representative from the state police warned that these services could be affected by a 1 mW/cm^2 limit.

Now that an RF/MW standard has been adopted, RCA's Dr. Fred Sterzer, chairman of the commission's nonionizing radiation subcommittee, told *Microwave News* that his group will address 60 Hz power line radiation. He noted that New Jersey has a voluntary field strength limit of 3 kV/m at the edge of power line right-of-ways (ROW), but that this two-year-old committee resolution is unenforce-

able. The guideline does not specify the width for ROWs.

A report of a playground located under a high power transmission line where electric fields are significantly higher than the voluntary limit aroused interest in reevaluating power line radiation safety. According to commission member Eugene Fisher of the State Bureau of Radiation Protection, only a preliminary report has been prepared and no details on the situation are available for release.

The commission, composed of representatives from state agencies, industry and the research community, is chaired by Max Weiss of AT&T Bell Labs.

Connecticut

Connecticut lawmakers will vote on adopting the ANSI standard before the legislative session ends May 6. Assembly Bill 5675, sponsored by Rep. Moira Lyons, originally called for establishing exposure limits at least as restrictive as ANSI's, but the qualifying language was dropped before the measure was reported out of the joint Environment Committee late last month (see *MWN*, March 1984).

The bill would empower the Commissioner of Environmental Protection to establish a non-ionizing radiation program for implementing and enforcing the standard. The commissioner's office would have the authority to exempt specific sources from compliance.

If the bill becomes law, Connecticut would become the third state to set its own RF/MW standard. Last year Massachusetts was the first, choosing exposure limits five times stricter than ANSI's (see *MWN*, September 1983).

Conferences: Busy Summer and Fall

The conference line-up for late summer and fall offers something for just about everyone interested in non-ionizing radiation, from ELF to visible light. And this is the year to go to Italy or Japan, if your travel budget will allow it.

In October, the Engineering Foundation will sponsor a small gathering on regulations governing the use of electromagnetic radiation. Those planning to site facilities but concerned about the uncertain and changing regulatory climate will want to consider attending the Hershey, PA, conference. You must apply, however, and attendance is limited to approximately 120 people. According to Dr. Sam Koslov, co-chairman of the conference organizing committee, the meeting is modeled on the Gordon Conferences, with all dissussions off-the-record to allow the free exchange of ideas and opinions.

Dr. Arthur Pilla of Mount Sinai Medical Center is arranging a Gordon Conference on bioelectrochemistry, especially the bioeffects and medical uses of electromagnetic energy. Pilla reports that there has already been a great deal of interest in the July 30-August 3 meeting, and he is scheduling a poster session every day. Those planning to go should consider bringing a paper along. Application forms are in the March 2 issue of *Science*, which also lists speakers and discussion leaders. Here again, a maximum of 120 attendees will be allowed.

Those working on the bioeffects of ELF and static electromagnetic fields will want to attend the Hanford Life Sciences Symposium in early October in Washington state. A preliminary program will be released by August 1. Those interested in the other end of non-ionizing spectrum will want to consider attending a meeting on the medical and biological effects of visible light to be held at the New York Academy of Sciences at the end of October.

If you can afford to go further afield there are two meetings in Italy this summer and two in Japan in the fall. The 21st General Assembly of the International Union of Radio Science (URSI) will be held in Florence at the end of August through early September. At that time there will be an open symposium on the interaction of electromagnetic fields with biological systems. Two weeks after URSI, a NATO workshop on electromagnetic field effects on cells will be held in Erice, on the island of Sicily. Attendance at the workshop is by invitation only.

There will be an international symposium on electromagnetic compatibility (EMC) in Tokyo in mid-October and the annual meeting of the Bioelectrical Repair and Growth Society (BRAGS) will be in Kyoto at the beginning of November. Special travel arrangements are being made for those wishing to attend both these meetings. For information on travelling to the EMC meeting, contact Donick Travel & Tours, 12425 Rancho Bernardo Rd., San Diego, CA 92128, (619) 451-2330; for the BRAGS meeting, contact the International Professional Meeting Coordinators, 711 Third Avenue, New York, NY 10017, (800) 221-2216, or (212) 757-5710 in New York. Details for all these conferences are provided below.

- July 30-August 3: *Bioelectrochemisty*, Tilton School, NH. Contact: Dr. Alexander Cruickshank, Gordon Research Center, University of Rhode Island, Kingston, RI, 02881, (401) 783-4011, or Dr. Arthur Pilla, Bioelectrochemistry Lab, Mount Sinai Medical Center, New York, NY 10029, (212) 650-7741.

- August 27-30: *Open Symposium on Interaction of Electromagnetic Fields with Biological Systems*, Florence, Italy. Contact: Dr. Elliot Postow, Naval Medical R&D Command, National Naval Medical Center, Bethesda, MD 20814, (202) 295-1140 or Ms. Alma Paoluzi, Physics Lab, Istituto Superiore di Sanita, Viale Regina Elena, 299, 00161 Rome, Italy. For information on the URSI General Assembly, to be held August 28-September 5 in Florence, contact: Professor A.M. Scheggi, IROE-CNR, Via Panciatichi, 64, 50127 Florence, Italy, (55) 4378512.

- September 17-21: *NATO Advanced Research Workshop on Interactions Between Electromagnetic Fields and Cells*, Erice, Italy. Contact Prof. A. Chiabrera, Biophysical and Electronic Engineering Department, Via all'Opera Pia, 11A, 16145 Genoa, Italy, (10) 311811

- October 2-4: *Interaction of Biological Systems with Static and ELF Electric and Magnetic Fields*, Holiday Inn, Richland, WA. Contact: Patricia Bresina, Biology and Chemistry Dept., Battelle Pacific NW Labs, PO Box 999, Richland, WA 99352, (509) 376-0100.

• October 16-18: *1984 International Symposium on Electromagnetic Compatibility,* Hotel Pacific, Tokyo, Japan. Contact: Professor T. Takagi, Dept. of Communications, Tohoku University, Sendai, 980, Japan, (0222) 22-1800, ext. 4266.

• October 21-26: *Managing the Electromagnetic Environment,* Pocono Hershey Resort, White Haven, PA. Contact: Harold Comerer, Engineering Foundation, 345 East 47th St., New York, NY 10017, (212) 705-7835.

• October 31-November 2: *Medical and Biological Effects of Light,* Barbizon-Plaza Hotel, New York, NY. Contact: New York Academy of Sciences, 2 East 63rd St., New York, NY 10021, (212) 838-0230.

• November 5-8: *4th International Meeting of the Bioelectrical Repair and Growth Society,* Holiday Inn, Kyoto, Japan. Contact: BRAGS, 425 Medical Education Bldg., 36th & Hamilton Walk, Philadelphia, PA 19104, (214) 898-8653.

Oven Sales Rebound in 1983

Microwave oven sales rebounded last year, with factory shipments running 64 percent over 1982's disappointing levels. Year-end figures from the Association of Home Appliance Manufacturers (AHAM) show that over six million units were shipped in 1983, two million more than the year before and a new annual record.

Shipments reached an all time high for one month when 737,800 units were sent out from factories in January 1984, supporting recent predictions that this will be another record year. In estimates released before the exceptionally strong December and January showings, AHAM predicted 1984 sales would fall a little short of 1983.

According to industry surveys, approximately 30 percent of American households already have microwave ovens.

Though sales are up, highly competitive marketing has left many retailers scrambling for profits. The February 13 *Home Furnishing Daily* (now a weekly) reports that some ovens are selling for as little as $139. As profit margins slip on many ovens, retailers push different models and hard sell accessories. *HFD* cites one store owner who explains, "If you merchandise microwave ovens today the same way as you did one year ago, you'll lose money."

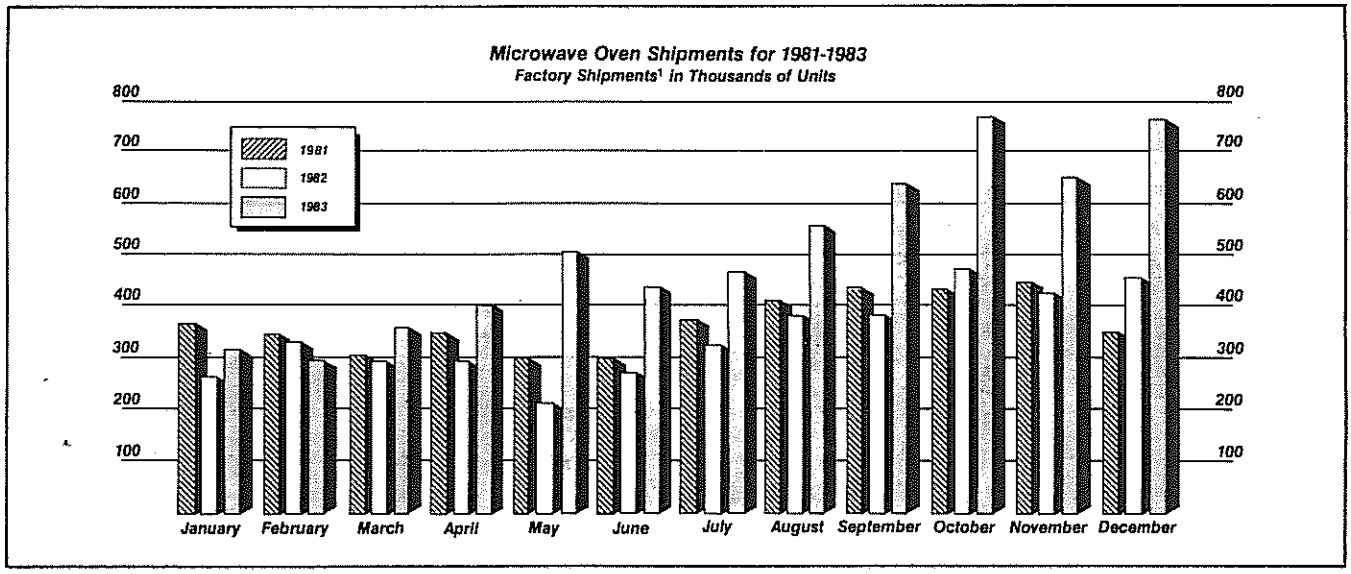
It appears that compact ovens will be a strong growth area in 1984. Sanyo's national sales manager predicted in the March 26 *HFD* that compacts will make up more than 30 percent of the seven million ovens he expects will be sold in 1984. He noted that, although market saturation is relatively high in urban areas where small ovens sell best, the premium on space in city apartments sustains the demand for compacts.

Selling compacts does not preclude offering consumers a stunning array of models and options. For example, one of the new Litton-Aire Generation II over-the-range ovens automatically determines cooking time and power setting and Magic Chef's Big-Little ovens can now be built into a wall with a special kit.

The upswing in microwave oven demand is clearly demonstrated in the table and chart below, which is based on AHAM statistics for ovens shipped in 1981-83.

Microwave Oven Shipments[1] (in Thousands)

		% Change Over				% Change Over	
	1983	1982	1981		1983	1982	1981
Jan.	312.0	16.7	-13.8	July	461.4	42.6	25.7
Feb.	291.0	-10.2	-12.8	Aug.	544.4	45.9	35.5
Mar.	356.5	20.4	18.9	Sept.	635.7	66.2	48.4
Apr.	398.2	39.4	17.0	Oct.	770.7	63.8	76.8
May	492.4	132.2	66.4	Nov.	648.1	52.9	46.0
June	431.3	55.3	29.1	Dec.	771.6	77.6	113.1
				Annual Total:	6113.3	50.2%	38.8%



[1]Includes US produced and imported microwave ovens and combination microwave ovens/ranges.
Source: the Association of Home Appliance Manufacturers (AHAM)

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SHORT COURSES

May 1-3: Mutual Design of Natural Gas Pipelines and Electric Power Lines, Palo Alto, CA. Fee: $75 (EPRI members), $275 (non-members). *Contact: John Dunlap,* Electric Power Research Institute (EPRI), PO Box 10412, Palo Alto, CA 94303, (415) 855-2305.

May 2-4: Health Safety and Other Human Factor Issues in Computer Graphics, Washington, DC. Fee: $695. Contact: George Harrison, Continuing Engineering Education, George Washington University (GWU), Washington, DC 20052, (800) 424-9773, or (202) 676-6106 in DC.

May 7-11: Electromagnetic Interference and Control, Washington, DC. Fee: $875. Contact: GWU, see May 2 above.

May 7-11: Microwave Circuits Design: Linear Circuits, Palo Alto, CA. Fee: $895. Contact: Continuing Education Institute (CEI), 5410 Leaf Treader Way, Columbia, MD 21044, (301) 596-0111 or (213) 824-9545. Repeated ***June 4-8:*** Boston, MA.

May 8-11: Grounding & Shielding, Honolulu, HI. Fee: $815. Optional fourth day for $235. Contact: Don White Consultants Inc. (DWCI), Star Route 625, PO Box D, Gainesville, VA 22065, (703) 347-0030. Repeated ***June 19-22:*** Chicago, IL.

May 14-18: Fundamentals of Communication Satellite Systems, Washington, DC. Fee: $875. Contact: GWU, see May 2 above.

May 15-17: Seminar on Mutual Design of Overhead Transmission Lines and Railroad Communications and Signal Systems, Chicago, IL. Fee: $100 (approx.). Contact: EPRI, see May 1 above. Repeated ***June 19-21:*** Washington, DC; ***September 11-13:*** Atlanta, GA.

May 15-17: Design Methods for Emission and Susceptibility Control, Boston, MA. Fee: $695. Contact: EMXX Corp., 6766 Deland Dr., Springfield, VA 22152, (703) 451-4619. Repeated ***June 25-27:*** Sunnyvale, CA.

May 15-17: An Introduction to EMI/RFI/EMC, Los Angeles, CA. Fee: $815. Contact: DWCI, see May 8 above.

May 18: Electrostatic Discharge Control, Boston, MA. Fee: $275. Contact: EMXX, see May 15 above.

May 21-23: Hazardous RF Electromagnetic Radiation, Washington, DC. Fee: $695. Contact: GWU, see May 2 above.

May 21-25: Microwave Circuit Design I: Linear Circuits, Los Angeles, CA. Fee: $895. Contact: UCLA Extension Short Course Program, PO Box 24901, 6266 Boelter Hall, Los Angeles, CA 90024, (213) 825-1295.

May 21-25: Radar Systems & Technology, Washington, DC. Fee: $875. Contact: GWU, see May 2 above.

May 21-25: Radiation Safety Officer's Course, San Antonio, TX. Fee: $650. Contact: Medical School Continuing Education Services, University of Texas Health Science Center, 7703 Floyd Curl Dr., San Antonio, TX 78284, (512) 691-6295.

May 22-25: MIL-STD-461/462 & System-Level EMI Testing & Procedures, Washington, DC. Fee: $995. Contact: DWCI, see May 8 above.

May 22-25: Modern Antennas, Washington, DC. Fee: $675. Contact: Linda Billard, Technology Service Corp (TSC), 8555 16th St., Suite 300, Silver Spring, MD 20910, (800) 638-2628, or (301) 565-2970 in MD.

May 24-26: European Workshop on Nuclear Resonance in Medicine, Wiesbaden, West Germany. Fee: $260. Contact: Dr. Peter Rinck, PO Box 2149, D6200 Wiesbaden 1, West Germany.

May 31-June 1: MIL-STD-461/462 Test Workshop, Suburban Philadelphia, PA. Fee: $575. Contact: R&B Enterprises, 20 Clipper Rd., W. Conshohocken, PA 19428, (215) 825-1960.

June 4-5: Lightning Protection, Washington, DC. Fee: $625. Contact: GWU, see May 2 above.

June 5-8: Radar Cross-Section Measurement Techniques, Atlanta, GA. Fee: $675. Contact: TSC, see May 22 above.

Different Views at FCC and EPA

EPA's willingness to take measurements in Honolulu is a recent change in policy. Correspondence obtained through the Freedom of Information Act by *Microwave News* reveals that as late as last fall officials at EPA's Office of Radiation Programs (ORP) were reluctant to start a field study, although they acknowledged that exposures created by commercial FM broadcast sources probably exceeded 1 mW/cm^2. (For excerpts of the letters and memoranda on the Hawaii radiation situation, see pp.8-9.)

In a November 28, 1983 letter to a concerned resident, which was later forwarded to Honolulu Councilwoman Marilyn Bornhorst and Hawaii Senator Daniel Inouye, ORP's David Janes stated there was sufficient evidence of a hazard without EPA measurements for residents to seek "corrective action." Janes cited measurements taken by Robert Hall, a Honolulu resident, and calculations made by Richard Tell, an EPA physicist in Las Vegas, NV.

Janes noted that it is "highly unlikely" that the agency will select limits higher than ANSI's 1 mW/cm^2 guideline and that, "Therefore, as an interim position, the agency considers exposures above the ANSI limit to be excessive."

The letter advised that EPA had no enforcement authority and recommended that concerned parties approach the broadcasters involved, the FCC, state health officials or local zoning officials.

The FCC strongly disagreed with EPA's conclusion. Having learned of the potentially hazardous situation in Honolulu from Councilwoman Bornhorst, FCC's Fowler wrote to EPA's Ruckelshaus on February 14 to argue that no "adequate measurement data are available on which to base any decision on corrective action," and that only EPA has the expertise to take these measurements.

Just what the commission will do if EPA provides evidence of unacceptably high exposures is unclear. Since commercial broadcasters are the primary source of environmental non-ionizing radiation exposures for the general public, the FCC could play a key role in implementing the guidance. The commission has announced its intention to enforce the guidance among new or modified broadcast facilities under the National Environmental Policy Act, but has said nothing about how it will handle existing sources.

The FCC's lack of a non-ionizing radiation program, as well as its lack of a radiation safety policy, worries EPA officials who believe the commission must develop its own resources for ensuring that commercial broadcasters comply with the guidance. The agency's March 12 response to the FCC pointed out that the field survey should give FCC field personnel "some valuable experience and training on how to measure potentially hazardous levels of radiofrequency radiation." Although the FCC has offered to help with the survey, it has not made a commitment to send its field personnel, who specialize in measuring sources of RF interference.

The FCC maintains that it is only reasonable for the commission to take a wait and see attitude, given the years EPA has already spent developing RF guidelines. As for the immediate problem in Honolulu, the commission's Robert Cleveland would only say that "we have never been faced with a situation like this before, and our general counsel's office is currently exploring our possible options." Another staffer, who asked to remain anonymous, explained that "the ball is in EPA's court until they provide hard evidence of exposures they consider to be hazardous."

EPA Action in 1975

Conditions in Honolulu were first reviewed by EPA in 1975, in response to a request from the Hawaii Department of Health after the state legislature ordered an RF hazard study. The calculations subsequently prepared by Tell revealed that exposures in several locations near broadcast sources could exceed 1 mW/cm^2 and go as high as 6 mW/cm^2 on the rooftop of one hotel. Requests for actual measurements to confirm these estimates have been made periodically by residents and state officials since the publication of Tell's report, *An Analysis of Broadcast Radiation Levels in Hawaii,* (Technical Note No. ORP/EAD-75-1) in August 1975.

The agency initially argued that actual measurements were not needed because the calculated levels were below the Occupational Safety and Health Administration's (OSHA) 10 mW/cm^2 voluntary standard for worker exposures, which was based on the then current ANSI guidelines. ANSI revised its standard downward from 10 to 1 mW/cm^2 for the 30-300 MHz band in 1982.

In 1975, EPA's Acting Deputy Assistant Administrator for Radiation Programs William Mills summed up the agency's position, stating that even if the estimates were confirmed by field measurements, "there would be no further guidance we could give at this time. Therefore, field studies [in Honolulu] are not required at this time."

Although the agency was planning to measure environmental levels to help develop its guidance, Mills explained that: "It is our determination that these efforts can most efficiently be carried out on a generic basis by a prescribed set of metropolitan area surveys. The choice of metropolitan areas will be based on their ease of access, representative characteristics and potentially unique contributions. These criteria do not appear to be met by the Hawaii situation."

No readings in subsequent field surveys in 15 cities approached the levels calculated for Honolulu. In its advanced notice for proposing the guidance (47 *FR* 57338, December 23, 1982), the agency reported that the maximum levels found near FM antennas were 350 uW/cm^2 in a residential neighborhood and 97 uW/cm^2 in an office building. The agency estimated that more than 99 percent of the population is exposed to less than 1 uW/cm^2 (see *MWN*, January/

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February 1983).

The only measurements on a par with calculated levels for Honolulu were taken at an isolated antenna farm on Mt. Wilson in California, where EPA found maximum readings in the 1 to 7 mW/cm^2 range. The agency's April 1977 report on these readings (ORP/EAD-77-2) states that Mt. Wilson is "probably unique to the entire nation in terms of source density and total number of stations."

Current Status

In describing developments in Honolulu since 1975, EPA's Tell reported in an October 25, 1983 memo to ORP's Janes that "the principal change has been an increase in the number of roof-mounted broadcast antennas." He wrote that measurements taken without professional assistance by Robert Hall were as high as 8.2 mW/cm^2 on the rooftop of the Villa at Eaton Square condominium. Noting that the readings "are in the range of my calculations," Tell concluded that "the time has come to conduct a careful field study in Honolulu."

In a telephone interview, Hall told *Microwave News* that he believes his measurements "were fairly accurate," though he stressed the need for "independent verification."

The scope of the EPA field survey in Honolulu has not been determined. The letters between the FCC and EPA only mention the Villa condominium, though Tell's 1975 report and subsequent correspondence between Tell and Hall indicate there are a number of similar trouble spots in the city. The FCC's Cleveland told *Microwave News* that the commission expects EPA to take measurements at a number of sites.

Tell suggested in the October 25 memo that the Hawaii survey be expanded to include the Lualualei Naval Communications Area Master Station and the US Coast Guard Omega low frequency navigational station elsewhere on the island. Tell noted that these sites would "fit directly into our interest of conducting federal guidance impact investigations at US government facilities that have been suggested as possibly exceeding our proposed guidance exposure limits." ●

EXCERPTS

Correspondence and Memoranda on RF Radiation in Honolulu, 1975-1984

Excerpted below are letters and memoranda to and from the Environmental Protection Agency (EPA) and the Federal Communications Commission (FCC) regarding radiofrequency radiation exposures in Honolulu, HI. The material was obtained by Microwave News *through the Freedom of Information Act.*

The following abbreviations are used for state and federal offices: EPA/ORP — EPA Office of Radiation Programs, Washington, DC; EPA/SF — EPA Regional Office for Region IX, San Francisco, CA; EPA/LV — EPA Electromagnetic Radiation Analysis Branch, Las Vegas, NV; EPA/HI — EPA State Office, Honolulu, HI; HDH — Hawaii Department of Health, Honolulu, HI.

May 22, 1975: Letter from George Yuen, HDH, to James Channell, EPA/SF. The Hawaii State Legislature has adopted a resolution...requesting the State Department of Health to study the possible effects of radiation emission from broadcast towers and the advisability of their relocation or redesign....[We] call on you for assistance in conducting investigations of radiation emission from broadcast towers located in Honolulu....

July 3, 1975: Memorandum from W.D. Rowe, EPA/ORP, to Frank Covington, EPA/SF. At this time it is premature to discuss field verification studies, since the need for such studies strongly depends upon the bounds placed on potential and possible exposure by the analytical study [of Honolulu exposures] now underway....

August 21, 1975: Memorandum from William Mills, EPA/ORP, to Frank Covington, EPA/SF. Enclosed is a report prepared by Mr. Richard Tell of our Environmental Analysis Division, which examines the potential for exposure to radiation from broadcast stations in Hawaii....There is a potential for a small number of people to be exposed in the range from 1 to 10 mW/cm^2. We term this a significant exposure range, because it lies within a factor of 10 of the occupational exposure standard, and it is of interest to document such potential exposures should research indicate that a limiting criteria should be established somewhere in this range....We would not recommend that any present action be taken by the Hawaiian State Health Department....Because none of the calculated values exceeds 10 mW/cm^2, verification that actual values are as high as calculated values would not alter our recommendation....The choice of metropolitan areas [for field studies] will be based on their ease of access, representative characteristics and potentially unique contributions. These criteria do not appear to be met by the Hawaii situation....

September 3, 1975: Memorandum from Richard Tell, EPA/LV, to James Channell, EPA/SF. In actuality the only exact method of determining the exposure level [in Honolulu] would be careful field measurements....

April 12, 1977: Letter from Robert Hall, Director, Yacht Harbor Towers Condominium Association, Honolulu, to EPA/HI. As a direct result of the new television antenna atop the Ala Moana Hotel, we have [seven] questions that reflect our concern....

April 15, 1977: Letter from Richard Tell, EPA/LV, to Robert Hall. ...a value of 0.9 mW/cm^2 might occur at a distance of 350 feet from the [Ala Moana Hotel] antenna complex, the distance you say your building is from the Ala Moana....I am most interested in keeping in touch about this situation....

April 27, 1977: Letter from Robert Hall to Richard Tell, EPA/LV. According to information that I have developed and information that you have sent to me, we apparently have a theoretical possibility of 450 uW/cm^2 in my apartment and 540 uW/cm^2 in an apartment on the 40th floor....I request that your agency take on-site readings in Honolulu....

May 6, 1977: Memorandum from Richard Tell, EPA/LV, to David Janes, EPA/ORP. ...the Yacht Harbor Towers in Honolulu may well represent an ideal site for [a detailed, single building] study in that the situation has already uncovered itself, and the maximum exposures are predicted to be very intense relative to our other metropolitan area survey measurements....

November 16, 1977: Letter from Edward Kuramoto, HDH, to James Channell, EPA/SF. I have enclosed a copy of "Electronic Smog in Honolulu" by Robert W. Hall and a copy of a survey report done for KITV Channel 4 by John Mullaney, Consulting Radio Engineer, "Engineering Statement in Support of Response to Comments of Robert W. Hall Regarding Electronic Smog in Honolulu." Would you please determine if Mr. Mullaney's report appears to be valid....

December 2, 1977: Letter from Richard Tell, EPA/SF, to John Mullaney, Consulting Radio Engineers Inc., Potomac, MD. I was happy to see that you have recently conducted [field] measurements to determine the actual exposure levels....From our own estimates of population exposure I have determined that your measured values of electric field strength by Mr. Hall's apartment mean that the exposure is more than an order of magnitude greater than our estimate of the median exposure in the cities we have looked at and represents a value to which only five percent of these cities' populations are more intensely exposed....

October 26, 1979: Letter from Richard Tell, EPA/LV, to John O'Connor, FCC, Washington, DC. In accordance with our recent telephone conversation...regarding a new proposed UHF TV installation in Honolulu, Hawaii...I am writing to you concerning my analysis of this situation. My analysis was prompted by the close proximity of the proposed installation to nearby high rise buildings and a concern over the possibility of a radiofrequency radiation hazard should the station be constructed....I feel that it would be wise to obtain and very carefully evaluate detailed information pertaining to this installation before it is concluded that it will be perfectly safe....

