PUBLICATIONS

BOOKS

A.J. Baden Fuller, *Microwaves, An Introduction to Microwave Theory and Techniques,* second edition (Elmsford, NY: Pergamon), 1979, 326 pp., $30 hardbound, $13 paperback.
This revised and expanded edition now includes up-to-date information on semiconductor oscillations and amplifiers as well as a chapter on stripline devices.

Charles Panati and Michael Hudson, *The Silent Intruder, Surviving the Radiation Age* (Boston, MA: Houghton Mifflin), 1981, 208 pp., $9.95
Using a question and answer format, Panati, a radiation health physicist and former Newsweek *science editor, and Hudson, a* Newsweek *staffer, discuss the various types of radiation and their health effects. A chapter on RF and microwaves and one on ELF review some of the work of Adey, Becker, Frey, Marha, Schwan, and Zaret in language easily accessible to a general audience.*

REPORTS AND PERIODICALS

BRH

Carl I. Vassar, Jr., et al., *Report of State and Local Radiological Health Programs,* Fiscal Year 1979, Bureau of Radiological Health, October 1980, No. FDA 81-8034.

ELF

Roland J. Starkey, Jr., "The Renaissance in Submarine Communications, Part III, The ELF Odyssey 1958-1979," *Military Electronics/Countermeasures,* January 1981, p. 26.

Ovens

"Microwave Ovens," *Consumer Reports,* March 1981, p. 128. *A feature report including brand name ratings.*

Power Lines

John A. Molino, et al., *Psychoacoustic Evaluation of Transmission Line Audible Noise: Building Attenuation Effects, Methodology Comparison, and Field Study Feasibility,* January 1, 1979 to December 31, 1979, Volume 1, Department of Energy, No. DOE/RA/29323-1.

Stephen Shoenholz, Joel Ray, "High Power Lines," *Bulletin of the Atomic Scientists,* February 1981, p. 59. *An exchange about an earlier article by Ray.*

RF Heaters

Guide for Submission of Information on Industrial Radiofrequency Dielectric Heater and Sealer Equipment Pursuant to 21 CFR 1002.10 and 1002.12, Bureau of Radiological Health, November 1980, FDA 81-8137.

Report on the Survey of Radiofrequency Heaters, Environmental Health Directorate, Health Protection Branch, Ottawa, 1980, 80-EHD-47. Available from the Information Directorate, Minister of National Health and Welfare, Brooke Claxton Building, Ottawa, K1A 0K9.

VDTs

Colin Mackay, *Human Factors Aspects of Visual Display Unit Operation,* Health and Safety Executive, London (UK): Her Majesty's Stationery Office, 1980.

SHORT COURSES

- May 5-8, *Modern Antenna Measurements,* Holiday Inn of Bethesda, MD. Contact: Technology Service Corporation, 8555 16th Street, Silver Spring, MD 20910, (301) 565-2870 or 2950 31st Street, Santa Monica, CA 90405, (213) 450-9755. Fee: $525.

- May 27-29, *Microwave Technology and Applications for Industry,* Central New Jersey, Center for Professional Advancement, in conjunction with the International Microwave Power Institute. Contact: Mrs. Edith Webb, P.O. Box 964, The Center for Professional Advancement, East Brunswick, NJ 08816, (201) 249-1400. Fee: $390 for two days, $560 for three days.

- June 9, *Measurements for Microwave Safety and Compliance,* Royal York Hotel, Toronto (immediately prior to the International Microwave Power Institute annual meeting). Contact: IMPI, 211 East 43rd Street, New York, NY 10017, (212) 867-4659. Fee: $125 IMPI members, $150 non-members.

- July 6-8, *Diagnostic and Therapeutic Applications of Microwave Technology,* George Washington University. Contact: Continuing Engineering Education Program at GWU, Washington, DC 20052, (202) 676-6106 or (800) 424-9773 toll free. Fee: $595.

- August 17-21, *Ultrasound, Microwaves, Laser, and Ultraviolet: Biophysical and Biological Basis, Applications, and Hazards in Medicine and Industry,* Massachusetts Institute of Technology. Contact: Office of the Summer Session, Room E19-356, MIT, Cambridge, MA 02139. Fee: $725.

Navy May Scrap Project ELF

(continued from p. 1)

Weinberger. Crutchfield said that the decision was based on the advice of Chief of Naval Operations Thomas Hayward. A spokesman for the Navy would only say that the Secretary of the Navy had sent his recommendation to the Secretary of Defense, and that the final decision would be made by the President.

In a 1979 report, the General Accounting Office recommended that the project be scrapped. And in its FY81 Department of Defense authorization last August, Congress required the President to report back on the Administration's plans for the deployment of Project ELF or its cancellation by April 1, 1981.

More than $100 million have been spent on the ELF project, and another $500 million would be needed to complete it.

MICRO WAVE NEWS

Vol. II No. 3 A Monthly Report on Non-Ionizing Radiation April 1982

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Microwave News is conducting a survey of microwave-related litigation. If you have already received our questionnaire, please return your completed form as soon as possible. If you would like to participate, please contact us for more information. Survey results will appear in the newsletter this spring.

Microwave Oven Cataract Trial Adjourned—All Parties Silent

After one day of a jury trial, in which two legal secretaries sought damages for radiation-induced cataracts from an Amana microwave oven, the attornies for both sides agreed to an adjournment. None of the parties would comment on the resolution of the case.

According to the clerk at the US District Court in Providence, RI, a "consent decree was entered for the defendant on March 22, and the case was dismissed." But no further details on the nature of the agreement could be discovered.

Mark Decof of Decof and Grim in Providence, RI, representing the plaintiffs, refused to discuss the case. Steve Gustafson, general counsel for Amana Refrigeration Co. in Amana, IA, would only say that it was "company policy not to discuss litigation, especially litigation of this type."

Dolores Delsesto and Lynn Spinella had been seeking $3 million from Amana; they claimed they had developed cataracts from microwave radiation leaking from a Radarange oven. (See *MWN,* November 1981.) Delsesto had two cataracts and Spinella one. Dr. Milton Zaret, an ophthalmologist in Scarsdale, NY, had concurred with another diagnosis that the cataracts had been caused by "radiant energy."

The two women, both in their 30's, worked as legal secretaries for the firm of Adler, Pollack and Sheehan in Providence. The lunch room at the office had an Amana oven, Model RR-4D operating at 2450 MHz and purchased in 1975. The employees had assigned seats in the room, with Delsesto and Spinella closest to the oven.

The oven was tested for leaks by Dr. Marc Richman of the mechanical engineering department at Brown University. His measurements indicated

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NMR Indicates Rabbit's Lens May Be Wrong Model for Human Lens

The biochemistry of the rabbit's eye is significantly different from that of the human eye, according to recent studies of phosphorus-containing metabolites in the lens. The findings could have a profound impact on the study of cataract formation due to microwave radiation.

Using phosphorus-31 nuclear magnetic resonance (NMR), researchers from the Chicago College of Osteopathic Medicine have studied the enzymatic processes that regulate the metabolism of the lens. They conclude: "Overall results indicate that the cat and dog lenses most closely resemble the human lens in that they have the fewest number of significant metabolite differences, four and three respectively, relative to the human. The rabbit and cow lenses are the least similar to the human with 10 and 12 significant metabolite differences, respectively."

Rabbits' lenses have long been used to study cataract formation in humans. Drs. Stephen Kopp, Thomas Glonek and Jack Greiner report in the March 26 *Science* that their previous studies had indicated a pronounced difference between rabbit and human lenses—greater than they had anticipated—and

(continued p. 8)

HIGHLIGHTS

OSHA Stops Enforcement of RF/MW Hazards

According to new enforcement guidelines, Occupational Safety and Health Administration (OSHA) inspectors can no longer issue citations to companies for exposing their workers to radiofrequency and microwave (RF/MW) fields of greater than 10 mW/cm^2.

New instructions, dated March 17, from OSHA's Office of Compliance Programming and approved by OSHA Administrator Thorne Auchter specify that the general duty clause "may not be used to enforce 'should' standards." The 10 mW/cm^2 RF/MW standard was found to be an "advisory" or a "should" standard in the *Swimline Corporation* case (decided in 1975 and affirmed in 1977) and, as such, was ruled unenforceable. Occupational standards for RF/MW are therefore in limbo; the 10 mW/cm^2 standard is unenforceable and OSHA will not enforce the standard under the general duty clause.

The general duty clause is Section 5(a)(1) of the Occupational Safety and Health Act, which provides that each employer shall furnish employees with a work place that is free of recognized hazards.

Officials at OSHA confirmed that the enforcement of nonionizing radiation standards was now "up in the air." Harold Engel of the Solicitor's Office said that OSHA was in the process of deleting all "should" standards and that the effort could be accomplished in about a year. Work on a new standard continues; a spokesman from the Office of Physical Agents Standards said that the estimated schedule for publishing an advanced notice of proposed rule making in the *Federal Register* is now the early fall.

Massachusetts Proposed Standard Delayed

The Massachusetts ad hoc committee on radiofrequency/microwave radiation has delayed issuing its draft guideline for general public exposures. At a March 26 meeting, the committee extended the peer review period for its working draft 90 days to June 15 and cancelled a public hearing scheduled for April 29. Release of an official draft is now tentatively set for late August, with public hearings to follow in the fall.

The guideline sets a 200 uW/cm^2 limit for public exposure to 30-300 MHz radiation, more stringent by a factor of five than the new ANSI standard. Like its ANSI counterpart, the Massachusetts draft is frequency dependent, with higher exposure limits at other frequencies. (See *MWN*, March 1982.)

According to Robert Watkins of the state's Radiation Control Program, the 20 or so comments received so far are generally favorable. The Canadian Department of Health and Welfare has suggested a safety factor of 10, while a couple of reviewers have recommended adopting ANSI's 1 mW/cm^2 limit. The largest number of comments have addressed registration and exemption issues.