October 8, 1983: Letter from Robert Hall, Hawaii Institute for Biosocial Research, Honolulu, to Richard Tell, EPA/LV. Since your original study, *An Analysis of Broadcast Radiation Levels in Hawaii* in August of 1975, the situation in Honolulu has changed considerably with regard to several new stations and generally more power....I have personally talked with a supervisor for the painting contractor for the [Villa on Eaton Square] where he reported that his men had difficulty handling metal objects while painting the side of the building facing the [KPOI-FM] tower....

October 25, 1983: Letter from Richard Tell, EPA/LV, to Robert Hall. We have performed a cursory look at the authorized broadcast stations in Honolulu following your inquiry and have noted a significant increase in the number of roof-mounted transmitting antennas....A major factor in interpreting the situation in Honolulu is the extremely complicated environment of many tall buildings with high power broadcasting facilities located on rooftops and adjacent tall towers....The only way to accurately determine these exposure levels is via careful field measurements which take into account the polarization of the incident fields, the frequency of the many signals simultaneously illuminating a given area and the complex reflection patterns which occur in such situations....

October 25, 1983: Memorandum from Richard Tell, EPA/LV, to David Janes, EPA/ORP. Mr. Hall's most recent letter provides some rooftop measurement data taken on the Villa on Eaton Square that show exposures as high as 8.2 mW/cm^2. In all honesty I don't know if the instrument he used was properly functioning but his data are in the range of my calculations. I believe that the time has come to conduct a careful field study in Honolulu....

November 1, 1983: Letter from Robert Werner, President, Villa on Eaton Square Board of Directors, Honolulu, to Richard Tell, EPA/LV. If you feel we are excessively concerned about this [RF exposure] situation please explain to us the reasons why we should be less concerned. On the other hand, if our situation is potentially dangerous, corrective action must be initiated now and a field study by your agency could provide us with the foundation necessary to launch such a program....

November 28, 1983: Letter from David Janes, EPA/ORP, to Robert Werner. Both model calculations by our Non-Ionizing Radiation Branch and measurements by the Hawaii Institute for Biosocial Research [Robert Hall] indicate that fields on the roof of the Villa exceed the recommendations of the American National Standards Institute (ANSI). This should be enough information for you to seek relief....In developing [RF] guidelines it is highly unlikely that EPA would choose levels in excess of the present ANSI voluntary standard and we may select lower levels. Therefore, as an interim position, the agency considers exposures above the ANSI limit to be excessive....We do not believe that additional measurements are needed for you to begin to explore avenues of corrective action....

December 8, 1983: Letter from Honolulu Councilwoman Marilyn Bornhorst to EPA/DC. [Honolulu] is a city with many high rises and very many radio and television transmitting stations. If there is a health problem to my consituents, I would like to know and I would like to have your best advice as to how this danger can be corrected....

December 21, 1983: Letter from David Janes, EPA/ORP, to Councilwoman Marilyn Bornhorst. We have received correspondence on [high RF levels in Honolulu] from Mr. Robert Werner and Senator Daniel K. Inouye and I have enclosed copies together with copies of our replies....If levels exceed those specified in the American National Standards Institute's (ANSI) standard, 1 mW/cm^2 for most of the broadcast frequencies, relief should be sought from the operator of the source, the Federal Communications Commission or state or local health or zoning authorities.

February 14, 1984: Letter from Chairman Mark Fowler, FCC, Washington, DC, to Administrator William Ruckelshaus, EPA, Washington, DC. We do not feel that adequate measurement data are available on which to base any decision on corrective action....Furthermore, the FCC lacks the resources and expertise to conduct the very specialized type of survey that would be required in this type of situation....We, therefore, ask that you commit the resources necessary to obtain the data needed on the RF environment in Honolulu. We will be happy to cooperate and assist in this endeavor to the full extent of our capabilities, but we must emphasize that although the commission may have certain jurisdictional authority over the broadcast transmitters in question, we are heavily dependent on EPA to provide us with the technical assistance necessary to determine the near-field RF environment in and around the area in question....

February 17, 1984: Letter to Councilwoman Bornhorst from Robert Powers, FCC. It is difficult at the present time to answer all of your questions satisfactorily since we feel that a comprehensive survey must be performed before we or any other government organization can determine whether a potential health hazard may exist at the location in question....We would also suggest that you consider contacting your local broadcasters and the Hawaiian Association of Broadcasters for assistance in resolving this matter....

March 12, 1984: Letter from Administrator William Ruckelshaus, EPA, to Chairman Mark Fowler, FCC. The field study you propose could provide an opportunity for both our agencies to work together on the problems of [guidance] implementation. The study should also give your field personnel some valuable experience and training on how to measure potentially hazardous levels of radiofrequency radiation. Once the study is completed, I believe the commission should then act to correct any detected problem....

UPDATES

BIOLOGICAL EFFECTS

News from Poland... Recent experiments carried out by Dr. Stanislaw Szmigielski in Warsaw indicate that microwave radiation can act as co-teratogen. In a letter to *Microwave News*, Szmigielski writes that he and his co-workers have found that microwaves enhance the teratogenicity of an anti-neoplastic drug, cytosine arabinoside (ara-C), in pregnant mice. Ara-C is itself a potent teratogen and when administered alone caused defects in 30 percent of the offspring. Microwave radiation alone did not result in an increase of resorption or malformations until hyperthermia was evoked at 40 mW/cm^2. When the mice were given the drug and simultaneously exposed to "non-thermal power levels" of 2450 MHz radiation (10 mW/cm^2), approximately 70 percent of the fetuses were deformed. Szmigielski concludes that "microwave radiation, not being teratogenic per se, enhances the teratogenic potency of other compounds and thus acts as co-teratogen." Szmigielski, who is at the Department of Biological Effects of Non-Ionizing Radiation at the Center for Radiobiology and Radioprotection in Warsaw, has submitted a paper detailing these results to *Teratology*.

Teratology at 6 GHz... Dr. Ronald Jensh of Jefferson Medical College in Philadephia, PA, has also been studying the teratologic potential of microwaves, but at higher frequencies. In two papers published in the February 1984 issue of *Radiation Research*, he describes the first experiments on the effects of 6 GHz microwaves on the developing organism. (Satellite communications as well as terrestrial telephone and television transmitters operate at this and nearby frequencies.) Jensh exposed pregnant mice to 35 mW/cm^2 microwaves (SAR = 7.28 W/Kg) throughout pregnancy; a level that did not cause a significant increase in maternal body temperature. At birth, he found that the 6 GHz radiation was "not overtly teratogenic," although the fetuses showed "slight but statistically significant growth retardation." Jensh suggests that this effect "may be a manifestation of a generalized heat-stress reaction." Among the mothers, there was a significant lowering of monocytes (a type of white blood cell). Jensh then followed the post-natal development of the offspring. He found that "the sexes appeared differentially affected." Irradiated females exhibited decreased and males increased activity levels in open field tests. Jensh concludes that the exposures "may result in subtle long-term neurophysiologic alteration not detectable at term using conventional morphologic teratologic procedures."

COMPATIBILITY & INTERFERENCE

FMAC on RFI...NTIA's Frequency Management Advisory Council (FMAC) has released a report on the cooperative effort between government and industry to reduce the susceptibility of consumer electronic devices to RFI. Because consumers must generally accept interference caused by authorized radio services, NTIA, on request, has been helping manufacturers design new products with a greater degree of electromagnetic compatibility by providing them with information about these services. FMAC has concluded that this effort should be continued and expanded. For information on *Coordination to Enhance Interference Rejection of Consumer Electronic Devices*, FMAC 36A-83, contact NTIA's Charles Hutchison, (202) 377-0805.

Radio Marti Snags... Radio Marti will not be beaming broadcasts to Cuba this month, and it now looks as though startup could be six months away. The Voice of America has leased office space for Marti headquarters, but not one of the 48-member staff is on board. The main reason, according to USIA Director Charles Wick, quoted in the March 29 *Broadcasting*, is time consuming security checks on potential candidates. He explained: "I'm sure you can imagine that Castro would just love to infiltrate this operation." Meanwhile, the March 14 *Washington Post* reported that Cuba's vice president has called Radio Marti an act of aggression, warning that Cuba will retaliate by jamming US broadcasters. All this has prompted the FCC to adopt final rules for compensating AM broadcasters for the cost of mitigating this RFI, as mandated by last year's Radio Broadcasting to Cuba Act (see *MWN*, November 1983). The new regulations, adopted March 15, allow compensation of up to $250,000 per case and go into effect August 1. In order to qualify, a station must experience interference "for at least 30 out of 60 consecutive days." How will the US react on a diplomatic level? Wick told Congress that he did not know what to recommend.

Power Systems EMC... There will be a one-day tutorial on "Electromagnetic Compatibility in Power Systems" on June 18 at the *1984 Power Electronics Specialists Conference* at NBS in Gaithersburg, MD (see Conference Calendar for details). Organized by Professor Ralph Showers of the University of Pennsylvania, the tutorial will review, among many other topics, the "techniques of measurement and control and the role of various standards, both voluntary and non-voluntary, in influencing the design of power systems." The following evening, a "rap session" on "EMI, RFI and Noise" will be moderated by R. Massey of AT&T's Bell Labs. The cost of the tutorial is $60 for IEEE members, $80 for non-members.

Changing Times...EMC engineers must adapt to changes in technology or they will become an endangered species. So says Dr. Heinz Schlicke, who spent 25 years at Allen-Bradley Co. and is now a freelance consulting engineer based in Milwaukee, WI. In a guest editorial appearing in the February issue of *IEEE Transactions on Electromagnetic Compatibility*, Schlicke warns: "Relearn or face obsolescence, that is the technical reality." Schlicke believes that the introduction of fiber optics will radically change the work of the EMC engineer, because it will make many systems immune to RFI. Instead of troubleshooting when faced with an interference problem, the EMC expert will have to participate in designing the *whole* system. In the course of a telephone interview with *Microwave News*, Schlicke cited a case of RFI at an automated shoe factory, located next to a railroad with steam engine locomotives. When the railroad was electrified, the factory started pro-

ducing only shoes for left feet. Schlicke emphasized that as factories become more and more automated, the costs of RFI are measured in thousands of dollars a minute when production lines are halted. EMC must be guaranteed in the factory design; it cannot wait until the factory is operational.

GOVERNMENT

Regulations and Standards... In the first part of a special report, "The Drive to Regulate Electromagnetic Fields" published in the March issue of *IEEE Spectrum,* Eric Lerner contrasts concerns over occupational and general population exposures to RF/MW radiation and illustrates the trend towards convergence among Eastern and Western standards. On the first point, he writes: "Paradoxically, while there is growing support for a standard to protect the public, which is rarely exposed to even moderate levels of EM fields, there is little pressure for a similar compulsory standard to protect employees at their work places, where the highest exposures occur....Thus, in some cases, regulators deem exposure levels as low as a few [hundredths of a uW/cm^2] sufficient to prevent a radio antenna from being built, as occurred in both the states of Washington and New Jersey, while at the same time state and federal agencies are permitting the exposure of some workers to radiation at 100 mW/cm^2, several million times more intense." Lerner notes for example that as many as 250,000 workers, "mostly women in a dozen industries, use [RF heaters and sealers] to make raincoats, handbags, furniture and a hundred other products" and that they are exposed to levels in excess of the new ANSI standard and often greater than even the old ANSI 10 mW/cm^2 standard. On another front, Lerner points to an emerging dichotomy among national standards: although the differences between, for instance, the Soviet and the ANSI standards are narrowing, Eastern and Western standards are being based on different quantitites. "For the Soviet, Chinese and Eastern European standards, total absorbed energy per unit mass...is key, while for the US standards, it is the rate of energy absorption per unit mass...Thus, for exposures of half an hour a day or less, there is in fact little difference among various national standards, but for a full working day there is still a factor of 40 separating Soviet and US standards." Lerner will be publishing a second article on EM fields in the May issue of *IEEE Spectrum,* focusing on recent research in biological effects, especially on the impact of weak fields. The May article, like the March one, is based on a round table discussion among a number of RF/MW experts who attended last summer's Bioelectromagnetics Society annual meeting.

MEDICAL APPLICATIONS

Hyperthermia Assessment... The Office of Health Technology Assessment (OHTA) in the Public Health Service is assessing what is known about the safety, clinical effectiveness and use of hyperthermia to treat superficial and subcutaneous tumors. OHTA will investigate: (1) hyperthermia used alone; (2) hyperthermia used with chemotherapy and (3) hyperthermia used with radiation therapy. OHTA wants to know if hyperthermia has significant advantages or disadvantages when compared to other modes of treatment. The assessment will be used by the Health Care Financing Administration in setting Medicare coverage policy. OHTA is encouraging public comments. For more information see the agency's notice in the March 13 *Federal Register* (49 *FR* 9476) or call Bette Lemperle at (301) 443-4990. Comments are due by May 14.

MILITARY SYSTEMS

Clear Accident... Alaska Congressman Don Young has asked the General Accounting Office (GAO) for a "detailed" investigation of the September 14 radar accident at Clear Air Force Station near Fairbanks, Alaska (see *MWN,* November 1983 and January/February 1984). In a March 8 letter, Young wrote that his purpose is "to insure that the affected employees have been afforded the best available medical evaluation, treatment and follow-up entitled to under law." To that end, Young asked for a review of Air Force actions and for a check that FELEC Services Inc., an ITT subsidiary, has complied with its AF contract. Young's request has been referred to GAO's National Security and International Affairs Division. Meanwhile, three of the six men who were exposed to microwaves have gone to Boston, MA, for further medical examinations.

Electromagnetic Envelopes... On March 30, the Associated Press' Barton Reppert reported that the "super-secret National Security Agency plans to shroud its main operations building at Fort Meade in an 'electromagnetic envelope' to prevent leakage of electronic signals that might be detected by spies." In congressional testimony, NSA Assistant Director Dale Seaberg said that the agency plans to include a $12.7 million "TEMPEST and energy retrofit package" for one of the operations buildings at its Maryland headquarters. Little is disclosed about the NSA budget and how much is spent to prevent the leakage of spurious signals that could be decoded by outsiders, but Seaberg did tell Congress: "We estimate that we now spend $4.5 million each year to build TEMPEST features into the individual pieces of equipment we buy. Provision of an electromagnetic envelope around the building will obviate the need for these expenditures." NSA's TEMPEST standard is classified — indeed the meaning of the term TEMPEST is itself secret — so the cost of meeting the specified leakage level is not commonly known. An item in the January 1984 *Defense Electronics* estimates that the costs of securing electronic equipment is "usually two or three times the price of commercial counterparts."

OVENS

A New Hazard...A medical doctor has reported a case in which radiation leaking from a microwave oven caused burns by heating up the metallic adhesive attached to a transdermal delivery patch. Such patches are a relatively new and increasingly popular way to deliver a drug over time — in this case, the patch dispensed nitroglycerine to a patient with a heart condition. Writing in the March 15 issue of the *New England Journal of Medicine,* Dr. Kent Murray of the University of Kansas School of Medicine in Wichita

describes how a 51-year old man received a second-degree burn from a Transderm Nitro-10 patch while sitting next to a microwave oven. The oven was later found to be leaking, although the emission level was not reported. Murray deduced that the patch's adhesive strip of aluminized plastic was heated by the microwave radiation, causing the burn. He warns that "other dermal delivery systems with metallic elements would present a similar hazard."

STANDARDS

C63 Meeting...ANSI's Committee C63 on Radio-Electrical Coordination will meet in San Antonio, TX, on April 27, immediately following the *IEEE 1984 Symposium on Electromagnetic Compatibility*. Among the agenda items are the results of numerous votes on C63 standards as well as a ballot to change the committee's name and scope.

VDTs

Reproductive Risks...NIOSH is investigating a cluster of miscarriages at Southern Bell's data processing center in Atlanta, GA. This is the tenth cluster of pregnancy problems to be made public (see *MWN*, March 1984). Workers at Southern Bell cited six miscarriages among 15 pregnancies in a complaint filed with OSHA in the spring of 1983. NIOSH, which agreed to investigate at OSHA's request, sent a team to the data processing center in September. A preliminary report based on that site visit was sent to Southern Bell on November 7. Neither NIOSH nor the company would release the report. John Morawetz, the principal investigator for NIOSH, said in a telephone interview that the report "suggested" that the cluster of miscarriages was a "random occurrence." He would not estimate when a final report on the investigation will be completed.

Radiation Tests... Four Australian researchers measured electric and magnetic fields from VDTs and found no evidence of health hazards for operators. Testing between 15 kHz and 100 MHz, the investigators found E-fields of 2.2-36 V/m at 5 cm from the screen and 0.22-2.7 V/m at 30 cm. The magnetic field was measured only at 30 cm, yielding levels of 0.26-76 mA/m. Near the cabinet surface, the maximum E-field was 65 V/m at 5 cm and 5.5 V/m at 30 cm; the maximum H-field was 0.18 A/m at 30 cm. Colin Roy and co-workers at the Australian Radiation Laboratory compared the readings to eastern bloc exposure limits below 300 kHz (50 V/m and 5 A/m) and calculated that maximum emissions levels at 30 cm were 5.4 percent and 1.5 percent of the E- and H-field limits, respectively. They also tested ultraviolet and visible light and, like the EM fields, found them well below applicable limits. Their report, "Measurement of Electromagnetic Radiation Emitted From VDTs," is published in the January 1984 *Radiation Protection in Australia: The Bulletin of the Australian Radiation Protection Society*, a quarterly journal....S.M. Harvey, of Ontario Hydro's Research Division in Toronto, has published "Electric Field Exposure of Persons Using Video Display Units," which presents data gathered as part of Ontario Hydro's ongoing study of VDT health and safety (see *MWN*, January/February 1984). The article, which appears in *Bioelectromagnetics* (Vol.5, No.1, 1984), includes details of the measurement method used for the "complex time variations and spatial distribution" of the E-fields from VDTs. Harvey concludes that "the partial body electric field exposures received by operators of the VDTs in our sample would be typically two or three orders of magnitude," below standards set for 1 MHz or less by the American Conference of Governmental Industrial Hygienists (600 V/m above 10 kHz and 60 V/m above 300 kHz), and that the VDTs tested "present no hazard to human health within the context of existing guidelines."

CONFERENCES

***May 2-5:** Dresden Symposium on Bone Healing with Electrical and Electromagnetical Stimulation*, Dresden, West Germany. Contact: Medical Academy "Carl Gustav Carus," Orthopaedic Clinic, Fetscherstrasse 74, 8019 Dresden, West Germany.

***May 6-12:** 6th International Congress of the International Radiation Protection Association (IRPA)*, Berlin, West Germany. Contact: Dr. R. Neider, Bundesanstalt fur Materialprurfung, Unter den Eichen 87, D-1000 Berlin 45, West Germany.

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

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

***May 20-24:** 16th Annual Meeting of the Conference of Radiation Control Program Directors*, Des Moines, IA. Contact: CRCPD, 71 Fountain Pl., Frankfort, KY 40601, (502) 227-4543.

***May 30:** Workshop on Payload Susceptibility to Space Shuttle Ku-Band Radiated Fields*, Johnson Space Center, Houston, TX. Contact: Ralph Lawton, McDonnell Douglas Technical Services Co., 16441 Space Center Blvd., Houston, TX 77058, (713) 488-5660, ext. 468.

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

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

***June 18-21:** 1984 Power Electronics Specialists Conference*, Gaithersburg, MD. Contact: Frank Oettinger, NBS, Room B344, Technology Bldg., Washington, DC 20234, (301) 921-3541.

***June 25-28:** 1984 International IEEE/AP-S Symposium and National Radio Science Meeting*, Westin Hotel, Boston, MA. Contact: Professor Harold Raemer, Dept. of Electrical Engineering, Northeastern University, Huntington Ave., Boston, MA 02115.

***June 26-28:** 7th International Symposium and Exhibition on Electromagnetic Compatibility*, Wroclaw, Poland. Contact: W. Moron, EMC Symposium, Box 2141, 51-645 Wroclaw 12, Poland.

***June 26-28:** 1984 International Conference on Lightning and Static Electricity*, Orlando, FL. Contact: J.J. Fisher, US Naval Air Systems Command, PO Box 15036, Arlington, VA 22215, (202) 692-7822.

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Microwave News invites contributions to *From the Field*, our occasional column featuring news and opinions from the non-ionizing radiation community. Letters from readers are also welcome.

FCC To Consider RF/MW Radiation Hazards

The Federal Communications Commission (FCC) has decided to require its applicants to consider the health risks associated with human exposures to radiofrequency and microwave (RF/MW) radiation emitted by certain types of communications facilities. At the same time, the commission has begun the process of fine-tuning the new rules by proposing to include and exclude specific classes of communications facilities.

The rules amend existing FCC regulations for compliance with the National Environmental Policy Act of 1969 (NEPA), which requires the preparation of environmental impact statements (EIS) for "major" federal actions. With respect to non-ionizing radiation, the agency will now define a major action as any facility, new or upgraded, which "would expose workers or the general public to levels of RF radiation exceeding health and safety guidelines issued by the American National Standards Institute" (ANSI).

Under the rules, which will take effect on October 1, applicants for construction permits, licenses or renewals as well as those seeking to modify existing facilities, would have to evaluate radiation hazards. If a project qualifies as a major action, with human exposures above the ANSI limits, a narrative statement describing the environmental conditions would have to be submitted to the commission. The FCC would then decide if an EIS is required.

In a series of telephone interviews, knowledgeable sources indicated that the net effect of the new FCC rules would be the enforcement of the

(continued on p.4)

AIBS ELF Study Completed

The American Institute of Biological Sciences (AIBS) has concluded that it is "unlikely" that the extremely low frequency (ELF) electric and magnetic fields associated with the Navy's Project ELF submarine communications system can lead to adverse health effects on the public, animals or plants.

Professor H.B. Graves of Pennsylvania State University in University Park, the chairman of the AIBS panel, told *Microwave News* that the committee was unanimous in reaching its conclusions and recommendations.

The U.S. Navy, which commissioned the study, plans to release it on April 1. In late March, Graves briefed legislators on Capitol Hill in Washington, DC, and state officials in Madison, WI, and Lansing, MI, on the study findings.

The Navy prepared a 38-page appendix to the 290-page AIBS report that details the characteristics of the electromagnetic fields associated with the ELF system.

News of the release of the AIBS study comes as we go to press. We will present a detailed summary of the report in our May issue.

HIGHLIGHTS

IBM Report Recommends Shielding Older VDTs

Dr. Bill Guy of the University of Washington in Seattle advised IBM in a report submitted last October that some older video display terminals (VDTs) emit levels of radiation that might cause biological effects. These terminals should be shielded to block emissions, he recommended.

At the same time, Guy concluded that newer models manufactured to meet federal standards for electromagnetic interference (EMI) reduce these fields to safe levels.

The 66-page report was kept confidential by IBM, but a copy was obtained by *Microwave News*. Last October, IBM released a six-page summary of the report, which did not recommend shielding older VDTs. In a telephone interview, Guy explained that he addressed only newer VDTs in the summary (see *MWN*, September and December 1984).

In the full report, Guy stated that: "The localized [electric] fields at the surface of an unshielded cover of a VDT nearest the flyback transformer can reach extremely high values. Since these fields have a capability of inducing much greater currents in an exposed user of the device than the relatively low magnetic field emissions, it certainly is desirable to shield the cover of the VDT. Since such shielding is relatively inexpensive the benefit to cost ratio is large. Such shielding is generally present in newer models of VDTs to satisfy [Federal Communications Commission] requirements for reducing [EMI]."

The FCC regulations took effect October 1, 1983 and apply to radiated emissions in the 30-1000 MHz frequency range. (They also set limits for conducted interference for 0.45-30 MHz.) The VDT fields studied by Guy were between 15-20 kHz with harmonics to about 1 MHz.

Guy recommended against shielding VDTs to block magnetic fields. Because these emissions are "significantly lower and induce much less current in an exposed subject" than the electric fields, "there is less need to provide magnetic shielding....unless it can be shown that there is a real hazard due to the magnetic field exposure," he explained.

Both documents were prepared for IBM's Office of the Director of Health and Safety. (The "Recommendations" from the full report, *Health Hazards Assessment of Radio Frequency Electromagnetic Fields Emitted by Video Display Terminals*, are reprinted on p.11.)

Tom Mattia, a spokesman for IBM, said that the report supported IBM's practice of shielding its terminals. He told *Microwave News* that all current IBM terminals are shielded to meet the FCC's EMI rules, and that in the past, the company has shielded its VDTs to meet the "most conservative" global EMI standards.

There are no statistics available on the number of VDTs still in use that were manufactured without shielding.

Emphasis Differs

The summary places a different emphasis than the original report on the importance of findings by the Delgado team in Spain that pulsed magnetic fields can cause teratological effects in chicken embryos. The summary discounts the possibility of a relationship between the Delgado fields and those from VDTs, but the full report states that a "relationship could exist," although it is "highly unlikely."

Guy said in a telephone interview that recently reported corrections in the Delgado team's experimental set up have not altered his assessment (see *MWN*, December 1984). He noted, however, that the revised information is more consistent with physical science than the original data.

Characterizing the Fields

The full report also assessed measurement problems faced by VDT researchers and recommended time domain methods using simple loops and Maxwell displacement current sensors for "predicting induced currents and energy absorption in exposed subjects." Frequency domain methods, such as those used in EMI measurements, are "not adequate for completely characterizing the fields."

Guy suggested that direct measurements of induced current to ground in a subject "may be the most convenient and accurate method for characterizing worst case exposure conditions." He concluded that the "maximum coupling of energy would occur...when the hands are in contact with the case of the VDT."

He measured maximum peak electric field levels of 30-100 kV/m for "direct hand contact with the surface" of an unshielded Hazeltine 1500 terminal, according to the report, with fields at the operator's position as high as 50 V/m. Guy told *Microwave News* that he was "shocked" by these levels. Overall, he said he found that shielded terminals reduced the fields by an order of magnitude such that the fields at the operator's position were less than 5 V/m.

Guy calculated that the total rms E-field from a VDT's flyback transformer is approximately double the field associated with the fundamental frequency. For the Hazeltine terminal, the E-field at 18.478 kHz (the fundamental frequency) at the casing surface was 14.2 kV/m, while the total E-field was 28 kV/m. This total is in line with the 38.2 kV/m field Guy measured from the same terminal.

IBM Radiation Research Continuing

IBM's Mattia told *Microwave News* that the company is measuring extremely low frequency (ELF) radiation from its terminals as part of its ongoing research program.

Guy said that he will present a paper based on the full report at the Bioelectromagnetics Society meeting in San Francisco in June. He also plans to submit the paper to the society's journal, *Bioelectromagnetics*.

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Confusion Over EPA ELF Research

There appears to be some confusion among senior officials at the Environmental Protection Agency (EPA) over the work going on in its own labs. Some believe that bioeffects research on extremely low frequency (ELF) or power line radiation has been completed and can be terminated, while others see the need to continue the work which has just begun.

Testifying before Congress on March 5, EPA Assistant Administrator for Research and Development (R&D) Dr. Bernard Goldstein explained why the non-ionizing radiation group at the Health Effects Research Lab in Research Triangle Park, NC, will be disbanded under the Reagan Administration's fiscal year 1986 (FY86) budget (see *MWN*, March 1985).

Goldstein told the subcommittee on natural resources, agriculture research and environment of the House Committee on Science and Technology that, "The reduction is due to the completion of health studies on the effects of extremely low frequencies [ELF] of non-ionizing radiation. The information produced by the program should provide a sufficient data base for EPA to establish exposure guidelines." Congressman James Scheuer (D-NY) is the chairman of the subcommittee.

Last August however, Sheldon Meyers, the acting director of EPA's Office of Radiation Programs, wrote to officials in the state of New Jersey that EPA would continue its work on ELF (or power line) radiation. He noted that EPA would provide assistance to those states which "do not have the resources to conduct the [R&D] necessary to promulgate exposure limits..." (see the complete text of Meyers's letter in "From the Field" on p.11).

Most of EPA's R&D work, with some notable exceptions, has been on radiofrequency and microwave (RF/MW) radiation. In 1983 Congress asked EPA to step up work on ELF and most of it is just getting underway (see *MWN*, June 1983).

At a hearing before the subcommittee on HUD and independent agencies of the House Appropriations Committee on March 20, Goldstein faced tough questioning from Congressman Edward Boland (D-MA), the subcommittee chairman. Boland quizzed Goldstein and EPA Administrator Lee Thomas on why EPA was closing the radiation program when the agency had asked for an increased budget last year, especially after EPA's Scientific Advisory Board had recommended continued funding.

The EPA officials replied that there were few effects of RF/MW radiation "at the levels of interest to EPA." They said that they would supply the subcommittee with additional information for the hearing record.

Meanwhile, a lobbying campaign has been started to pressure Congress to restore funding for the EPA non-ionizing radiation research group. Officials of the Bioelectromagnetics Society, the IEEE's Committee on Man and Radiation (COMAR) and the Electromagnetic Energy Policy Alliance (EEPA) are all working towards that goal.

A staffer with the Scheuer subcommittee said that while there was some sentiment among committee members that the research program should continue, it was still "too premature" to say whether the funds would be restored. He explained that there had been a large number of cuts and that the Congress would be facing some "tough decisions." The subcommittee will consider the budget request in mid-April.

An aide to Boland's subcommittee said that there is no clear sense among the members that the funds should be restored. No schedule for subcommittee action has been set, he added.

Ironically, at the same time that EPA is trying to disband the non-ionizing radiation group, it has awarded prizes to some of the group's members for excellence in research. The 16-member group collected the top award for *all* agency health-related papers, as well as three other prizes. Only five other awards were given out to the rest of the Health Effects Lab, where about 250 researchers work.

HS Student on PEMF Effects

Jarrett Shustrin, a student at South Shore High School in Brooklyn, NY, has found that pulsed electromagnetic fields (PEMFs) "doubled the rate of cell growth in [human] melanoma cells." Shustrin exposed the melanoma cells in tissue culture to 72 Hz PEMFs for five hours a day over five days and counted the cells each day.

His project was exhibited March 18-22 at the IBM Gallery of Science and Art in New York City as part of the 47th School Science Fair held by the American Institute of Science and Technology.

Shustrin, working in the Surgical Research Laboratory of biochemist Joseph Scherrer at the Brookdale Hospital Medical Center in Brooklyn, was inspired by the work of Dr. Andrew Bassett of the Department of Orthopedic Surgery at Columbia University Medical School, one of the pioneers in the use of PEMFs for hard-to-heal fractures.

For his work, Shustrin won a "Junior Academy of the New York Academy of Sciences Award," which consists of a one-year membership in the academy, a t-shirt, and a certificate from the U.S. Marine Corps. (The top five prize winners won $2,500 scholarships from ITT.)

Power Line Studies at IEEE PES Meeting

Outlined below are some of the papers on transmission line effects presented at the Institute of Electrical and Electronics Engineers' (IEEE) Power Engineering Society winter meeting, held in New York City on February 3-8. (The order numbers of the papers follow the titles.)

- "Probability and Consequence of Gasoline Ignition

under HVAC Transmission Lines," (85 WM 224-1). Using computer simulations, Dr. Don Deno of General Electric and Mike Silva of Enertech evaluated the likelihood of fuel ignition caused by sparks during refueling for various types of trucks and automobiles along the right-of-way (ROW) of a 500 kV line. They found that the risk for an automobile is less than one in a trillion. The greatest probability is for a trailer truck on a blacktop road: approximately one in seven million. If a spark were to cause ignition, an explosion would be very unlikely, the researcher found.

• "Testing of Railroad Signal Equipment for Power Line Interference Susceptibility Part I: The Test Jig" (85 WM 113-6) and "Part II: Test Results" (85 WM 114-4). Much of this work has already been reported (see *MWN*, September and December 1983). Allen Taflove, formerly with IITRI and now an associate professor at Northwestern University in Evanston, IL, John Dunlap of the Electric Power Research Institute and Raymond Zalewski of IITRI advise utilities "to work with the railroads to set up measurement procedures (or procurement standards) to test each item of vital railroad signal equipment that may be subjected to AC interference. Both safe failures and false clear failures should be tested."

• "Measurement and Statistical Analysis of Ozone from HVDC and HVAC Transmission Lines," (85 WM 226-6). A team from Hydro-Quebec and its research institute (IREQ) led by L. Varfalvy found that, in most cases, a 735 kV AC line had negligible effects on ambient levels of ozone. Even in worst case situations, the maximum contribution of the power line will not exceed 5-10 parts per billion along or near the ROW. For a ± 900 kV DC line during bad weather conditions, the maximum contribution to ozone levels could be quite significant.

• "Analysis of Effect of Shield Wires on Electrostatic Induction by AC Transmission Lines," (85 WM 223-3). A group of Japanese researchers has devised a model for the effectiveness of shield wires on the ground level electric field. Measured values were in good agreement with the group's calculations.

• "Exposure to Transmission Line Electric Fields During Farming Operations," (85 WM 225-5). Mike Silva and Dennis Huber of Enertech have estimated the exposures experienced by farmers whose property is crossed by various types of power lines. For instance, for a 765 kV line, a farmer would spend about 20 hours a year in fields above 3 kV/m and one hour in fields above 8 kV/m. They note that the cabs of most farm machinery shield workers to a level of five percent of the unperturbed electric field outside the cab.

Single copies of the above papers are available for $3.00 (IEEE members), $6.00 (others) from: Single Publication Sales Dept., IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854.

A tutorial on "Power System Harmonics," held at the PES meeting, was well attended, attracting about 75 participants. The course text (84 EH0221-2-PWR) is available for $8.00 (IEEE members), $16.00 (others).

FCC on Radiation Hazards

(continued from p.1)

ANSI standard. The time and effort needed to prepare an EIS is such that most applicants will design their facilities to comply with the ANSI limits, one FCC staffer said.

Indeed, an FCC attorney told *Microwave News* that since NEPA became law in 1969 the commission has written fewer than six EIS's. None of these addressed RF/MW radiation.

Technical Bulletin

The FCC is preparing a technical bulletin to help evaluate compliance with the new rules. According to Dr. Bob Cleveland of the commission's Office of Science and Technology, the bulletin will help broadcasters predict field strengths from antennas and will review measurement procedures. Cleveland said that the bulletin would be updated as needed. He also said that the commission will consult with staffers at the Environmental Protection Agency (EPA) in developing the bulletin. In addition, the National Association of Broadcasters has offered its assistance.

In adopting the radiation rules, the FCC acknowledged the absence of federal standards but argued that, "We believe the fact that there are currently no mandatory federal standards for exposure of the public to RF radiation does not excuse us from our obligations under NEPA to evaluate the FCC actions for significant environmental impact."

The new rules will apply to: (1) radio and television broadcast stations, (2) experimental broadcast stations including radio transmitters, (3) low-power television stations and (4) transmitting satellite earth stations.

In a separate action, the FCC proposed to exclude categorically land-mobile transmitters and microwave point-to-point relay links from the NEPA requirements. The commission also proposed to apply the rules to shipboard satellite earth terminals. In so doing, the commission asked interested parties to respond to a series of questions on worst case exposures, field strength prediction models, measurement methods and other related issues.

No Federal Preemption

In explaining its decision, the FCC noted that:

• Though standards more restrictive than ANSI's are being proposed and adopted by national and international organizations, the commission decided not to wait for the "ultimate standard," but to act on the basis of the available record. The commission advised that "we may revisit this issue and recommend use of a different standard in the future."

• Though a number of commenters called for the agency to quash the movement towards state and local safety standards in the absence of federal rules, the commission said that, after having given the matter "serious consideration," it had decided not to resolve the issue of federal

preemption at this time. But it warned that, "Should non-federal RF radiation standards be adopted, adversely affecting a licensee's ability to engage in commission-authorized activities, the commission will not hesitate to consider this matter at that time."

• Though the FCC had originally proposed to key its actions under NEPA to the Occupational Safety and Health Administration's (OSHA) 10 mW/cm^2 standard, because the OSHA standard was based on the old ANSI standard, which was revised in 1982, the commission decided to base its rules on the more recent guidelines.

Dr. Robert Powers, FCC's chief scientist, will outline the new rules at a panel discussion on non-ionizing radiation at the *Annual Convention of the National Association of Broadcasters* in Las Vegas, NV, the week of April 14. And Cleveland will address the rules at the May 14-17 *Annual Meeting of the Electromagnetic Energy Policy Alliance* in San Diego, CA. Excerpts of the FCC's "Report and Order" appear below.

The FCC began considering radiation hazards in 1979 when it issued a Notice of Inquiry (NOI). In February 1982, the commission proposed the rules which it has now adopted with some revisions (see *MWN*, March 1982). Nineteen organizations filed comments and reply comments on the FCC's proposal (see *MWN*, September 1982). Comments on the new proposal are due on June 19, with reply comments due on July 19.

The "Report and Order" appears in the March 20 *Federal Register*, (50 *FR* 11151), and the proposed revision appears in the March 18 *Register* (50 *FR* 10814). For more information, contact FCC's Cleveland at (202) 632-7040 or Stephen Klitzman at (202) 632-6405. ●

EXCERPTS

FCC's RF Human Exposure Rules Under NEPA

Reprinted below are excerpts from the Federal Communications Commission's (FCC) rules to consider radiofrequency (RF) hazards under the National Environmental Policy Act (NEPA). All footnotes have been deleted from the original FCC text, which appeared in the March 20 Federal Register *(50* FR *11151). These rules are part of FCC's General Docket No. 79-144. They were adopted on February 26 and released on March 14.*

Summary

1. The Commission is amending Part 1 of its rules implementing the National Environmental Policy Act of 1969 (NEPA), 42 U.S.C. 4321 *et seq.* (1976). The amendment provides for environmental analysis of major Commission actions that may result in non-compliance with applicable health and safety guidelines for radiofrequency (RF) radiation. Our processing guideline for determining the significance of human exposure to RF radiation will be the "Radio Frequency Protection Guides" adopted in 1982 by the American National Standards Institute (ANSI). At this time, the rule amendment will only apply to major actions taken by the Commission with respect to the following facilities authorized by the FCC Rules and Regulations: (1) broadcast facilities authorized under Part 73; (2) broadcast facilities authorized under Part 74 (Subparts A and G only); (3) satellite-earth stations authorized under Part 25; and (4) experimental facilities authorized under Part 5. An accompanying *Further Notice of Proposed Rule Making*, also being issued today, proposes to categorically exclude other FCC-regulated facilities and operations from the provisions of this rule, except for shipboard satellite-earth terminals.

II. Background

2. On June 7, 1979, the FCC issued a *Notice of Inquiry* (NOI) concerning the responsibility of the FCC to consider biological effects of radiofrequency (RF) radiation when licensing facilities and authorizing equipment that utilize RF energy....

3. As a result of the comments received in response to the FCC's NOI and our assessment of the Commission's statutory responsibilities under NEPA, the Commission issued a *Notice of Proposed Rule Making* (NPRM) on February 18, 1982, proposing...that applications for equipment authorizations would be treated as "major actions" triggering environmental assessment when the equipment in question did not comply with RF radiation emission standards. It was also proposed that applications for construction permits or licenses to transmit would be treated as "major actions" triggering environmental assessment when the proposed operation would result in the exposure of workers or the general public to levels of RF radiation in excess of safe levels established by federal agencies which have jurisdiction to set such standards.

III. Discussion

A. General

4. A total of twenty-three filings of comments and reply comments was received at the FCC in response to the Commission's NPRM in Docket 79-144....The respondents included individuals, broadcast groups, major corporations, trade associations, a labor union, local government officials, and the U.S. Environmental Protection Agency (EPA)....

5. With a few exceptions, respondents to the NPRM generally supported the thrust of the Commission's proposal. The general tone of the comments indicated a desire by many respondents that the Commission clearly establish a policy regarding RF radiation hazards and clarify Commission and licensee responsibilities in this area of growing public concern. Several of the respondents also suggested the Commission take actions that, we believe, go beyond the scope of this proceeding. Although various broadcast groups, such as the National Association of Broadcasters (NAB), the TV Broadcasters All Industry Committee (TVBAC), the Association for Broadcast Engineering Standards, Inc. (ABES), and the National Association of Public Television Stations basically supported the proposed rule, they and others urged the Commission to issue a policy statement dealing with federal preemption of local and state standards for RF radiation....

6. Two respondents felt that the Commission should not adopt the proposed rule amendment at this time. The Utilities Telecommunications Council (UTC) recommended "that the Commission postpone adoption of its proposal until the EPA or another responsible federal agency establishes a legally enforceable exposure standard." UTC felt that it would be premature for the

FCC to adopt its proposed rule in view of the fact that various federal agencies "are only in the preliminary stages of standard development and in light of the disparate views and positions of scientists the world over concerning what constitutes a radiation 'hazard'...."

7. Similarly, RCA Corporation, while endorsing the concept of national standards and while recognizing the proposed Commission regulation as "meritorious," nonetheless felt that the Commission should "defer adoption of the regulations implementing NEPA until such time as the Federal agencies issue suitable radiation standards." RCA feared that if the Commission adopted regulations before the issuance of federal standards, "such regulations may be ineffective, inappropriate, or detrimental to those persons regulated thereunder." The UTC and RCA comments, however, were outweighed by those comments supportive of our taking action at this time.

8. It is our judgment that the Commission is required to make a threshold determination as to whether the facilities it approves are "major Federal actions significantly affecting the quality of the human environment," thus triggering environmental review, regardless of whether federal guidelines or standards currently exist for general public exposure to RF radiation....

B. Guidelines for RF Radiation Exposure

9. A major topic of discussion among the respondents was the matter of which RF standard or guideline the Commission should use as its criterion for identifying a "major action" for processing under the NEPA rules. The Occupational Safety and Health Administration (OSHA) of the U.S. Department of Labor has jurisdiction to establish RF exposure standards for workers. EPA has the authority to recommend safe levels for exposure of the general public to RF radiation. Our NPRM noted that OSHA had previously issued a radiation protection guide for workers, and that, until a federal standard for the general public was developed, we proposed to use the OSHA workers' exposure guidelines for determining what constituted a "major action" with respect to general public exposure to RF radiation. In May 1982, OSHA proposed to revoke its advisory standards, including the advisory standard for exposure of workers to non-ionizing radiation. However, subsequently, OSHA reconsidered and decided to retain its advisory standard for RF radiation.

10. In light of OSHA's proposed revocation, some respondents felt that the Commission should reconsider its proposal to use the OSHA guidelines....Other parties, including most of the broadcast groups, did not think that OSHA's action should affect the Commission's proposal....

11. GTE Service Corporation, Aeronautical Radio, Inc. (ARINC), [American Radio Relay League] ARRL, Thomas Agoston, Donald E. Clark, and Motorola, Inc. advanced an alternative approach. They proposed that, in place of the OSHA guidelines, the Commission should use, as an interim or provisional standard, the voluntary RF radiation protection guides issued in 1982 by the American National Standards Institute (ANSI)....

13. Although several of the broadcast groups would have preferred that the Commission use the OSHA radiation protection guide, they indicated that use of the ANSI standard would be acceptable. For example, to quote TVBAC, "while the ANSI standards are more stringent than the 10 mW/cm^2 standard at certain frequencies, they are not so stringent as to impair broadcasting services."...

17. Significant misgivings about Commission use of the OSHA guidelines were expressed from another perspective in comments of EPA. EPA noted that, "in general, we are in agreement with the subject document as written, but we have reservations about the use of the OSHA occupational standard as an interim standard for exposure of the general public until EPA issues guidelines for exposure of the public." EPA observed that factors related to environmental heat stress and the health of exposed individuals suggested that the OSHA standard may not provide adequate protection for certain segments of the public."...

19. Reservations about FCC adoption of the OSHA guidelines were also expressed in comments submitted by Oregon officials Donald E. Clark and Dr. Charles P. Schade. For example, Schade maintained that occupational exposure standards "do not protect persons in the population who might be especially sensitive to radiofrequency energy." He mentioned small children and persons with chronic illnesses as examples of individuals who might be adversely affected by the Commission's use of an occupational standard as a standard for exposure of the general public.

20. There were two reasons for our initial proposal to rely on the OSHA occupational standard as an interim guideline for exposure of the general public. First, no standard had been established by the Federal Government for exposure of the general public to RF radiation. Second, as indicated in the NPRM, we believed that some guideline is necessary to facilitate the Commission's environmental review process until such time as EPA or another responsible federal agency recommends or adopts guidelines or standards for exposure of the general public to non-ionizing RF radiation....

22. Absent a federal standard for exposure of the general population, and in the face of the Commission's acknowledged statutory obligation under NEPA, two questions, therefore, remain. Under these circumstances can the Commission rely on existing exposure guidelines in view of the lack of federal standards? If it can, upon which guidelines should it rely?

23. First, we believe that the Commission can rely on existing exposure guidelines as long as they are technically sound and scientifically supportable....

24. Second, regarding the exposure guidelines on which the Commission will rely, in light of recent developments, and as a result of comments received in this proceeding, we are modifying our original proposal for evaluating RF radiation exposure. We are incorporating by reference into our NEPA rules the guidelines recommended by ANSI...

25. We have selected the non-government ANSI guidelines to evaluate general population and worker exposure to RF radiation because they are scientifically based and widely accepted guidelines that are applicable to the general population as well as to workers....Although we have neither the expertise nor the jurisdiction to *develop* our own radiation exposure guidelines, we believe, as supported by comments received in this proceeding, that the Commission does have the expertise and authority to *recognize* technically sound standards promulgated by reputable and competent organizations such as ANSI. The OSHA radiation protection guide upon which we had originally proposed to rely was based directly on the prior ANSI standard of 10 mW/cm^2 originally issued in 1966. ANSI's revision of that standard, in 1982, reflected recently acquired knowledge of the biological effects of RF radiation. We, therefore, believe that the 1982 ANSI standard is more appropriate than the OSHA advisory guideline. Furthermore, the OSHA guidelines were written as an exposure guide for workers, whereas the 1982 ANSI recommendations "are intended to apply to non-occupational as well as to occupational exposures." The revised ANSI guidelines also apply to a broader frequency range than the OSHA guidelines and, unlike the OSHA guidelines, contain recommendations for exposure in the standard (AM) broadcast band.

26. We would prefer to defer in this area to the expert federal health and safety agencies. We believe, however, that NEPA requires us to consider the environmental impact of the operations and facilities we license or approve, regardless of whether federal standards currently exist or we have the requisite expertise to set such standards....

27. ...If a proposed operation or facility will result in human exposure in excess of the ANSI limits, environmental analysis will be required. However, the application can be amended to reduce or eliminate the possibility for excessive exposure....

28. We are aware of new or proposed recommendations for exposure to RF radiation promulgated by other organizations subsequent to the issuance of our NPRM. For example, new exposure guidelines, more restrictive than the ANSI standard for exposure of the general public, were released in April 1984 by the International Radiation Protection Association (IRPA). The National Council on Radiation Protection and Measurements (NCRP) is currently developing RF exposure guidelines for workers and the public. In addition, the American Conference of Governmental Industrial Hygienists (ACGIH) and the National Institute for Occupational Safety and Health (NIOSH) have recommended or are developing recommendations for occupational exposure to RF radiation, and...EPA has been in the process of developing federal guidelines for RF exposure. While IRPA has now issued guidelines and other groups may do so in the future, we believe that the Commission should act on the basis of the record before us at the present time rather than postpone action indefinitely as we seek the ultimate standard. It is possible that we may revisit this issue and recommend use of a different standard in the future. However, for the present, the record before us supports use of the 1982 ANSI standard.

C. License Renewals and Modifications

29. We have determined that we are legally obligated under NEPA to include license renewal and facility modification applications within the scope of our environmental processing guidelines. To clarify as well as qualify the applicability of our amended NEPA processing rules to such applications, we would note the following points. First, both the NEPA case law and regulations of the Council on Environmental Quality implementing the statute make clear that the statutory term "major Federal action" includes both new and continuing federal activities such as initial licensing as well as license renewals and modifications....

31. ...Based on industry comments received in this proceeding, it is our expectation that, in fact, the vast majority of license renewal and facility modification applications will comply with the ANSI standard we are incorporating today into our NEPA processing guidelines. Thus, our approval of such applications in most instances will not constitute a "major Federal action significantly affecting the quality of the human environment" so as to trigger environmental processing with respect to RF radiation....

D. Evaluation of Compliance

32. Many respondents raised questions that related to the evaluation of whether a facility or operation was in compliance with a given standard. For example, American Telephone and Telegraph (AT&T) expressed its concern that "the intent of the proposed rule is not sufficiently clear and...this slight ambiguity may result in an unnecessary burden to the Commission as well as applicants."...

33. Concern over measurement procedures, particularly in the near-field of a radiating source, was expressed by some respondents. Motorola felt that adoption of the proposed rules without establishing measurement procedures was "in effect, adoption of no rules at all...Enforcement of the rules could be next to impossible in near-field situations. We urge the Commission to promulgate rules *only* after appropriate measurement procedures have been established...."

35. In its comments, NAB also discussed the problem of locations where many different sources of RF energy are present. NAB contended that "in some instances, there is no practical alternative but to locate a variety of transmitting antennas on one tall building or mountain peak. At these locations, the cumulative radiation levels might exceed the new ANSI standard —but almost never in any area accessible to the public." NAB suggested that the Commission should consider various methods to prevent exposure to hazardous radiation at these sites but maintained that "no licensee or applicant should be subjected to special processing where transmitting equipment under that licensee's control by itself produces radiation levels not in excess of the standards."

36. In order to address these various concerns related to the determination of compliance with standards, and to give guidance to our licensees, we plan to issue a technical bulletin which will be developed by Commission staff before the effective date of our rule amendment. This bulletin will discuss prediction methodology, evaluation of exposure situations, measurement problems, multiple source siting, and other relevant issues....

39. Concerning the problem of multiple transmitters at the same location, if a proposed facility or modification would result in an incremental increase in RF radiation in an accessible area causing overall non-compliance with the specified guidelines, then we can see no practical way to address this situation other than to require an environmental assessment of the proposal. *Existing* facilities that are not proposing modifications in their operations or are not applying for renewal would not be subjected to NEPA processing under our rules. In the case of renewals at multiple-use sites, all licensees involved will be *jointly* responsible for resolving problems that may arise relative to exposure to RF radiation. Further guidance on evaluation of multiple-use situations will be provided in the bulletin....

F. Federal Preemption of Local and State Standards

42. We continue to be aware that, largely due to the lack of a federal standard, various state and local jurisdictions around the country either have adopted or have proposed standards for exposure of the general public to RF radiation. The issue of federal preemption of such local and state RF standards was a recurring theme in many of the comments....

43. We have reviewed these comments closely and given the matter serious consideration. However, we do not believe it is necessary at this time to resolve the issue of federal preemption of state and local RF radiation standards. Should non-federal RF radiation standards be adopted, adversely affecting a licensee's ability to engage in Commission-authorized activities, the Commission will not hesitate to consider this matter at that time.

G. Other Issues

44. Various respondents raised a few other issues, mostly dealing with particular operations or exposure situations. For example, the Radio Officers Union (ROU) of the National Marine Engineers' Beneficial Association, AFL-CIO, submitted comments pertinent to the maritime mobile service. Although ROU could foresee no RF hazards associated with conventional maritime radio transmitters and ship radar equipment, the union felt that shipboard satellite earth stations posed a potential hazard that should be promptly addressed by OSHA and the FCC....Accord-

ing to ROU, the primary hazard of such equipment results from their antennas frequently being mounted only a few feet above deck level. The union also expressed concern about port operation of satellite equipment with regard to tankers, LNG carriers, ammunition ships, and similar vessels, as well as the potential for exposure of persons standing dockside.

45. Some respondents urged the Commission to exclude certain types of transmitters from consideration under the NEPA processing rules because of the apparent incapacity of these devices to cause potentially hazardous exposure to RF radiation. For example, Motorola mentioned portable radios operating between 300 kHz and 1 GHz with output powers of seven watts or less. NAB suggested an exemption for mobile electronic news gathering ("ENG") equipment used by broadcasters. According to NAB, "these services also pose virtually no health hazard because of the transient nature of the exposure." NAB further urged the Commission to exclude all transmitters with power outputs below ten watts from the environmental assessment rules. Similarly, ARINC urged the Commission to exclude the aeronautical mobile service from consideration under Section 1.1305, and ARRL proposed an exemption for amateur radio....

IV. Conclusions

55. Maximum power limitations for broadcast facilities authorized under Part 73 range from 50 kilowatts (AM radio) to over 5 megawatts (UHF television). Also, for applicable Part 74 facilities there are no limitations on maximum power under Subpart A (experimental broadcast stations), and under Subpart G (low power television) no maximum for effective radiated power is stipulated. Therefore, these various broadcast facilities may operate with effective radiated powers (ERP) of thousands to millions of watts. Since broadcast transmitters are sometimes located in areas that are accessible to workers or the general public, and broadcast stations generally transmit over major portions of a 24-hour day, it is possible that such transmitters could cause exposures in excess of safety standards. Moreover, comments filed previously in this proceeding presented evidence that it is possible for some broadcast facilities to create conditions that might lead to significant human exposure to RF radiation.

56. Transmitting satellite-earth stations authorized under Part 25 of the FCC Rules and Regulations operate with very high ERPs. However, the high degree of directionality of the transmitted beam makes excessive exposure unlikely. Our experience over the past several years in this area and on-site measurements have demonstrated that normal design and operating practice make it highly unlikely that workers or the general public would be exposed to excessive levels of RF radiation from these facilities. Nevertheless, we believe it necessary to subject these facilities to the provisions of this rule because of the high amounts of RF energy involved. Similarly, experimental facilities authorized under Part 5 may operate with relatively high power levels, and, therefore, will be subject to this rule amendment.