In a telephone interview, Professor A.W. Guy of the University of Washington, Seattle, said that the Massachusetts plan for combining a lower exposure limit with a longer averaging time for measuring exposures was a "clever" way of dealing with the chronic exposure problem. Guy chaired the panel that drafted the new ANSI standard.

Several experts contacted by *Microwave News* feared that the Massachusetts action was part of a trend toward independent state and local regulation which could create problems for manufacturing and communications companies. In fact, Arizona has begun work on a guideline that, said the director of the state's Radiation Regulatory Agency, Charles Tedford, "won't necessarily be the same as Massachusetts'."

Guidelines for Exposure to NMR Systems

The Bureau of Radiological Health (BRH) has issued guidelines to help evaluate the risks from nuclear magnetic resonance (NMR) devices in clinical trials. Exposure below the following levels is believed to be free of unacceptable risk. *Static (DC) Magnetic Fields:* Whole or partial body exposures of 2 tesla. *Time-Varying Magnetic Fields:* Whole or partial body exposures of 3 tesla/second. *Radiofrequency Electromagnetic Fields:* Exposure to RF fields that result in a specific absorption rate (SAR) that exceeds 0.4 W/Kg as averaged over the whole body or 2 W/Kg as averaged over any one gram of tissue.

Under Food and Drug Administration (FDA) rules, medical devices can qualify for an investigational device exemption (IDE) for use in trials if they do not present a "significant risk." By meeting these new BRH guidelines, NMR devices can win exemption from a local institutional review board. A finding of significant risk does not mean the device is too hazardous for clinical trials, only that an IDE must be submitted to the FDA for approval.

BRH's Dr. Whit Athey explained that the guidelines "are not meant to be general safety standards." They simply indicate permissible levels for clinical trials, he said.

The guidelines are modeled after those recently published by Professor Thomas Budinger of the University of California, Berkeley ("Nuclear Magnetic Resonance (NMR) *In Vivo* Studies: Known Thresholds for Health Effects," *Journal of Computer Assisted Tomography, 5,* 800, 1981), and by the National Radiological Protection Board (NRPB) ("Exposure to Nuclear Magnetic Resonance Clinical Imaging," *Radiography, 47,* 258, 1981). The BRH proposal for time varying magnetic fields is more stringent than that of the NRPB, which recommends a limit of 20 tesla per second for pulses of 10 msec or less. BRH's Athey explained that the bureau had opted to set one level to cover all contingencies, including variations in waveforms and repetition rates.

The guideline for partial body exposure to RF fields is stricter than the new ANSI standard which specifies an allowable SAR of 8 W/Kg. BRH notes that the ANSI standard is "based on the assumption that the far-field or near-field exposure produces a localized maximum in SAR." But in the case of NMR coils, "the peak SAR is deposited regionally in a layer of near-surface tissue that extends completely around the body. Therefore, a lower level of 2 W/Kg was chosen as the limit on peak SAR to prevent overloading the thermoregulatory system in any region of the body."

A number of NMR clinical trials are underway across the country. To date, there have been no reports of unanticipated effects from use of the machines.

For a copy of the guidelines contact: Robert Phillips, HFX-460, BRH, Rockville, MD 20857, (301) 443-3426. See also: 47 *FR* 11972, March 19, 1982.

Bioeffects Literature Digest Published

The National Telecommunications and Information Administration (NTIA) has resumed publication of its quarterly compilation of the bioeffects literature, *Biological Effects of Non-Ionizing Electromagnetic Radiation: A Digest of Current Literature.* This issue, Volume VI No. 1, covers July-

September 1981 and is the first to appear since work on the digest was suspended in September 1980 (after Volume V No. 1) because of lack of funds. A catch-up volume for the intervening period, ending June 1981, is at the printer now and should be available soon. Volume 6 No. 2 is due out in June.

The digest includes full citations and abstracts for current research as well as author and subject indexes. Continued publication of the series, which began in 1974, is very uncertain. There are no funds for it in the present NTIA budget.

The new volume is available from the National Technical Information Service (NTIS), Springfield, VA 22161. At press time its NTIS accession number and price had not been assigned, but it can be ordered by its NTIA number, NTIA-CR-81-15. For more information contact: Eugene Zucker, acting executive secretary of ERMAC, NTIA, 1325 G Street, NW, Washington, DC 20005, (202) 724-3323.

Power Line Studies Chosen in NY

The New York State Overhead Power Lines Project's Scientific Advisory Panel has recommended funding 15 studies on the health effects of power line radiation. These two- and three-year studies will receive the bulk of the project's $3.5 million research budget.

The panel will initiate two other efforts to confirm and to replicate Dr. Nancy Wertheimer's epidemiological study that found a correlation between 60 Hz magnetic fields and the incidence of childhood cancer. ("Electrical Wiring Configurations and Childhood Cancer," *American Journal of Epidemiology, 109,* 273, 1979.) First, $25,000 will be allocated to put Wertheimer's data into a machine-readable format suitable for re-analysis. Second, the state will soon issue a request for proposals for a replication study slated to cost about $500,000.

The advisory group has chosen three engineering experts to assist with the dosimetry in the various studies. They are: Dr. Don W. Deno of General Electric Co., Pittsfield, MA; Dr. Stephen D. Umans of MIT, Cambridge, MA; and Dr. Anthony R. Valentino of Argonne National Laboratory, Argonne, IL.

Dr. Maria Reichmanis, the scientific research coordinator for the project, resigned as of April 1. Michael Rampola of the state's Department of Health will fill in until a replacement is found.

Recommended Awards

Genetic, Cytogenetic, Teratogenic and Reproductive Studies: Dr. Maimon M. Cohen; University of Maryland School of Medicine, Baltimore, MD; $162,813; 2 years; *In Vitro* Genetic Effects of Electromagnetic Fields. Dr. Gordon K. Livingston; University of Utah Medical Center, Salt Lake City, UT; $151,088; 2 years; Reproductive Integrity of Mammalian Cells Exposed to 60 Hz Electromagnetic Fields. Dr. Arland L. Carsten; Brookhaven National Laboratory, Upton, NY; $384,864; 3 years; Mutagenicity and Toxicity of Electric and Magnetic Fields.

Cell and Organ Culture Studies: Dr. Wendell D. Winters; University of Texas Health Science Center, San Antonio, TX; $125,668; 2 years; Biological Functions of Immunologically Reactive Human and Canine Cells Influenced by *In Vitro* Exposures to Electric and Magnetic Fields. Dr. Ross W. Gundersen; University of Wisconsin-Parkside, Kenosha, WI; $122,374; 3 years; Effects of 60 Hz Electromagnetic Fields on Calcium Efflux and Neurotransmitter Release. Dr. Prasanta K. Basu; University of Toronto, Toronto, Ontario; $134,380; 2 years; Biological Effects of Extremely Low Frequency Electric and Magnetic Fields on the Ocular Tissues; An *In Vitro* Study. Dr. Gideon A. Rodan; University of Connecticut Health Center School of Dental Medicine, Farmington, CT; $106,513; 2 years; Effect of 60 Hz Electric and Magnetic Fields on Neural and Skeletal Cells in Culture.

***In Vivo* Animal Physiology and Pathophysiology:** Dr. Frank M. Sulzman; State University of New York at Binghamton, Binghamton, NY; $134,161; 3 years; Effects of Electromagnetic Fields on Circadian Rhythms.

Animal and Human Neurobiology: Dr. Amos G. Gona; University of Medicine and Dentistry of New Jersey, Newark, NJ; $118,306; 3 years; Effects of 60 Hz Electric and Magnetic Fields on the Developing Rat Brain. Dr. Jonathan R. Wolpaw; New York State Department of Health, Albany, NY; $251,785; 3 years; Chronic Effects of 60 Hz Electric and Magnetic Fields on Primate Central Nervous System Function. Dr. Klaus-Peter Ossenkopp; University of Western Ontario, London, Ontario; $32,993; 2 years; ELF Low Intensity Magnetic Fields and Epilepsy.

Animal and Human Behavior: Dr. John R. Thomas; Naval Medical Research Institute, Bethesda, MD; $110,390; 2 years; Investigation of Potential Behavioral Effects of Exposure to 60 Hz Electromagnetic Fields. Prof. Kurt Salzinger; Polytechnic Institute of New York, Brooklyn, NY; $199,365; 3 years; Biological and Behavioral Effects of ELF.

Multidisciplinary Human Studies with Controlled Exposure Conditions: Dr. Charles Graham; Midwest Research Institute, Kansas City, MO; $375,000; 2 years; Influence of 60 Hz Fields on Human Behavior, Physiology and Biochemistry.

Epidemiology of Human Populations: Dr. Samuel D. Kaplan; SRI International, Menlo Park, CA; $280,958; 2 years; Historical Cohort Mortality Study of Electric Utility Workers Exposed to Strong Electromagnetic Fields.

Miscarriage Cluster in Toronto

A cluster of miscarriages among employees in Toronto's Old City Hall is being investigated by the Ontario government. In 1980-1981, 10 out of 19 pregnant women working for the provincial Ministry of the Attorney-General had miscarriages; the 10 included all four of the pregnant women working in an office with two video display terminals (VDTs). All of the women used two photocopy machines located in a separate room. The ministry employs approximately 150 women in the office complex.

At the attorney-general's request, the Ontario Ministry of Health will soon appoint Dr. John Harkins, a physician at the University of Toronto, to determine if the ratio of miscarriages to pregnancies is statistically significant and if further investigation is necessary. Meanwhile, the Ministry of Labor has tested the VDTs for radiation leaks and has collected air samples from the offices to check for abnormal levels of ozone and toners and other potentially hazardous substances. According to a spokesman for the Ministry of Labor, Harkins could finish his investigation by early May.