57. It should be noted at this point that we have already been reviewing radiation hazards of land based satellite-earth stations as part of our domestic satellite-earth station licensing process since our 1972 *Memorandum Opinion and Order* in Docket No. 16495. Since the rule amendment we adopt today will be applicable to satellite-earth stations authorized under Part 25 of the FCC Rules, it will supersede the 1972 action.

58. With regard to other categories of FCC-regulated operations and facilities, because of relatively low operating power levels, intermittent use, or relative inaccessibility, it appears unlikely that they would cause exposure in excess of safety standards during routine use. Therefore, we are today also issuing a *Further Notice of Proposed Rule Making* in which we propose to exclude from the provisions of this rule other transmitting facilities and sources which are not included in the categories listed above. Through this *Further Notice* we are soliciting information, comments, opinions, and suggestions relevant to the legitimacy of this proposed categorical exclusion....even though we are proposing to exclude a large number of Commission actions from consideration under this rule, the Commission "on its own motion or on motion of any interested person, may determine that the environmental consequences of a particular action are such as to warrant preparation of an environmental impact statement."...

59. In our *Further Notice* we are also proposing the inclusion of shipboard-satellite earth stations...

60. ...We believe that the overwhelming majority of applications to the Commission will not be subject to environmental impact analysis as provided for in our NEPA rules and by this amendment....

UPDATES

COMPATIBILITY & INTERFERENCE

Aircraft RFI... In our November issue, we reported that the FAA announced plans to set rules clearly permitting the use of computers and other electronic devices in flight — except during takeoffs and landings. The release caught a number of people by surprise because the RTCA Special Committee 156 (SC156), which had been asked to evaluate the EMI risk to aircraft avionics and communications equipment, had not yet completed its work (see *MWN*, October 1983). Jack Flavin, manager of the avionics branch in the FAA's Office of Air Worthiness in Washington, DC, told *Microwave News* that the press release was issued because, after checking with RTCA, there seemed to be little chance of EMI, and because there was a lot of passenger confusion due to conflicting rules among the various airlines. "The phone was ringing off the hook," he said. Flavin added that the advisory circular, cited as forthcoming in the release, did not now have a high priority within the agency and there were no immediate plans for its release. In a telephone interview, Frank White, the chairman of SC156, said that he hoped to complete a working draft of the committee's report by its next meeting on April 23-24 and a final report by the end of the year. White pointed out that some data for certain frequency bands must still be collected and that the measurement program is ongoing — in part because some of the necessary test equipment is not yet available. FAA's Flavin said that if SC156 finds something, "we will change the rules."

NBS to Study Test Methods... The Electromagnetic Fields Division at NBS's Boulder labs in Colorado will try to resolve an ongoing debate on the preferred test method for evaluating the susceptibility of home electronic equipment

to conducted EMI from the power line and the VHF and UHF antenna ports (see *MWN*, January/February 1985). Under the leadership of NBS's Mark Ma, models will be developed to see "if a correlation can be achieved between injection testing methods and radiated field methods." That is, staffers will compare the results obtained from a bench setup with those from an open area test site. The study is being carried out under a $100,000 contract from the Electronic Industries Association. An NBS spokesman said that the final report should be completed by the end of September.

GOVERNMENT

First Cuban Interference Claim... The FCC has approved its first compensation payment — to Plough Broadcasting Co., Inc. — under the Radio Broadcasting to Cuba Act of 1983 (see *MWN*, November 1983). AM station WSUN is now eligible to receive $12,265.24 for "expenses incurred in modifying its transmitter facilities to offset the effects of Cuban interference to its daytime service area." The actual monetary award will be made by the U.S. Information Agency. WSUN was allowed to increase daytime power in June 1983 because of Cuban interference. At that time, the station was owned by Plough; it was later sold to Taft Radio and Television Co., Inc.

The Bulletins Are Back... The *Radiological Health Bulletin* and the *Medical Devices Bulletin*, both published by FDA's Center for Devices and Radiological Health, will be back in print in April after a five-month hiatus. FDA was forced to suspend publication of the two newsletters when the Office of Management and Budget (OMB) failed to renew their approval — the previous authorization expired at the end of the last fiscal year, on September 30. The go-ahead finally came in early March and the bulletins will once again be available without charge. For more information, contact the Division of Information Services, Office of Management and Systems, Center for Devices and Radiological Health, FDA, Rockville, MD 20857.

MEASUREMENT

Magnetic Measurements... According to an NBS survey, nearly all of the 481 companies and research organizations involved with magnetic technology favor the creation of a federal facility for magnetic measurements and calibration. It should have the capability to measure all common magnetic parameters and to handle unusual shapes and sizes of samples, according to the survey respondents. NBS also found that "extreme measurement accuracy is not generally necessary": one percent is adequate in most cases — though even this is often hard to achieve. When asked how such a program should be supported, respondents expressed a willingness to pay "reasonable" fees but not the entire cost of setting up and maintaining the lab. *Magnetic Measurements, Calibrations, and Standards: Report on a Survey* (NBSIR No. 84-3018) by F.R. Fickett of NBS's Electromagnetic Technology Division, is available from the National Technical Information Service (NTIS), Springfield, VA 22161, $7.00, prepaid. Order No. PB 85-127827.

MEETINGS

Japanese Symposium... The Japan Health Physics Society (JHPS) will hold its 20th annual meeting in Kyoto on May 13-14. On the agenda is a symposium on "Some Problems on Health Physics of Non-Ionizing Radiation," which will be chaired by Dr. Y. Honda of Kinki University. For more information, contact: JHPS, c/o Kyoto University Research Reactor Institute, 590-04 Osaka-fu, Sennan-gun, Kumatori-cho, Noda, Japan, 81-7245-2-0901.

MILITARY APPLICATIONS

Opposition to EMPRESS II... Samuel Q. Johnson, III, a Democrat representing the 37th District in the Maryland House of Delegates, introduced *House Joint Resolution 67*, which seeks to stop the Navy from siting the Electromagnetic Pulse Radiation Environment Simulator for Ships (EMPRESS II) in the Chesapeake Bay. On March 20, the House Environmental Matters Committee approved *HJR 67* by a vote of 22 to 1. It will now go to the full house.

POWER LINES

Freak Accidents... Seven people were electrocuted March 23 attempting to escape a fire caused by a downed power line in Jupiter, FL, according to UPI. As the people climbed into a car, 7,620 volts of electricity surged through one of the car doors as it touched an adjacent car that was in contact with the downed line....Then on March 26, woodpeckers caused a utility pole to fall, taking with it a 230 kV transmission line. An estimated 170,000 Florida Power Corp. customers in the Tampa area were blacked out, UPI reported.

RADAR

Radar Detectors... Radar detectors are illegal in some states and are tempting to thieves everywhere. One device which overcomes both of these problems are the new "remote-mount detectors" which can be placed under the hood and linked to a display next to the driver. Twelve companies now make them, and *Car and Driver* magazine presents the results of rigorous comparison tests in its March issue. The units, which range in price from $220 to $445 (though some are available at a discount), are sensitive to both K- and X-band microwaves. They were rated on the basis of the warning distance provided in three types of police traps, a torture test to simulate under-the-hood wear-and-tear and their propensity to false alarms. The detectors ranged in performance, but the editors at *Car and Driver* found that Cincinnati Microwave's new, small Passport and its older Escort models scored better than any remote detectors.

IEEE Special Issue... The February 1985 issue of the *Proceedings of the IEEE* is devoted to radar, with 14 papers on various topics. The issue is introduced by Dr. Merrill Skolnik of the Naval Research Lab in an overview, "Fifty Years of Radar." What's left out of the issue is also of

interest. According to the April issue of *The Institute*, the IEEE newsletter, two Lincoln Lab engineers from Lexington, MA, did not receive clearance from the U.S. Army and so had to withdraw their paper on "High Power 35 and 95.5 GHz Instrumentation Radar," which describes an advanced radar system designed to gather high-resolution diagnostic signature data on R&D missile flights. The IEEE, the Army and the Lincoln Lab are discussing who will pay the expenses for the mix-up.

STANDARDS

IEC & Industrial EMC... The International Electrotechnical Commission (IEC) has issued the third part of its new standard, *Electromagnetic Compatibility for Industrial-Process Measurement and Control Equipment*. Publication No. 801-3, *Part 3: Radiated Electromagnetic Field Requirements*, details test procedures for determining the susceptibility of industrial equipment to spurious signals and recommends severity levels. The IEC points out that walkie-talkies are the most common sources of EMI but also lists radio and TV transmitters, welders and fluorescent lights as other sources of interfering electromagnetic energy. The IEC specifies the use of shielded enclosures as the "most efficient" means of performing radiated susceptibility tests and favors the anechoic chamber as "the most preferred type of enclosure." With respect to the stripline circuit, the IEC notes that, as specified in MIL-STD-461 and 462, the stripline is of "limited application" due to restrictions on the size of the equipment under test and its maximum frequency of operation (35 MHz). TEM cells are relegated to the appendix because they "can only accommodate very small items." In the frequency band 27-500 MHz, the IEC sets out three severity levels for measuring degree of susceptibility. Class 1: 1 V/m, a low-level radiation environment with radio and TV stations more than 1 km away; Class 2: 3 V/m, a moderate electromagnetic environment with walkie-talkies more than 1 meter from industrial equipment; and Class 3: 10 V/m, a severe electromagnetic area, typical of high-power walkie-talkies next to control equipment. (A fourth level is left open for "situations involving very severe electromagnetic radiation environments.") Publication 801-3, which includes detailed drawings of various test set-ups, costs $36.00 plus postage. It will be available soon from the International Sales Office, American National Standards Institute, 1430 Broadway, New York, NY 10018, (212) 354-3300. For details on Parts 1 and 2, see *MWN*, January/February 1985.

SAE AE-4 & ANS C63...SAE Committee AE-4 on EMC met on March 26-27 in Albuquerque, NM, and the next meeting of American National Standards Committee C63 on EMC has been scheduled for 9 a.m. on May 24 at the EEI in Washington, DC. C63's Subcommittee 1, on Techniques and Developments, will meet on May 23 at 10:30 a.m., also at the EEI. For more information on AE-4, contact SAE's David Bentley at (412) 776-5760; and on C63, contact IEEE's Fred Huber at (212) 705-7960.

TECHNOLOGY

Microwave Drying... The Electric Power Research Institute (EPRI) has contracted with Professor Philip Schmidt of the University of Texas's Mechanical Engineering Department in Austin to devise ways of optimizing the use of microwave energy in order to make it cost-effective in drying applications. At present there are no analytical models to test which combinations of microwave and conventional heating systems work best. Under the $57,194 contract, Schmidt will develop such a model — specifically for heating and drying porous solids internally by microwaves and from the surface by infrared radiation and convection. He will then test the results with a bench-scale setup. The work should be completed by the end of 1985.

ULTRASOUND

Chromosomal Effects... An attempt to replicate the reported finding that diagnostic ultrasound can increase the frequency of sister chromatid exchanges (SCE's) has failed. (SCE's are a sensitive indicator of potential genetic or carcinogenic hazards.) In 1979, a group at Albert Einstein College of Medicine in the Bronx, NY, reported that ultrasound, as used to monitor the developing fetus, increased the incidence of SCE's in human lymphocytes (*Science, 205*, 1273, 1979). Now, a team led by Dr. V. Ciaravino of the University of Rochester, using the same clinical device, found "no significant effect" on SCE's among human lymphocytes exposed in vitro. In a paper published in the March 15 *Science*, they conclude that "the reasons for [the original] results may be coincident with some subtle yet unidentified procedural factor." Dr. Robert Bases of the Department of Radiology at Albert Einstein, one of the authors of the 1979 study, told *Microwave News* that he was preparing a reply for publication in *Science*. He said that he would prefer not to comment further on the new results at this time.

VDTs

Australian Radiation Measurements... Researchers at the Australian Radiation Laboratory (ARL) have concluded that electromagnetic emissions from VDTs "do not pose a health hazard to operators" after testing fifty color and monochrome units. Electric and magnetic fields were measured from 14 kHz to 100 MHz, and broadband readings were taken from 10 MHz to 26 GHz. Maximum fields measured at 30 cm were: 3.1 V/m for E-fields from color VDTs, 15 V/m for one monochrome unit; 78 mA/m for H-fields from color terminals, 76 mA/m for monochrome. Median field levels in all categories were considerably less. ELF fields were not measured, and no ionizing radiation was detected — the minimum detection level of the meter was 0.05 mR/hr. For a copy of the report, *Electromagnetic Emissions from VDTs* (ARL/TR067), write to the ARL, Lower Plenty Road, Yallambie, Victoria 3085, Australia.

Legislation...New Mexico Governor Toney Anaya has signed *Executive Order 85-11* regulating the purchase and use of VDTs by state agencies. Other states are considering

the following bills: **California** Assembly Bill No. 1006 (Assemblyman Tom Hayden's second VDT bill this year), **Iowa** Senate File 322 (Senator Charles Bruner) and companion House File 329 (Rep. Gary Scherzan), **Massachusetts** House Bill 1501 (Rep. Nicholas Buglione) and House Bills 3082, 3084, 3085 and 3089 (Rep. Timothy Bassett), **Rhode Island** Bill Nos. H5387 and H6079 (Rep. Edward Dambruch) and Bill No. H6128 (Rep. Robert Tucker), and **Washington** substitute House Bill 468 (Rep. Janice Niemi) replacing legislation proposed earlier.

ETC...

Moscow Bugs... Electronic bugs placed inside typewriters used at the U.S. embassy in Moscow may have helped Soviet intelligence agents learn highly classified secrets, CBS News revealed on March 25. The listening devices transmitted signals to antennas hidden in the embassy's walls, which then broadcast the information to Soviet listening stations. The bugged typewriters were in use from 1982 until 1984, when the bugs were discovered. (In 1960, U.S. officials announced that they had found a bug in 1952 in a "Great Seal" that had been hanging over the Ambassador's desk — the seal had been a gift from the Soviets.) This latest episode follows upon years of controversy about the Soviets' beaming microwaves at the U.S. embassy for reasons that have never been explained fully, though some experts have argued that the microwaves recharged the batteries that powered the bugs.

FROM THE FIELD

VDT Radiation: Guy's Report for IBM

Reprinted below are the recommendations of Dr. Bill Guy to IBM in his October 29 report, Health Hazards Assessment of Radiofrequency Electromagnetic Fields Emitted by Video Display Terminals. *See story on p.2.*

Though it is highly unlikely that there is any relationship between the birth defect clusters and VDT emissions, the clinical work on magnetic bone growth stimulators and the magnetic field work of Ubeda et al. (1983) replicated by Mild (1984) does indicate that there could be a relationship. This perceived relationship prevails even though the wave form of VDT emissions differs markedly from those of bone growth stimulators and the Delgado apparatus. A major question, however, is the validity of the bone growth stimulation work and the reported effects by Ubeda et al. Until this validity issue is resolved, critics will use the results of the above works to argue that the level of emissions from VDTs are not safe. The localized E-fields at the surface of an unshielded cover of a VDT nearest the flyback transformer can reach extremely high values as a result of the associated high voltage and close proximity of the transformer to the cover. Since these fields have a capability of inducing much greater currents in an exposed user of the device than the relatively low magnetic field emissions it certainly is desirable to shield the cover of the VDT. Since such shielding is relatively inexpensive the benefit to cost ratio is large. Such shielding is generally present in newer models of VDTs to satisfy FCC requirements for reducing electromagnetic interference. Since the magnetic fields emitted by the VDTs are significantly lower and induce much less current in an exposed subject, there is less need to provide magnetic shielding. Therefore unless it can be shown that there is a real hazard due to the magnetic field exposure such cost may not be warranted. Since the Ubeda, et al. (1982) work implies that there may be a hazard, however, the work should be replicated and the data carefully analyzed to determine whether further research is needed to answer the questions concerning the applicability of the results to the VDT magnetic field waveform. Such work should be carried out by a team of highly reputable teratologists and engineers to minimize or eliminate possible artifacts in the exposure systems and the biological assay protocols. Also a careful and thorough characterization of the induced fields and currents in subjects exposed to VDTs should be carried out and the levels compared to levels known to be safe, based on the most reputable scientific literature.

EPA on ELF Research

Reprinted below is the text of a letter from Sheldon Meyers, acting director of the Environmental Protection Agency's (EPA) Office of Radiation Programs, to Eugene Fisher, assistant director of the Division of Environmental Quality in New Jersey's Department of Environmental Protection in Trenton. See story on p.3.

August 24, 1984

Dear Mr. Fisher:

I am writing in response to your July 31, 1984, letter in which you and Mr. Weiss, Chairman, New Jersey Commission on Radiation Protection, petition the Environmental Protection Agency to initiate development of guidance to limit exposure of the public to electromagnetic fields from high voltage power lines.

Over the next several years, the Agency will be collecting information that will be useful in determining if there is a need to develop guidance for controlling exposure to the fields produced by high voltage power lines. Our activities will include (1) continuing to closely monitor the results of the biological effects research supported by the Department of Energy, the Electric Power Research Institute, and the State of New York, (2) continuing to support the efforts of the National Council on Radiation Protection and Measurements to collect and analyze the biological effects literature, (3) extend the capability of the Agency's biological effects research in this frequency range, and (4) continue to collect and analyze data on ambient electric and magnetic fields.

Your letter raises two very valid points. First, that some States do not have the resources to conduct the research and development necessary to promulgate exposure limits and, second, that there is a potential for individual States to adopt different limits. I hope that as work in this area proceeds we will be able to provide you the assistance you need. However, it will take at least 2 to 3 years to collect the information and perform the analyses that will be required to determine if guidance or some other method of control is required.

Sincerely yours,
Sheldon Meyers, Acting Director
Office of Radiation Programs (ANR-458)

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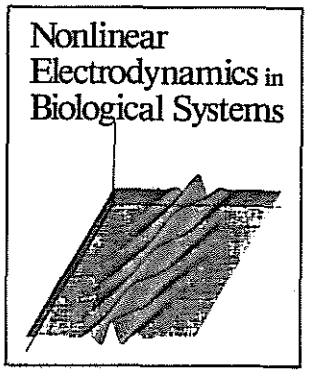
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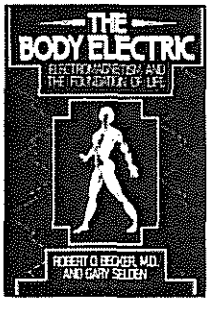
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MICRO WAVE NEWS

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CONFERENCE CALENDAR p. 8

Clarification: In our November report on birth defects and miscarriages, the time period for the cluster among Air Canada employees was two *years.*

Microwave News invites letters from its readers. We ask writers to be brief, and we reserve the right to edit contributions for length.

EPA and ERMAC To Consider RF/MW Population Standard

A number of key decisions on the development of a population standard for non-ionizing radiation are slated for this month. Senior officials of the Environmental Protection Agency (EPA) will decide whether to issue an advance notice of proposed rulemaking (ANPRM) on a safety level, and the Electromagnetic Radiation Management Advisory Council (ERMAC) and the Frequency Management Advisory Council (FMAC) have scheduled a meeting to discuss other avenues towards an interim standard.

On December 11, David Janes, Richard Tell and Norbert Hankin of EPA's Office of Radiation Programs (ORP) will brief EPA Assistant Administrator Kathleen Bennett on the status of the radiofrequency and microwave (RF/MW) population "guidance." EPA does not have the legal authority to set an enforceable standard; instead it will offer a guidance, or a recommended safety level. Soon after the meeting, Bennett will receive a decision memorandum for the publication of an ANPRM in the *Federal Register.*

EPA has been working on the guidance for a number of years. According to the agency's most recent regulatory agenda, published in the *Federal Register*

(continued p. 3)

Cost-Benefit Meeting in Ann Arbor

Thirty experts representing a wide range of interests met at the University of Michigan, November 12–13, and agreed to a joint statement on the application of cost-benefit analysis to radiofrequency and microwave (RF/MW) bioeffects. In general, the participants took a cautious view of the utility and feasibility of the technique as a formal decision-making tool.

The meeting was organized by Professor Nicholas Steneck, a historian at the University of Michigan, Ann Arbor. The context for the day and a half of discussions was set by a historical review by Steneck and by 12 invited papers. These covered a wide range of topics going far beyond cost-benefit analysis. For instance, Robert Cleveland of the Federal Communications Commission (FCC) described the responses to the commission's notice of inquiry on bioeffects and FCC policy. Dr. Zory Glaser of the Bureau of Radiological Health and Christopher Dodge of the Congressional Research Service compared the Eastern and Western approaches to standard setting. (Though Dodge co-authored a paper, he did not attend the meeting.)

Two of the participants used the meeting to point out what they perceived to be inappropriate research in the RF/MW bioeffects field. Allan Frey of Randomline criticized the direction in which research had been oriented by what he called a "small extremist group" that is not representative of the community at large. In an interview after the meeting, Frey said he had tried to document the way this group, which includes some of the best known members of the RF/MW community, Drs. A.W. Guy, Don Justesen, Sol Michaelson, John Osepchuk and Herman Schwan, was distorting science to meet the dictates of standard setting. Frey suggested, as an example, that research on the blood

(continued p. 2)

COST-BENEFIT MEETING

(continued from p.1)

brain barrier had been cut off prematurely. Dr. Rochelle Medici, a consultant now in private practice in San Marino, CA, sub-titled her paper, "Where Has All the Science Gone?" In it she challenged much of the experimental work of this same group. "It does no good to search for effects that are subtle or complex with inappropriate techniques," she wrote.

A collection of excerpts from the invited papers is presented below. The complete text of the joint statement is reprinted on the opposite page, followed by a list of those attending and endorsing it. (Drs. Richard Albanese and John Osepchuk did not agree with some of the points; see list.)

Excerpts from Invited Papers

Albanese: Thus, in a discipline such as radiofrequency radiation research, one must expect that, on the average, as the discipline matures and more bioeffect endpoints are evaluated, critical bioeffects will be found occurring at lower and lower doses....

With the presently limited available data in the radiofrequency radiation field, the use of a technique like the Delphi Technique appears unavoidable to estimate benefits....

Czerski: All RF-protection standards are mandatory in Poland, Czechoslovakia and the USSR. One of the important provisions is that all new RF generating devices have to be approved from the point of view of safety at the design stage (roughly equivalent to US premarket approval procedure). Any equipment imported from abroad has also to conform to the existing Polish standards.

Frey: Scientists, as well as science, are paying a price for what is happening in the microwave bioeffects area. Freedom of investigation is limited and there are distinct limits on what kind of data one may collect....

There are also restrictions on what data is permitted into the scientific journals....

The number of legal actions is rising....Thus, science's contribution to cost/benefit analysis in the bioeffects area will be determined by the courts. This is expensive and time consuming, and likely to force a hazard standard which is substantially lower than is necessary to protect the public....

Gandhi: Unfortunately, the adverse publicity given the alleged biohazards of non-ionizing radiation has conditioned the public to be suspicious of any and all of the applications of this energy. There is obviously a great need for public education in this regard if society is to reap the full advantages of this promising technology. There also is a need for continued and invigorated research to understand the biological effects of the electromagnetic environment on man.

Glaser & Dodge: It is also interesting to note the lack of most adverse clinical findings in Western workers who are "protected" by a recommended standard endorsed by OSHA of 10 mW/cm^2 for an 8 hour day, which is many times higher than either the Soviet, Czech or Polish standard....

How do we interpret the epidemiologic data which is apparently available from Soviet and East European sources? This is a perennial and recurring problem. We also, regretfully, do not have an answer to that question....

Groth: Cost/benefit analysis *can't* resolve the microwave problem. The primary reason is the lack of an adequate data base from which estimates of critical variables would be derived—especially in the all-important area of potential effects on human health. [author's emphasis]....

Given the crude state of fundamental understanding of how microwaves interact with living organisms, research will be raising more questions and generating more hypotheses than it will be providing firm answers, at least for many years.

Johnson: Cost/benefit analysis does not seem to fit the need of public health standards analysis, especially where the causal relationship to human health is unknown. In this area, cost/benefit analysis is an idea whose time has not come....

In spite of all the problems of unlocking the regulatory process and in spite of no reasonable proof of hazard to humans from exposure to low-level non-ionizing radiation, there is a need for an acceptable standard to be adopted by the federal government or at least one standard acceptable and uniformly enforced by every state....

Koslov: I...violently disagree with the current ANSI draft defining mid-range as 30 MHz to 300 MHz, "ramped" to a [permissible exposure level] of 5 mW/cm^2 at 1.5 GHz....I believe that the proposed contour is a grotesque violation of [as low as reasonably achievable], introducing considerable risk with little benefit to either the industry or military organizations involved....

In summary, any factual analysis of military use of electromagnetic radiation has to conclude that: • The benefits are substantial and well-recognized. • Alternative technology is not really possible. • While some effects may be present or not yet discovered, they clearly are not significant....

Medici: It is my opinion that *it is in the context of discovery that studies of microwave bioeffects are floundering*....Pre-experimental decisions about what to study and how to study it are being made in an arbitrary—and sometimes unintelligible!—way. [author's emphasis]....

The likelihood of detecting any possible effects of *weak* electromagnetic fields using [activity measures and open field tests] is virtually nil—even after long exposure. A study with such behavioral end points is only likely to *demonstrate* that if one uses an insensitive technique, no effects will be observed. [author's emphasis]....

One must question why so many behavioral/CNS studies are being done with unmodulated carrier frequencies....If one chooses to use modulation in a bioeffects experiment, it must be a modulation frequency that is relevant to both the animal of choice and the behavior being measured....

Osepchuk: The status of today's exposure standards for microwaves are primitive precisely because of the lack of human data on injury which would motivate more serious development of standards....A fact in support of the adequacy of US safety standards is the reported absence of adverse health effects from the thirty years of microwave diathermy employing partial-body exposures....

Risks of "microwaves" in today's society are trivial in general. There is general public misinformation and confusion on the subject, however. The media in large measure is responsible for this state of affairs.

The costs of the perceived risks and dealing with them are significant though difficult to calculate....

Swicord: It is not surprising that the proposed [ANSI] standard was interpreted by some as an attempt to create a thermally based standard by those who hold that temperature increase in a portion of the absorbing body is the only result of exposure to radiofrequency radiation, and this temperature increase leads to the observed biological effect....

The weighing of cost and benefit can and does play an important role in radiofrequency health protection. However, before cost/benefit anlaysis is considered the proper negotiating atmosphere must be created....

Cost-Benefit Analysis and RF Bioeffects: Some Points of Agreement and Disagreement

Summary statement drawn up at a conference in Ann Arbor, Michigan, November 12–13.

Should and can cost-benefit analysis be used when making decisions involving the biological effects of radiofrequency (RF) and microwave radiation?* This question was put to the individuals listed below at a recent meeting at the University of Michigan in Ann Arbor. As might be expected, the replies to the basic question varied enormously. Nevertheless, there was agreement on many of the issues covered and a general understanding of the main areas of disagreement. So that the common ground and understandings reached after a day and a half of intense discussion were not lost, the following list of accepted points of agreement and disagreement has been prepared for public distribution. *It should be stressed that the persons listed as subscribing to this list have done so as individuals, not as representatives of their employers or other interested parties.*

1. Keeping in mind the fact that the RF bioeffects issue is not unique, it is agreed that not all of the factors that are needed for a comprehensive cost-benefit analysis of the RF bioeffects issue can presently be quantified. *Some* costs and benefits can be quantified, but not *all* costs and benefits.
2. The first limitation notwithstanding, it is agreed that cost-benefit analysis can be part of the process used for making policy decisions relating to RF bioeffects. The usefulness of this and other analytical methods will vary with particular situations.
3. Those factors that *can be quantified* (within the bounds of commonly accepted quantification procedures and present-day knowledge) include:
   - the costs of complying with designated standards
   - the costs of undertaking medical surveillance
   - the economic impact of perceived risks
   - the benefits of RF technology.
4. Those factors that *cannot be quantified* (within the bounds of commonly accepted quantification procedures and present-day knowledge) include:
   - the costs of possible negative consequences on the health of the general population
   - the costs and benefits of perturbations in the quality of life
   - the costs of ecological impacts.
5. Opinions differed on the measurability of possible short-term human health effects in the occupational setting. Some believed that such effects are quantifiable using existing methods and data bases; others believed that they are not. The possible long-term health effects of low-level occupational or general population RF exposure are *not* quantifiable at the present time.
6. In a full and responsible cost-benefit anlaysis, all values should be made explicit and a clear division drawn between issues that properly belong to science as opposed to those that properly belong to policy. Care must be taken to prevent science from inappropriately influencing policy, or policy inappropriately influencing science.
7. A greater understanding of the mechanisms by which RF radiation interacts with living tissue could aid cost-benefit analysis significantly.

*"Cost-benefit" analysis is herein understood as the formal, largely social-science technique through which costs and benefits are estimated and weighed against one another in an attempt to assist decision-making processes. "Cost" and "benefit" are defined broadly and not restricted to monetary terms. Throughout this statement, "RF" is used to include both radiofrequency and microwave portions of the spectrum.

Attendees

Richard Albanese, Air Force School of Aerospace Medicine (not points no. 4 & 5); Peter Baragona, Concerned Citizens of Rockaway Township, NJ; Daniel Cahill, Environmental Protection Agency (EPA); Robert Cleveland, Federal Communications Commission; Przemyslaw Czerski, Bureau of Radiological Health (BRH); Allan Frey, Randomline Inc.; Om Gandhi, University of Utah; Zory Glaser, BRH; Edward Groth III, Consumers Union; Arthur Guy, University of Washington, Seattle; Charles Hall, Lawrence Livermore National Lab; Janet Healer, National Telecommunications and Information Administration; Howard Johnson, RCA; Don Justesen, VA Hospital, Kansas City; Gordon Kane, University of Michigan, Ann Arbor (UM); Samuel Koslov, Johns Hopkins Applied Physics Lab; James Lin, University of Illinois, Chicago Circle; Karel Marha, Ontario Hydro; Rochelle Medici, consultant; John Osepchuk, Raytheon (not point no. 7); Elliot Postow, National Naval Medical Center; Thomas Rozzell, Office of Naval Research; Matthew Shafner, O'Brien, Shafner, Garvey, Bartinik & Stuart; Nicholas Steneck, UM; Paul Strudler, National Institute for Occupational Safety and Health; Mays Swicord, BRH; Richard Tell, EPA; Art Vander, UM; Roby Enge, Navy Bureau of Medicine and Surgery; William Wisecup, Aerospace Corp.

Population Standard *(continued from p.1)*

on October 30, a proposed guidance is scheduled for release in September 1983. If Bennett gives her approval, EPA will set up a working group to prepare a draft proposal for inter-agency review, which should be completed by the 1983 deadline. Dr. Daniel Cahill's group at EPA's Environmental Biology Division in Research Triangle Park, NC, is now circulating a draft of the criteria document for the guidance.

Meanwhile, ERMAC and FMAC will meet in Washington, DC, on December 18 to take up the problems caused by the absence of a national standard. (The joint meeting of the two councils is unusual.) Donald Jansky, associate administrator of the National Telecommunications and Information Administration (NTIA)—the Commerce Department group which ERMAC and FMAC advise—said that the question of health standards was "under debate" and that "it is not clear what action NTIA might take." NTIA usually deals with spectrum management rather than safety issues.

After the last ERMAC meeting in July, the council sent Secretary Malcolm Baldridge a letter advising him, "as a matter of considerable urgency," to recommend the development of a national RF/MW standard. The National Association of Broadcasters (NAB) and the Communications Satellite Corporation (COMSAT) also decried the lack of a standard. "The pot has been stirred," said ERMAC's Janet Healer. (The NAB has recently set up an advisory committee on radiation regulations.)

The reaction to the NTIA move was mixed. EPA's Tell, who is responsible for guidance development, expressed his concern that an interim effort could have a "detrimental effect" on EPA's work. In any case, he went on, "I'm not convinced that an inter-agency group could get together on a numerical standard." RCA's Howard Johnson, who has long lobbied for a national standard, said he was "pleased with the initiative." Of course, any interim standard catalyzed by ERMAC or NTIA would also be advisory and unenforceable.

Johnson added that he had written to Dr. George Keyworth, the president's science advisor, petitioning the new Interagency Science/Health Coordination Group (ISHCG) to "place the need for a radiofrequency exposure standard on its docket." The ISHCG has taken over some of the work of the Interagency Regulatory Liaison Group (see *MWN*, November 1981).

Work began last October on a study of the economic impact of the EPA guidance. Under an inter-agency agreement between EPA's ORP and the Department of Energy's Lawrence Livermore National Lab in Livermore, CA, a team in the Environmental Sciences Division will estimate the cost of industry compliance for possible guidance values ranging from 10–20 uW/cm^2 to 10 mW/cm^2. Charles Hall is the lab's project officer for the $350,000 study.

According to EPA's Tell, the study will focus on the economic impacts on FM, AM, TV and satcom stations, and on radar and microwave relay towers, but will not address ELF radiation. The report, officially titled "A Proposal to Develop and Apply a Methodology to Assess the Economic Effects on Transmission Sources of Radiofrequency Radiation Guidelines Proposed by the EPA," is due to be completed by December 1982.

HIGHLIGHTS

Czech Epidemiology

Dr. Jana Pazderova-Vejlupkova from the Clinic for Occupational Diseases at the Charles University in Prague, Czechoslovakia, believes industrial RF exposure in her country presents "no problem in need of urgent resolution." The comment was part of her review of non-ionizing radiation exposure epidemiologies in Eastern Europe presented at this summer's URSI meeting.

According to Pazderova-Vejlukova, the Prague clinic's examination of 95 radio station employees found that response to the glucose-tolerance test was the only "reliable difference" between exposed workers and a control group. And current medical investigations of all Czech television workers have yet to find any signs of damage from exposure. She did cite Soviet and Polish surveys which found a higher frequency of lenticular opacities, retinal lesions, hematological effects, cardiovascular changes and electrocardiogram disturbances among workers exposed to fields in the low uW/cm^2 range.

Pazderova-Vejlupkova attributed the difference in results to a dramatic improvement in working conditions—exposure levels—over the last ten years. She concluded that "it is not surprising, therefore, that observed frequencies of field-related maladies are very low at the present time."

Pazderova-Vejlupkova closed with a plea that industrial hygienists not overestimate the subjective complaints of workers who earn hazardous duty pay for working in non-ionizing radiation fields. "Some workers will exaggerate in discussing their problems out of fear they will lose their extra pay," she wrote.

The report, edited by Dr. Don Justesen and read to the URSI conferees by Professor A.W. Guy, was not released at the meeting. It will be published in the conference proceedings.

US-USSR to Discuss Measurement Standards

A three member delegation from the USSR's Gosstandart—approximately their equivalent of our National Bureau of Standards (NBS)—is visiting the US this December as part of the Joint Working Group for Metrology under the 1972 US-USSR cooperative agreement on science and technology. One of the topics for discussion is the development of a common standard for measuring non-ionizing radiation fields that may cause biological effects. The Soviets proposed such a project in 1979, and some US scientists support the idea in the hope this project could help reconcile the differences between the two countries' exposure standards.

During their two week stay, the Soviet scientists will tour the NBS labs in Boulder, CO, the Environmental Protection Agency radiation lab in Las Vegas and the bioelectromagnetics lab at the University of Washington, Seattle, according to Dr. Arthur McCoubrey, associate director for measurement services at NBS and leader of the US metrology group.

ELF Magnetic Fields and Suicides

A joint English-American study has identified a connection between the intensity of 50 Hz magnetic fields from high voltage power lines and suicides. In what the authors believe is the first demonstrated correlation between human behavior and environmental fields, they have shown that there were significantly more suicides at locations with high magnetic fields.

Dr. F. Stephen Perry, a general practitioner living in central England, initiated the study after noting an apparent connection between depression and proximity to power lines among his patients. In 1979, Perry and members of Dr. Robert Becker's lab at the Upstate Medical Center in Syracuse, NY, reported a correlation between the calculated electromagnetic fields associated with power lines and suicides. Now, after having taken magnetic field readings at 1,184 locations, the same team has shown that the suicide rate increases with the intensity of the 50 Hz magnetic field. The most recent results were published in the August issue of *Health Physics*. (Becker has since retired and closed his lab.)

While cautioning against overgeneralizing their findings, the authors called for more detailed large-scale epidemiological studies of power line radiation and for considering electromagnetic fields when designing public facilities.

Developments at OSHA

The Occupational Safety and Health Administration (OSHA) is considering setting up a forum at which the agency can provide advice to employers on ways to shield RF heat sealers, according to Sheldon Weiner, director of OSHA's Office of Physical Agents Standards. He added that the agency is evaluating the radiofrequency and microwave (RF/MW) standard internally, and plans to ask for public comment on issues related to the standard. Weiner expects to publish a notice on the standard in the *Federal Register* early next year.

OSHA's regulatory analysis group has awarded Centaur Associates of Washington, DC, a six-month, $161,000 contract to assess the potential impact on small businesses and the economy at large of possible regulations in RF/MW radiation.

Meanwhile, the agency has still not released a standard enforcement policy for RF/MW inspections. A draft policy is awaiting approval by senior OSHA management. And informal negotiations on setting up a joint labor-management committee to reduce occupational exposures to RF/MW radiation are continuing.

Protective Fibers

The Bekaert Steel Wire Corporation of Atlanta, GA, has developed stainless steel fibers for weaving fabrics that can protect workers from radiofrequency and microwave radiation. Marketed under the name Bekinox, the fine metal fibers can be blended with any natural or synthetic fibers.

Writing in the September issue of *Industrial Fabric Products Review*, John Toon, product manager for metal fibers at Bekaert, claimed that a suit made of twill polyester cotton with ten percent stainless steel can provide at least a 27 dB reduction in radiation exposure in the frequency range from 10 MHz to 100 GHz. This would represent a 99.8 percent reduction in the amount of energy passing through the fabric. The fiber weighs 200 g/m^2 and provides protection in fields of up to 200 mW/cm^2. Under some conditions, a 40 dB reduction can be achieved.

Bekaert has also developed anti-static fabrics and radar scattering products.

In a telephone interview, Toon said that preliminary tests of a radiation shielding suit on top of the Hancock building, the site of the main TV antennas in Chicago, had been very encouraging. Plans to continue testing are under way.

Risk Assessment at BRH

The Division of Biological Effects (DBE) at the Bureau of Radiological Health (BRH) is being reorganized to put greater emphasis on risk assessment. The division, which is responsible for research on ionizing and non-ionizing radiation as well as ultrasound, has moved towards the analysis of risks over the last few years, according to DBE director, Dr. Moris Shore.

Shore did not think that the reorganization would have much impact on the non-ionizing radiation research program. "The present level of activity will be maintained, but not expanded," he said. There may be some changes in direction, however. Shore cited the possibility that the bureau will initiate work on the effects of magnetic fields now increasingly used in diagnostic devices such as NMR imaging.

The greatest changes will be for ionizing radiation research. For instance, the bureau is looking for new ways to fund its long-term study on the effects of ionizing radiation on beagles at Fort Collins, CO, because of growing expenses at a time of budget cuts. The cost of the project has doubled from $1 million in FY78. Some of the ionizing radiation work will probably be transferred to the National Cancer Institute, though no formal arrangement has yet been worked out.

Final decisions on the division's structure and staffing will be made by March. While the proposed reorganization must still be approved by the bureau's parent organizations, the Food and Drug Administration (FDA) and the Department of Health and Human Services, Shore expects the new arrangement to be in place by the end of the fiscal year.

In other changes, Dr. Alan Anderson, the past associate director of DBE, has joined the FDA's Bureau of Medical Devices as associate director for standards. Dr. Kenneth Krell is now serving as the acting associate director of DBE.

UPDATES

Biological Effects....The Air Force School of Aerospace Medicine at Brooks AFB, TX, is looking for a contractor to review and assess the RF/MW bioeffects literature for a computerized retrieval system (PMRN 82-68). SRI International has already completed a pilot study of the project, and Brooks will be issuing a technical report as soon as it returns from the printer. Brooks' James Merritt expects this to be a multi-year effort and hopes it will begin early next year....Meanwhile, the National Telecommunications and Information Administration (NTIA) has renewed its abstracting of the bioeffects literature. Bruce Kleinstein's Science Information Service in Philadelphia, PA, won a $55,000, six-month contract to resume the *Biological Effects of Non-Ionizing Electromagnetic Radiation Digest.* Kleinstein worked at the Franklin Institute, which used to do the abstracting, before he went off on his own. The last issue of the digest was dated September 1980. Kleinstein hopes to have his first issue out soon.... The New York State Overhead Power Lines Project received 164 preproposals for its research funds. The Scientific Advisory Panel selected 60 applicants to submit proposals, which are due January 15. Awards should be announced in March. The panel has scheduled a meeting for February 19-21 in New York City. There will be a public meeting at that time....A new journal will appear next year. The *Journal of Bioelectricity*, edited by Dr. Andrew Marino of the Department of Orthopaedic Surgery at the LSU Medical Center in Shreveport, LA, will publish "original work involving the electrical properties of biological tissue, natural bioelectrical phenomena and the interaction of non-ionizing radiation with biological systems—from DC to visible light—with particular emphasis on non-thermal interactions." The institutional rate will be $75.00; the cost to individuals will be $37.50. For a complimentary copy contact: Mrs. Eridania Perez, Promotion Department, Marcel Dekker, Inc., 270 Madison Avenue, New York, NY 10016....University of Maryland's Leonard Taylor reviews "The Mechanisms of Athermal Microwave Biological Effects" and a team from Seattle, WA, led by Ceon Ramon describe the inhibition of *E. coli* by weak ELF magnetic fields in the third issue of *Bioelectromagnetics*....In the same issue, a group from the Environmental Protection Agency led by Dr. Ralph Smialowicz reports that rats exposed to 970 MHz radiation for 22 hours a day for 70 days (SAR 2.5 W/Kg) had "significantly higher serum levels of triglycerides, albumin and total protein" compared to controls. They suggest a "non-specific stress reaction" may be responsible. And a joint study by the National Institute of Environmental Health Sciences and North Carolina State University has found that Japanese quail eggs exposed to 2.45 GHz continuous wave radiation (SAR 4.03 W/Kg) during the first 12 days of embryology resulted in female offspring with "reduced cell-mediated immune potential and induced general leukocytosis." Males were unaffected....The Department of Energy has issued two reports: *Tissue Interaction with Non-Ionizing Electromagnetic Fields,* by W.R. Adey *et al.* of the VA Hospital in Loma Linda, CA, February 1981 (No. DOE/ET/29078-T1 and DE81027654) and *Biomedical Effects Associated with Energy Transmission Systems: Effects of 60-Hz Electric Fields on Circadian and Ultradian Physiological and Behavioral Functions in Small Rodents,* Report for the Period January 1-December 31, 1980, by C.F. Ehret *et al.* of the Argonne National Lab (No. DOE/TIC/1027653 or DE81027653). They are available from the National Technical Information Service....A group from the University of Utah describe an empirical relationship for energy absorption in the near field and another group from Nehru University, New Delhi, India, report their measurements of the dielectric loss in biogenic steroids at 3.3 and 9.4 GHz in the November issue of the IEEE's *Transactions on Microwave Theory and Techniques*....The December issue of *Scientific American* features an article on "Magnetic Navigation in Bacteria" by Richard Blakemore and Richard Frankel.

Communications....The Bell System could lose its guaranteed share of cellular mobile communications markets. The FCC will consider its earlier ruling on market allocation at a December 17 meeting.... Meanwhile, 12 radio common carriers in the Northeast have formed a consortium to get a piece of these mobile phone markets. Cellular Systems, Inc., is described in the October 12 *Electronic News*.... Sideband Technology, Inc. (STI), of Rochester, NY, has worked out a way to fit more radio channels into a given bandwidth. Testing by Standard Oil Company (Indiana) of a mobile radio system using STI "amplitude compandored sideband" equipment was approved by the FCC this fall....A Mobile Services Advisory Committee has been set up by the FCC to hear industry and public concerns over mobile telephone and paging systems rules. Contact: Michael Menius at the commission, (202) 632-6450....The November 30 *Wall Street Journal* reports that the market for radio pagers is expected to grow to $1 billion a year within a decade from the present $400 million level.... A flood of applications have upset FCC plans for low-power television stations. A story in the October 30 *Journal* details the headaches created by the fierce competition for the 500 to 1,000 planned low-watt, low-cost stations....The FCC has so far accepted seven proposals for digital electronic message systems (DEMS), a new tech-

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nology for microwave-relayed private phone service.... *In response* to a request from M/A-COM Inc., the FCC has extended the comment period for its rulemaking on digital termination systems to January 14, 1982 (46 *FR* 55124, November 6). (See *MWN*, October 1981.) ...The FCC has ruled against reducing AM channel spacing to 9 kHz from 10 kHz (46 *FR* 56214, November 16). The commission found the benefit of more stations at 9 kHz spacing would not outweigh the problem of possible interference and the excessive costs to alter broadcast facilities....The FCC regulatory agenda was published in the November 17 *Federal Register*.... Pacific-Sierra Research Corp. will analyze ultra-low-frequency propagation data for the Office of Naval Research (*Commerce Business Daily*, November 30, 1981).

Government.... Battles over budgets are continuing in Washington. The Office of Management and Budget has proposed cutting the Environmental Protection Agency's (EPA) Office of Research and Development (ORD) budget by 51% for FY83, according to the *New York Times*....Testifying before a subcommittee of the House Committee on Science and Technology on October 22, EPA Administrator Anne Gorsuch said that she considered the ORD program "critically important to the goal of more informed decision making." But she felt the headquarters office was too "top heavy" with an "astonishing" 31 percent of the 230 staffers employed as managers.... *And* the Center for Disease Control (CDC), which has been trying to bring most of the National Institute for Occupational Safety and Health *(NIOSH) down to Atlanta, now has troubles of its own.* The *Washington Post* reports that CDC may have to lay off between 350 and 780 of its 3,700 employees if planned budget cuts go through.... EPA's Office of Radiation Programs (ORP) issued a revised publications list on October 23. For a copy write to: EPA, ORP (ANR-461), 401 M Street, SW, Washington, DC, 20460.... According to the draft agenda for the Bureau of Radiological Health's (BRH) Technical Electronic Product Radiation Safety Standards Committee (TEPRSSC) December 9–10 meeting, William Herman will present a status report on the bureau's microwave oven amendment and Dr. Mays Swicord will present a short briefing on RF sealers....When the government closed down on November 23, researchers at EPA's ORD Research Triangle Lab were allowed to continue their experiments; they were deemed "essential."

Litigation.... Hellen Formakis lost her $1 million suit alleging a malfunctioning Tappan microwave oven caused burns on her hand. A jury in the Bronx County Supreme Court, NY, found for the defendant, the Tappan Company, on November 30. Formakis had claimed she was injured when her 1976 counter-top model continued to operate after she opened its door. Tappan's counsel, Remo Acito of Acito and Klein in New York City, maintained that the oven worked properly and that, in fact, no injury was sustained. The attorney for Formakis, Cecile Weich of Bronx, NY, said lack of funds will prevent an appeal....The family of seaman Charles Day is attempting to file suit against the US government for his "wrongful" and unexplained death at age 19 while serving in the Navy. Their son, who died of cardiac arrythmia after a prolonged illness, had been assigned to a NATO base in Naples, Italy. The Navy has refused to divulge the nature of Day's work, though Christopher Scanlan reports in the October 11 *Providence Sunday Journal* that Day helped install microwave equipment. (The article is reprinted in the October 29 *Congressional Record*, p. S12613.) Senator Claiborne Pell (D-RI) introduced private bill S493 on February 18, 1981 (*CR*, p. S1351) to permit the Days to try and force the Navy to provide them with more information....A decision on New York Telephone's appeal of Nettie Yannon's successful worker's compensation claim (see *MWN*, April 1981) is expected next spring.... A defense motion to dismiss Yannon's suit against RCA is scheduled to be argued on January 8 in the New York Supreme Court, Richmond County, according to Jerome Ellis of Staten Island, NY, co-counsel for Yannon in this case....The Microwave Radiation Information & Action Center (MRIAC) is open for business. (See *MWN*, September 1981.) A brochure and membership information are now available and the center's first bimonthly newsletter is scheduled for early next year. The sliding scale of fees for members range from $180 for attorneys with active cases to $20 for the newsletter. Contact: J. Stuart Lemle, MRIAC, 1320 19th Street, NW, Washington, DC 20036.

Medical Applications.... Some 200 scientists, clinicians and engineers attended the first annual meeting of the Bioelectrical Repair and Growth Society (BRAGS) in Philadelphia, PA, November 9–11. BRAGS President Dr. Carl Brighton of the University of Pennsylvania medical school was impressed by the "tremendous enthusiasm" of the participants, as was Columbia University medical school's Dr. Andrew Bassett, though the latter was disturbed by the "general lack of understanding of the pitfalls of the research." The abstracts of the meeting's 87 papers and posters are available for $10.00 from: N. Thiede, 425 Medical Education Building, 36th and Hamilton Walk, Philadelphia, PA, 19104. Next year's meeting is scheduled for Oxford, England, in September (see Calendar p. 8).... There will be a special symposium on "Electrochemistry for the Study and Control of Cell and Tissue Growth and Repair" at the Electrochemical Society meeting in Montreal, May 9–14. Contact: A.A. Pilla, Bioelectrochemistry Lab, Columbia University, 630 West 168 St., New York, NY 10032....*The surge of research using* nuclear magnetic resonance (NMR) continues, with England leading the way. A team from Oxford applied P-31 NMR to diagnose muscle disorders. (D. Gadian *et al.*, "Examination of a Myopathy by Phosphurus Nuclear Magnetic Resonance," *Lancet*, October 10.) EMI and London's Hammersmith Hospital researchers scanned the brains of patients with MS and demonstrated abnormalities "on a scale not previously seen except in necropsy." (I.R. Young *et al.*, "Nuclear Magnetic Resonance Imaging of the Brain in Multiple Sclerosis," *Lancet*, November 14). A group from Aberdeen have used the technique on alcoholics and found, contrary to popular thinking, that "water intoxication might be an important part of the delirium tremens syndrome." (J.A.O. Besson *et al.*, "Nuclear Magnetic Resonance Observations in Alcoholic Cerebral Disorder and the Role of Vasopressin," *Lancet*, October 24.) And a joint US-UK study by Yale and Oxford Research Systems scientists shows that naturally occurring C-13 NMR can be used to study disorders of fat metabolism and carbon labeled substrates for investigations of carbohydrate metabolism. (J.R. Alger *et al.*, "In vivo Carbon-13 Nuclear Magnetic Resonance Studies of Mammals," *Science*, November 6.)...But Glasgow's Thurstan Brewin issued a note of caution about ordering too many scans in the November 14 *Lancet*: "Perhaps, before [NMR] and other advances place still further temptations in our path, we should spend a little more time discussing the principles involved."... Andrew Scott presents a general introduction to NMR and its applications in the November 12 *New Scientist*....The first issue of the new journal, *IEEE Transactions on Medical Imaging, will appear next* spring. Dr. Michael Ter-Pogossian of Washington University School of Medicine, St. Louis, MO, is the editor-in-chief. The subscription price for IEEE members will be $8.00; others will have to pay $50.00 a year. For a sample copy contact: Martin Plotkin, Brookhaven National Lab, Bldg. 902A, Upton, NY 11973....The program for the March 15–18 *International Workshop on Physics and Engineering in Medical Imaging* is now available. (See conference calendar p. 8 for address.)...NMR diagnostics is only one of the many topics to be addressed at the National Council on Radiation Protection and Measurements (NCRP) annual meeting next April 6–7 in Washington, DC. Bureau of Radiological Health (BRH) Director John Villforth will be one of the speakers at the session on "Radiation Protection and New Medical Diagnostic Approaches." For more information contact: NCRP, (301) 657-1652....The Public Health Service's Office of Health Research, Statistics and Technology (OHRST) is assessing "what is known of the safety and clinical effectiveness of diathermy." OHRST seeks all relevant information on shortwave, microwave and ultrasound diathermy in order to assist the Health Care Financing Administration in establishing Medicare coverage policy (46 *Federal Register* 58599, December 2). Comments are due March 2. For more information contact: Dennis Cotter, (301) 443-4990....BRH's Donald Witters and Gideon Kantor have just published "An Evaluation of Microwave Diathermy Applicators Using Free Space Electric Field Mapping," in *Physics in Medicine and Biology*, an English journal (*26*, 1099, 1981). They show that a prototype applicator, specially

designed by BRH, is superior to those now on the market in terms of uniformity and effectiveness of energy deposition and minimal radiation leakage.... Researchers at the University of Utah are continuing their work on the measurement of lung water content. The most recent paper is in the December issue of the *IEEE Transactions on Biomedical Engineering*.... Dr. Robert Gordon of Lutheran General Hospital outside Chicago has received a third patent on the injection of magnetic particles to collect applied fields, according to the November 28 *New York Times*.... In its annual report, Clini-Therm Corp. of Dallas, TX, announced its intent to produce and ship about 40 hyperthermia systems in 1982.