Union officials are not satisfied with the government action. Robert DeMatteo of the Ontario Public Service Employees Union has called for a "thorough and truly independent investigation to resolve office safety issues," rather than a "statistical manipulation" that could dismiss a potential problem. At the Communications Workers of Canada, Gary Cwitco agreed that an epidemiology is needed, adding that "at this point simply testing the VDTs is not conclusive proof of their safety." US and Canadian government experts are of the opinion that the five other recently reported clusters of pregnancy problems among clerical workers were probably statistical quirks. (See *MWN,* November 1981 and January/February 1982.)

Dr. Anthony Muc of the labor ministry's Radiation Protection Service reported that the radiation levels from the two

VDTs "conform to levels seen in all other responsible testing." He said, "There is no adequate indication, and I don't think there will be, of any link between alleged clusters and something in the working environment."

The government's investigation began after minority party members of the provincial legislature questioned Labor Minister Russell Ramsay and Attorney-General Roy McMurtry on March 15 about the miscarriages. The situation, which has received national television coverage in Canada, has prompted the legislature's Richard Johnson to reintroduce his VDT safety bill, which failed to reach committee earlier this year. (See *MWN,* December 1981.)

According to DeMatteo, workers first told a supervisor at the ministry about the miscarriages last November. At the same time, the workers complained that using the photocopy machines, located in an unvented room, caused respiratory problems.

BRH Reorganization Moves Forward

The reorganization of the Division of Biological Effects (DBE) at the Bureau of Radiological Health (BRH) has taken another step forward with the announcement that four new branches have been approved by the parent agency, the Food and Drug Administration (FDA). Last year BRH revealed that it would transform DBE into the Division of Risk Assessment to reflect a greater emphasis on risk analysis (see *MWN,* December 1981). This change requires approval from FDA's parent, the Department of Health and Human Services, and is not expected until the end of the year.

In a shift from past practice, the four branches are arranged by radiation type rather than by biological or medical area. The new branches and their chiefs, who are expected to be named soon, are: Electromagnetic Radiation, Dr. Mays Swicord; Light, Dr. Elizabeth Jacobson; Ionizing Radiation: Dr. Richard Chiacchierini; and Ultrasound, Dr. Melvin Stratmeyer.

The electromagnetics branch will have responsibility for non-ionizing radiation with a staff of 10–12 professionals—significantly larger than before. The ultrasound program has also been increased.

EISs Out for Proposed Satcom Stations

RCA

A draft environmental impact statement (EIS) for RCA's proposed satellite communications station on Bainbridge Island, WA, has been released for public review. The facility would relay commercial communications to and from the Seattle area.

The two-volume document, prepared at RCA's expense by CH2M Hill, Inc., in Seattle, contains lengthy discussions of the bioeffects of microwave radiation prepared by Professor A.W. Guy of the University of Washington, Seattle, Dr. Don Justesen of the VA Medical Center in Kansas City, MO, and the Battelle Human Affairs Research Center in Seattle.

The maximum public radiation exposure next to the 7.9 acre site is estimated to be 4.14 uW/cm² with 14 transponders on each of three antennas in use. RCA wants to start with only two 12-meter parabolic antennas, each with three transponders in use, though, which drops potential exposure to 0.228 uW/cm².

Comments on the EIS are due by April 14. Officials at the Kitsap County Department of Community Development hope to publish a final EIS around mid-May. The county hearing examiner and the Board of County Commissioners will then hold public hearings before the board issues a final ruling. Rick Kimball of the development department said a decision could come as early as mid-August. Either side could then appeal the decision to the courts.

A draft EIS for an alternative site in a forest north of Bainbridge Island was released on March 31, with comments due by May 5. RCA opted to process two separate proposals simultaneously after the Bucklin Hill Neighborhood Association, led by Jerome Hellmuth, delayed construction plans for Bainbridge by successfully arguing that the county should require an EIS. (See *MWN,* October 1981.)

Copies of both draft EISs are available from CH2M Hill. After initial supplies are gone, the company will charge ten cents per page. Contact: Signe Gilson, CH2M Hill, Bellevue, WA 98105, (206) 453-5000.

Hughes Aircraft

The National Satellite Services, Inc., a subsidiary of Hughes Aircraft Co., has filed a draft EIS with the City of New York on its proposal to build a satcom station in the Spring Creek section of Brooklyn, NY. The draft EIS, released March 5, was prepared for Hughes by Fred Hart Associates of New York, NY, and has already been favorably reviewed by the city's Department of Environmental Protection and Department of Health.

The Hughes station would be part of its $20 million domestic communications satellite network known as the "Galaxy System." The Brooklyn proposal calls for building a total of seven 33-foot antennas operating at 6 GHz (with a 4 GHz downlink), though only two would be built initially.

According to an analysis by Hughes, public exposures to electromagnetic radiation from the station will never exceed 1–2 uW/cm². The power density study was performed by E. Villaseca and R. Berchtold of Hughes' Communications and Radar Division. They used Geometric Theory of Diffraction which, they claim, "provides precision computation of the fine structure of the antenna patterns." The calculations were validated by Dr. Samuel Koslov of the Johns Hopkins University's Applied Physics Laboratory.

Hughes also contracted with Dr. Herbert Pollack for an evaluation of the health implications of the station. Pollack concluded: "The power density at ground level and the nearest buildings from the proposed [station] will be in the very low microwatt level....In no area of the world is this considered a health hazard."

The site will have a microwave link with a relay facility on the roof of Two World Trade Center in downtown Manhattan. An interference analysis by Spectrum Planning of Richardson, TX, indicates that the station is compatible with Kennedy airport, local TV stations and other RF sources. A 40-foot wall will be built, however, to "improve interference margins."

According to Mira Ledman, director of the city's Office of Environmental Impact, a monitoring procedure will be set up once the station becomes operational to check ambient radiation levels. If the levels exceed some still to be determined level, mitigation measures will be initiated, she said.

The EIS is now being reviewed by Community Board No. 5 in Brooklyn. The board held a hearing on the proposal on March 24; neighborhood residents approved of the plan in concept, but wanted more information on the health effects of microwaves. Another hearing is scheduled for April 28. If it is approved by the board, the proposal will be the subject of a joint hearing by the city's Department of Environmental Protection and Department of City Planning this summer.

For information on the availability of the EIS contact: James Coyle at Fred Hart Associates, (212) 840-3990.

Hyperthermia Systems Under Study

Five teaching hospitals are in the process of evaluating hyperthermia systems for the National Cancer Institute (NCI). Each institution will be testing at least two systems. (See *MWN,* November 1981.) At the request of *Microwave News,* NCI has released a list of the types of equipment available at each medical center. The table given below is a modified and updated version of the NCI data.

The deadline for proposals in NCI's hyperthermia quality assurance program—a second and separate initiative—has been extended to April 30 and a pre-proposal conference was held on March 17 at NCI in Bethesda, MD.

Institution and Principal Investigator	*Type of Equipment*					
	Interstitial	*RF Capacitive*	*RF Inductive*	*Microwave*	*Phased Array*	*Ultrasound*
University of Arizona Medical Center Dr. Michael Manning, (602) 626-6723	✓*	✓*	✓+&*	✓*	✓*	
M.D. Anderson Hospital, University of Texas Dr. Peter Corry, (713) 792-3292	✓*	(✓*)	✓*			✓*
MIT-New England Deaconess Hospital Dr. Padmakar Lele, (617) 253-5235		✓†	✓+		✓‡‡	✓*
Stanford University Medical Center Dr. Malcolm Bagshaw, (415) 497-5650	✓*			✓‡	✓‡‡	✓*
University of Utah Medical Center Dr. J. Robert Stewart, (801) 581-8793			✓+	✓‡	✓‡‡	

* = in-house design; + = Henry Radio Magnetrode; † = IIMS System; ‡ = BSD-1000; ‡‡ = BSD Phased Array; (✓*) = rarely used; IIMS = International Institute for Medical Sciences.

UPDATES

Biological Effects....Some 35 scientists and engineers participated in the March 16–19 *Workshop on the Behavioral Effects of Microwave Radiation Absorption.* Workshop organizer Professor John D'Andrea said he was pleased with its outcome: "It gave everyone an opportunity to hash out controversial subjects." The proceedings, papers and excerpts from the discussions will be edited by D'Andrea and BRH's John Monahan and should be available next February ....Dr. William Morton's study correlating RF/MW levels with cancer among Portland, OR, residents (see *MWN,* January/February 1982) has been circulated for peer review by EPA....The AF's School of Aerospace Medicine at Brooks AFB will issue an RFP at the end of April for research on the physics of RF/MW interactions with biological systems. The AF wants to develop data on mechanisms. For more information contact: Dr. David Erwin, (512) 536-3582, cite PMRN 82-95....Drs. Przemyslaw Czerski and Ewa Manikowska's paper on their recent work, which we said last month would be covered in this issue, has been delayed at the typist. We hope to report on it next month....Drs. Robert Becker and Andrew Marino's new book *Electromagnetism and Life* has just been published by the State University of New York Press in Albany, NY (cloth: $33.50, paper: $10.95). And John Ott's *Light, Radiation, & You* will soon be released by Devin-Adair Co. of Old Greenwich, CT (cloth: $14.50). We will review both books in a forthcoming issue.