Military Systems.... The House and Senate Appropriations Committees are divided about the new proposal for Project ELF. On November 18, the House committee rejected an appropriation for $34.9 million for the project. The Senate, however, recommended that amount be spent. The difference must now be hammered out in a Senate-House conference scheduled for December 9.... There have been allegations that the ELF signal will be modulated at 16 Hz. A Navy spokesman denied this, explaining: "The ELF signal is transmitted by sending a sequence of zeros and ones; a total of 16 zeros and ones are transmitted each second. Zeros are sent by energizing the antenna with 72 Hz current, and ones with 80 Hz current. This is minimum shift keying modulation, which generates a continuous frequency spectrum in the 71-81 Hz frequency band. Accordingly, no measurable signals are transmitted by the antenna at 16 Hz. Essentially, the minimum shift keying has nothing to do with human resonance."... Meanwhile, the Navy is continuing to develop the blue-green laser. The Naval regional contracting office in Long Beach, CA, awarded Mathematical Sciences Northwest, Inc., of Bellevue, WA, $9,482,174 on September 30 to develop a mercury bromide laser.... Professor Michael Callaham of Carnegie-Mellon University has published a review article on "Submarine Communications" in the November issue of *IEEE Communications Magazine*.... The Air Force issued a request for a contractor to write an environmental impact statement (EIS) for its PAVE PAWS radars at Robins and Goodfellow AFBs. One EIS will cover both installations (*Commerce Business Daily*, November 4).... The AF's armament division at Eglin AFB, FL, is developing a safety program, which will include electromagnetic radiation hazard analysis (*CBD*, November 24).... The Rome Air Development Center at Griffis AFB, NY, is looking for a contractor to work on millimeter wave communications—in the 30-50 GHz range (*CBD*, October 27).

Occupational Health.... The National Institute for Occupational Safety and Health (NIOSH) in Cincinnati, OH, is looking for a contractor to write a report listing companies in the US currently using more than 30 dielectric heaters operating in the 3-100 MHz range (RFQ 82-14).... The Environmental Health Directorate of the Canadian Department of Health and Welfare has issued a report, *Dielectric (RF) Heaters: Guidelines for Limiting Radio-Frequency Exposure* (No. 80-EHD-58). Copies are available from: Information Directorate, Department of National Health and Welfare, 5th Floor, Brooke Claxton Building, Ottawa K1A OK9, Canada.... Two GE walkie talkies were withdrawn from use at the Toronto *Globe and Mail* last year after measurements indicated that they caused radiation levels above the current exposure standard. One of them had a recorded level of 22.5 mW/cm^2, according to a check by Dr. Anthony Muc of the Ontario Ministry of Labour.

Ovens.... The November issue of *Consumer Reports* rates four combination microwave/convection ovens manufactured by Sharp, Panasonic, Quasar and Amana.... The Association of Home Appliance Manufacturers (AHAM) reports that 430,500 microwave ovens were shipped from the factory in October, down 5.1 percent from last year. Nevertheless, shipments are up 23.9 percent for the year for a total of 2,840,700. (See also Litigation Update.)

Radar & Technology.... The National Highway Traffic Safety Administration (NHTSA) has decided to scrap its proposal to set performance standards for speed measuring devices (see *MWN*, February 1981). The National Bureau of Standards (NBS) still intends to publish a list of devices that meet its radar specifications. (46 *Federal Register* 56823, November 19). According to NHTSA's Kathy DeMeter, states will now be free to use federal funds for the purchase of any radars they wish, whether or not they meet the NBS criteria.... A two-part overview of "Space-Based Radar" is featured in the September and October issues of *Military Electronics/Countermeasures*.... Raytheon's Albert Jelalian reviews laser radar in the November *IEEE Spectrum*.... The Federal Aviation Administration (FAA) is requesting comments on a draft Technical Standard Order (TSO-C104), which prescribes a minimum performance standard for microwave landing systems (see *MWN*, February 1981). For more information contact: FAA's Bobbie Smith, (202) 426-8395 (46 *FR* 54958, November 5).... The November-December issue of *Radio Science* presents a special collection of papers presented at the *Munich Symposium on Electromagnetic Waves*.... The program for the *National Radio Science Meeting* to be held in Boulder in mid-January is now available (see conference calendar p.8).... The Department of Energy has issued the final report of work done by GE, *Analysis and Measurement of Electric Fields from DC Transmission Lines* (No. DOE/CE/29006-1), May 1981. It is available from the National Technical Information Service, $11.00 printed copy, $4.00 microfiche.... A laser-induced device for generating millimeter waves is described in the November *IEEE Transactions on Microwave Theory and Techniques*.... The Georgia Institute of Technology is holding a short course on *Millimeter Wave Systems and Technology*, January 26-28 in Atlanta. Fee: $420. Contact: (404) 894-2400.

Satellite Communications.... Local zoning board approval for a Communications Satellite Corp. (COMSAT) satcom station in Cleveland Township, PA, was not challenged before the period for appeal expired in late October. Following FCC approval, COMSAT plans to solicit contracting bids for the facility and begin construction next year.... NASA will hold its third industrial briefing on the 30/20 GHz communications satellite program on April 20-21 in Cleveland, OH. Contact: Joseph Sivo, Space Communications Division, NASA, Lewis Research Center, Cleveland, OH 44135.... Alascom, the Alaskan phone company, proposes to build a satcom station on Vashon Island to serve nearby Seattle, WA. Two 47-foot-diameter antennas are planned for the site. Vashon is south of Bainbridge Island where RCA plans to build a similar station.... The benefits of creating more orbital slots by reducing satellite spacing to 2° from 4° must be weighed against the costs of upgrading existing ground facilities, including antennas, according to an analysis in the November issue of *Satellite Communications*. The official FCC proposal for 2° spacing was published in the November 20 *Federal Register*.... The FCC accepted eight out of 14 applications to develop direct broadcast satellite service. In the October 22 action (46 *FR* 54796, November 4), the commission accepted applications from CBS, Direct Broadcast Satellite Corp., Focus Broadcast Satellite, Graphic Scanning Corp., RCA American Communications, US Satellite Broadcasting Co., Video Satellite Systems and Western Union Telegraph Co. Five applications were rejected for being incomplete. An application from Satellite Television Corp. had already been accepted.... A Frost & Sullivan study predicts a booming market for satellite services by the end of the decade. In fact, it forecasts demand will outpace supply. Contact: Frost & Sullivan, 106 Fulton Street, New York, NY 10039; Report No. 954, $1,150.... Satellite Television Corp., a subsidiary of COMSAT, plans to introduce a two-channel pay television service for the northeastern US in late 1983. The November 20 *Washington Post* reports that the television programming service would be distributed to subscribers in multiple resident buildings through a master antenna system. COMSAT must win FCC approval for the plan.... The Air Force wants to develop an airborne UHF satcom terminal. The 100-watt unit should weigh 40 pounds (*Commerce Business Daily*, November 9, 1981).... The Air Force Communications Command recently demonstrated a portable UHF satcom terminal for use in the field. According to the November issue of *Military Electronics/Countermeasures*, production models of the seven-pound mobile unit are expected next year.... Scientific-Atlanta's 7th Satellite Com-

(continued p. 8)

(continued from p. 7)

munications Symposium drew over 600 participants to Atlanta on November 2–4. A company spokesman said the enthusiastic participation of the business community was the most significant trend signaled by this year's gathering.... A low-cost, one-meter-diameter antenna has been designed for 12 GHz direct broadcast television in Europe. The receiver system, designed by a French firm, is described in the November 17 *Electronics*.... RCA's auction of seven leases for transponders on its Satcom IV satellite, scheduled for a January launch, brought $90.1 million in winning bids at Sotheby Park Bernet in New York City on November 9. FCC approval of the auction is still pending.... RCA successfully launched its Satcom III-R on November 19. Satcom III disappeared soon after its December 1979 blast-off.

Standards.... Only one comment was submitted to the Institute of Electrical and Electronics Engineers (IEEE) and the American National Standards Institute (ANSI) on the proposed, revision of ANSI's safety standard (C95.1). RCA's Howard Johnson registered his objections. (See *MWN*, May 1981.) The comment period expired December 1.... ANSI has now published the new C95.5-1981 standard "Recommended Practice for the Measurement of Hazardous Electromagnetic Fields—RF and Microwave." A copy is available for $6.00 from ANSI's Sales Department, 1430 Broadway, New York, NY 10018.

VDTs.... The Ontario Ministry of Labour's Advisory Council on Occupational Health and Occupational Safety has set up a task force on video display terminals (VDTs). The seven member group will investigate possible health hazards, including cataracts, discomfort, degradation of visual acuity and excessive fatigue. The task force, chaired by Dr. Gordon Stopps of the University of Toronto's Occupational and Environmental Health Unit, met for the first time on November 2. The other group members are: Drs. Steven Garnette, J. Purdham and Robin Roberts of McMaster University; Dr. E. Kaegi of C-I-L Inc.; Dr. John Parker of the University of Toronto; and Professor Stan Stuchly of the University of Ottawa.... A bill addressing VDT radiation as well as ergonomic issues was introduced in the Ontario provincial legislature on November 17 by Richard Johnson. The "VDT Operators' Safety Act, 1981," would prohibit the sale or lease of any terminal emitting radiation other than visible light, insure operators the right of alternative work during pregnancy and provide standards for VDT work. For more information contact: (416) 965-7771.... The National Academy of Sciences' Committee on Vision is preparing a summary and overview of key issues discussed at its symposium on VDTs and vision this August. (See *MWN*, September 1981). The paper will be published in the journal, *Behavior and Information Technology*, early next year. A VDT literature review by Dr. Marvin Dainoff, a visiting scientist at NIOSH's Division of Biomedical and Behavioral Sciences, is scheduled to appear in the same issue.... Fumes, caused by the over-heating of a transistor in a VDT, have been linked to an operator's headaches, according to the November 27 Newspaper *Guild Reporter*.

Etc..... Janet Raloff of *Science News* and William Broad of *Science* won National Association of Science Writers awards for their articles on electromagnetic pulse (EMP) radiation (see *MWN*, June 1981).... A new band, "Los Microwaves" is on tour. A New York *Soho News* critic described them this way: "LA 'technicano': smart, sharp, sassy, hook-laden, Latin-infected electro-pop with plenty of bounce to the ounce. Check 'em out."

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CONFERENCE CALENDAR

• December 7–12: 6th International *Conference on Infrared and Millimeter Waves*, Carillon Hotel, Miami Beach, FL. Contact: K.J. Button, MIT National Magnet Laboratory, Cambridge, MA 02139.

• December 29–30: *International Symposium on Microwaves and Communications*, Kharagpur, India. Contact: Professor B. Chatterjee, Department of Electronics and Electrical Communication Engineering, Indian Institute of Technology, Kharagpur-721302, India.

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• January 13–15: *National Radio Science Meeting*, University of Colorado, Boulder, CO. Contact: S.W. Maley, Dept. of Electrical Engineering, University of Colorado, Boulder, CO 80309.

• March 15–18: *International Workshop on Physics and Engineering in Medical Imaging*, Asilomar Conference Grounds, Pacific Grove, CA. Contact: University Extension, University of California, PO Box AZ, Irvine, CA 92716.

• March 29–April 2: 3rd *International Congress of Thermology*, Bath, England. Contact: Congress Secretariat, Martlet Conference Services, 24 Preston Street, Brighton, Sussex BN1 2HN, England.

• April 21–23: *Biomedical Engineering Society Annual Meeting*, New Orleans, LA. Contact: Dr. Yoram Ruby, Department of Biomedical Engineering, Case Western Reserve University, Cleveland, OH 44106.

• May 24–28: *International IEEE/APS Symposium, National Radio Science Meeting and Nuclear Electromagnetic Pulse Meeting*, University of New Mexico, Albuquerque, NM. Contact: Dr. Kendall F. Casey, Dikewood Corp., 1613 University Blvd., NE, Albuquerque, NM 87102.

• June 7–8: 1st *Southern Biomedical Engineering Conference*, Louisiana State University Medical Center, Shreveport, LA. Contact: Dr. S. Saha, Department of Orthopaedic Surgery, Louisiana State University Medical Center, PO Box 33932, Shreveport, LA 71130.

• June 15–17: IEEE MTT-S *International Microwave Symposium*, Hyatt Regency Hotel, Dallas, TX. Contact: J.R. Griffin, Texas Instruments, Mail Stop 3432, PO Box 405, Lewisville, TX 75067.

• June 28–July 2: 4th Annual *Bioelectromagnetics Society Meeting*, Beverly Wilshire Hotel, Beverly Hills, CA. Contact: BEMS, 1 Bank Street, Suite 307, Gaithersburg, MD 20878.

• July 25–30: 17th Annual Symposium of the *International Microwave Power Institute*, Town and Country Hotel, San Diego, CA. Contact: IMPI, 211 East 43rd Street, New York, NY 10017.

• August 11–13: 4th *Satellite Communications Users Conference*, Regency Inn, Denver, CO. Contact: Satellite Communications Magazine, 3900 S. Wadsworth Blvd., Denver, CO 80235.

• September 6–10: 7th *Colloquium on Microwave Communication*, Budapest, Hungary. Contact: Secretariat of the 7th Microcoll, H-1525, Budapest 114, POB 15, Hungary.

• September 20–21: 4th Annual *Conference of the IEEE Engineering in Medicine and Biology Society*, Marriott Hotel, Philadelphia, PA. Contact: Dr. Alfred R. Potvin, Department of Biomedical Engineering, PO Box 19138, University of Texas, Arlington, TX 76019.

• September 20–22: 2nd Annual *Meeting of the Bioelectric Repair and Growth Society*, Oxford, England. Contact: Dr. B.F. Sisken, Wenner Gren Research Laboratory, University of Kentucky, Lexington, KY 40506.

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Microwave News *invites letters from its readers. We ask writers to be brief, and we reserve the right to edit contributions for length.*

1982 RF/MW Litigation Survey

Litigation over siting new radiofrequency and microwave (RF/MW) installations is on the rise, according to our 1982 case survey. Companies and local residents have turned to the courts to resolve disputes in four states. With many other siting applications now meeting local opposition, these cases may well mark the beginning of an important new trend.

The survey also reveals that most product liability claims are still being settled out of court, following the pattern reported in last year's survey (see *MWN*, April 1981). Several plaintiffs have dropped suits in exchange for settlements which stipulate that the terms remain confidential. The Delsesto and Spinella microwave oven case, for example, was dismissed with the consent of both parties after one day of trial last March: neither side would discuss the details. And news of the Karras $200,000 settlement for various severe injuries he claims resulted from working on radar leaked out months after the suit was quietly dropped last year.

The announced pre-trial settlements of the Kerch case for $30,000 this spring and the Foley case for $25,000 last year were exceptions to the rule. Both men alleged radiation-induced cataracts from exposure to radar. New cataract claims were filed late this year by former radar technicians Coatney and Becker.

Because no radar case has yet been decided by a jury, lawyers are closely watching the Engell suit against ITT, which is scheduled to go to trial this month. Lawyers for Robert Engell, a former radar technician who now has cancer, settled out of court with four other defendants this November, agreeing not to discuss the awards.

The major occupational exposure case to come before a workers' compensation board is now closed. This year a New York state appeals court upheld Antoinette Yannon's award for the death of her husband. Mrs. Yannon successfully maintained her husband's death was caused by chronic radiation exposure while tuning television relay equipment for New York Telephone. In a separate action, Mrs. Yannon is appealing the dismissal of her product liability suit against RCA, a manufacturer of relay equipment.

In litigation against the US government, George Watson has appealed the dismissal of his claim that he suffered genetic damage from exposure to microwaves at the US embassy in Moscow, which caused birth defects in his son. Other embassy cases are still pending.

Plaintiffs in several cases reported this year have turned to the Microwave Radiation Information and Action Center (MRIAC) for assistance. (See *MWN*, September 1981.) J. Stuart Lemle reports that the center is no longer a membership organization, but is now offering consulting services. Lemle is handling one of the Moscow embassy cases.

Summaries of over 30 cases, which are either in progress or have been recently settled, appear on pp. 2–4 and are followed by a list of participating attorneys. (The names of attorneys who are on the list appear in italics in the case summaries.) Included whenever possible are counsel for both plaintiffs and defendants and case numbers. Because a number of attorneys refuse to discuss litigation, however, the list is not complete.

1982 RF/MW LITIGATION SURVEY: CASE SUMMARIES

Siting Cases

In Progress:

• RCA Americom filed suit against Kitsap County, WA, and its Board of Commissioners on November 17, 1982. Claim: no basis to indicate that Americom's proposed satellite communications station poses health hazards. Specific information submitted by Americom not considered in board deliberations. Company wants court to set aside board ruling denying company's application and to direct county to issue permit. Status: county deputy prosecutor ordered application returned to board on December 3. Board must now reconsider all material and issue another ruling. Attorney for plaintiff: *William Rives.* Attorney for defendant: Patricia Shafer, Kitsap County, WA, deputy prosecutor. See *MWN,* May, July/August and November 1982. [*RCA American Communications v. Kitsap County,* State Superior Court for Kitsap County, Port Orchard, WA, No. 82-2-01177-2.]

• Vashon for Quality Environment (local citizens group) filed a petition against the King County Council, WA, the County Zoning and Subdivision Examiner and Alascom Inc. in October 1982 to block further construction of a satellite communications station. Claim: improper procedures followed by zoning examiner in refusing group's appeal of building permit issued to Alascom in September 1982. Also challenging legality of zoning examiner's permit and variance. Seeking review of proceedings and voiding of county action. Status: pending. Attorney for petitioner: *Michael Gillett. [Vashon for Quality Environment v. King County et al.,* State Superior Court for King County, Seattle, WA.]

• Carole Halloran and other local residents filed suit against the Coventry, CT, Zoning Board of Appeals and US Transmission Systems, an ITT subsidiary, in May 1982. Claim: board acted improperly in processing ITT application to build microwave relay tower. Citizens seek reversal of board's April 20 approval of tower, which they believe poses a health hazard. Status: trial date expected for early next year. Attorney for plaintiffs: *Lawrence Bates.* Attorney for defendant, ITT: *William Hall.* See *MWN,* June 1982. [*Halloran et al. v. Coventry Zoning Board of Appeals and US Transmission Systems,* State Superior Court for Tolland County, Rockville, CT, No. CV-82-27799.]

• Leo and Muriel Shuerman filed suit against Pacific Telephone and Telegraph in 1980 and amended complaints in September 1980 and August 1981. Claim: point-to-point relay transmitter sited near their property and sending a beam across it renders property valueless and may pose health hazards. Seeking inverse condemnation (PT&T, as a quasi-public agency with power of eminent domain, would be required to buy the property) and $10 million in punitive damages. Status: trial date set for April 4, 1983. Attorney for plaintiffs: *Joe Aklufi.* See *MWN,* April 1982. [*Shuerman v. Pacific Telephone and Telegraph,* State Superior Court for Riverside County, Riverside, CA, No. 136703.]

• Filmways Communications of Syracuse, NY, filed suit against the town of Onondaga, NY, in November 1981. Claim: town's 1980 moratorium on construction of new broadcast sources infringes on company's first amendment rights. Company, which wants to build a TV station, seeks lifting of ban (see *MWN,* October 1982) and more than $5 million in damages. Status: pre-trial discovery. Attorney for plaintiff: *Robert Bernius.* Attorney for defendants: *Raymond D'Agostino. [Filmways Communications v. Town of Onondaga et al.,* US District Court for Northern District of New York, No. 81-CV-1293.]

• Attorney *Michael Prigoff* is investigating a possible suit against the operator of a "microwave tower" sited in a residential community. Concern in community that long-term radiation exposure is responsible for cluster of various tumors, some cancerous, among residents.

Concluded:

• Cylix Communications Network of Memphis, TN, and Anthony Capodanno lost their appeal of a Township of Haverford, PA, zoning board ruling blocking construction of a low-power satellite communications station in May 1982. Claim: board abused its discretion in denying zoning variance. Status: zoning board ruling upheld. Attorney for plaintiff, Cylix: *John Trevaskis, Jr.* See *MWN,* October 1981. [*Capodanno and Cylix Communications Network v. Zoning Hearing Board of Haverford,* Court of Common Pleas of Delaware County, PA, No. 81-15321.]

• WIXT Television and Albert and Beatrice Peck lost their appeal of an Onondaga, NY, Zoning Board of Appeals decision blocking construction of a TV transmission tower in May 1979. Claim: board's determination was unsupported and arbitrary. Maintained hardship was grounds for land use variance and that tower would pose no health hazards in case filed February 1979. Status: after the judicial review opinion of May 21, 1979, town went on to impose moratorium on new broadcast sources in 1980. Attorney for intervenors in opposition to applicants: *Robert Liegel.* [*Peck and WIXT Television v. Petrie et al.* (Town of Onondaga Zoning Board of Appeals), State Supreme Court for Onondaga County, NY.]

• William Pomeroy's application for a transmitting tower in LaFayette, NY, was denied in 1979. Town ruling cited potential health hazards. Decision followed May 1978 ruling against WIXT proposal by Onondaga, NY (see above). Status: decision not appealed to court. Attorney for intervenors opposed to application: *Robert Liegel.*

• MCI Telecommunications' application for a transmitting tower in Skaneateles, NY, was denied in 1980. Town ruling cited potential health hazards. Decision followed ruling against WIXT proposal by Onondaga, NY (see above). Status: decision not appealed to court. Attorney for intervenors opposed to application: *Robert Liegel.*

Radar Cases

In Progress:

• Robert Engell filed suit against General Dynamics, ITT, Raytheon, Rockwell International and Varian Associates in March 1977. Claim: radiation exposure while working on TACAN and other radars from 1964 to 1975 caused pancreatic cancer. Status: out of court settlements reached with all but ITT in November 1982. ITT trial expected to begin in December, jury selection completed in November. Attorneys for plaintiff: *Marc Moller* and *Matthew Shafner.* Attorney for defendant, ITT: *John FitzGerald.* See *MWN,* November 1982. [*Engell v. ITT,* US District Court for Connecticut, Hartford, CT, No. H77-130.]

• Robert Barbee filed suit against Bendix, General Electric, Raytheon, RCA, Reeves Instrument, Western Electric and Zenith Radio in Mississippi in October 1982. Claim: radiation exposure while serving as a radar technician in the armed forces from 1942 to 1951 caused cataracts. Status: waiting for pleadings from defendants. Case previously filed in 1979 in Nevada and dismissed in the Ninth Circuit Court of Appeals because of statute of limitations in Nevada. Attorney for plaintiff: *James Cothren.* Previous attorney for plaintiff: *Brent Leavitt.* [*Barbee v. Bendix et al.,* Circuit Court for the First Judicial District of Hinds County, Jackson, MS. Initially filed in US District Court for Nevada, Las Vegas, NV, No. CV-LV-79238.]

• Joseph Coatney filed a claim with the Veterans Administration (VA) in 1981 and filed suit against General Dynamics, Hughes Aircraft and Westinghouse in 1982. Claim: radiation exposure from onboard radar while serving in navy for six years caused cataracts. Status: Claim for VA benefits still pending. Suit against radar manufacturers pending. Attorney for plaintiff: *John Sweeney.* [Administrative agency: VA. Court: State Superior Court, Los Angeles, CA.]

• Frederick Becker filed a claim with the VA several years ago and is in the process of filing suit against radar manufacturers. Claim: radiation exposure from radar on aircraft he serviced while in armed forces caused cataracts and other injuries. Attorney for plaintiff: *John Sweeney.*

• William Farnham filed suit against Hughes Aircraft, Northrop Aviation and Rockwell International in October 1978. Claim: radiation exposure in air force aircraft from 1951 to 1973 caused cataracts. Status: pre-trial. Defendants' offer to settle not accepted, though out of court settlement still possible. Attorney for plaintiff: *Seymour Ellison.* [*Farnham v. Northrop Aviation et al.*, State Superior Court, San Francisco, CA, No. 744782.]

• Glenn Lough filed suit against ITT, Raytheon, Sperry Rand and Western Electric in 1978. Claim: radiation exposure in 1955 and 1956 while in the armed forces caused cataracts. Status: pre-trial. Attorney for plaintiff: *Seymour Ellison.* [*Lough v. Raytheon et al.*, State Superior Court, San Francisco, CA, No. 744781.]

• Don Turner filed suit against Hughes Aircraft, Lockheed, McDonnell Douglas Aircraft and Northrop Aviation in May 1978. Claim: radiation exposure aboard US aircraft from 1954 to 1967 caused cataracts. Status: pre-trial. Defendants' offer to settle not accepted, though out of court settlement still possible. Attorney for plaintiff: *Seymour Ellison.* [*Turner v. Lockheed et al.*, State Superior Court, Los Angeles, CA (moved from State Superior Court, San Francisco, 738065).]

• Stanley Burgis filed suit against Western Electric in 1980. Claim: radiation exposure from M-33 radar he worked on for nine months between 1952 and 1954 while in the army caused cataracts and retina damage. Status: pre-trial. Attorney for plaintiff: *Jeffrey Slopford.* [*Burgis v. Western Electric,* US District Court for Eastern Pennsylvania, Philadelphia, PA (moved from Pennsylvania state court soon after initial filing).]

• Attorney *Richard Leonard* is preparing a case for a former B-47 aircraft crew member. His client alleges one hour of close-range exposure to an electronic countermeasures device mounted under a plane caused severe injuries. Exposure occurred in the 1960s. Leonard seeking medical experts to support the claim, which is not yet filed.

Concluded:

• Joseph Kerch settled his suit against Air America in spring 1982. Claim: radiation exposure from on-board radar and navigational equipment while working as a pilot caused cataracts. Prior to Air America, Kerch served in the air force for 20 years. This workers' compensation case filed in December 1980 under the Defense Bases Act. Status: settled out of court for $30,000. Attorney for plaintiff: *Matthew Shafner.* [*Kerch v. Air America,* Department of Labor, Office of Administrative Law Judges, No. 15-19092 80-LHCA-1388 and No. 15-16930 80-LHCA.]

• Leo Foley settled his suit against General Electric, Hazeltine, Hughes Aircraft, Lockheed Aircraft, Philco-Ford, Raytheon and Telerad-Lionel in 1981. Claim: radiation exposure while serving on EC-121 constellation aircraft between 1957 and 1975 caused cataracts. Case filed April 1979. Status: settled out of court for $25,000. Attorney for plaintiff: *Seymour Ellison.* See *MWN,* November 1981. [*Foley v. Lockheed Aircraft et al.*, State Superior Court, Sacramento, CA, No. 280696.]

• Ronald Karras settled his suit against General Electric and Western Electric early in 1981. Claim: exposure to radiation while working on Nike Hercules radars for 14 years resulted in multiple injuries, including bleeding eyes, deafness and systemic hemorrhaging. Status: settled out of court for $200,000. Attorney for plaintiff: John Phillips of Chicago, IL. See *MWN,* July/August 1981. [*Karras v. General Electric and Western Electric,* Cook County Circuit Court, IL, No. CV-79-L-20237.]