Communications....Local opposition could hold up the World Christian Broadcasting Corp.'s plans for a 100 kW shortwave (5.9–17.9 MHz) radio station near Anchor Point, AK. An informal objection filed with the FCC by a citizen's group last November has prompted the commission to ask EPA to analyze radiation levels from the proposed Alaskan station....Another community group, in Scotts Mills, OR, has hired a lawyer in its fight against an existing KECH-TV broadcasting tower that it fears might pose health risks....The FCC has published its notice of proposed rule making to bring RF/MW hazards under its environmental protection rules in the February 25 *Federal Register* (47 *FR* 8214). (See *MWN,* March 1982.) Note the correction for a formula footnoted in the original notice (47 *FR* 10871, March 12)....The commission is seeking comments in preparation for the 1984/1986 WARC on the use of the HF bands allocated to the broadcasting service....Five companies must compete for the new AM stereo market. Broadcasters and receiver manufacturers had hoped the FCC would approve a single system in its final rules for AM stereo broadcasting (47 *FR* 13152)....On the cellular communications front, Western Union has entered the arena by acquiring an interest in Cellular Communications Inc. of New York City and by joining a venture with three other companies to get franchises for mobile telephone networks....Meanwhile, Millicom Inc. plans to begin testing its mobile telephone system in the Raleigh-Durham, NC, area this month.... The FCC published its final rules for the new cellular service on March 9 (47 *FR* 10018)....Up to 4,000 new low-power television stations are expected to spring up in the next few years. The FCC is bracing itself for as many as 18,000 new license applications for the stations, which received final approval on March 4....At the request of Marti Electronics Inc., the commission has released a notice of proposed rule making for microwave boosters, a relay device that receives and retransmits a signal at the same frequency.

Compatibility and Interference...."Do radio broadcasts and radar transmissions pose a threat to chemical plant safety? The answer is yes, according to a small body of experts, who now suspect that large metal structures can act as receiving antennas for wave energy. Under the right conditions, they say, this energy can be converted into sparks of static electricity strong enough to cause explosions of flammable gases." So begins a special report on RFI in the chemical and oil industry in the March 8 *Chemical Engineering* magazine. According to the article, while no one has yet linked a disaster with electromagnetic energy, the UK and West Germany will soon issue guidelines for the joint siting of antennas and chemical plants. The authors refer to the case of a local AM station in Scotland which will have to move to make way for a tanker-loading terminal. They quote a British expert's view that loop-shaped structures like cranes and piping are the most efficient absorbers at frequencies below 30 MHz; radar at higher frequencies is also a threat due to its high energy pulses. An accompanying editorial advocates regulation before an accident happens "that would put vast areas of the country off-limits to the builders of new plants."...The space shuttle's third mission was hailed as a success despite problems with the mechanical arm and radio transmitters. The *Washington Post*'s Thomas O'Toole reported on a less publicized disturbance: every time the spacecraft flew north toward the Soviet Union, the astronauts heard loud static noises. Engineers at the Johnson Space Center in Houston speculated that the interference was caused by the Soviet's "Woodpecker" over-the-horizon radar at Rostov....The FCC has decided that anyone applying to build a new TV station on channel 14 or 69 (or modify an existing one) will have to protect against "objectionable interference to existing land mobile facilities in the 460–470 MHz (channel 14) or in

the 806–816 MHz (for channel 69) band *prior to program test authorization*."...The National Association of Broadcasters released a report on interference to US AM radio stations from Cuban transmitters to a House Foreign Affairs Committee hearing on March 4. The administration wants to set up a 50 kW station, Radio Marti, at 1040 kHz to broadcast news to Cuba. Some fear that Cuba will retaliate by building more interfering transmitters. At the mark up of HR 5427, which allocates funds for Radio Marti, Congressman Dante Fascell (D-FL) added a provision that would compensate AM stations for Cuban RFI. For a copy of the NAB report call (202) 293-3557....A team from Japan reports on an experimental study of noise generated by microwave oven magnetrons in the December 1981 *Journal of Microwave Power.*

EMP....William Broad continues to report on the potentially crippling effects of electromagnetic pulse (EMP) radiation in the March 12 *Science.* In his article, "A Fatal Flaw in the Concept of Space War," he writes that a single nuclear blast in outer space "would instantly set up an electric pulse of up to a million volts per meter in hundreds of satellites and battle stations....A 2-megaton blast just outside the earth's atmosphere would set up a pulse in objects as far away as geosynchronous orbit, some 36,000 kilometers above the earth." Such pulses could knock out laser weapons that DoD is developing at a cost of $300 million a year. Broad attributes part of the snafu to the lack of coordination between the Defense Advanced Projects Agency (DARPA) and the Defense Nuclear Agency (DNA). DARPA is responsible for the laser program and DNA for radiation effects....In contrast to Broad's article, William Scott writes in the March 15 *Aviation Week and Space Technology* that recent test data from DNA indicate that satellite hardening techniques currently in use are "more effective than predicted initially."...With respect to the vulnerability of electronics on earth, the February *Microwave Systems News* quotes James Wade, the deputy under secretary of defense for research and engineering, as telling a closed session of the House Armed Services Committee's r&d subcommittee that he favors an above ground nuclear test to gauge the impact of EMP on hardened electronics....In contract news, the air force at Kirtland AFB, NM, has awarded the Dikewood Corp. of Albuquerque, NM, more than $6 million for "EMP hardening and hardness assurance development." And the Naval Surface Weapons Center in Silver Spring, MD, is negotiating with Rockwell International of Anaheim, CA, for EMP testing of Tacamo aircraft.

Government....The Senate Judiciary Committee's subcommittee on agency administration will hold a hearing on the *Feres* doctrine on April 14. Under the doctrine, the federal government is not liable for injuries to members of the armed services on active duty. A suit is possible, however, if Congress passes a "private release bill." Spokesmen from DoD, the VA and Justice will address such bills at the hearing. In addition, Senator Claiborne Pell (D-RI) will testify on the Charles Day case. Day died under mysterious circumstances while in the Navy—some people suspect microwaves were involved. (See *MWN,* December 1981.) Christopher Scanlan has written a long piece on the case for the *Providence Sunday Journal Magazine* (March 28): "What Killed Chuck Day? His parents blame malnutrition, malpractice and microwave radiation. The Navy won't talk about it."... BRH has announced the names of the new members of the Technical Electronic Product Radiation Safety Standards Committee (TEPRSSC). They are: Dr. Thomas Budinger, University of California, Berkeley; Janice Gordon, International Union of Electrical, Radio and Machine Workers; David Janes, Environmental Protection Agency; Maurice Neuweg, Illinois Department of Nuclear Safety; David Sliney, US Army Environmental Hygiene Agency; and Dr. Max Weiss, Bell Laboratories. For more information contact: BRH's Dr. Zory Glaser, (301) 443-3429....DOE is planning to prepare an EIS on the construction and operation of an overhead, 450 kV powerline, which will run between a Hydro-Quebec substation in Sherbrooke, Quebec, and a New England Power Pool facility in Grafton County, NH. For more information contact DOE's Linda Desell at (202) 252-6374 and see 47 *FR* 8619, March 1.

Litigation....A trial date of May 10 has been set in the case of Leo and Muriel Schuerman v Pacific Telephone and Telegraph Co. in Superior Court of California, County of Riverside (No. 136703). Pacific Telephone is building a line of sight microwave relay system between Los Angeles and San Diego with seven 55-watt transmitters. The Schuermans own property that lies beneath the proposed microwave beam. In their complaint (filed September 16, 1980, and amended August 5, 1981), they charge Pacific Telephone with nuisance and trespass as well as conducting an "ultra hazardous activity." Dr. A.W. Guy and Don Justesen are scheduled to testify for Pacific Telephone. The Schuermans, represented by Joseph Aklufi of Redwine and Sherrill in Riverside, want the telephone company to buy their property and are seeking punitive damages.

Medical Applications....There is a new association for those interested in NMR: *The Society of Magnetic Resonance in Medicine.* Its president, Dr. Paul Lauterbur of SUNY, Stonybrook, is being assisted by Dr. Gerald Pohost of Mass General Hospital (MGH). The new group was incorporated on the first of the year, and has already received some 500 inquiries about membership. Its first meeting is scheduled for August 16–18 in Boston; see conference calendar on p. 8 for details....On April 21, Professor Robert E. Steiner of Hammersmith Hospital, London, UK, will deliver the 15th Aubrey O. Hampton Lecture at MGH and NMR and its clinical applications. Contact Dr. Juan Taveras at MGH for details (617) 726-8344....The meeting on the *Application of Optical Instrumentation in Medicine,* scheduled for New Orleans, LA, May 9–12, will feature two sessions on NMR. For more information contact the Society of Photo-Optical Instrumentation Engineers in Bellingham, WA 98227, (206) 676-3290....Yet another popular article on NMR ran in the April *Discover*....Dr. Betty Sisken of the University of Kentucky, Lexington, was this month's participant at the ONR seminar series in Bethesda, MD. She spoke on "Electrical Stimulation of Nerve Growth in Vitro and Limb Regeneration in Vivo."...Recent studies of hyperthermia applicators (operating at 2450 and 434 MHz) by a team of French scientists demonstrate "the necessity of surface cooling and the advantage of 'cross-fire' configuration in localized hyperthermia." Their report appears in the most recent issue of the *Journal of Microwave Power,* December 1981....And a group from the University of Utah is working on models to determine the optimal arrangement of dipoles in regional and whole-body applicators. See the March *Proceedings of the IEEE.*

Military Systems....The Wisconsin state senate did not pass a resolution calling for the dismantling and removal of the Project ELF antenna on March 23. The vote was 19–13 with one abstention....Dr. Thomas Amlie, the former technical director (1968–70) of the Naval Weapons Center at China Lake, CA, has caused quite a stir with an article in the April *IEEE Spectrum:* "Radar: Shield or Target? Costly radar being developed by the US may give an opponent a decisive advantage by broadcasting the position and makeup of forces." Before the issue reached the IEEE membership, it was front page news in the *Washington Post,* and the next day a feature story in the *New York Times.* Amlie does not want to eliminate radar but to reduce its vulnerability. He cites the case of an American Shrike missile homing in on a US destroyer's radar in the gulf of Tonkin....The navy's development of a laser submarine communications system continues: the Naval Ocean Systems Center is negotiating a contract with W.J. Schafer Associates of Wakefield, MA, for research on operational concepts; the Naval Electronic Systems Command in Washington, DC, has signed a $1.3 million contract with GE's Space Systems Division in Philadelphia, PA, for a conceptual design study; and ONR is negotiating with the Westinghouse R&D Center in Pittsburgh, PA, for work on the blue-green laser itself....The army's Electronics R&D Command in Fort Monmouth, NJ, has contracted with Hughes Aircraft Co. of Fullerton, CA, for 12 AN/TPQ-37 artillery-locating radar systems at a cost of $59.7 million.

Occupational Health....Two congressmen have introduced bills which would move NIOSH out of CDC and into NIH. After holding hearings before the subcommittee on labor and HHS of the House Appropriations Committee on February 25, Congressman David Obey (D-WI) sponsored HR 5914, which would reorganize the Public Health Service, with NIOSH becoming one of the institutes under the NIH umbrella. Congressman Henry Waxman (D-CA), chairman of

the health and environment subcommittee of the Committee on Energy and Commerce, introduced HR 5919 on March 22, which, among other provisions, would have the same effect on NIOSH. Hearings on the Waxman proposal are scheduled for April 23....The Rocky Mountain Center for Occupational and Environmental Health (RMCOEH) at the University of Utah is sponsoring a course on *Current Issues and Trends in Controlling Occupational Exposures to RF/Microwave Radiation,* September 8–10 and again February 9–11, 1983. Robert Curtis, a clinical instructor at RMCOEH and a senior industrial hygienist with OSHA, will teach the course. For more information contact: Ms. K. Blosch, RMCOEH, Bldg. 512, University of Utah, Salt Lake City, UT 84112, (801) 581-5710.

Ovens....Worries about the spread of trichonosis from the incomplete cooking of infected pork in microwave ovens cropped up again last month when newspapers picked up some comments by Dr. Peter Schantz of CDC. The Department of Agriculture had warned customers about the possibility of non-uniform heating of pork in microwave ovens and the attendant risk of failing to kill any *Trichinella* larvae last year (see *MWN,* June 1981). Schantz wrote up the USDA report for CDC's *Veterinary Public Health Notes;* this was picked up by the Atlanta papers and by others across the country. The message remains the same as last year: be sure to heat *all* parts of the pork to above 137° F (58.3° C). Or at least about the same. USDA had recommended that the pork reach 170° F. Schantz's warning appeared in the last issue of the *Notes;* CDC stopped its publication due to budget cuts....Factory shipments of microwave ovens were down again in February in relation to both January and February 1981. The Association of Home Appliance Manufacturers' statistics show that 261,800 ovens were produced or imported in February, compared with 333,900 in February 1981 and 304,000 in January 1982.

Satellite Communications....*NASA Space Communications Program,* February 1982, a report on the 30/20 GHz project, is now available from the House Committee on Science and Technology.... NASA has scheduled its third industry briefing on the 30/20 GHz program for April 20–21 in Cleveland, OH....Comsat is building a satcom station with a 61-foot dish antenna near Lenox, WV, to serve as a backup for its Etam facility 22 miles away....The company is also building an earth station at Palau, Micronesia, the first of seven Intelsat earth stations planned for island communications....The first international teleconferencing service could start this year. Intercontinental Hotels Corp. and Comsat plan to link New York and London in December....The FCC has received many unfavorable responses to its proposed reduction of satellite spacing to 2° from 4°. Both the March 29 *Electronic News* and the March 15 *Broadcasting* review the comments on the plan....The National Association of Broadcasters has come out against quick approval of direct broadcast satellite (DBS) service. In a recent policy statement, the NAB favored developing high definition television in the 12 GHz band over DBS, which would not provide a new service....But the FCC's broadcast bureau chief, Larry Harris, has said the commission will authorize DBS this summer or earlier, according to a report in *Broadcasting,* March 22....United Satellite Television is ready for this move. The company plans to offer four channels of programming via DBS next year....Britain has already approved the service, which could begin there in 1986....European worries over DBS are explored in the March 22 *Wall Street Journal*....The RCA transponder saga continues: the FCC approved RCA's plans to lease transponders on its new Satcom IV satellite at a price reflecting market demand. A suit filed by UTV Cable Network and Kentucky Educational TV temporarily blocked the scheme, but then a federal appeals court freed the company to offer transponders at $13 million each.

Short Courses....• April 27–29: *Electromagnetic Radiation Hazards and Medical Applications* by Dr. L. Larsen and J. Jacobi of Walter Reed Army Institute of Research at Georgia Institute of Technology, Atlanta, GA, fee $400. Contact: (404) 894-2400....• May 17–18: *Hazardous Electromagnetic Radiation and its Biological Effects* by Dr. Bernhard Keiser at George Washington University (GWU), Washington, DC, fee $530. Contact: (202) 676-6106 or (800) 424-9773....• August 9–13: *Laser, Microwaves, Ultraviolet and Ultrasound: Biophysical and Biological Basis, Applications, and Hazards in Medicine and Industry* by Dr. P. Lele at MIT, Cambridge, MA, fee $775. Contact: Director of Summer Sessions, Room E19-356, MIT, Cambridge, MA 02139. In addition, GWU sponsors a host of other courses on radar, spectrum management, remote sensing, and microwave and millimeter technology. Contact GWU for details. See also occupational health update.

Standards....ANSI is making a last minute effort to reach consensus on its new RF/MW standard, which is already in galleys. ANSI asked Allan Eckhaus of Consumers Union to reconsider his negative vote; it would have settled for an abstention. In a March 12 letter, Eckhaus stood firm; he still could not agree with ANSI's six-minute averaging time for measuring exposures (see *MWN,* May 1981). It's not clear what action, if any, ANSI will now take....There will be a session on state regulations for non-ionizing radiation on May 26 at the *Conference on Radiation Control;* see conference calendar (p. 8) for details.

Technology....Microwave landing systems are beginning to be installed at airports across the country. With them come citizen apprehension over radiation risks; FAA officials are attempting to reassure them that there are no hazards....The FAA's 20-year, $10 billion program to modernize and automate the national airspace system is described in the March 8 *Aviation Week & Space Technology* and the April *Technology Review*....The March 1 *Aviation Week* reports that Westinghouse has successfully demonstrated a railgun that fired a projectile at more than 13,000 feet per second. The launcher will now be moved to the Picatinny Arsenal, NJ, where tests will resume in August....Microwaves continue to dominate the *Wall Street Journal*'s weekly "Technology" column: on March 12, the *Journal* reported that Ideal Research Inc. of Rockville, MD, has developed a device that can measure the thickness and growth rate of ice on a plane's surface—ice changes the principal frequency of the beam. There is one hitch, though: the instrument does not work too well if there is water mixed with the ice. On March 19, the *Journal* ran a piece about a radar system developed by the Canadian government for use on satellites to gather data on ice fields in shipping lanes....*Science* ran a two-part series on the first ten years of Landsat in its March 26 and April 2 issues....A three-day international conference on *Electrotechnologies in Industry* is scheduled for May 25–27 in Montreal, Canada. There will be a number of sessions on the use of RF energy. Contact: Sandra Wilkins, MITRE Corp., 1820 Dolley Madison Blvd., McLean, VA 22102, (703) 827-6211.

VDTs....The Massachusetts legislature will consider a VDT safety bill during its 1982 session. House bill 2910, introduced by Rep. John Driscoll, a Republican from Northbridge, MA, includes a number of ergonomic requirements for VDT work stations and calls for periodic rest breaks and annual eye exams for operators....Bell Canada tested several hundred of its VDTs for X-ray radiation between July and November of last year. According to the company's regional director of safety, Jim Allan, "nothing came up to cause any concern whatsoever, so we don't plan to do more testing."...An Australian Postal and Telecommunications Union's report on VDTs (or VDUs), *VDUs and Ill-Health: The Evidence,* found "a sufficiently large body of evidence to cast grave doubts on the claim that [VDTs] are completely safe." Its concluding policy statement calls for a three-day week for full-time operators until more is known about the terminals. Contact: G. Slater at the union, PO Box 208, Carlton South, Victoria, 3053, Australia....David Eisen of the Newspaper Guild and William Murray of NIOSH have called for research on the low-level, low-frequency radiation emitted by VDTs. According to an article in the March 12 *Guild Reporter,* both men noted the complete absence of knowledge about 15–125 kHz radiation at the American Industrial Hygiene Association seminar on VDTs, March 1–2 in Denver....A summary of the National Academy of Sciences' August 1981 symposium on VDTs and vision will soon be published in *Behavior and Information Technology.* In their abstract, authors Barbara Brown and Key Dismukes of the NAS Committee on Vision and Edward Rinalducci of the Georgia Institute of Technology recommend "properly designed epidemiological studies comparing the incidence of visual problems in VDT operators with that of non-VDT workers."

Etc....Professor James Gould of Princeton University has published "The Map Sense of Pigeons," in the March 18 *Nature,* and

Thomas Maugh II reviews the implications of recent findings that species ranging from humans to algae contain magnetic material in "Magnetic Navigation and Attractive Possibility," in the March 19 *Science*.... Could quartz-bearing rock emit radio waves before an earthquake? If so, they could become the basis of a warning system. See the March 20 *Science News* for details.... IMPI's membership directory is now available to the institute's members for $10. Contact: IMPI, 301 Maple Ave. W., Tower Suite 520, Vienna, VA 22180.... Dr. Vernon Riley died of a sudden heart attack on March 30 while attending the American Cancer Society meeting in Daytona Beach, FL. Riley had been affiliated with the Hutchison Cancer Research Center and the University of Washington Medical School in Seattle. He was well known for his work on the relationship between stress and cancer.

Microwave Oven Trial *(continued from p. 1)*

that the oven met the Bureau of Radiological Health's 1970 emission standard, which specifies a maximum leakage of 5 mW/cm^2, five centimeters from the external surface of the oven after purchase.

Zaret, who was scheduled to testify at the trial, said that he thought the adjournment of the case was a "form of censorship," placing the cataract case out of reach of the medical community. "There is no reason in the world to settle," he added, "if the cataracts were not caused by the oven."