Oven Cases

In Progress:

• Mildred Beadles, Delores Terhaar and Patricia Seelye filed suit against Litton Industries, Litton Microwave Division, and City Electronics in December 1980. Claim: a malfunctioning Model 800 microwave oven in the restaurant where they worked burned two of the women and traumatized all three. Approximately $5 million sought. Status: pre-trial. Attorneys for plaintiffs: *Riner Deglow, Leonard Schroeter* and *Robert Scanlon.* Attorney for defendant: *James Connelly.* [*Beadles et al. v. Litton,* Superior Court, Spokane, WA, No. 80-2-04512-6.]

• Joyce McCarty filed suit against Magic Chef in 1978. Claim: her son's lymphatic cancer and eventual death were caused by radiation leaking from a microwave oven where he worked. Status: pre-trial, on hold while McCarty seeks medical experts to support claim. Attorney for plaintiff: *Wallace Stephens.* [*McCarty v. Magic Chef,* Second Judicial District Court, Washoe County, NV.]

Concluded:

• Delores Delsesto and Lynn Spinella ended their suit against Amana Refrigeration out of court in March 1982. Claim: radiation from a leaking microwave oven in their company lunch room induced cataracts in both women. Approximately $3 million sought in suit filed February 1979. Status: case dismissed with consent of both parties after one day of trial in March 1982. Both parties refused to give details. Attorney for plaintiffs: *Mark Decof.* See *MWN,* April 1982. [*Delsesto and Spinella v. Amana Refrigeration,* US District Court, Providence, RI, No. 79-0082.]

• Helen Formakis lost her suit against Tappan in November 1981. Claim: counter-top microwave oven malfunctioned and burned her hand. $1 million sought. Status: jury found for defendant. Attorney for plaintiff: *Cecile Weich.* Attorney for defendant: *Remo Acito.* See *MWN,* December 1981. [*Formakis v. Tappan,* State Supreme Court, Bronx County, New York, NY.]

US Embassy in Moscow

In Progress:

• George Watson filed suit against the US government in January 1981. Claim: genetic changes and injury from radiation exposure while serving as a marine guard at the US embassy in Moscow caused birth defects in his son. Status: charge that microwave radiation played role in causing defects—negligent failure to warn of hazard under Federal Tort Claims Act—dismissed in spring 1982 under the *Feres* doctrine and is now being appealed. Trial on second charge of medical malpractice by navy doctors set for March 1, 1983. Attorneys for plaintiff: *Peter Danelo* and *Charles Peery.* See *MWN,* January/February 1982. [*Watson v. US,* US District Court, Central District of California, Los Angeles, CA, No. CV 80-5737-CHH. Appeal on first charge filed in Ninth Circuit Court of Appeals, San Francisco, CA.]

• Attorney *John Parker Hills* has filed four cases for people exposed to radiation at the US embassy in Moscow. Two claims filed several years ago with the Department of Labor Employment Standards Administration, Office of Workers' Compensation Programs, were denied by a special claims examiner on July 19, 1982. One of these, filed by the spouse of an embassy employee who died of brain cancer, is being appealed to the Employees' Compensation Appeal Board. Hills also filed an individual and a class action suit for a woman who worked at the embassy and now has cancer. This case, filed with the State Department, is pending. See *MWN,* January 1981.

• Barton Reppert filed suit against the Central Intelligence Agency in July 1981. Claim: seeking documents under the Freedom of Information Act relating to the bioeffects of microwave radiation and to the Soviet microwave irradiation of the US embassy in Moscow. Status: pre-trial. Attorney for plaintiff: *J. Stuart Lemle.* See *MWN,* September 1981. [*Reppert v. CIA,* US District Court, Washington, DC.]

Other Work-Related Claims

In Progress:

• Attorney *Robert Young* added a ninth flight controller claim to the eight reported in last year's survey. Claim: radiation from communications, navigation and radar equipment near control towers and possibly cathode ray tube (CRT) displays in the work place caused cataracts. Status: all nine cases pending. [Administrative agency: Department of Labor Office of Workers' Compensation Programs, Branch of Special Claims.]

• Antoinette Yannon is appealing the July 1982 dismissal of her product liability suit against RCA. Claim: husband's illness and eventual death caused by long-term exposure to microwave radiation while

working on TV relay equipment for New York Telephone. Seeking $3.5 million from equipment manufacturer for breach of warranty and negligence in suit filed in May 1976. Status: case dismissed on pre-trial motion in July 1982. Appeal filed this fall. Attorneys for plaintiff: *Jerome Ellis* and *David Paully.* See *MWN,* April 1981, July/ August and November 1982. [*Yannon v. RCA,* State Supreme Court for Richmond County, Staten Island, NY, No. 1009-1976. Appeal filed in State Supreme Court Appellate Division, Second Department, Brooklyn, NY.]

• Frederick Nepa filed a workers' compensation claim against the Port Authority of NY and NJ in February 1979. Claim: radiation from a walkie-talkie he used as a PA policeman caused cataracts. Status: pending. Attorney for plaintiff: *Angelo Gucciardo.* [*Nepa v. Port Authority,* Administrative agency: New York State Workers' Compensation Board, New York, NY.]

• Attorney *Angelo Gucciardo* is handling a workers' compensation claim filed this year for a Long Island, NY, police officer. Claim: radiation from a walkie-talkie caused a cataract. Status: waiting for hearing date. [Administrative agency: New York State Workers' Compensation Board, New York, NY.]

Concluded:

• Antoinette Yannon's workers' compensation award for the death of her husband has been upheld in appeals made by New York Telephone. Claim: husband's illness and eventual death caused by long-term exposure to microwave radiation while working on TV relay equipment for New York Telephone. Status: awarded benefits by New York Workers' Compensation Law Judge in 1980. Decision upheld by Workers' Compensation Board on February 26, 1981 and in appeal to a state court on May 6, 1982. Award of $45 per week and $29,000 in retroactive benefits. Attorney for plaintiff: *Angelo Gucciardo.* Attorney for defendant: *Saul Schier.* See *MWN,* April 1981, June and November 1982. [*Yannon v. New York Telephone,* Administrative agency: New York State Workers' Compensation Board, New York, NY, No. 0714-2308 and No. 0752-3602. Appeal filed May 1982 in New York State Supreme Court Appellate Division, Third Department, NY, No. 41045.]

• Sybil Barker and Industrial Indemnity, the workers' compensation carrier for her employer in San Francisco, reached a private settlement for her 1982 partial-disability claim. Claim: visual demands of VDT work caused debilitating eye problem (diagnosed as accommodative spasm). Status: $7,500 settlement reached in October-November 1982 without compensation board ruling. Attorney for plaintiff: *Kathryn Ringgold.* [Administrative agency: State Workers' Compensation Board, San Francisco, CA.] ●

DIRECTORY OF ATTORNEYS

Remo J. Acito: Acito & Klein, 800 3rd Avenue, New York, NY 10022, (212) 688-2720.

Joe Aklufi: Redwine & Sherrill, 3737 Main Street, Suite 1020, Riverside, CA 92501, (714) 684-2520.

Lawrence W. Bates Jr.: PO Box 488, Coventry, CT 06238, (203) 742-7301.

Robert C. Bernius: Nixon, Hargrave, Devans & Doyle, Lincoln First Tower, Rochester, NY 14603, (716) 546-8000.

James Connelly: Winston & Cashatt, Seafirst Financial Center, Spokane, WA 99201, (509) 838-6131.

James P. Cothren: Cothren & Pittman, 425 Tombigbee Street, Jackson, MS 39201, (601) 948-6151.

Raymond R. D'Agostino: Costello, Cooney & Fearon, 600 Monroe Building, Syracuse, NY 13202, (315) 422-1152.

Peter Danelo: 4th and Blanchard Building, 24th Floor, Seattle, WA 98121, (206) 464-1490.

Mark Decof: Decof & Grim, One Smith Hill, Providence, RI 02903, (401) 272-1110.

Riner E. Deglow: North 910 Washington, Spokane, WA 99201, (509) 328-6770.

Jerome O. Ellis: 1010 Forest Avenue, Staten Island, NY 10310, (212) 442-0900.

Seymour L. Ellison: 1005-1045 Sansome Street, San Francisco, CA 94111, (415) 392-1884.

John R. FitzGerald: Howard, Kohn, Sprague & FitzGerald, 237 Buckingham Street, Hartford, CT 06106, (203) 525-3101.

Michael B. Gillett: Law Offices of Roger M. Leed, Suite 520, 1411 4th Avenue, Seattle, WA 98101, (206) 382-0217.

Angelo Gucciardo: Israel, Adler, Ronca & Gucciardo, 160 Broadway, New York, NY 10038, (212) 227-1350.

William E. Hall: Schwebel, Burke & Hall, PO Box 757, Rockville, CT 06066, (203) 875-3391.

John Parker Hills: 4715 Sellman Road, Beltsville, MD 20705, (301) 937-4430.

Brent E. Leavitt: Leavitt & Leavitt, 229 Las Vegas Boulevard South, Las Vegas, NV 89101, (702) 384-3963.

J. Stuart Lemle: Lemle & Associates, 1701 K Street, NW, Suite 1000, Washington, DC 20006, (202) 775-0044.

Richard Leonard: Leonard, Prolman & Leonard, 5 Prospect Street, Nashua, NH 03060, (603) 883-0928.

Robert G. Liegel: Failmezger & Liegel, 202 North Townsend Street, Syracuse, NY 13203, (315) 472-6388.

Marc Moller: Kreindler & Kreindler, 99 Park Avenue, New York, NY 10016, (212) 687-8181.

David J. Paully: 56 Bay Street, Staten Island, NY 10301, (212) 447-6820.

Charles E. Peery: Preston, Thorgrimson, Ellis & Holman, 2000 IBM Building, Seattle, WA 98101, (206) 623-7580.

Michael L. Prigoff: Lebson & Prigoff, 39 Park Place, Englewood, NJ 07631, (201) 568-4000.

Kathryn E. Ringgold: 1242 Market Street, First Floor, San Francisco, CA 94102, (415) 558-9611.

William D. Rives: Davis, Wright, Todd, Riese & Jones, 4200 Seattle First National Bank Building, Seattle, WA 98154, (206) 622-3150.

Robert Scanlon: Roberts, DeLuzio & Scanlon, North 910 Washington, Spokane, WA 99201, (509) 328-4600.

Saul Schier: New York Telephone Company, 1095 Avenue of the Americas, New York, NY 10036, (212) 395-0009.

Leonard Schroeter: Schroeter, Goldmark & Bender, 540 Central Building, 3rd and Columbia, Seattle, WA 98104, (206) 622-8506.

Matthew Shafner: O'Brien, Shafner, Bartinik, Stuart & Kelly, Bridge Street at Route One, PO Drawer 929, Groton, CT 06340, (203) 445-2463.

Wallace D. Stephens: Stephens, Kosach, Knight & Edwards, 401 Ryland Street, Suite 330, Reno, NV 89502, (702) 786-5776.

Jeffrey M. Stopford: Litvin, Blumberg, Matusow & Young, 210 West Washington Square, Philadelphia, PA 19106, (215) 925-4500.

John E. Sweeney: 800 West First Street, Plaza Level, Los Angeles, CA 90012, (213) 620-0401.

John P. Trevaskis, Jr.: 327 West Front Street, Media, PA 19063, (215) 566-9100.

Cecile C. Weich: One Riverdale Avenue, Riverdale, NY 10463, (212) 549-2238.

Robert G. Young: Young & Murphy, 1902 Peachtree Center Cain Tower, 229 Peachtree Street, NE, Atlanta, GA 30303, (404) 523-5083.

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HIGHLIGHTS

Broadcasters Balk at Proposed Massachusetts Standard

At a public hearing convened by the Massachusetts' Department of Public Health in Boston on November 29, representatives from the broadcasting industry complained that the state's draft regulations on non-ionizing radiation are too strict. Neil Smith, a consulting engineer testifying on behalf of RKO General, accused the department of trying to satisfy "irrational" public fears by setting an "unnecessarily stringent standard."

Massachusetts became the first state to propose general population health standards for radiofrequency and microwave (RF/MW) radiation last February. (See *MWN*, March 1982.) The Massachusetts proposal is in fact identical to the recently approved American National Standards Institute (ANSI) standard except that it is five times stricter over the entire frequency range between 300 kHz and 100 GHz. The standard is most strict in the 30–300 MHz band, where it specifies a maximum exposure of 200 uW/cm^2. Although the February draft required the registration of all major stationary RF/MW sources and prescribed limits for occupational exposures, the revised draft, the subject of the hearing, limits registration to *new* sources and drops the occupational standard altogether. (A number of different types of sources are exempt from the rules.)

Jules Cohen, a consulting engineer based in Washington, DC, speaking on behalf of the National Association of Broadcasters, said that if Massachusetts could not wait for a standard to be set by the federal Environmental Protection Agency, "the new ANSI criteria should form the basis for the [standard] — not ANSI divided by five." Douglas Rowe, an attorney in Marlborough, MA, representing the Massachusetts Broadcasters Association, agreed saying the ANSI standard is "more than sufficient."

Others have endorsed the new standard however. In a November 22 letter to the Department of Public Health, Professor A.W. Guy wrote that the proposal is "an excellent compromise that should satisfy the concerns of the public about long-term exposure to non-ionizing radiation without unnecessarily being too restrictive to the users of the radio spectrum." Guy was the chairman of the subcommittee that drafted the ANSI standard. Raytheon's John Osepchuk told *Microwave News* at the hearing that the state did an "eminently reasonable" job, which only needs a little refinement. Osepchuk is a member of the *ad hoc* committee that advised the state on developing the standard over the last two years.

The hearing was relatively brief as most of the 35 attendees preferred to listen rather than testify. Participation was livelier at an informal question-and-answer period that followed the hearing. After repeated complaints about the stringency of the standard, Robert Watkins, a radiation scientist at the department, gave three reasons for the decision to add a safety factor to the ANSI standard, which he called an occupational standard despite ANSI's claims to the contrary: (1) the classic distinction between the general public and workers with respect to age, health and length of exposure; (2) the recommendation of international organizations, especially the World Health Organization, for dual standards; and (3) the language in the ANSI standard that, "Because of the limitations of the biological effects data base, these guides are offered as upper limits of exposure, particularly for the population at large ..." As for the origin of the factor of five, Watkins said "our committee picked it."

Another contentious topic was the problem of assigning responsibility for a given level of radiation when there are multiple sources. The only way to deal with it, according to Robert Hallisey, was on a case-by-case basis. Hallisey is the director of the department's radiation control program; he chaired the meeting.

Hallisey said the rules could be promulgated within 90 days of the close of the comment period on December 13. He said that unless "substantial" changes are made after public comments are reviewed, there will be no further hearings. He also noted that the Massachusetts Department of Labor and Industry was developing an occupational standard.

Also testifying were Dr. Don Justesen of the VA Medical Center in Kansas City, MO, on behalf of RKO General and Dr. Russell Carpenter, who retired from the Bureau of Radiological Health in September. Carpenter said that the major problem with RF/MW radiation was the "illusion of risk." He called the level of public ignorance "appalling."

A second hearing on the proposed rules was held in Holyoke, MA, on December 2. According to Watkins, some 25–30 people attended the meeting. He said that they raised similar complaints as those who spoke at the Boston meeting. Ron Peterson of Bell Labs and a representative from Northeast Utilities were among those testifying.

Leukemia and Electromagnetic Fields: New Evidence and a Dissenting Opinion

Researchers at the University of Southern California (USC) School of Medicine have uncovered new support for the hypothesis that there is a link between leukemia and exposures to electrical and magnetic fields. Three members of the school's Department of Family and Preventive Medicine have found that white males in Los Angeles County whose jobs required contact with electromagnetic fields had a greater risk of developing leukemia, especially acute myelogenous leukemia (AML).

In a letter published in the November 20 *Lancet*, Drs. William Wright, John Peters and Thomas Mack write that their data are consistent with those of Dr. Samuel Milham who reported a similar link among workers in Washington state last July (see *MWN*, July/August 1982). The USC team identified power linemen as one class of workers who are at increased risk of developing both acute leukemia and AML; telephone linemen had a significantly higher chance of getting AML.

Speaking from his office at the Division of Occupational Health, Dr. Wright told *Microwave News* that he had read Milham's letter when it was published and thought that it would be interesting to apply the same methods to data collected by Mack's Cancer Surveillance Program for Los Angeles. He said he would like to continue this line of research and is looking for a suitable cohort population.

Although the USC researchers warn that the sample size is small and that the workers could have been exposed to other carcinogenic agents, they conclude that the connection between leukemia and non-ionizing radiation deserves further study.

Meanwhile, Dr. Robert Liburdy of the New York University Medical Center takes issue with Milham's paper in a letter to the *New England Journal of Medicine* (November 25). Citing work from the National Institute for Occupational Safety and Health (NIOSH) and the World Health Organization (WHO) and the epidemiological study of employees at the US embassy

in Moscow, Liburdy judges that the "mechanism of interaction of electrical and magnetic fields with biologic materials, although not well understood, differs importantly from the etiology of cancer, which is also not well understood. Negative results do not conclusively rule out a health risk; the data, however, argue against an association."

Busy Times for ANSI C63

Members of the American National Standards Institute (ANSI) Committee on Radio-Electrical Coordination (C63) have been very active revising existing standards and initiating new ones. At meetings held November 3–4 in Washington, DC, they made substantial progress on a number of fronts related to electromagnetic compatibility (EMC), especially with respect to instrumentation and the measurement and control of radiation emissions.

The C63 Committee is in the process of revising two of its standards and has completed work on its one draft standard: ANSI C63.2-1980, *Specifications for Electromagnetic Noise and Field Strength Instrumentation, 10 kHz to 1 GHz;* ANSI C63.4-1981, *Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 10 kHz to 1 GHz;* and ANSI C63.12 (draft), *Recommended Practice on Procedures for Control of System Electromagnetic Compatibility.*

Outlined below are reports of various subcommittee 1 (Techniques and Development) activities, most of which were presented at its November 3 meeting:

• A draft addition to ANSI C63.4 on "Open Area Test Sites," has been forwarded to the full committee for a vote. According to subcommittee chairman Edwin Bronaugh of Electro-Metrics in Amsterdam, NY, most members approved the draft. Representatives of the Federal Communications Commission (FCC) were concerned over the use of broadband antennas to be specified in the new standard. The commission staff prefers making measurements with tuned dipole antennas and is seeking more data before a vote is taken by the full committee next February. The FCC members abstained in the subcommittee balloting.

• The proposed revisions to C63.2 and C63.4 to extend their frequency range down to 20 Hz and up to 18 GHz are nearing completion. A task force chaired by Marge Stone of AEL Industries in Farmingdale, NJ, has finished working on the lower frequencies for both standards. William Lambdin of Electro-Metrics has nearly completed the revisions to C63.2 for higher frequencies. Only the revision extending C63.4 to 18 GHz, coordinated by James Klouda of Elite Electronics Engineering in Downers Grove, IL, will not be ready for balloting until next summer.

• Don Heirman of Bell Labs in Holmdel, NJ, has developed a first draft for an addition to C63.4 on "Immunity Measurements of Electronic Products." Heirman expects to have a second draft by February and a version ready for a subcommittee vote by June.

• Preparation of a national EMC standard is underway under the direction of Herb Mertel of EMACO in San Diego, CA. The document will compile all EMC standards in the US, either by inclusion or by reference.

• A draft standard for measurement of radiated emissions from and susceptibility of medical devices is being circulated for comment among subcommittee members. The work of the task force, chaired by Al Smith of IBM in Poughkeepsie, NY, has been partially stalled by the loss of several members. A decision on how to proceed will be made at the next subcommittee meeting.

At the full C63 committee meeting on November 4, following the subcommittee session, a decision was made to accept the draft C63.12 EMC standard as final without modification. At the next meeting a new task force chairman will be appointed by members of subcommittee 1 to begin working on refinements to this standard.

The C63 meeting also featured reviews of on-going revisions of the International Electrotechnical Vocabulary and efforts towards international standardization. And Professor Ralph Showers, chairman of the C63 committee, reported on the International Special Committee on Radio Interference (CISPR) meeting held in Stockholm in September. (Showers, who is with the Department of Electrical Engineering at the University of Pennsylvania in Philadelphia, is also the president of CISPR.) *Microwave News* will run an update of CISPR activities in a future issue.

Bronaugh has tentatively scheduled a meeting of subcommittee 1 for next February. A date for the next C63 committee meeting has not been set.

UPDATES

Biological Effects ... *Radio Science,* the journal of the American Geophysical Union, has published the proceedings of URSI's *Symposium on Biological Effects of Electromagnetic Radiation,* held in Helsinki in 1978, as a supplement to its September-October 1982 issue (Volume 17, Number 5S). Among the papers is the study of the effects of prenatal and postnatal exposure to 2450 MHz radiation on squirrel monkeys, which caused quite a stir when it first appeared at a poster session four years ago. At that time, Dr. Joel Kaplan and co-workers reported that, while most of the monkeys suffered no ill effects, there was a high mortality rate among those animals exposed to an average SAR of 3.4 W/Kg before *and* after birth. EPA, the sponsor of the original study, agreed to supply more money for a replication study to see whether this new effect was more than a statistical anomaly—a possibility given the small sample size and the fewer than expected deaths among the controls. The results of that second experiment, reported in a *note added in proof* to the original paper, "did not support those obtained in the initial experiment. No differences were found between irradiated and control monkeys in the number of abortions, stillbirths or livebirths that occurred or in the number of offspring that died." In a telephone interview from his office at SRI International, Kaplan said that he believed the matter was now settled. At EPA, Dr. Joe Elder, the acting director of the division that supported the SRI work said, "The suggestions that were raised by the first study have now been satisfactorily answered." This view was echoed by Dr. Michael Gage, who is a co-author of the paper and one of Elder's colleagues at EPA. Though Gage agreed that the question of lethality is now settled, he still favors more work on behavioral teratology, a research area he describes as "not very well explored." Among the 24 other papers in the collection are: "Measurements of Electric and Magnetic Stray Fields Produced by Various Electrodes of 27 MHz Diathermy Equipment" by a team from Finland; "Coherent Oscillations in Biological Systems: Interaction with Extremely Low Frequency Fields" by F. Kaiser of the Institute of Theoretical Physics at the University of Stuttgart; "ELF Magnetic Fields in Electrosteel and Welding Industries" by a group from Linkoping University in Sweden; and "Population Exposure to VHF and UHF Broadcast Radiation in the [US]" by R. Tell and E. Mantiply of EPA ....In another teratology study, a group from Thomas Jefferson University in Philadelphia, PA, reports on the effects of prenatal exposure of rats to 10 mW/cm² of 915 MHz for six hours a day throughout gestation in the October issue of *Radiation Research.* They found "no significant teratogenic activity" at this exposure level—a level which did not induce a "significant" increase in the rat's body temperature (average SAR = 3.57 W/Kg)....And a team from EPA has

found that the exposure of pregnant rats to 425 MHz continuous wave radiation (SAR = 3.1–6.7 W/Kg) "may lead to increased mitogen-stimulated responses by lymphocytes." Writing in the September issue of the *Journal of Microwave Power*, the authors state that they do not know what mechanism is responsible for the observed changes, though it does not appear to be frequency dependent: "Whether these changes in lymphocyte response reflect an alteration in the functional integrity of the exposed animal's immune system remains to be investigated."... Dr. Gregory Lotz of the Naval Aerospace Medical Research Laboratory in Pensacola, FL, has issued a technical report, *Hyperthermia in Rhesus Monkeys Exposed to a Frequency (225 MHz) near Whole-Body Resonance*, describing the work that prompted great interest when he first presented it at the 1981 BEMS conference (see *MWN*, September 1981). At power levels in excess of 5 mW/cm² (SAR = 2.3 W/Kg), Lotz observed "severe hyperthermia" and concludes that "the effects on rhesus monkeys of exposure to a resonant frequency (225 MHz) were substantially greater than what could be predicted based upon straightforward comparisons of dosimetric information (SAR) and the effects of exposures to a much higher frequency (1290 MHz)."...Do non-thermal effects of RF/MW radiation exist? Professors Herman Schwan and Sol Michaelson, neither one a stranger to this continuing debate, offer opposite views in recently published papers. In a presentation at last year's 10th *L.H. Gray Conference* (see Medical Applications Update), Schwan describes "observed non-thermal effects of alternating fields" and states that he believes that "ponderomotoric" forces are responsible—these are caused by electrical fields acting on non-polar particles. Among the non-thermal effects listed by Schwan are: pearl chain formation, movement in inhomogeneous fields and changes in the shape of cells as well as their destruction and fusion. Michaelson takes an opposite view in an unfavorable review of the World Health Organization's (WHO) criteria document on RF/MW radiation (see *MWN*, March 1982). In the October issue of *Radiation Research*, Michaelson writes: WHO's "unqualified acceptance of postulated non-thermal bioeffects with resonant frequency dependence and 'windows' is not justified by the evidence. There are many scientists who hold a working hypothesis that all RF/MW bioeffects are explainable as the result of internal heating (albeit nonuniform throughout the organism). Much of the literature on 'non-thermal' effects is marred by artifacts, conceptual problems or misinterpretation of data. It is regrettable the author(s) of the present document neglected to fully explore and take such factors into cognizance." Overall, he finds the document "distressing" because it "does not come up to the high scientific caliber and accuracy of the usual WHO publications."...Another paper presented at the Gray Conference argues for the presence of non-thermal effects of microwaves. A group of German researchers report on experiments in which they monitored the growth rate of yeast exposed to radiation in the frequency range 41.640–41.835 GHz. Previous work had indicated the occurrence of "very remarkable effects": the growth rate increased and decreased at certain specific frequencies and there were a number of resonances, each with a line-width of about 10 MHz. The new work provided confirmation. They conclude, "There are changes in yeast growth rate, caused by low intensity microwave irradiation. These effects depend on frequency, showing a strong resonant-like behavior, and are not correlated to the microwave power used. These effects are not explainable in terms of simple thermal response."...Commenting on the paper connecting fluorescent light with skin cancer (see *MWN*, September 1982), Allan Jensen of the Danish National Institute of Occupational Health proposes that polychlorinated biphenyls (PCBs) may be the more likely toxic agent. PCBs can be emitted by fluorescent light fixtures, especially after the burnout of a ballast. His letter appears in the October 23 issue of *Lancet*....The *IEEE Transactions on Microwave Theory and Techniques* will publish a special issue on "Electromagnetic Wave Interactions with Biological Systems" in July 1984. Georgia Institute of Technology's James Toler is the guest editor of the collection. Papers are due by October 12, 1983.

Communications...The New Jersey Department of Health will investigate a possible link between microwaves and birth defects and cancer in Vernon, NJ. Responding to local fears stirred up in a siting battle over a proposed RCA Americom relay tower, the Sussex County Health Department contacted the state's Epidemiology and Disease Control Division late last month. (There are already a number of RF/MW sources in Vernon. See *MWN*, November 1982.) A health department spokeswoman said the Sussex request is routine except for the possible link with microwaves: the department gets "a number of cancer clusters reports" every month. Charles Lawson, an epidemiologist with the department's Parental and Child Health Services, said the analysis would probably include a review of local hospital records for 1979–1981 and whatever other information the county board could provide. According to Lawson, this type of analysis usually takes over six months to complete. Meanwhile, Americom is scheduled to host a public meeting to discuss its proposed tower on December 11....NTIA plans for developing long-range international telecommunications policies appear in the November 2 *Federal Register* (47 *FR* 49694).