Others scheduled to participate at the trial were Leo Birenbaum of the Polytechnic Institute of New York in Brooklyn, NY, for the plaintiffs and Drs. Przemyslaw Czerski of BRH, A. William Guy of the University of Washington, Seattle, and John Osepchuk of the Raytheon Co. for the defendant. Amana is a subsidiary of Raytheon.

In the first and only day of the jury trial, Leonard Decof made the opening statement for the secretaries, followed by their testimony and cross-examination. Before the trial could resume the next day, both parties agreed to call it off.

Rabbit's and Human Lenses *(continued from p. 1)*

that they had undertaken the present work to identify the type of mammal whose lens most resembles the human one.

Speaking from the NMR Laboratory at the college, Kopp warned that the rabbit's eye should not be used as a surrogate for the human eye. "We need to reassess the animal models we are using," he said.

Most experts on the effects of microwaves on the eye contacted by *Microwave News* had not had a chance to review the paper. All agreed, however, that the rabbit's eye had been the preferred experimental system to study microwave-induced cataracts because of its size, its general anatomical similarity to the human lens and because rabbits are cheap and easy to work with. Professor Stephen Cleary of Virginia Commonwealth University pointed out that research to date indicates the rabbit is one of the species most sensitive to cataract development.

Kopp and his co-workers found that, "generally, the rank order of lens metabolism from most to least similar to human is: cat > dog > pig > rat > sheep > rabbit > cow."

See also: J.V. Greiner *et al.*, "Organophosphates of the Crystalline Lens: A Nuclear Magnetic Resonance Spectroscopic Study," *Investigative Ophthalmology & Visual Science* (St. Louis), *21*, 700, 1981; and S.J. Kopp *et al.*, "Analysis of Intact Lens Metabolites by P-31 NMR Spectroscopy," *Current Eye Research* (London), *1*, 375, 1981.

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

CONFERENCE CALENDAR

• May 24–27: 14th Annual *National Conference on Radiation Control,* Holiday Inn, Portland, ME. Contact: Wallace Hinckley, Maine Dept. of Human Services, 157 Capitol St., Augusta, ME 04333.

• 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 3–8: *International Symposium on Electromagnetic Effects,* University of Ottawa, Canada. Contact: Dr. Patrick Babin, 1982 Learned Societies Conference, University of Ottawa, 65 Halsey Street, Ottawa, Ontario, Canada K1N 6N5.

• 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. On June 18 immediately after the conference, there will be a one-day workshop on *Medical Applications of Electromagnetic Energy.* Contact: Dr. Gordon Short, BSD Medical Corp., 420 Chipeta Way, Salt Lake City, UT 84108.

• June 28–July 1: *Conference on Precision Electromagnetic Measurements,* University of Colorado, Boulder, CO. Contact: Robert Kamper, National Bureau of Standards, Boulder, CO 80303.

• 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 20–22: IEEE Annual Conference on *Nuclear and Space Radiation Effects,* Caesars Palace, Las Vegas, NV. Contact: A. Ochoa, Jr., Div. 2144, Center for Radiation-Hardened Microelectronics, Sandia National Laboratory, Albuquerque, NM 87185. This meeting will be followed on July 23 by the *Hardened Electronics and Radiation Technology Conference* hosted by the Defense Nuclear Agency. A Secret security classification is required to attend. Contact: Director, DNA, Attn: ISSO/Barbara Perkins, Washington, DC 20305.

• July 25–30: 17th Annual Symposium of the *International Microwave Power Institute,* Town and Country Hotel, San Diego, CA. Contact: IMPI, 301 Maple Ave. W., Tower Suite 520, Vienna, VA 22180.

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

• August 16–18: 1st Annual *Meeting of the Society of Magnetic Resonance in Medicine,* Boston, MA. Contact: Deedee Correia, NMR Laboratory, Research 501, Massachusetts General Hospital, Boston, MA 02114.

• September 5–11: *World Congress on Medical Physics and Biomedical Engineering,* including the 13th *International Conference on Medical and Biological Engineering* and the 6th *International Conference on Medical Physics,* Congress Center, Hamburg, Germany. Contact: MPBE 82, Congress Organization, PO Box 302360, D-2000 Hamburg 36, Federal Republic of Germany.

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

• September 8–10: *International Symposium on Electromagnetic Compatibility,* Marriott Hotel, Santa Clara, CA. Contact: Dr. Andrew Nalbandian, 20617 Debbie Lane, Saratoga, CA 95070.

• September 13–17: 12th *European Microwave Conference,* Helsinki, Finland. Contact: Prof. M. Tiuri, Helsinki University of Technology, Radio Lab, Otakaari 5A, 02150 Espoo 15, Finland.

• 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.

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A Monthly Report on Non-Ionizing Radiation April 1983

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A report on the 1983 EMC conference held in Zurich on March 8-10 will appear next month.

States Propose VDT Legislation

State regulations for video display terminals (VDT) may be on the way. An informal survey conducted by *Microwave News* last month found safety bills or requests for VDT studies pending in five states and planned in four others.

For the most part, legislators are addressing ergonomic issues. As the list of proposed actions on page 2 shows, guidelines for lighting, furniture and terminal design are the central elements in bills from Connecticut, Illinois, Maine, Massachusetts and Oregon. Groups in California, Ohio, Texas and Washington are also considering introducing legislation.

Only Oregon and Massachusetts would require employers to offer alternative work to pregnant women, a clause included in several Canadian union contracts. Many of the states would require regular eye examinations.

No state has proposed monitoring VDT radiation emissions. A provision requiring radiation checks for VDTs was cut from Connecticut's safety bill before it left committee.

In addition to bills with specific regulations, Connecticut and Massachusetts are considering setting up committees to investigate VDTs and then draft legislation if necessary. In New York, a hearing on VDTs scheduled for April 14 could result in the introduction of a safety bill.

Several bills have also been introduced in Canadian provincial legislatures but none has become law.

Though growing public awareness of VDT health issues has prompted some legislators to propose rules, the need for regulations is under dispute. At a March hearing on Connecticut's proposed VDT safety bill, for example, spokesmen for IBM advised that long experience and numerous studies show that VDTs are completely safe. Further, the company maintained that marketplace competition assures manufacturer responsiveness to the needs of users.

(continued on p. 2)

VDT-VLF Radiation Tests in Canada

Two recent reports from Canada describe measurements of the very low frequency (VLF) radiation emitted by video display terminals (VDTs). One by Dr. Stuart Harvey of Ontario Hydro details the characteristics of pulsed 16 kHz radiation. The other by Dr. Hari Sharma of the University of Waterloo, Ontario, presents the results of his VDT surveys at Surrey Memorial Hospital in Vancouver, BC.

As part of an ongoing investigation of VDTs at Ontario Hydro, Harvey measured and analyzed terminal emissions below 10 MHz. His tests of four VDTs found "no fields having characteristics presently known or suspected of being detrimental to human health."

For VLF, the peak pulse value of the 16 kHz field ranged from 19 to 170 V/m at a distance of 30 cm from the front of the sets: the pulses had a rise time of 2 to 4 microseconds and harmonics were observed up to 1 MHz. The root mean square (rms) varied from 3 to 30 V/m at 30 cm. VLF levels at the back of the terminals near the flyback transformers were much higher than at the front and Harvey notes that someone working within one foot of a VDT's rear casing "could receive an exposure in excess of the most restrictive standards." He describes this risk as being "largely confined to service personnel."

(continued on p. 2)

VLF Radiation Tests *(continued from p.1)*

Sharma, on the other hand, is not convinced exposure to pulsed VLF fields is safe. On the basis of his radiation tests at Surrey Memorial and an informal survey of workers at seven other British Columbia hospitals, Sharma believes a careful study at the hospitals is warranted. But he warns that a "linkage" between adverse health effects and VLF radiation may not be inferred at this time. He recommends shielding to reduce VLF emissions as a precautionary step.

Radiation measurements were taken at the request of the Hospital Employees Union last fall after six out of seven pregnancies among workers in Surrey's accounting office ended in miscarriage, birth defects or premature birth (see *MWN*, July/August 1982). Sharma's survey of hospital clerks using the same type of plastic-cased VDTs found an unexpectedly high incidence of pregnancy problems: workers, including the Surrey operators, reported only five normal births out of 17 pregnancies.

An arbitration panel was recently set up to hear the union's grievance against Surrey's administration for its handling of VDT safety issues. The hospital maintains that the terminals are safe; radiation tests by its consultant, Professor A.W. Guy of the University of Washington, Seattle, found no emissions over a few volts/meter (see *MWN*, March 1983). The union seeks guaranteed safeguards against potential VDT health hazards. Meanwhile, concerned workers in the accounting office staged a protest last month and turned off their machines for four days.

According to Sharma's preliminary report released last month, the "maximum average value" of VLF radiation at the back of the VDTs near the flyback transformers was as high as 1,250 V/m, with a peak pulse value of up to 15,000 V/m. The average value of the field at 30 cm from the sets dropped to 25 V/m. Sharma found no evidence of significant emissions of X-ray, ultraviolet, infrared or microwave radiation or of PCBs.

The December 16 Ontario Hydro report states that available evidence suggests shielding for VLF is unwarranted. Harvey did investigate the effectiveness of shielding, however, and found that lining the inside of a plastic-cased terminal with copper foil and then grounding the foil substantially reduced 16 kHz emissions.

Harvey, who is with Ontario Hydro's research division in Toronto, also looked at the DC fields produced by the positively charged display screen: field levels ranged from 700 to 7,000 V/m at a distance of 30 cm. The DC field was "modulated, when a display is present, by the process of writing on the CRT screen." He found that "the modulation waveform has a 60 Hz repetition rate and can be quite complex, depending on the display format." The report states that "although there are no known direct health effects from such fields, an indirect effect from atmospheric positive ions has been suggested."

Ontario Hydro has also completed an ergonomics survey among some of its clerical workers. See the VDT update on page 8.

VDT Legislation *(continued from p.1)*

Labor representatives disagree. Carl Rude of the CWA in Washington state argued that "we need rules because there are still too many unanswered questions and too many user complaints. Until more research is done, we need some type of protection." Commenting for the Newspaper Guild, David Eisen said "legislation will provide a minimum workplace standard to protect millions of non-union workers." He is confident that "sooner or later, laws will be pushed through."

The Computer and Business Equipment Manufacturers Association (CBEMA) opposes the proposed regulations. The trade association maintains that "inflexible regulation" of this fast developing technology will hurt businesses, users and manufacturers. The threat of VDT legislation has been targeted as a major issue by CBEMA and will be addressed by Columbia University Professor Alan Westin at the group's annual spring meeting in Phoenix, AZ.

Proposed State VDT Legislation

Connecticut: House Study Bill 5132: An Act Establishing a Committee To Investigate Workplace Hazards Caused by Video Display Terminals. Sponsor: Rep. William Kiner. Would set up a study committee which could develop appropriate VDT legislation. Status: approved by the Committee on Labor in March and sent to the Appropriations Committee.

Connecticut: Senate Bill 811: An Act Concerning Protection for Users of Video Display Terminals. Sponsor: Senator Michael Skelley. Employers would be required to inform workers of potential hazards associated with VDTs, including eye problems, headaches and musculoskeletal problems. Workers would also be informed of the advisability of annual eye exams and the need for a rest period of up to 20 minutes after two hours of work. Also calls for study of VDTs. Status: approved by the General Law Committee in March.

Illinois: House Bill 274: An Act to Provide Occupational Safeguards for Operators of Video Display Terminals. Sponsor: Rep. John Matijevich. Parallels Maine's proposed bill (see below) with the addition of specific requirements for terminal design, office furniture and lighting as presented in an earlier Maine bill (HP 880, 1981). Status: tabled after March hearing and unlikely to see action this session.

Maine: House Paper 657: An Act to Provide Occupational Safeguards for Operators of Video Display Terminals. Sponsors: Reps. Edith Beaulieu and James Mayo. Would require employers to ensure safe workplace conditions, inform employees of potential hazards associated with VDTs, provide semiannual terminal maintenance, pay for annual eye exams, provide a 15-minute rest break every two hours. Status: hearing before the Joint Standing Committee on Labor expected late March or early April. An almost identical bill, HP 880, failed to win approval in 1981.

Massachusetts: House Study Bill 2267: Untitled. Sponsor: Rep. Timothy Bassett. Order for the Committee on Commerce and Labor to investigate VDTs and draft legislation, if necessary. Status: hearing scheduled for April 20 in Boston.

Massachusetts: House Bill 2658: An Act to Provide Occupational Safeguards for Employees Resulting from the Introduction and Utilization of Video Display Terminals. Sponsor: Rep. Elizabeth Metayer. Employer intending to install over $5,000 in hardware would be required to notify employees six months in advance, pay for annual eye exams, provide properly designed furniture, terminals, and lighting and adequate air quality, provide 15-minute breaks every one or two hours depending on visual demands of work, provide semiannual terminal maintenance and offer alternative work to employees during pregnancy without loss of pay. Limit total VDT work to five hours per day. Status: hearing scheduled for April 20 in Boston.

New York: Hearing on VDT safety issue and possible need for legislation tentatively scheduled for April 14 in New York City. Sponsor: Rep. Frank Barbaro.

New York: Hearing on consumer products and radiation, including VDTs, expected in late spring. Sponsor: Senator Tony Masiello.

Oregon: Senate Bill 568. Untitled. Sponsor: Senator Margie Hendriksen. Employers would be required to ensure adequate lighting, furniture and terminal design, pay for annual eye exams, provide semiannual terminal maintenance, inform workers of potential hazards associated with VDTs, provide 30-minute break from VDT work after two hours at terminal, provide alternative work for pregnant women on request. Status: hearing before Labor Committee expected mid- to late April.

Washington: Plans underway to place rules similar to those in the Maine bill (see above) in the state's administrative code. Status: the Department of Labor and Industries plans to form a committee this spring to draft rules.

HIGHLIGHTS

More Comments on EPA's RF/MW Guidance

The Environmental Protection Agency (EPA) has received 23 sets of comments on its plans to propose a public exposure guideline or "guidance" for radiofrequency/microwave (RF/MW) radiation. Of the fifteen responses summarized below and the eight reviewed last month (see *MWN*, March 1983), the majority call for quick action in adopting a pre-emptive federal guideline.

Federal Communications Commission (FCC) Chairman Mark Fowler summed up the concern of his agency and of the companies it regulates: both, he wrote, "are concerned about safe exposure levels and the possiblity of a confusing and costly proliferation of inconsistent state and local standards." Fowler asked EPA to set standards for use by the FCC and other agencies "as expeditiously as possible." The problems posed by local regulations were also addressed by the American Radio Relay League (ARRL), Raytheon, RCA and Westinghouse Electric.

The New Jersey Department of Environmental Protection cited its own plans to adopt an RF/MW exposure standard in urging the EPA to speed up its schedule for the guidance. Comments submitted by the Commission on Radiation Protection Chairman M.M. Weiss of Bell Labs and Frank Cosolito of the NJ Bureau of Radiation Protection explained why the state's action is necessary: local decision makers, spurred by growing public apprehension, are "inhibiting the often vital expansion of the nation's communications system by declining to issue required permits, variances, etc."

Many of those commenting suggested modeling federal rules on the American National Standards Institute (ANSI) standard. Robert Misterka of the New England Power Service, for example, called the ANSI guideline "the latest most comprehensive document available" and "well recognized as the authoritative guide" for evaluating exposure to non-ionizing radiation. Also recommending the ANSI standard were John Mitchell of the Air Force School of Aerospace Medicine, Raytheon's John Osepchuk, F.S. Beal of Western Electric, S. Baron of Burns and Roe and Christopher Imlay for the ARRL.

EPA received the following responses to specific questions in its advanced notice of proposed recommendation (47 *FR* 57338, December 23, 1982):

- Many of the comments recommended that the guidance cover frequencies below the 300 kHz cutoff in the ANSI standard. L.J. Chapman of Madison, WI, urged including frequencies down to 1 Hz, Ford and the Motor Vehicle Manufacturers Association recommended starting at 60 Hz and the ARRL at 1 kHz. Raytheon suggested including frequencies down to at least 100 kHz. Westinghouse preferred ANSI's 300 kHz and the air force suggested starting higher, at 3 MHz.
- All comments comparing a flat with a frequency dependent standard concluded the guidance should set different exposure limits for different frequencies.
- Responses varied over whether limits should be set for partial body exposures. The Air Force, the ARRL, the Federal Aviation Administration and Westinghouse recommended addressing only whole body exposures. Raytheon and the NJ Department of Health supported partial body exposure rules and Ford suggested that these rules be developed later. Motorola advocated a detailed approach, which is excerpted below.

EPA's Office of Radiation Programs is finishing its preliminary draft of the guidance and plans to meet April 14 with the interagency group established to help with guidance development. The final draft of the agency's criteria document on RF/MW bioeffects, the basis of the guideline, will be reviewed by an ad hoc committee of the Scientific Advisory Board in May (see *MWN*, March 1983). The document will be made publi at that time.

For a review of EPA's notice of proposed recommendation, see *MWN*, January/February 1983.

Excerpts From Comments on EPA RF/MW Guidance Development

The 15 sets of comments excerpted below, along with eight sets reviewed in Microwave News *last month, were submitted to EPA in late February. (See* MWN, *March 1983.)*

Air Force School of Aerospace Medicine: Whole body average specific absorption rate (SAR) with a maximum localized SAR should be used to establish exposure limits in terms of incident power density (mW/cm^2)....The ANSI standard...is intended to apply to non-occupational (general public) as well as to occupational exposures and should receive serious consideration in setting safety guidelines for public exposure to [RF] radiation.

American Radio Relay League: We emphasize the need to distinguish between biological *effects* from RF energy and biological *hazards* from RF energy. While advances in technology and science may increase our ability to detect biological effects, such advances need not directly result in changes in protection standards.

Burns and Roe: Our view is that the ANSI standard provides sufficient guidance while additional necessary research is being performed and we therefore endorse the proposed standard.

L.J. Chapman: Present standards and research programs do not adequately address the low frequency portion of the RF spectrum. Especially in the frequency range from 1 to 100 Hz, population exposures may have significance and the existent research information base is minimal.

Federal Aviation Administration: In developing your guidance document you should consider setting limits for maximum as well as average exposure. We urge you to address nonthermal effects and their health implications, an issue which is far more sensitive in the general public arena than in the occupational.

Federal Communications Commission: The FCC lacks the necessary expertise and statutory authority to promulgate its own health and safety standards and, therefore, must look to EPA and other responsible agencies for guidance in this area....We would like to make clear our support for your guidance development. We encourage the EPA to complete this process as expeditiously as possible so that a uniform federal standard will be available for use by the FCC and other affected agencies.

Ford: We see no reason to limit the range of frequencies included in the guidance. In particular, those frequencies which are known to be used by powerful radiating sources should be included. These frequencies could extend, for example, from the 60 Hz employed in domestic electric power transmission and the 10.2 to 13.6 kHz employed by Omega radionavigation systems through the commercial AM and FM broadcast spectrums to the frequencies employed by microwave radar and the satellite communications/energy systems.

Motor Vehicle Manufacturers Association: MVMA is particularly interested in whether mobile radio transmitters, not specifically identified in the ANPR, will be considered in the course of this rule making....MVMA recommends that the [frequency] ranges not be limited. In particular, we recommend that frequencies of known high field strengths in the proximity of public roads should be included.