Compatibility & Interference... Competition between land mobile services and UHF-TV stations for spectrum space continues and promises to get worse: often, the result is unacceptable interference. A classic example is WVEU, Channel 69 in Atlanta, GA. The station, operating at 800–806 MHz from the roof of the Peachtree Plaza Hotel, has been forced to broadcast at an ERP of 2.63 kW, 30 dB or a thousand times below its authorized level, because of out-of-band interference with land mobile (806–807 MHz) repeaters located on the same roof. As the "newcomer" WVEU has the responsibility for correcting the RFI problem. Last April, the station asked the FCC for permission to operate at 50 percent power but the petition was denied on September 29. The station has now filed a petition for reconsideration. Also in November, the commission proposed rules to allow the operation of public land mobile units on UHF Channel 14 in Pittsburgh, PA (see 47 *Federal Register* 53752, November 29). According to Ralph Justus of the FCC's Broadcast Bureau, "Unless the spectrum is managed to afford protection between these services, the interference problem is going to recur many times over the next 20 years." He cites UHF stations in Tyler, TX, Boulder, CO, San Diego, CA, and Washington, DC as other potential trouble spots. The commission's Private Radio Bureau has released an interim report, *Future Private Land Mobile Telecommunications Requirements*.... With respect to satellite communications, the FCC has issued an alert on the need to consider the potential for RFI in designing and manufacturing direct broadcast satellite home receivers. Specifically, the commission noted that, based on theoretical considerations, out-of-band emissions from terrestrial systems could fall into the 12 GHz band, as could harmonics from ISM equipment — especially microwave ovens—and very high-power radars....On September 10, the American Satellite Co. of Rockville, MD, filed a petition asking the FCC to adopt standards that would protect against RFI from the improper operation of transmitting earth stations. One commission staffer told *Microwave News* that the FCC has not received a large number of complaints with respect to RFI from satcom stations and that "there are differences in opinion on how serious this problem is."...The October 11 issue of *Broadcasting* features a summary of comments submitted on the FCC's proposed rule for resolving FM blanketing interference (see *MWN*, May 1982)....And the FCC has found that, while cordless telephones do not comply with its rules on radiated signals, they do not constitute a serious problem: it has received few RFI complaints from amateur radio operators in the 1.8–2.0 MHz band. The FCC plans to propose new rules for cordless telephones in 1983 .... State policemen have begun noticing that signals from their walkie talkies can interfere with their Breathalyzer units, used to test the sobriety of drivers. A spokesman for Smith & Wesson, the manufacturer of the units in Springfield, MA, admits such RFI, though rare, can occur....George Washington University's Continuing Engineering Education program is sponsoring a course on *Electromagnetic Interference and Control* in Washington, DC, January 10–14. For more information, call (800) 424-9773.

Government... For a brief moment in early October there were rumors that EPA management had officially approved long stated plans to set safety levels for public exposure to RF/MW radiation. Work on the guidance has been going on for some time: EPA's Office of Research and Development in Research Triangle Park, NC, is in

the final stages of preparing a criteria document on the effects of non-ionizing radiation—due for release early next year—which will serve as the basis for the guidance. And a group at the Environmental Sciences Division of DOE's Lawrence Livermore Laboratory in Livermore, CA, is studying the economic impact of the guidance (see *MWN*, December 1981). EPA Assistant Administrator Kathleen Bennett did approve the advanced notice of proposed rule making (ANPRM), but Administrator Anne Gorsuch has yet to sign it. As we go to press at the end of November, there is still no sign as to when the ANPRM will appear in the *Federal Register*....The National Center for Devices and Radiological Health (which absorbed BRH) is reviewing its reporting and record-keeping requirements for radiation emitting products as required under the Radiation Control for Health and Safety Act of 1968. According to present rules, manufacturers must submit data on the operation, labeling and design of electronic devices as well as incidents of accidental radiation exposure. In addition they must maintain records on quality control procedures, test results and methods for controlling radiation emissions. Among those devices using non-ionizing radiation that fall under these regulations are: microwave heating equipment, RF heaters and sealers and diathermy machines. A task force at the center is assessing whether or not the regulations are still needed and is soliciting public comment. As the center's John Bailey put it: "We are looking to see if there is a better or alternative way of satisfying the act." For more information see the notice in the November 16 *Federal Register* (47 *FR* 51706) or call Bailey, (301) 443-3434. Comments are due by February 14, 1983; Bailey hopes to have recommendations ready by next September....The Consumer Product Safety Commission (CPSC) has proposed rules to decide when to release complaints on specific products. The proposal, published in the November 5 *Federal Register* (47 *FR* 50283), would make it easier for CPSC to disclose information to the public .... NIOSH's Division of Biomedical and Behavioral Science in Cincinnati, OH, is looking for a chief for its Physical Agents Effects Branch to replace Dr. Wordie Parr who is retiring at the end of the year. A candidate must be an engineer or a physicist and be able to direct a research program on the health and safety impact of occupational exposures to radiation, noise, vibration as well as high and low temperatures and pressures. The salary range is $41,000–$48,500. For more information contact: Jon Ruse, Personnel Office, NIOSH, 4676 Columbia Parkway, Cincinnati, OH 45226.

Measurement...A team from Italy's National Research Council in Florence has developed an RF hazard monitor to protect workers against overexposure to RF heater and sealer radiation. The patented instrument has a flat frequency response in the 2–100 MHz range, with an overall accuracy of ±2.5 dB with a typical value of ±0.7 dB. The monitor incorporates applicable safety standards: red and yellow indicator lights turn on in the presence of "excessive" power levels. In the description of the monitor, presented in the September issue of the *Journal of Microwave Power*, the team advises that it could also be used in a number of other applications, including exposures to AM and FM broadcast radiation, short-wave diathermy and military communications....The publication of NBS' draft handbook for its Electromagnetic Calibration Services Voluntary Laboratory Accreditation Program, due out this month, has been held up as the bureau resolves a number of tricky technical questions. According to NBS' John Locke, the draft handbook should be available early next year. ...In a paper to appear in a forthcoming issue of *IEEE Transactions on Instrumentation and Measurement*, David Wait of NBS' Boulder laboratories reviews NBS' noise measurement program for antenna systems with gains between 51 and 65 dB in the 1–10 GHz frequency range. For large antennas, 11–28 meters in diameter, radio stars are used as the known noise source. For smaller antenna systems, 4–5.5 meters in diameter, the moon is the preferred source....Among the papers to be presented at the *National Radio Science Meeting* in Boulder during the first week in January are "Preliminary Results from Measurements of 800 MHz Radio Transmission into Residential Buildings" by a team from Bell Labs in Holmdel, NJ, and "Measurements of the Microwave Dielectric and Attenuation Properties of Plants" by two researchers from the Remote Sensing Lab at the University of Kansas in Lawrence. For details see Conference Calendar on p. 10.

Medical Applications...The National Center for Devices and Radiological Health's Radiological Devices Panel is set to meet on December 8 and 9 in Rockville, MD. On the agenda are a review of the current status of NMR imaging devices and a premarket approval application for a RF/MW hyperthermia machine. The identity of the manufacturer seeking approval is confidential until the meeting. Dr. R.D. Saunders of the NRPB in the UK was scheduled to review the British experience with NMR, but will not be able to attend. At the request of the National Electrical Manufacturers Association (NEMA), there will be a discussion of the reorganization of the BRH and the Bureau of Medical Devices. What concerns NEMA, according to one of its staff, is that BHR's past authority should not get diluted by the change. For more information contact: Dr. Robert Phillips, (301) 443-3426....The North American Hyperthermia Group (NAHG) will hold its third annual meeting during the Radiation Research Society's conference February 27–March 7 in San Antonio, TX. For more information contact: Dr. Dennis Leeper, 925 Chestnut Street, Philadelphia, PA 19107. The abstracts of the papers from this year's NAHG meeting, held in Salt Lake City, UT, April 17–19 are published in the August issue of *Radiation Research*....The Proceedings of the 10th *L.H. Gray Conference: Ultrasound, Microwave and Radiofrequency Radiations: the Basis for Their Potential in Cancer Therapy*, held in Oxford in July 1981, are published in a supplement to the March 1982 issue of the *British Journal of Cancer*. Among the large number of papers is one from Poland that compares the effects of whole-body and local microwave hyperthermia on the immune system. Drs. M. Janiak and S. Szmigielski of the Center for Radiobiology and Radioprotection in Warsaw report that local heating is preferable to whole-body hyperthermia because the former does not inhibit the immune response....Fonar announced a breakthrough at the Radiological Society of North America meeting in Chicago at the end of November: a new 3,000-gauss permanent magnet for use in whole-body NMR imagers. A spokesman for Fonar said the magnet has a very small fringe field and is therefore much easier for hospitals to house. He added that Fonar hopes to get FDA approval for its NMR units in the first half of 1983. The news sent the price of Fonar stock to new highs....The program for the first annual *Meeting of the Society for Magnetic Resonance Imaging* to be held in Colorado Springs in February is now available. See Conference Calendar on p. 10 for details.

Military Systems...Wisconsin Governor-Elect Anthony Earl has confirmed his campaign commitment to oppose Project ELF, the navy's land-to-submarine communication system. In a post-election statement, he called it "primarily an offensive system which would not help to move us along the road to arms control and arms reduction," and announced plans to contact Michigan's Governor-Elect James Blanchard to work together against the project. On another front, the Wisconsin Natural Resources Board passed a resolution affirming its opposition to Project ELF on November 17....The Department of Transportation has approved the construction of the H-3 highway project, part of which will be under the coast guard's Omega antenna (see *MWN*, July/August 1982). Construction could begin in January. ...The navy is building an AEGIS Combat System Center on Wallops Island, VA. In a November 1 notice in the *Federal Register* (47 *FR* 49437), the navy announced that it would not prepare an environmental impact statement for the project but that an environmental assessment had been completed. The navy notes that, "The radars utilized do constitute a hazard zone extending some 2,000 feet seaward; however, the beam is elevated to keep radiation levels at the shoreline within the standard of 10 mW/cm² for continuous exposure. Continuous monitoring and built-in system checks will automatically turn off the equipment if radiation levels are excessive so that there is no perceived hazard to operating personnel, shoreside or surface inhabitants."

Mobile Communications...Allocating cellular mobile phone markets is proving to be a tough job. The second FCC cellular construction permit went to AT&T's Boston subsidiary last month. But at about the same time, the Justice Department asked the FCC to delay issuing permits to phone companies until the commission clears up

questions over its licensing procedures, which some applicants argue are anti-competitive. And the commission must now wade through almost 400 applications received for the 30 second-largest cellular markets.

Ovens...It looks as if a large number of people are planning to put a microwave oven under their Christmas trees, or at least that is what retailers are betting on. Factory shipments of ovens exceeded 470,000 in October, the largest number for any month in history. A spokeswoman for the Association of Home Appliance Manufacturers, which compiles these statistics, noted that microwave ovens are popular gift items in the current economic climate because they meet the needs of working women. Even with a record-breaking October, microwave oven shipments for the year are still down 11.2 percent over the first ten months of 1981....A one-month-old baby girl was hospitalized with third degree burns on the left hand, right foot and abdomen in Caledonia, MI, on October 31. State police Detective Sgt. Robert Golm suggested that the burns were caused by the microwave oven in the home of the baby's parents; the police have impounded it. Golm told *Microwave News* that there were no defects in the oven and that it would not operate with the door open. "We do not feel it was an accident," he said. The case is now being handled by Barry County Prosecutor Judy Hughes. Repeated attempts to reach Hughes were unsuccessful....A November 29 pre-trial conference on the FTC's complaint against Amana Refrigeration Inc. for deceptive advertising (see *MWN*, November 1982) was rescheduled for December 9. On November 30, the FTC moved for a "summary decision," according to FTC attorney Andy Sachs. If accepted, there would be no trial; a decision would be issued by the administrative law judge hearing the case....Thermador/Waste King Co. has reissued a booklet, *Microwave Nutrition Report*, first released in 1977, which compares the reduction of Vitamin C (ascorbic acid) in fruits and vegetables cooked in microwave ovens and by other conventional methods: "In 18 out of 24 instances studied, the ascorbic acid content of the microwave cooked product was significantly higher than that observed after the conventional and convenient methods were used." The studies were carried out by Professor Gertrude Armbruster at Cornell University's Division of Nutritional Sciences. Copies are available from the company at 5119 District Blvd., Los Angeles, CA 90040....General Electric has introduced a new line of microwave ovens. Its Dual Wave system cooks food from the top with a rotating antenna and from the bottom with a static wave guide. GE is marketing eight models in the line, with prices ranging from $300 to $550. Among their features are "Auto Roast" with automatic temperature control and "Auto Defrost."...The International Electrotechnical Commission has published its standard IEC 705-1981, *Methods for Measuring the Performance of Microwave Cooking Appliances for Household and Similar Purposes.* A copy is available for $14.00 from the American National Standards Institute, 1430 Broadway, New York, NY 10018.

Power Lines...DOE held a meeting to review its sponsored research on 60-Hz electric field effects, November 15-18 in Denver, CO. Representatives from seven research groups presented progress reports on 28 different projects. A limited number of copies of the abstracts of the papers are available from Kenneth Klein, Electric Energy Systems Divison, CE-143, DOE, Forrestal Building, Mail Stop 5EO52, Washington, DC 20585. No other proceedings of the meeting will be prepared. DOE is still operating on last year's budget under a continuing budget resolution. As a consequence, Klein said in an interview, it is doubtful that any new contracts will be signed this fiscal year: all available money will be devoted to work already in progress....The Minnesota Environmental Quality Board (MEQB) is scheduled to meet on December 16 to review a number of studies on the effects of the Cooperative Power Association-United Power Association DC power line (running from a coal field in North Dakota to Minneapolis-St. Paul) and to consider whether its construction and operation permit requirements adequately protect health and safety. According to a presentation by Professor Frank Martin of the University of Minnesota, Minneapolis, at a November 13 MEQB public meeting, preliminary evidence from a study of dairy cattle indicates no ill effects due to the 400 kV line. The board's ion monitoring program did uncover one surprising result: a relatively high concentration of small ions (5,000/cc) a quarter of a mile downwind from the line. Final reports are scheduled for release in January. For more information contact: MEQB's George Durfee, 15 Capitol Square Building, 550 Cedar Street, St. Paul, MN 55101, (612) 296-2878....Last month we reported on a Swedish study linking power lines with cancer. We have now learned that one of the authors, Professor Bengt Enander of the Royal Institute of Technology in Stockholm died in June 1981; he was only involved in the early stages of the project helping Dr. Lennart Tomenius make magnetic field measurements. Dr. Tomenius was the principal author of the report.

Satellite Communications...The Stamford, CT, Citizen Action Group is pressing for satcom station siting rules. A proposed city ordinance that would require current and future station operators to perform environmental impact studies is now before the Health and Protection Committee of the Stamford Board of Representatives—the town council. According to a group spokesman, local concern focuses on Group W Satellite Communications' new Stamford facilities. If the draft ordinance passes a committee vote, which the group expects will happen soon, a public hearing on the rules will be held early next year....Progress toward developing direct broadcast satellite (DBS) services continued last month as seven applicants joined Comsat's Satellite Television Corp. in winning FCC construction permits for DBS systems....As the future grew brighter for domestic DBS last month, the international picture dimmed. According to a November 29 report in *Broadcasting*, a UN special political committee voted to bar direct satellite transmissions across national borders without the receiving country's consent.

VDTs...According to Dr. Michael Rosenberg, chief of reproductive health at NIOSH in Cincinnati, negotiations are still underway for a planned reproductive study of VDT operators. As we reported last month, NIOSH is in the process of setting up an epidemiological study, which will include over 5,000 pregnancies, to investigate charges that the sets are associated with miscarriages and birth defects. Rosenberg said that the negotiations should be concluded by the beginning of the new year....NIOSH is also planning a reproductive study of women exposed to PCBs. This work is unrelated to VDTs, but may be of interest to those who believe they are exposed to these chemicals in the office either from fluorescent light fixtures or from VDT capacitors and transformers. (See also Biological Effects Update.) NIOSH will investigate 200 women who worked at a New York factory that manufactured transformers between 1940 and 1976. Rosenberg is the project officer for the PCB study....Two ergonomics studies are also getting started. NIOSH has contracted with Dr. Marvin Dainoff of Miami University in Oxford, OH, to evaluate three of its in-house studies on the effects of adjustable furniture and lighting, separately and together, on worker health and productivity. In another project scheduled to begin this January, NIOSH will monitor the vision and blood pressure of 24 professional typists for nine months in an experimental study of VDT workplace design. The institute's Dr. Michael Smith is the project officer for both projects....An Ontario task force investigating VDTs has recommended shielding all flyback transformers and testing all units for X-rays before they leave the manufacturer. The group's draft report, *Possible Health Hazards of Video Display Units*, also calls for a major epidemiological study of potential reproductive hazards, including radiation and PCBs. It advises that when alternative work is not available, pregnant operators should be eligible for workers' compensation, with the employer making up any loss in income. The task force, chaired by Dr. Gordon Stopps of the University of Toronto, presented its draft report to the Ontario Ministry of Labor's Advisory Council on Occupational Health and Safety on November 30....Maria Stuchly and colleagues at the Radiation Protection Bureau of Health and Welfare Canada in Ottawa have a different view of potential VDT hazards. They made measurements of ELF (5-500 Hz) magnetic fields and RF (10-200 kHz) electric fields from VDTs. For the three units tested for ELF, most emissions were at 60 Hz and its harmonics, with higher levels for even harmonics than odd ones. At 30 cm from the front of the screen, magnetic fields were between 0.097 and 0.217 A/m. Only one reading was taken close to the transformer at the back of a unit, the Perkin Elmer Model 550: there

the magnetic field was 4.019 A/m. According to bureau scientists, these radiation levels were in line with other electrical devices; for instance, a hand mixer has been found to have localized fields of 9.295 A/m. They say that ELF magnetic fields around VDTs "are of such low intensities that they are very unlikely to have any biological effects, let alone represent a health hazard." The bureau staff tested 57 models (86 sets) for RF radiation and found emissions in this frequency range were also well below safety limits. At the operator's position, 30 cm from the screen, electric field intensities for 20 models were in the range between 1 and 5 V/m and for 37 models below 1 V/m. Maximum readings were generally found near the flyback transformer, but for three models the maximum reading was found at the screen, with emissions dropping from above 200 V/m to less than 70 V/m at a distance of 10 cm. For 10 other models, maximum readings above 200 V/m, but not specified, were identified on the top, side and back of the units....Plans are still in the works for introducing a VDT safety bill into the Connecticut Legislature. State Senator Michael Skelley is likely to submit a bill to the legislature's Labor and Public Employees Committee early next year (see *MWN*, November 1982).... A VDT safety bill introduced in the British Columbia Legislature failed to receive consideration this year. Private members bill No. M210 was introduced by legislator Karen Sanford in October.... The Australian Council of Trade Unions published its "Guidelines for Working with Screen-Based Equipment" in its *Health and Safety Bulletin* this May. The 44-page report lists cataracts and pregnancy problems among potential VDT hazards. It states that "no satisfactory long-term follow-up study of operators of [VDTs] has been performed,and so statements to the effect that the equipment does not or cannot damage, e.g. eyes or eyesight, are without foundation. In the light of disastrous experiences associated with introduction of new technologies in the past, [union] affiliates should regard screen-based equipment as a likely cause of severe health effects until it is shown to be safe." The guidelines were edited by John Mathews and Nick Calabrese, ACTU/VTHC Occupational Health and Safety Unit, Trades Hall, Box 93, Carlton South, 3053 Victoria, Australia....The Newspaper Guild has warned its locals not to accept VDT radiation tests performed by the Research Institute of the American Newspaper Publishers' Association. Guild President Charles Perlik argues that an impartial third party should perform the tests.

Etc...The papers presented at the Ann Arbor meeting on risk analysis and microwaves (see *MWN*, December 1981) have been edited by University of Michigan Professor Nicholas Steneck and have just been published by the San Francisco Press. In one of the conference's more controversial and widely circulated papers, Allan Frey criticizes Professor Bill Guy's experiment on the long-term, low-level effects of 2450 MHz radiation. (The study, funded by the air force, is now nearing completion at the University of Washington, Seattle.) When the paper was first distributed, Guy and his co-workers asked Steneck for the opportunity to respond, and Frey in turn was allowed a brief reply. All of this was to be published in the book, but as Steneck notes, on seeing Frey's second statement, Guy's group withdrew its critique. Steneck published Frey's reply anyway; in it Frey asks, "Why did Guy take on a project which involved the expenditure of approximately $1.5 million of public funds with the known critical sensitive tests ruled out by the sponsor for a nonsensical reason? Is this science?" *Risk/Benefit Analysis: The Microwave Case* is available for $15 from the San Francisco Press, Box 6800, San Francisco, CA 94101....In an article published in the summer 1982 issue of *Science, Technology & Human Values*, Steneck argues for involving historians in policy deliberations. He uses the microwave debate as a case study, which "shows how history has been misused, abused and neglected ..." Steneck is with the Department of History at the University of Michigan....There is a new computer game called *Microwave* on the market. The objective is to direct Teddy the Salvage Man through a maze so that he can repair equipment and computers (thereby collecting points) while avoiding attacks by alien beings. Teddy can outrun the aliens or fight them off with dishes that spew out lethal microwaves. This writer who has little talent for such games nevertheless found *Microwave* quite addictive. The game is designed for an Apple II computer; it is available for $34.95 from Cavalier Computer Corp, PO Box 2032, Del Mar, CA 92014. ●

CONFERENCE CALENDAR

- January 5–7: *National Radio Science Meeting*, University of Colorado, Boulder, CO. Contact: T.E. VanZandt, NOAA/ERL/R445, 325 Broadway, Boulder, CO 80303.

- February 14–18: 1st Annual *Meeting of the Society for Magnetic Resonance Imaging*, Broadmore Hotel, Colorado Springs, CO. Contact: SMRI, Suite 506, 4720 Montgomery Lane, Bethesda, MD 20814.

- February 14–19: 7th *International Conference on Infrared and Millimeter Waves*, University of St. Jerome, Marseille, France. Contact: Kenneth Button, National Magnet Lab, MIT, Cambridge, MA 02139.

- February 27–March 3: 31st Annual *Meeting of the Radiation Research Society*, Hyatt Regency, San Antonio, TX. Contact: RRS, 925 Chestnut Street, Philadelphia, PA 19107. The 3rd Annual *Meeting of the North American Hyperthermia Group* will be held simultaneously, February 27–March 1.

- March 8–10: *Microwave Systems Applications Technology*, Sheraton Washington, Washington, DC. Contact: Richard Hartman, EW Communications, 1170 East Meadow Drive, Palo Alto, CA 94303.

- March 8–10: 5th *Electromagnetic Compatibility Symposium and Technical Exhibition*, Zurich, Switzerland. Contact: Dr. T. Dvorak, EMC-83, ETH Zentrum-IKT, 8092 Zurich, Switzerland.

- April 5–8: *International Magnetics Conference*, Franklin Plaza Hotel, Philadelphia, PA. Contact: F.J. Friedlander, School of Electrical Engineering, Purdue University, W. Lafayette, IN 47907.

- April 6–7: Annual *Meeting of the National Council on Radiation Protection and Measurements*, Washington, DC. Contact: NCRP, 7910 Woodmont Avenue, Bethesda, MD 20814.

- April 10–13: 61st Annual *Convention of the National Association of Broadcasters*, Las Vegas Convention Center, NV. Contact: NAB, 1771 N Street, NW, Washington, DC 20036.

- April 12–15: 3rd Annual *International Conference on Antennas and Propagation*, University of East Anglia, Norwich, UK. Contact: IEE, Savoy Place, London WC2R OBL, United Kingdom.

- May 2–5: 2nd Annual *Test & Measurement World Expo*, Convention Center, San Jose, CA. Contact: Meg Bowen, Conference Director, 215 Brighton Avenue, Boston, MA 02134.

- May 15–19: 15th Annual *Meeting of the Conference of Radiation Control Program Directors*, Eldorado Hotel, Reno, NV. Contact: Charles Hardin, CRCPD, 65 Fountain Place, Frankfort, KY 40601.

- May 22–25: 18th Annual *Meeting of the Association for the Advancement of Medical Instrumentation*, Loews Anatole, Dallas, TX. Contact: AAMI, Suite 602, 1901 N. Fort Myer Drive, Arlington, VA 22209.

- May 23–26: *International IEEE/APS Symposium and National Radio Science Meeting*, University of Houston, TX. Contact: Professor Liang Shen, Department of Electrical Engineering, University of Houston, TX 77004.

- June 1–3: *IEEE/MTT-S International Microwave Symposium*, Sheraton Boston Hotel, Boston, MA. Contact: Frank Leith, Alpha Industries, 20 Sylvan Road, Woburn, MA 01801.

- June 12–16: 5th Annual *Bioelectromagnetics Society Meeting*, University of Colorado, Boulder, CO. Contact: BEMS, 1 Bank Street, Gaithersburg, MD 20878.

- June 21–23: *International Aerospace and Ground Conference on Lightning and Static Electricity*, Fort Worth, TX. Contact: Nick Rasch, FAA Technical Center, ACT-340, Atlantic City Airport, NJ 08405.

- July 18–21: 20th Annual *IEEE Conference on Nuclear and Space Radiation Effects*, Sheraton Gatlinburg Hotel, Gatlinburg, TN. Contact: E.F. Hartman, Div. 9336, Sandia National Laboratories, Albuquerque, NM 87185.

- July 18–22: 7th *International Symposium on Bioelectrochemistry and Bioenergetics*, Stuttgart, West Germany. Contact: Professor M. Blank, Department of Physiology, Columbia University Medical School, 630 West 168th Street, New York, NY 10032.

- August 23–25: *IEEE International Symposium on Electromagnetic Compatibility*, Hyatt Regency-Crystal City, Arlington, VA. Contact: Aaron Sullivan, Jr., 7121 Wolf Tree Lane, Rockville, MD 20852.

- August 23–26: *URSI International Symposium in Electromagnetic Theory*, Santiago de Compostela, Spain. Contact: Dr. J.L. Sebastian, Dept of Electricidad y Electronica, Facultad de Ciencias Fisicas, Ciudad Universitaria, Madrid (3), Spain.

- October 3–5: 3rd Annual *Meeting of the Bioelectrical Repair and Growth Society*, San Francisco, CA. Contact: Dr. Lorraine Day, San Francisco General Hospital, 1001 Potrero, San Francisco, CA 94110.