Motorola: In the close vicinity of sources, reactive electric energy can cause high readings in E-field sensing instruments, even though limited

power flow (in the far-field sense) may be present. It is therefore recommended that the EPA weigh the H-field levels more heavily than E-field levels in the case of partial body exposure. In addition, it is recommended that the EPA allow the same peak and average SAR in human organs for whole and partial body exposure....The best known (and independently repeated) of [non-thermal] effects is the change of [calcium ion] efflux from brain tissue in certain amplitude modulated fields... This effect may concern the EPA because it points out that there might be particular windows of bio-response to certain weak electric signals. Motorola would like to point out that the frequency modulated (FM) signals usually employed by the land mobile communications industry do not cause such [a calcium ion] efflux effect.

New England Power Service: It is in the best interest of the public and the users of devices which generate electromagnetic fields that any regulations promulgated to regulate exposures to these fields provide a clear, understandable and straightforward standard of compliance which will allow both EPA and the radio users to easily insure that exposure guidelines are not exceeded....We recommend that EPA consider [adopting the ANSI standard] in its guidance.

New Jersey Department of Environmental Protection: The subject of radiofrequency hazards has become of increasing concern to this [Commission on Radiation Protection] in the face of increasing proliferation of [RF] radiation sources in the state and an accompanying and inevitable apprehension on the part of residents as to whether they are being unduly exposed to possibly hazardous radiations....In the absence of a national guide for [RF] radiation limits, and lacking the resources to independently develop state limits, this commission is in the process of adopting guideline limits patterned after [ANSI's].

New Jersey Department of Health: Even though the Eastern European studies, which were based on behavioral and clinical studies, have not been repeated in the United States, we recommend that the data from these studies be used for setting exposure limits until a peer reviewed study from the Western countries either confirms or disproves the findings of the Eastern European countries.

Raytheon: The exposure limits should exhibit frequency dependence as in ANSI C95– so that the safety factor or real risk is the same regardless of which part of the spectrum is involved. Furthermore, such limits should be expressed as continuous functions of frequency. Mixed fields or sources can be evaluated as in ANSI C95 by adding fractions representing ratios to exposure limits for the respective frequencies. The relatively minor calculations are a minor burden to those responsible for using the guidance (professional users, not the public) and are a small price to pay for the avoidance of a distorted and unfair perspective on risk which would result if a simplistic single number approach were to be followed....Survey instruments will measure only time-averaged fields (averaging time in the order of 1 second). At present there is no limit on instantaneous fields or power densities such as exist in a pulsed radar beam. There is no evidence that existing environmental radar fields are hazardous. Certainly any limitation on peak fields should be set above those already in the environment accessible to the general public. In such existing cases the peak values may be 10,000 times the six-minute average or more.

RCA: The lack of a general population radiation limit has seriously complicated siting plans for the communications industry....In the absence of national guidance, state and local jurisdictions have felt the need for establishing radiofrequency exposure limits. Not surprisingly, these limits lack uniformity; e.g., Texas has an exposure limit of 10,000 uW/cm^2, New Jersey is proposing 1,000 uW/cm^2, and Massachusetts is proposing 200 uW/cm^2. The consequences of this regulatory patchwork quilt are that those who are concerned about the potential hazards are confused and fearful, and those who have responsibility for maintaining the communications resources of this country cannot allay these fears by comparing their predicted exposure levels with nationally accepted, uniform exposure limit levels.

Westinghouse Electric Corp.: The ANSI committee, as well as other scientific committees (e.g. National Council on Radiation Protection), use the threshold for adverse biological effects concept and include an order-of-magnitude safety factor when establishing limits for exposure to humans. This conceptual approach should be used by EPA in order to maintain consistency in establishing limits for exposure to the general public....The range of frequencies to be included should be from 300 kHz to 100 GHz....The standard should consider only whole body exposure rate. The only partial body exposure rate to the general public would be from sources to which they are in close proximity such as microwave ovens. Exposure rates from these and other consumer products are best controlled through product performance standards.

EMP and Nuclear Power...

Electromagnetic pulse (EMP) radiation from a high altitude nuclear blast would not stop a nuclear power plant from achieving a safe shut down, according to a report prepared for the Nuclear Regulatory Commission (NRC) by Sandia National Laboratories. A number of experts have taken issue with the study's conclusions, however.

Critics of the report contend that the study's assumptions —especially the way the EMP problem is defined— seriously undermine the value of its findings. As Dr. Conrad Longmire cautioned, "with a sufficiently long chain of plausible assumptions one could reach almost any conclusion desired." He advocated an investigation of the EMP threat on reactors "with the maximum degree of realism." Longmire, who is with Mission Research Corp. in Santa Barbara, CA, offered these comments on a draft of the report. The authors contend that the assumptions are "solid and reasonable" and that running tests with a nuclear power plant would be "extremely expensive."

In an interview, NRC's Demetrios Basdekas said that "the report presents a pre-conceived set of conclusions." Calling the study a potential "embarrassment" for the agency, Basdekas said that the primary damage from EMP is not due to the energy imparted by the radiation itself, but from the secondary and tertiary effects on the system as a whole. "These can be very significant and are left out of the report," he said. Basdekas was the first to publicly raise the issue of an EMP-nuclear power plant threat at congressional hearings in 1976.

A spokesman for the NRC said that the question of whether or not more research is needed is still "under review and is not resolved."

Interaction of Electromagnetic Pulse with Commercial Nuclear Power Plant Systems by David Ericson, Jr., *et al.* (No. NUREG/CR-3069; SAND82-2738/1&2; Volume 1: Executive Summary, Volume 2: Main Report) is available from the NRC/GPO Sales Program, NRC, Washington, DC 20555 or from the National Technical Information Service, Springfield, VA 22161. The GPO price for Vol. 1 is $4.75 and Vol. 2 is $11.00. An appendix to the main report contains reviewers' comments.

...NAS To Study EMP Threat

The National Academy of Sciences (NAS) has set up a committee to evaluate models which estimate electronic stress and failure due to EMP radiation from nuclear explosions. The Committee on Electromagnetic Pulse Environment of the National Research Council held its first meeting in early February, and is scheduled to issue its report in the summer of 1984.

The committee, which is working under the council's Energy Engineering Board, will determine the reliability of methodologies now used to determine EMP effects and the efficacy of shielding and other protective strategies.

Much of the data for the committee's work is classified, but according to Dr. John Richardson, the study's director at the NAS, "the present thinking is that an unclassified report would make the widest and greatest contribution to the problem."

Members of the committee are: Dr. John Pierce, Professor Emeritus, California Institute of Technology (chairman); Profes-

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."

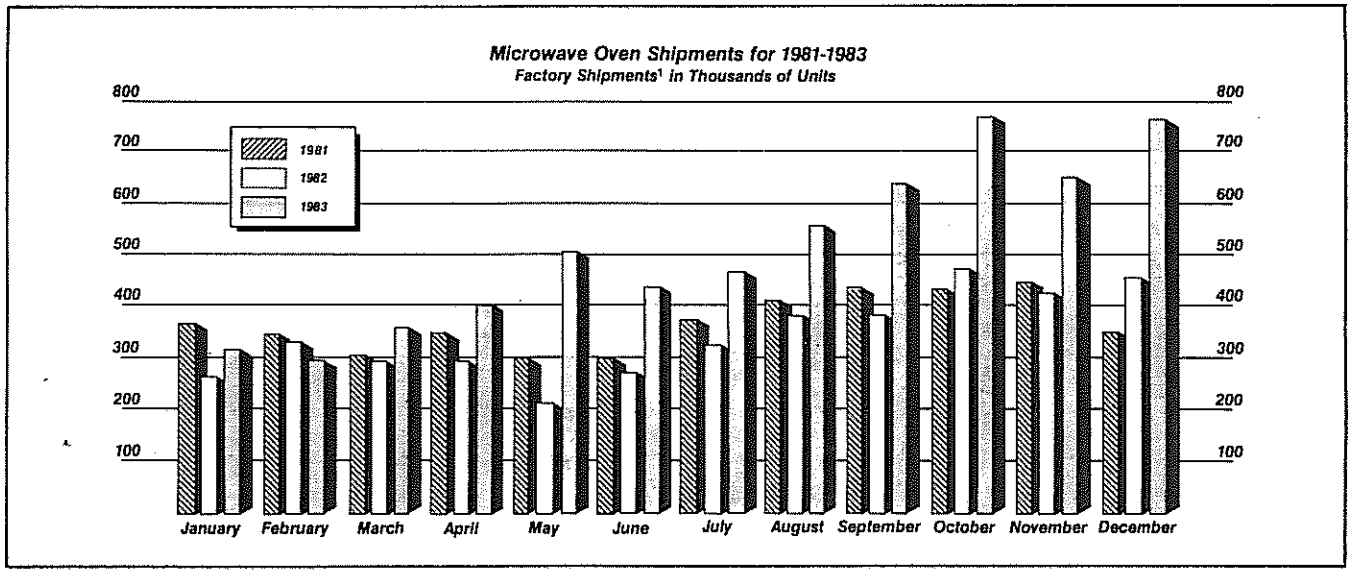
It appears that compact ovens will be a strong growth area in 1984. Sanyo's national sales manager predicted in the March 26 *HFD* that compacts will make up more than 30 percent of the seven million ovens he expects will be sold in 1984. He noted that, although market saturation is relatively high in 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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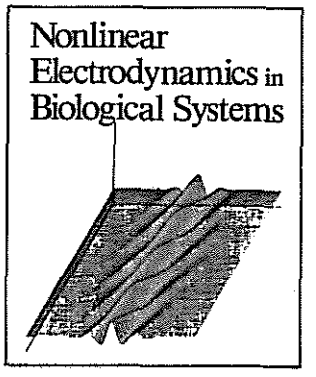
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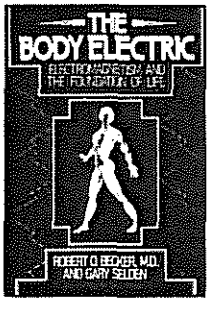
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CONFERENCE CALENDAR p. 8

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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